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Reduction of Knee MRIs in the Setting of Severe Degenerative Changes

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Introduction

- Problem Statement
  - *Many primary care physicians order knee MRIs in the setting of severe degenerative changes in patients who are candidates for total knee replacements.*
- Background Information
  - *Osteoarthritis is the most common joint disorder in the United States with 10% of males and 13% of females over the age of 60 reporting symptomatic knee osteoarthritis according to a study performed in 2010. This number is expected to increase with an aging population.*
  - *Primary care physicians who see these patients have multiple available treatment options available for patients with knee pain including physical therapy, support devices, referral to orthopedic surgery, and joint injections*
  - *Knee radiograph is often the first step to determine the level of degenerative changes and screen for other contributing abnormalities and has been shown to have a high correlation with knee MRI for grading severity of degenerative changes.*
  - *These patients are generally not candidates for repair of the support structures to the knees and findings of ligamentous or meniscal injuries which are better seen on MRI are not repaired.*

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Step 1: Analyze the Current State

- *Over a six month time period in 2017, 882 knee MRI examinations were obtained at Parkland Hospital (the county hospital in Dallas, TX).*
- *294 MRIs were randomly selected*
  - *MRI reports evaluated by musculoskeletal fellow (PGY-6) for severe degenerative changes, defined as high grade cartilage thinning or worse over an area of at least one centimeter on MRI.*
    - *Subset of images were independently reviewed for quality control*
- *Corresponding radiographs were evaluated by a musculoskeletal trained radiologist who was blinded to the MRI results*
  - *Graded the degree of degenerative changes using the Kellgren-Lawrence (KL) scale (please refer to figure 1)*
- Pre-intervention assessment: 55% of knee MRIs demonstrated severe degenerative changes.
- Only 1 MRI without severe degenerative changes had a KL score of 3 (less than 1%).
- MRIs with severe degenerative changes had wide variety of KL scores, although majority were 2, 3, or 4.

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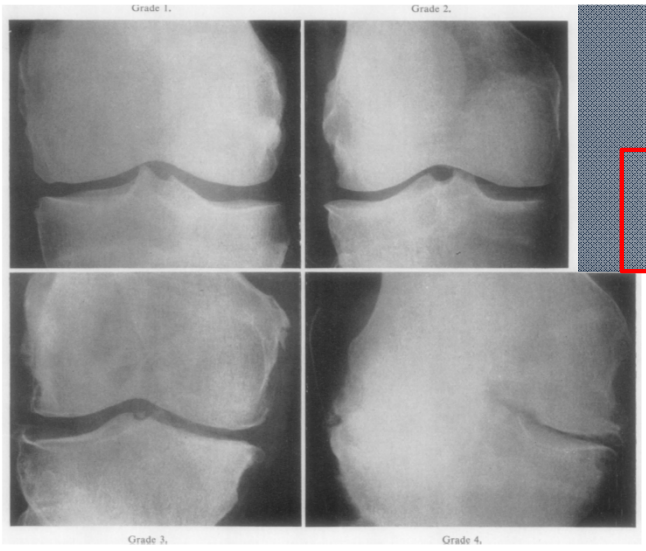
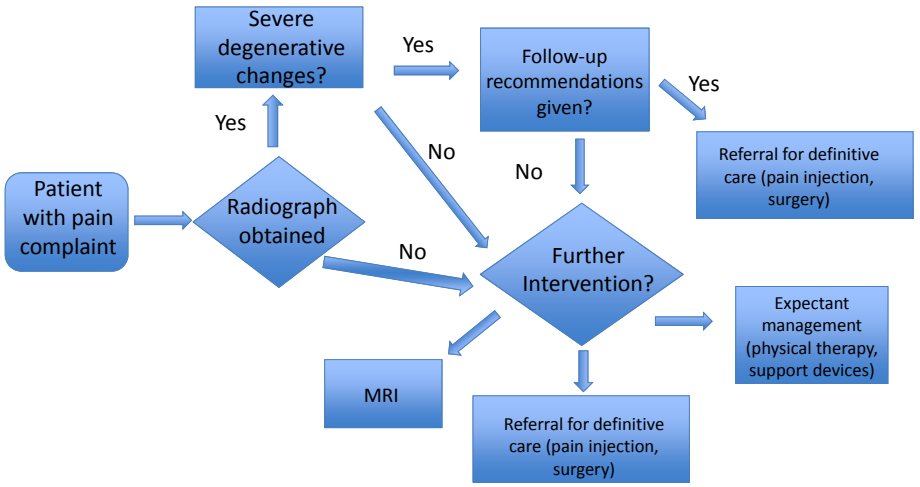
Figure 1: Kellgren Lawrence (KL) Grading scale



- Grade 0: no DJD
- Grade 1: Doubtful
- Grade 2: Minimal
- Grade 3: Moderate
- Grade 4: Severe

Significant degenerative changes defined as Grade 3 or 4

Step 2: Determine Current Process Map



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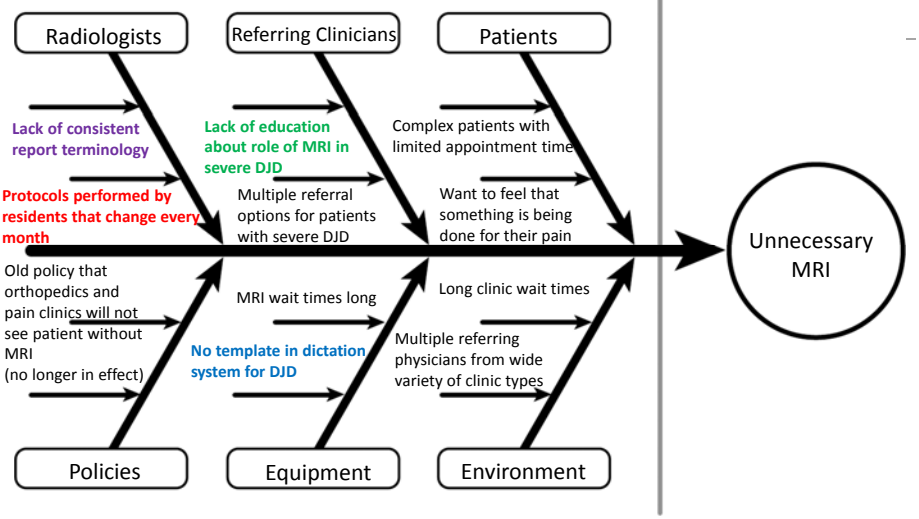
Step 3: Root Cause analysis



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Interventions: Creation and implementation of reporting system

#1: August 2017: dictation template created and placed into PACS and education of musculoskeletal (MSK) attendings at monthly staff meeting.

→ Result: Minimal use of system due to high volume of knee MRIs and cumbersome task to place into dictation system

#2: September: new reporting system automatically integrated into dictation system and email sent to radiology residents educating them on new reporting system and its purpose.

→ Force of use (or can delete the entire grading system from a report if not applicable such as in patients with joint replacements)

→ Result: Significant increase in use of system.

#3 November: MSK attendings report discrepancies between overnight reports and final reports formal radiology resident education via formal didactic lecture with further discussion of rationale and education with examples of various levels of degenerative changes

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Step 4: Analyze the data for 6 months

- Analyzed the data every 10 days for all MRIs performed without contrast during that time period
- First analysis: Determine if the knee MRI has a corresponding radiograph with a KL score (Figure 2)
  - To determine the impact of the primary intervention
  - Helps with confounding if there is a delay between the radiograph and the MRI
- Second analysis: Determine the percentage of knee MRIs with severe degenerative changes (Figure 3)

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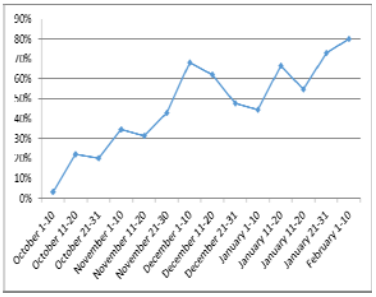
Figures 2 and 3: Post-Intervention Data

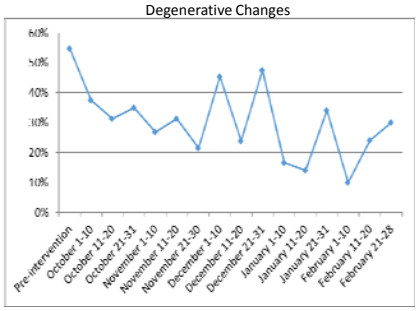
Figure 2: Knee MRIs with KL Score on X-ray



Most common reasons not to have score on radiograph:

1. No radiograph obtained.
2. Radiograph obtained before implementation of new grading system.
3. X-ray linked with other examination and grading system not automatically placed in dictation system (example if linked to femur and femur study was opened first)

Figure 3: Percentage of Knee MRIs with Severe Degenerative Changes



Most common reason for severe degenerative changes on MRI:

1. MRI ordered on patients with KL grade 3 and 4 on radiographs despite recommendations.
2. MRI with severe DJD in patients with KL grade 2 on radiograph (upgraded from radiograph).
3. No KL score on corresponding radiograph/ no corresponding radiograph (as seen in Figure 2).

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Conclusion

1. Percentage of knee MRIs with full thickness cartilage loss or high grade defects decreased from 55% (161/294) pre-intervention to 30% (74/245) post-intervention. The difference was statistically significant ($p<0.0001$).
2. Knee MRIs without significant degenerative changes had corresponding radiograph scores of 1 and 2 while knee MRIs with significant degenerative changes had wide variety of corresponding radiograph scores which makes this an effective screening tool as it will not stop patients from getting MRIs by overcalling degenerative changes.
3. If further questions arise, please email Avneesh.Chhabra@utsouthwestern.edu or Kelly.Tornow@phhs.org

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