Perspectives and Institutional Policies on Patient Safety and Image Quality Regarding the Use of Knee-Spanning External Fixators in MRI: A Survey Study of the Society of Skeletal Radiology

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Background

- Joint-spanning external fixation may be indicated for highly unstable knee dislocations (KDs) to:
    1. Maintain tibiofemoral reduction
    2. Protect the patient from potentially limb-threatening neurovascular injury
- Subsequent magnetic resonance imaging (MRI) to assess soft tissue injury and plan for surgery is an essential next step in the treatment of KDs
- Concerns with placing a knee-spanning external fixator in the MR bore:
    1. Patient Safety
    2. Poor image quality
- Clinical Challenges
    1. Evolving MR safety terminology
    2. Limited manufacturer instructions
    3. Lack of Universal safety guidelines
- Radiologists have refused to scan externally fixated patients
- Delayed MRI may consequently delay diagnosis and surgical treatment and have a negative impact on patient outcomes, as KD patients who undergo acute ligamentous repair/reconstruction have demonstrated better post-operative results

Objectives

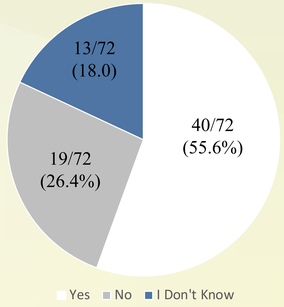
- To conduct an electronic poll of practicing musculoskeletal radiologists on their personal experiences regarding the use of knee-spanning external fixators in MRI
- To consolidate current trends and common practices regarding MRI in the presence of a knee-spanning external fixator in order to help provide clarity to the uncertainty that exists regarding this clinical scenario

Methods

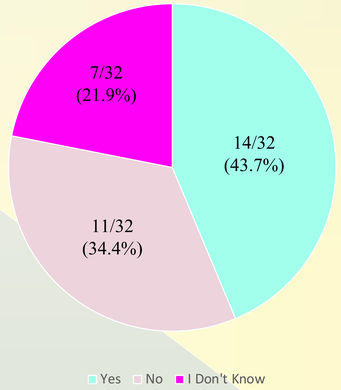
- Institutional review board (IRB) approval was not required for this study, per the Yale School of Medicine IRB guidelines.
- A 27-item survey, consisting of 26 questions and 1 free comment was created
- This survey targeted the institutional use, safety, adverse events, quality, and personal perspectives of the radiologist with regard to the use of knee-spanning external fixators in MRI. Questions were derived from dilemmas discussed in the existing literature and commonly known controversy over the use of external fixators inside the MR bore.
- This survey was approved by the Society of Skeletal Radiology Research Committee and was distributed to 1,739 active members via an e-mail listserv.
- Survey responses were collected anonymously through Qualtrics XM.
- The initial e-mail inviting Society of Skeletal Radiology members to participate in the survey was distributed on March 3, 2023
- A second e-mail reminder was sent to the same listserv of Society of Skeletal Radiology members on March 17, 2023.
- The survey was closed on March 25, 2023.
- There was no direct contact between authors and survey respondents. Additionally, identifiable information of survey respondents was not collected
- Survey respondents were required to answer Question 1 (At your institution, are knee-spanning external fixators permitted to be placed inside the MR bore for imaging of the knee?). If the respondent's answer to Question 1 was "Yes," they were permitted to complete the rest of the survey. If the respondent's answer to Question 1 was "No" or "I don't know," they were instructed to please explain their answer, answer Question 15 (Is a patient who needs an MRI for a non-knee injury (e.g., head, shoulder, etc.) permitted to obtain an MRI if they are in a knee-spanning external fixator? Example: A polytrauma patient.), and refrain from completing the remainder of the survey.

Results

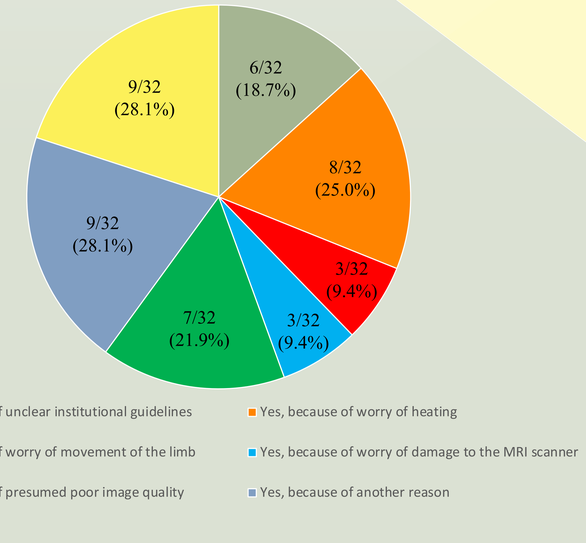
Question 1: At your institution, are knee-spanning external fixators permitted to be placed inside the MR bore for imaging of the knee?



Question 6: Does your institution have clearly written, easily accessible guidelines on how to safely perform an MRI of an externally fixated knee?



Question 17: Have you ever refused to perform an MRI of an externally fixated knee? Select all that apply.



Free Comments

- "We only allow external fixators that were placed in our institution in which we know which external fixator device and parts were utilized. We have encountered a situation where orthopedic surgeons mix and match external device parts from different generations of a device that have different MRI safety conditions"
- "The gain usually outweighs any risks"
- "We scan patients with external fixators all the time without incident, and just use a hand magnet to check for ferrous components. In the past, we have found having the manufacturer device information to be non-reliable because the surgeons would mix-and-match equipment"
- "Our ortho trauma surgeons insist the ex-fix frame they use is completely "MR compatible" in their opinion however they do not understand the complex nuances of MR compatibility and safety of devices. Unfortunately, our radiologists and MR techs are equally poorly informed, and our institution does not have any adequate guidelines regarding MR safety"

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Conclusion

We found a general lack of consensus regarding institutional policies for the decision to scan or not scan a patient in MRI with a knee-spanning external fixator. Additionally, many institutions lack safety guidelines in this context, and providers rely upon a heterogeneous breadth of resources to find answers to safety questions. Pre-test protocols, to include risk-benefit discussions with the ordering provider and the patient, use of a bar magnet, required personnel in attendance, and mental status of the patient, also vary widely. While adverse safety events appear to be rare, they do occur. This, in conjunction with degraded image quality that may be present, may all contribute to inconsistencies in performing this exam. As there is no perfect algorithm to apply to the "MR Conditional" status of these devices, many radiologists are uncomfortable overseeing this study.