Reclaiming Hands-On Ultrasound for Radiology: A Simulation Based Ultrasound Curriculum for Radiology Residents

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RSNA 2019
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December 1–6

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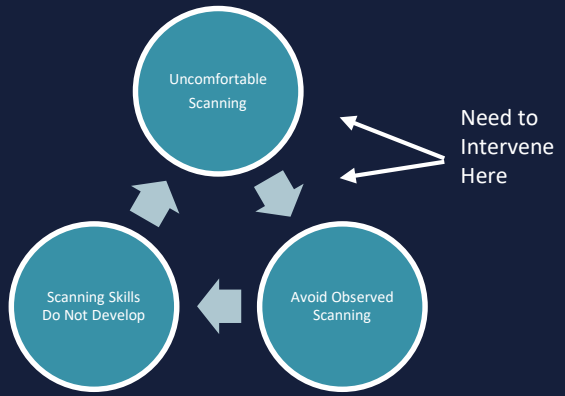
Introduction

- Hands-on ultrasound skills are important
- Current literature suggests an increase in utilization of and training in ultrasound in non-radiologic specialties (EM, surgery, family medicine, etc) as well as in medical school curricula
- Decline in US interest and training amongst radiologists (lower RVUs, more resource intensive/operator dependent)
- Increased clinical volume results in:
  - Less time for hands on scanning
  - Less time for attending instruction
- Loss of ultrasound is a universal threat to radiology
- Simulation-based training allows for broad, thorough training with minimal time demands on senior trainees and attendings



Study Design

All program residents surveyed prior to course

Two-week simulation based US course completed by first year residents only

First year residents surveyed again following course completion

Pre-Course Survey Results

Survey of all residents (n = 30)

- Not prepared to scan independently
- Unsure of technique
- Not confident
- Anxious
- US skills are important

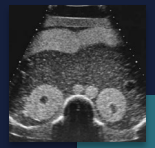
Question	Results
I am prepared to technically assist with ultrasound scanning if an ultrasound technologist runs into a problem while scanning and requests my help.	17% Strongly Agree 38% Agree 31% Disagree 14% Strongly Disagree
I am prepared to independently complete an ultrasound scan on a patient if an ultrasound technologist is not available.	3% Strongly Agree 7% Agree 38% Disagree 52% Strongly Disagree
I am knowledgeable with Sonographic Anatomy (anatomy seen via ultrasound)	17% Strongly Agree 59% Agree 17% Disagree 7% Strongly Disagree
I am knowledgeable with Sonographic technique to accurately image body part	3% Strongly Agree 28% Agree 52% Disagree 17% Strongly Disagree

Question	Results
How confident are you in your technical skills to accurately perform an ultrasound procedure on a patient?	14% Very Confident 14% Confident 41% Slightly Confident 31% Not Confident
What is your estimated anxiety level prior to performing an ultrasound procedure on a patient?	3% Extremely Anxious 10% Very Anxious 38% Slightly Anxious 31% Anxious 17% Not Anxious
Ultrasound training is important in your radiology residency training	69% Strongly Agree 31% Agree 0% Disagree or Strongly Disagree
It is important to acquire proper ultrasound skills/technique	28% Strongly Agree 72% Agree 0% Disagree or Strongly Disagree

Daily Schedule

8 – 9 am

- Abdominal Imaging Rounds



9 am – 12 pm

TRAINING LAB

- Course learning modules (didactic)
- Course virtual simulation
- Course assignments
- Phantom scanning practice

12 – 2pm

- Conference

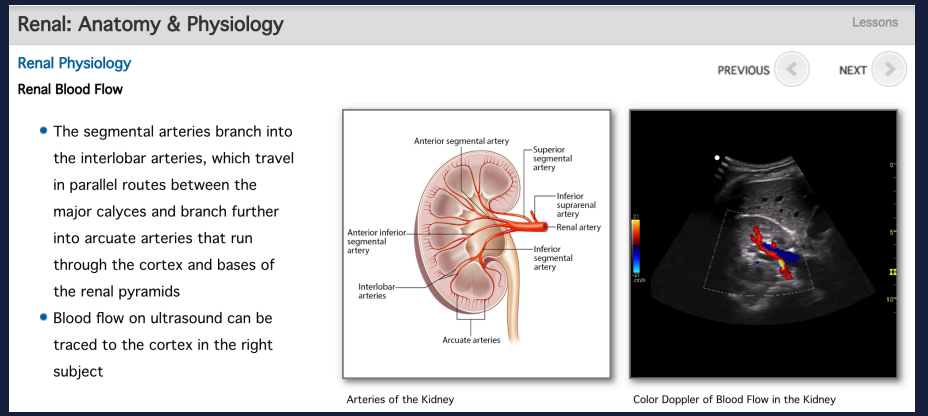
2 – 5 pm

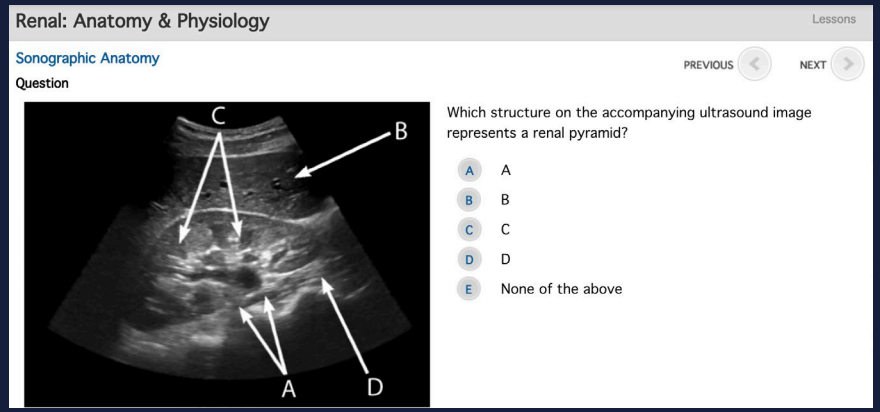
- Live patient scanning with sonographer
- Dictate studies scanned

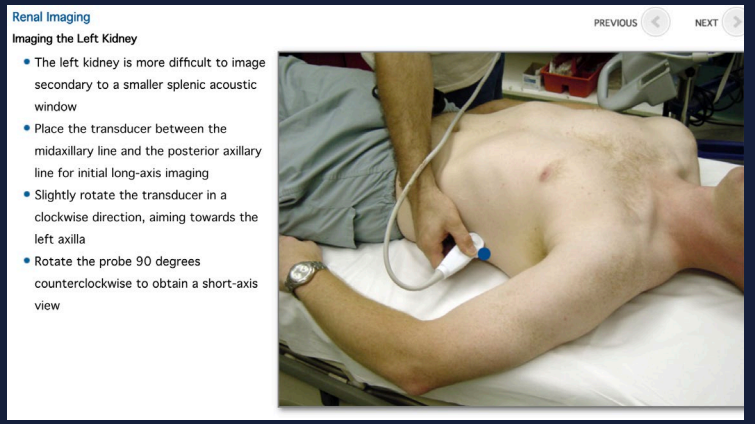
Course Schedule

WEEK ONE Monday	Tuesday	Wednesday	Thursday	Friday
Modules: - Fundamentals of US - Renal (2) Simulation: - Renal (2)	Modules: - Bladder (2) Simulation: - Bladder (2)	Modules: - Aorta/IVC (2) - Leg venous Simulation: - Aorta/IVC - Leg Venous	Modules: - Liver - Pancreas - Spleen Simulation: - Liver - Pancreas - Spleen	Catch up day
WEEK TWO **Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Modules: - Thyroid - Intestinal/Biliary Simulation: - Thyroid - Intestinal/Biliary	Modules: - MSK (2) Simulation: - MSK	Modules: - Female Pelvis - Ob/Gyn Simulation: - Female Pelvis - Ob/Gyn	Modules: - Prostate - Scrotum Simulation: - Prostate - Scrotum	Catch up day

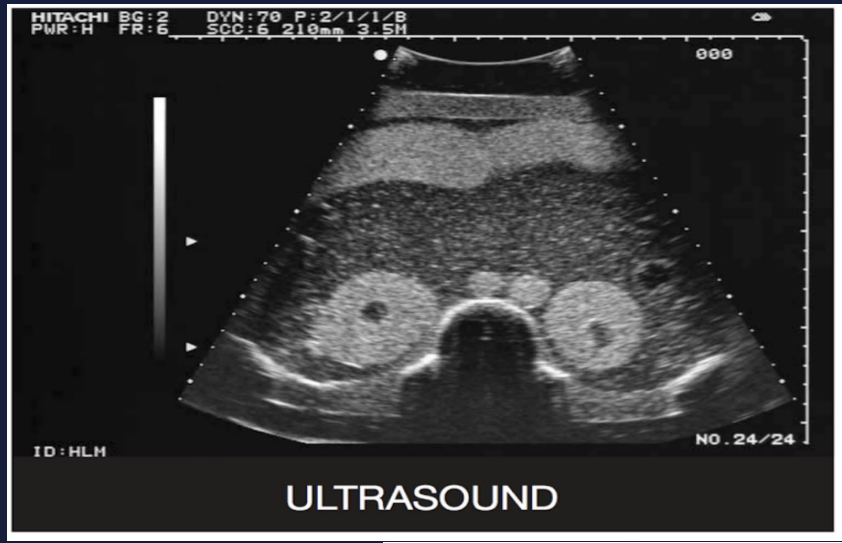
Computer Learning Modules

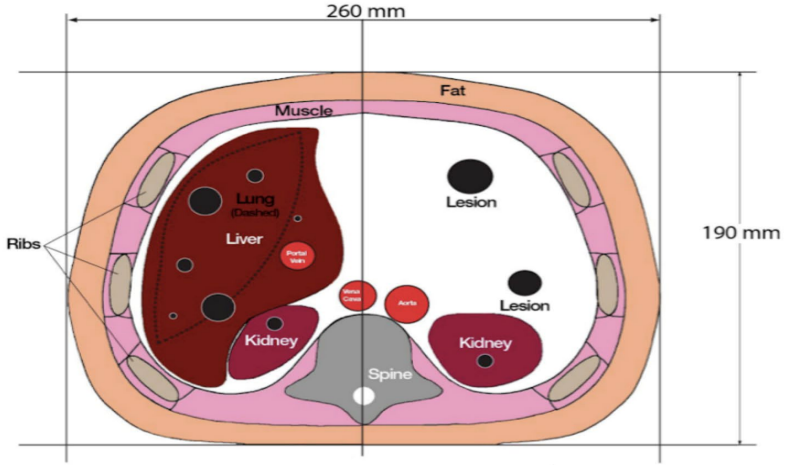






Simulation: Abdomen Sample





*Lung is under liver in Model 057A

INTERNAL ORGANS Adult abdomen	• (1) Liver with six lesions • (2) Kidneys with one lesion each • (1) Spine • (1) Partial lung • (1) Portal Vein • (1) Vena Cava • (1) Aorta • (6) Ribs • Surrounding Soft Tissue with two lesions

Task: Find all listed structures.

Post-Survey Results

Only first year residents surveyed (n = 6)

- Substantial improvements:
  - US anatomy
  - US technique
  - Confidence
- Didactic modules and simulation cases helpful

Question	Results
I am knowledgeable with Sonographic Anatomy (anatomy seen via ultrasound)	Pre-course 17% Strongly Agree or Agree 83% Disagree or Strongly Disagree Post-course 83% Strongly Agree or Agree 17% Disagree or Strongly Disagree
I am knowledgeable with Sonographic technique to accurately image body part	Pre-course 17% Strongly Agree or Agree 83% Disagree or Strongly Disagree Post-course 67% Strongly Agree or Agree 33% Disagree or Strongly Disagree
How confident are you in your technical skills to accurately perform an ultrasound procedure on a patient?	Pre-course 17% Very Confident 0% Confident 17% Slightly Confident 67% Not Confident Post-course 0% Very Confident 17% Confident 67% Slightly Confident 17% Not Confident

Question	Results
The SonoSim modules contained helpful information for my level of training.	33% Strongly Agree 66% Agree 0% Disagree or Strongly Disagree
The SonoSim virtual simulation cases were helpful for my level of training	33% Strongly Agree 66% Agree 0% Disagree or Strongly Disagree
Practicing with phantoms was helpful for my level of training	0% Strongly Agree 66% Agree 33% Disagree 0% Strongly Disagree

Results

- Survey results suggest a perceived need for hands-on US training amongst radiology residents
- Two-week simulation course contributed to improved perceived scanning knowledge and comfort for participating first year residents
- Phantoms and non-structured scanning were useful; however, computer modules were most beneficial

Discussion

- Radiology-performed exams can remain the gold standard if we ensure high quality US exams
- Hands-on scanning skills are necessary to maintain quality
- More research and experience is needed to explore simulation-based training and other educational methods for trainees