



Original Research Article

MRI versus clinical examination for the diagnosis of meniscal and ligamentous injuries of knee

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Abstract

Objective: The purpose of this study was to correlate clinical and MRI findings in diagnosing ligament and meniscus tears in knee joint injuries.

Material and methods: 30 cases with history of rotational injury having knee pain and recurrent swelling were subjected to study. The age range of 11-60 years who were referred to Radiology Department for MRI of knee joint following injury to the knee was included. Prior to MRI, a detailed history, clinical, and local examination was done in all the subjects. MRI was carried out on 1.5 Tesla MR Machine and the standard protocol consisted of fat-suppressed PD (TE 45, TR 2800) in axial, sagittal, and coronal planes, T2W (TE 80, TR 4000) in sagittal plane and T1W (TE 11, TR 495) in sagittal plane.

Results: MRI had 100% sensitivity and negative predictive value (NPV) of diagnosing ACL tears in this study. Clinical examination had sensitivity of 88% and NPV 75% in diagnosing ACL injuries as compared to arthroscopy. There was high NPV of MR examination (96%) in diagnosing meniscus tear while the PPV of MR examination was low (71%) as compared to arthroscopy. These values were low in case of clinical examination.

Conclusion: Magnetic resonance imaging is useful as a pre operative diagnostic tool in selected cases where a clinical examination cannot be performed as in acute injuries or in cases where clinical examination is inconclusive. The efficacy of MRI in diagnosing a tear varies among different intra articular structures. MRI has a high accuracy in diagnosing a tear of PCL. Sensitivity for medial meniscal tear is higher as compared to lateral meniscus and high for PCL as compared to ACL. MRI has a high positive predictive value for ACL, but has a low negative predictive value. For PCL tears, MRI has a high negative predictive value which indicates that with a negative result for PCL on MRI, a diagnostic arthroscopy can be avoided.

Key words

MRI, Clinical examination, Knee injuries, Meniscal injuries, Ligamentous injuries.

Introduction

Approximately 28% of patients present in orthopedic outdoor patient department (OPD) with complaints of knee pain [1]. The cause ranges from trauma, degenerative joint conditions, infections, inflammatory conditions, and congenital lesions [2]. In the diagnosis of the lesion in the knee, the surgeon has to obtain a thorough clinical history, examine the patient, and do investigations as may be required.

Knee injuries represent roughly 6% of all acute injuries treated at emergency department and between 27% and 48% of these have been reported to be sports related [3].

The commonly missed diagnoses in the knee are osteochondral fractures, partial anterior cruciate ligament (ACL) tears, and loose bodies [4].

Failure to recognize these has both medical and socioeconomic complications. The common medical complications include an unstable knee, chronic knee pain, and post traumatic arthritis [5, 6].

The socioeconomic complications include loss of working hours during the treatment, high cost of medical care for procedures such as total knee arthroplasties and a perception of general poor health [7].

Moreover the ligaments of knee are divided into intra-articular and extra-articular; consequently MRI plays a most important role in their evaluation. This division is important as the extra-articular ligaments are not visible on routine arthroscopic procedures [8].

Material and methods

The ethics committee of our institute approved this prospective study. Informed consent was taken from all patients undergoing this study. We prospectively studied 30 patients in the age range of 11-60 years over a period of 14 months starting from January 2014. All patients of knee injury who underwent MR imaging were included in the study. Patients excluded from the study were those

- With contraindications to MR.
- Prior arthroscopy or surgical intervention.
- Known joint disease like neoplasm, inflammatory or infectious disorder.
- History of old significant trauma to the currently injure.

Findings of specific local examination of injured knee were recorded in detail and a clinical diagnosis was established in all the cases. Screening X-rays were documented for evidence of bony injury. MR examination was done on all the patients and findings were documented.

Initial clinical evaluation included general physical examination, palpation for patellar crepitus, patellar mal tracking and specific tests for intra-articular lesions – McMurry's test. Appley's grinding test, Squat test, and drawer tests.

The results of MRI were compared with clinical examination.

MRI technique

MR scan in all the patients included in this study was carried out on MAGNETOM Avanto 18 Channel 1.5 Tesla MR Machine by Siemens India Ltd. Patient was positioned supine and feet-first



in the MR imager, with the knee to be imaged in approximately 100-150 degree external rotation to aid the imaging of the ACL in the sagittal plane. Studies were performed with a 5 1/2-inch flat surface coil placed posterior to the knee of interest. The knee to be imaged was centered within the 16-cm field of view, including in the image both the suprapatellar bursa and the insertion of the patellar ligament on the tibial tubercle.

MRI protocol

Localizer was taken in axial, sagittal, and coronal planes after patient in proper position. The MRI protocol consisted of fat-suppressed PD (TE 45, TR 2800) in axial, sagittal, and coronal planes, T2W (TE 80, TR 4000) in sagittal plane and T1W (TE 11, TR 495) in sagittal plane. A 170-mm field of view and a 256 × 192 matrix with one signal average was used. The slice thickness was 4 mm. The images interpreted by two qualified radiologists individually that had experience of about 10 years in this field. All clinical and MR Imaging findings were recorded. All the patients underwent clinical examination by a qualified and experienced orthopedic surgeon. Subsequently analysis for comparison between clinical, MRI findings was undertaken.

All patients underwent diagnostics arthroscopy and the results were compared to the clinical impression and the MRI reports of the patients.

Results

MRI had 100% sensitivity and negative predictive value (NPV) of diagnosing ACL tears in this study. Clinical examination had sensitivity of 88% and NPV 75% in diagnosing ACL injuries as compared to arthroscopy. There was high NPV of MR examination (96%) in diagnosing meniscus tear while the PPV of MR examination was low (71%) as compared to arthroscopy. These values were low in case of clinical examination.

Discussion

Currently MRI is gaining popularity as a diagnostic tool in knee injuries due to increasing sports injuries, and road traffic accidents.

The single most common indication of performing a knee MRI is to diagnose internal derangements in an injured knee.

Clinical examination may be difficult in acute injury and is inconclusive in cases with injuries of multiple ligaments/menisci.

In our study, in case of meniscus tears, MR had sensitivity of 91% and NPV of 96%. These values were low in case of clinical examination, 66% and 86%, respectively. There was not much difference in specificity and positive predictive value (PPV) of MR and clinical examination in case of meniscus tears.

Sensitivity and NPV of MR examination were very high in diagnosing ACL tears. MR had 100% sensitivity and NPV of diagnosing ACL tears in this study. Clinical examination had sensitivity of 88% and NPV of 75% in diagnosing ACL injuries. Specificity and PPV were relatively low for MR as compared to clinical examination in diagnosing ACL tears. MR had specificity of 50% and PPV of 89% while clinical examination had specificity and PPV of 100%.

Diagnostic accuracy was 90% in diagnosing ACL tears for both clinical and MR examination while MR had marginally higher diagnostic accuracy in case of meniscus tears.

The criterion to diagnose meniscus tear was hyper intense signal extending to the articular surface (Grade III signal) on PD and STIR seq.

Other findings in our study were a full-thickness longitudinal tear leading to the development of bucket handle tear. In a bucket handle tear, the



inner fragment becomes displaced either centrally giving “fragment in notch” sign or “double PCL” sign or anteriorly giving “large anterior horn” or “Flipped Fragment” sign, Partial tear of PCL leading to its buckling, Complete tear of ACL seen as disruption of fibers with hyper intense signal.

Magnetic resonance imaging is useful as a diagnostic tool in internal derangements of the knee. It is useful in circumstances where there is a need for detailed differential diagnosis. It is also an important diagnostic tool in cases of acute and painful knees, where clinical examination is difficult to perform.

Rubin, et al. [9] reported 93% sensitivity for diagnosing isolated ACL tears. Similarly several prospective studies have shown a sensitivity of 92 – 100% and a specificity of 93 – 100% for the MR Imaging diagnosis of ACL tears [10, 11, 12].

The sensitivity for diagnosing isolated medial meniscal tears in Rubin's series was 98% and it decreased when other structures were also injured. The specificity in isolated lesion was 90%. In a multi centric analysis, Fisher [12] reported an accuracy of 78-97% for the anterior cruciate ligament and 64-95% for medial meniscal tears.

Barronian et al. [13] in their study of 22 patients showed results similar to ours. They calculated PPV and NPV of MR examination and concluded that the NPV was 92% for cruciate ligaments, whereas the PPV was 50%. (i.e., a negative MRI was more accurate). The high NPV is important and indicates that a negative MRI is quite reliable for cruciate ligaments.

The accuracy of the clinical diagnosis of meniscus tears is about 75-80% compared with 88-90% for MRI [14].

A further improvement in the techniques and increasing experience in interpretation of the images is likely to reduce the false positive and false negative results in future.

Magnetic resonance imaging also helps the surgeon to plan the definitive management of a tear during the same session.

Conclusion

Magnetic resonance imaging is useful as a pre operative diagnostic tool in selected cases where a clinical examination cannot be performed as in acute injuries or in cases where clinical examination is inconclusive. The efficacy of MRI in diagnosing a tear varies among different intra articular structures. MRI has a high accuracy in diagnosing a tear of PCL. Sensitivity for medial meniscal tear is higher as compared to lateral meniscus and high for PCL as compared to ACL. MRI has a high positive predictive value for ACL, but has a low negative predictive value. For PCL tears, MRI has a high negative predictive value which indicates that with a negative result for PCL on MRI, a diagnostic arthroscopy can be avoided.

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