10678 - Improved Evaluation Around Oncologic Reconstructions Using a Novel Metal Artifact Reduction MR Imaging Technique

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Background: With improvements in operative techniques, a premium has been placed on surveillance to detect for local recurrence or complications related to complex reconstructions after oncologic limb salvage. Traditional CT and MRI imaging typically exhibit susceptibility artifact, which may obscure areas of concern adjacent to metallic implants. Advancements in MR imaging techniques, particularly metal artifact reduction, may facilitate local oncologic surveillance, as well as the assessment of concerns around metallic reconstructive hardware.

Purpose: The current study assesses the ability for a novel MRI metal artifact reduction technique to evaluate oncologic limb salvage reconstructions with metallic implants.

Materials/Methods: We performed a retrospective analysis of prospectively collected data on ten consecutive patients imaged with a dedicated high-spatial resolution Metal Artifact Reduction Sequence MRI technique for evaluation of bone and soft tissues adjacent to oncologic limb salvage reconstructions. A high degree of metal artifact reduction was realized using a modified Slice Encoding for Metal Artifact Correction (SEMAC) algorithm affording 15-19 encoding steps and acceleration of data acquisition through pseudo-random k-space undersampling and iterative image data reconstruction. Using this approach, the original acquisition time of a pulse sequence reduced by 50-70% and averaged to 5 min. Data collected included age, anatomic location, and oncologic diagnosis. In addition, we evaluated the relative ability to evaluate the clinical concern/question of interest, as compared to other imaging modalities utilized, and whether this changed the oncologic workup or operative plan.

Results: All ten patients had at least radiographs and CT utilized in their workup for the question of interest. Three of these patients had a prior MRI without dedicated MARS protocol, which was unable to fully address the clinical suspicion. All patients had meaningful improvement in the ability to evaluate the area of interest, as compared to other imaging modalities. In 9/10 patients, the accelerated SEMAC MARS MRI was felt to be able to entirely replace CT for the assessment of clinical concerns. Furthermore, for 4/10 cases, accelerated SEMAC MRI demonstrated a finding that was not visualized on CT. The accelerated SEMAC MARS MRI findings altered the preoperative workup or operative plan for 6/10 patients, and was confirmatory of clinical suspicion/alternative imaging for 4/9 patients.

Discussion: This study demonstrates the potential utility of accelerated SEMAC MARS imaging for evaluation adjacent to oncologic reconstructions. The high resolution adjacent to the metallic implants improved our ability to assess for local recurrence, as well as additional reconstructive concerns adjacent to the orthopaedic hardware. These findings will continued to be studied prospectively, but has already begun to change our clinical practice for these complex limb salvage patients.

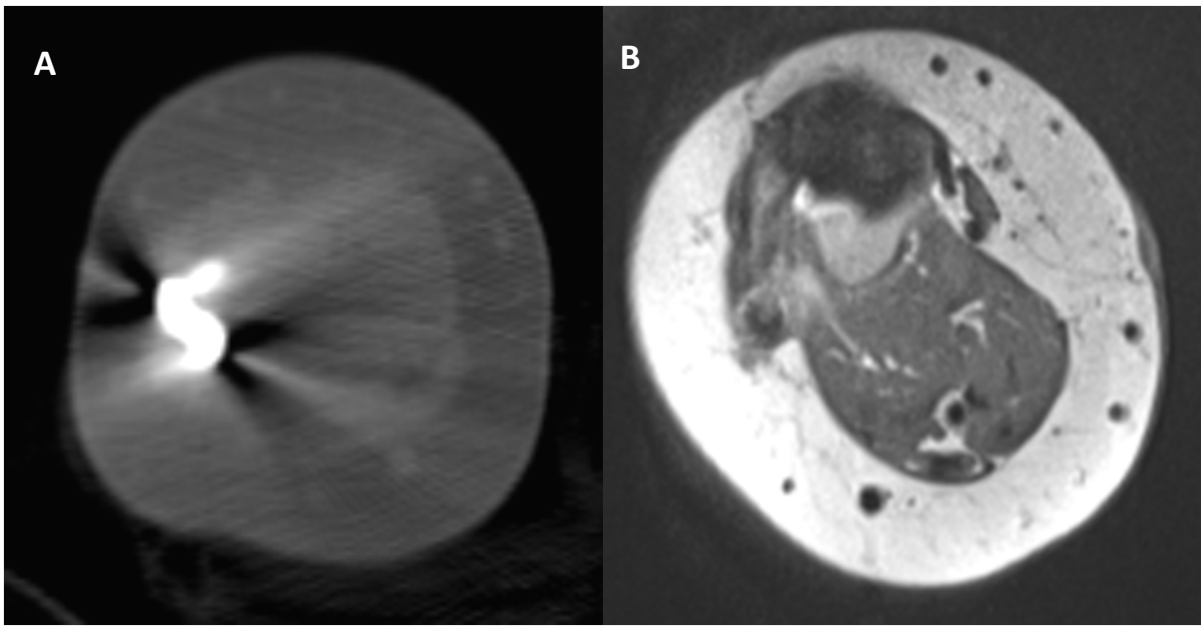

Figure 1: A 17 year-old patient with a history of prior resection and reconstruction for a desmoplastic fibroma. SEMAC MARS imaging (B) allows visualization of a local recurrence of disease that is poorly imaged with CT (A).

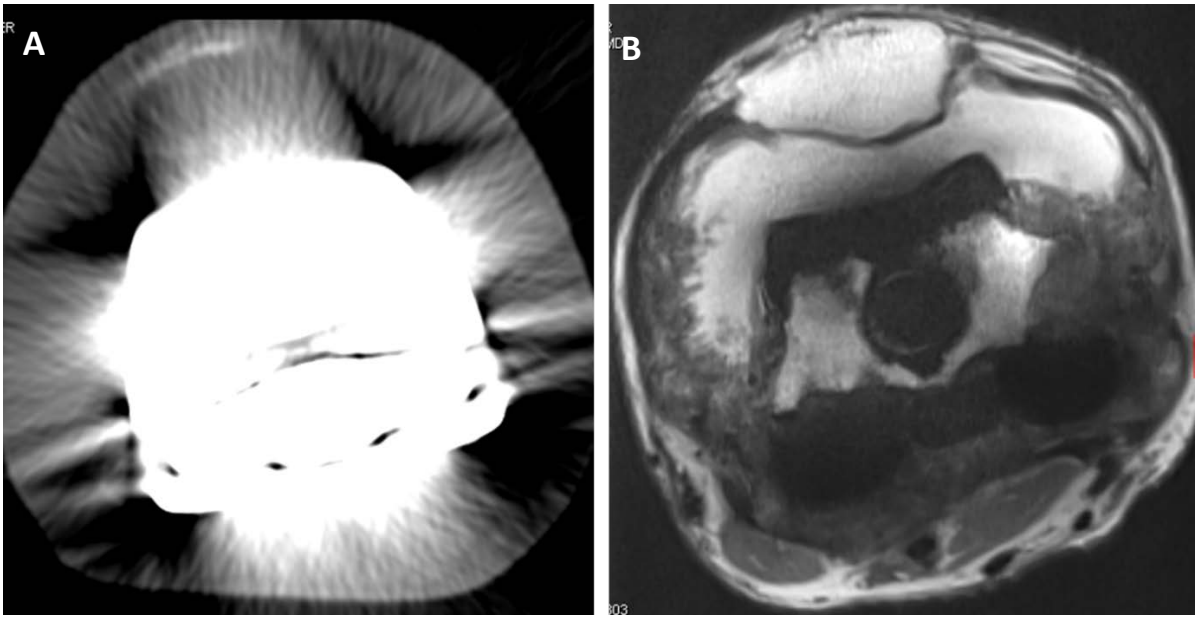

Figure 2: A 34 year-old patient presented 13 years after proximal tibia resection and reconstruction with a proximal tibia replacement, with a large painful effusion and osseous destruction of the distal femur. CT (A) was poorly able to evaluate, though MR imaging (B) was strongly suggestive of synovitis related to wear debris.