Utilization of Radiograph Markers for Imaging of the Trauma Patient

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Introduction:
Trauma patients often have subtle injuries, and imaging often proceeds without detailed documentation of the patient's physical exam or symptoms. It is common for patient's imaging to arrive for interpretation with a limited history of 'trauma' or 'fall.' The average rate of a missed fracture by radiograph is approximately 4% (Wei 2006; Pa Patient Saf Adviz, 2015.). Trauma patients with musculoskeletal injuries may benefit through improved localization of their symptoms for closer scrutiny by the musculoskeletal radiologist.

Plan:
By May of 2017, radiographic markers will be utilized to find the lateral ankle may assist you in finding the lateral time the radiograph arrives on your PACS system. An arrow marker pointing to the lateral ankle may assist you in finding the lateral time the radiograph arrives on your PACS system. One is not available at the hospital that tells you which side of the foot or ankle the patient is facing. Therefore, a marker is helpful.

Figures 1 & 2: Radiographs of the foot (left) and ankle (right) in two different patients. Can you spot the acute fracture in each image? Does a history of 'trauma' help? Would you like a physical exam that tells you which side of the foot or ankle the patient is facing? It is common for patient's imaging to arrive for interpretation with a limited history of 'trauma' or 'fall.'

Do:
On January 25, 2017, radiographic markers were distributed to all technologists at the University of Minnesota Medical Center. An accompanied e-mail from the Radiology & Ultrasound Manager was distributed the same day requesting compliance and explaining the goal initiative.

Study:
Systematic review of all radiographs with a reported history of trauma, from May 6-12, 2017. No radiographic markers were visible on any of the reviewed exams.

Root Cause Analysis:
Discussion with technologists and MSK staff:
• Radiographic markers are utilized for trauma at other hospitals, e.g.:
  - UC San Diego
  - Park Nicollet/TRIA
  - Mayo Clinic
  - St. Francis Regional Medical Center (Shakopee)

Technologist Survey:
• 100% reported that they have access to an appropriate radiographic marker to localize trauma symptoms.
• 100% reported they were aware of the MSK division's goal to use markers for all extremity trauma radiographs.
• Multiple comments advocating for a post-processing arrow instead of a lead marker.
• Multiple comments suggesting students be provided with markers, since they are commonly asked to obtain radiographs in the target population.

Select Quotes from the survey:
• "If a patient has a trauma and a specific body part is ordered you should be evaluating that body part for the trauma. I'm not sure how pointing to it is helpful."..."If you are not in the habit of using markers it can be hard to remember...other techs simply refuse to use them. Some techs don't even carry any markers.
• "I just honestly forget to use the markers." I'm sure you have found the triquetral fracture seen on the lateral view only.

Images 3 & 4: AP and lateral views of the right hand. Can you identify the fracture? History of "fall on an outstretched hand." Would an arrow pointing to the ulnar side of the hand help? I'm sure you found the triquetral fracture seen on the lateral view only.

Which of the following options would increase the likelihood that you will use a marker to localize symptoms during a radiograph following extremity trauma?

Citations:
1. Wei CJ, TsaI WC, Tu CM, Wu HT, Chiou HJ, Chang CY: Systematic review of all radiographs with a reported history of trauma at the University of Minnesota Medical Center (UMMC). A systematic review of all radiographs with a reported history of trauma will be done in the 2nd week of May 2017 to determine the percentage of radiographs with a visible radiographic marker.
2. ”I’m sure you have found the triquetral fracture seen on the lateral view only.

Images 3 & 4: AP and lateral views of the right hand. Can you identify the fracture? History of "fall on an outstretched hand." Would an arrow pointing to the ulnar side of the hand help? I'm sure you found the triquetral fracture seen on the lateral view only.

Act:
✓ Given there is a significant portion of the technology staff who do not think a radiographic marker is useful, recommend a mini-case conference with the technologists to highlight cases where a radiographic marker is useful.
✓ Provide a forum for technology staff to ask questions regarding marker placement, and provide direct input prior to creating a written protocol.
✓ Further explore the ability to add a post-processing arrow, given this was commented on frequently by the technology staff.
✓ Create reminder posters or cards to display near technologist workstations. This was the most favored method for increasing marker use, based on technologist survey.
✓ Provide markers to technologist students. This was brought up by the technology staff, and it may have the added benefit of influencing these students early in their careers to use markers.
✓ Once the markers are being used, survey the MSK radiology staff and residents to see if they find them useful for detecting injuries.

Conclusion:
Failure to diagnose is the leading cause of malpractice lawsuits against radiologists, and non-spinal musculoskeletal is the leading organ system, only behind missed diagnosis of breast cancer (Whang et al. 2013). An effort to localize symptoms is intended to reduce missed fractures, increase confidence in diagnosis, and help form differentials. Current barriers to implementing the use of radiographic markers include: a lack of technologists "buying in" to their use, questions pertaining to whether or not a lead marker is optimal, availability of markers for ankle students, and simply forgetting to use them when imaging trauma patients.

Images 3 & 4: AP and lateral views of the right hand. Can you identify the fracture? History of "fall on an outstretched hand." Would an arrow pointing to the ulnar side of the hand help? I'm sure you found the triquetral fracture seen on the lateral view only.

Do you see the value in using radiographic markers for extremity trauma imaging?

Figure 1: Reminder cards or posters at technologist work stations, followed by in-person training or discussion were surveyed to be the most likely methods to increase the use of trauma markers.

Figure 2: Survey results showed that 60% of technologists who responded to the survey stated they were likely or very likely to use a trauma marker.

Figure 3: 20% of technologists stated they did not see the value in using a radiographic marker for extremity trauma. This could be a potential area for education and collaboration to improve patient care.