

Spectrum of complications demonstrated on MRI in patients who undergo revision total knee arthroplasty

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Purpose

Total knee arthroplasty (TKA) is one of the most common orthopedic procedures, with 719,000 TKA performed in the United States in 2010.¹ Despite technical successes of the procedure, approximately 20% of patients experience pain in the long term following TKA.² The rate of arthroplasty failure requiring revision increases with the number of years an arthroplasty has been placed, with approximately 10% of knee arthroplasties requiring revision at 10 years. Imaging plays an important role in the diagnostic workup of a painful knee arthroplasty. The purpose of this study is to determine the prevalence of the most common complications seen on MRI in patients who subsequently undergo revision knee arthroplasty.

Method

Patient selection: Subjects were retrospectively identified from a database of patients, with IRB approval, who underwent revision TKA at our institution from January 2010 to April 2014. Patients who had an MRI of the knee arthroplasty within 12 months of the revision date were included in the study.

Imaging protocol: All patients were scanned using a standardized departmental protocol on a 1.5T magnet. This consisted of axial, coronal and sagittal fast spin echo (FSE) sequences, optimized for metal artifact reduction, as well as commercially available multiacquisition variable-resonance image combination (MAVRIC) sagittal inversion recovery and FSE sequences.

Analysis: MRI exams were assessed for the absence or presence of the following complications: osteolysis, loosening, periprosthetic fracture, polymeric synovitis, infection, non-specific synovitis, and prominent synovial scarring and arthrobrosis. Osteolysis is indicated by replacement of periprosthetic bone by geographic hyperintense areas, which may contain debris. Loosening is suggested when there is circumferential bone resorption around the prosthesis. Polymeric synovitis is characterized by a low to intermediate signal intensity thick particulate-appearing synovitis with varying amounts of fluid. Infection appears as a hyperintense lamellated synovitis, with prominent periprosthetic soft tissue edema.³

Results

From the database of 504 patients who underwent revision total knee arthroplasty from 2010-2014, 113 patients had MRI within 12 months of revision arthroplasty date. The spectrum of complications identified on MRI included the following: polymeric synovitis in 37 (32%), osteolysis in 31 (27%), loosening in 25 (22%), non-specific synovitis in 23 (20%), arthrobrosis and prominent synovial scarring in 15 (13%), infection in 19 (17%) of patients, and periprosthetic fracture in 1 (1%) patient. Of the 37 patients who had polymeric synovitis, 22 patients also demonstrated osteolysis and 6 demonstrated MRI features suggestive of loosening.

Discussion

Our results were comparable to an analysis of worldwide registries of TKA which demonstrated the main cause for revision total knee arthroplasty to be the following: aseptic loosening (29.8%), septic loosening (14.8%), pain without other cause (9.5%), wear (8.2%), instability (6.2%), implant breakage (4.7%), and technical failure (4.6%).⁴ These percentages are expected to differ from our MRI findings, as some complications including instability and implant breakage can be diagnosed clinically or through other imaging modalities including radiographs and may not require MRI evaluation. MRI findings may also overlap as patients may have multiple complications visible on MRI. Patients with severe polyethylene wear often present with MRI features of osteolysis and loosening in addition to polymeric synovitis.

Conclusion

MRI is useful in evaluating the painful total knee arthroplasty and identifying complications in patients who subsequently require revision total knee arthroplasty.

References

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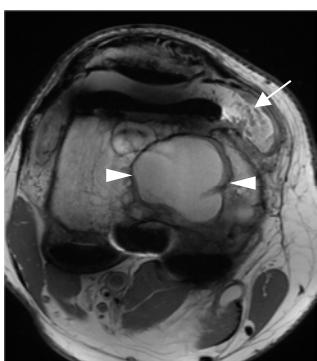


Figure 1. Axial FSE MR image in a patient with polyethylene wear demonstrates thick polymeric synovitis with particulate debris (arrow). A large area of osteolysis is seen in the distal femur (arrowhead).



Figure 2. Sagittal FSE MAVRIC image in a patient with loosening of the TKA. There is extensive bone resorption (white arrowheads) around the tibial component with loosening. The tibial component (white arrow) is displaced anteriorly relative to the posterior tibial cortex (black arrowhead).

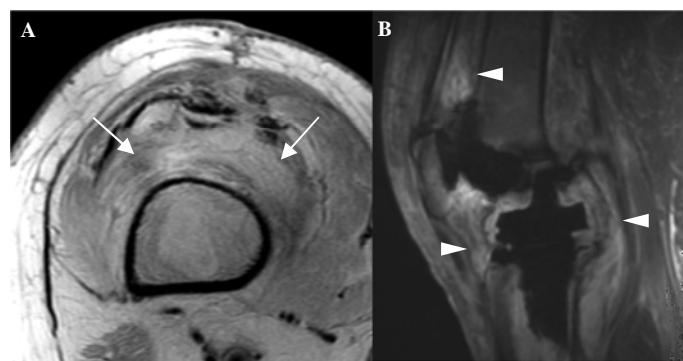


Figure 3. Axial FSE image in a patient with an infected TKA. There is a thick, lamellated synovium (white arrows). Sagittal inversion recovery MAVRIC image demonstrates extensive surrounding soft tissue edema (white arrowheads).