Clinical Effectiveness of MRI in Diagnosis of Infection in Patients With Total Knee Arthroplasties

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Synopsis

In this study we sought to determine the accuracy and clinical effectiveness of diagnosing post operative infection in total knee arthroplasties using MRI and simple artifact reduction sequences. The study entailed the retrospective evaluation of 18 total knee arthroplasties. We correlated the MRI readings of two blinded radiologists with the clinically determined infectious status. We found that those patients with confirmed infection displayed signs consistent with infection, while those who were pathology free showed normal exams. We conclude that MR imaging of total knee arthroplasties can yield accurate and clinically relevant diagnoses with straightforward sequence modifications.

Introduction

Total knee arthroplasty is a relatively common procedure performed in the United States. Complications after surgery include such entities as infection, foreign body granulamatosis, and aseptic loosening. The main diagnostic modality for these post operative complications has been plain radiography. However, signs demonstrated on plain radiographs are usually non-specific, and in the case of infection are often not evident until late. While magnetic resonance imaging is effective in the pre-operative assessment of the joint, metal artifact, which degrades the diagnostic quality of the image, has limited its use in patients with orthopedic implants. There have been several descriptions in the literature of modification techniques to reduce metal artifact and increase the quality of images involving metallic implants. Despite this, to our knowledge, no clinical study to date has focused on the effectiveness and clinical relevance of MRI in detecting infectious complications after total knee arthroplasty. In this study, we performed a retrospective investigation aimed at determining the accuracy of MRI in diagnosing post-operative complications in patients with total knee arthroplasties.

Materials and Methods

58 total knee arthroplasties were evaluated retrospectively at our institution. All patients were studied at 1.5 Tesla with artifact reduction sequences (fast spin echo, maximum bandwidth, avoidance of GRE and fat suppression, use of STIR), with contrast enhancement. The patients without documentation of infectious status (40) were discarded. Infectious status inclusion criteria included microbiological and pathology reports, operative reports, and clinical discharge diagnoses. 8 knees were found to be infected clinically and 10 were found to be infection free. The MRI images of the 18 knees were then reviewed by two radiologists who were blinded to the radiographic findings and clinical symptoms. The images were assessed for the presence of joint effusion, synovial enhancement, synovial outpouching, adventitial bursitis, soft tissue collections, T1 and T2 marrow edema patterns, and marrow enhancement. Lastly extent of soft tissue and osseous infection were correlated with the operative findings.

Results

Six of the 8 infected knees had confirmed deep infections. Five of these six patients had abnormal, edematous, and enhancing marrow. Three had joint effusions with synovial enhancement, 2 had synovial outpouching with soft tissue fluid collections (1cm, 4cm). The one remaining patient with a documented deep infection displayed *normal* marrow on T1 and T2, but a marked joint effusion with synovial out pouching and a 2cm posterior soft tissue collection. Of note, this patient had received a 6 week course of IV amoxicillin and gentamycin prior to MR imaging.

Two knees were diagnosed with superficial infections from their both their medical records and operative findings. Both of these knees had normal appearing marrow on T1 and T2 without enhancement. Both had joint effusions with synovial enhancement. One demonstrated synovial out pouching and a 4cm lateral soft tissue collection.

Ten knees were not infected. Five of these demonstrated essentially normal exams. Four of the ten knees displayed abnormal marrow patterns on T1 and T2 with enhancement. Of these four, 3 displayed joint effusions with synovial enhancement, one had synovial outpouching, two showed evidence of soft tissue collections (4cm, 6cm), and one demonstrated periosteal reaction. Two of these four knees were given the surgical diagnosis of aseptic loosening. One other patient showed normal marrow on T1 and T2 without enhancement, but demonstrated a joint effusion with synovial enhancement and out pouching and was given the surgical diagnosis of aseptic loosening.

Discussion

Given our results, we conclude that MRI of total knee arthroplasties can yield diagnostic quality images with simple artifact reduction sequences. Despite metallic susceptibility artifact, signs consistent with septic arthritis and periprosthetic infection were reliably demonstrated for those patients with pathology and absent for those without. In addition to providing accurate diagnoses, MRI was able to delineate the extent of disease and differentiate superficial from deep infection. However, aseptic loosening may appear similar to infected arthroplasties.
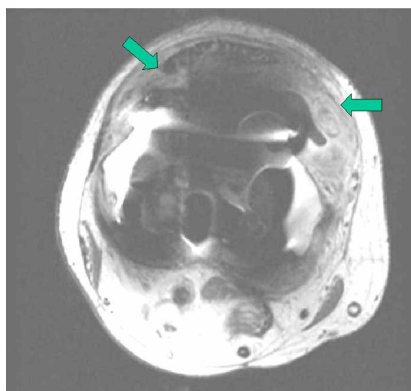

Figure 1. Noted on this transverse image is a supra patellar effusion with synovial enhancement in a patient diagnosed with aseptic loosening.

Figure 2. A sagittal STIR image using artifact reduction techniques, demonstrates marrow edema within the patella, straight arrows, and a supra patellar effusion, curved arrow, in a patient with a proven infected prosthesis.
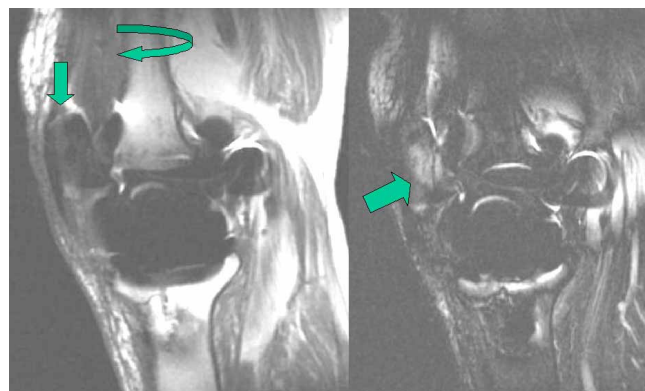

Fig. 1   Fig. 2

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