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MRI and Clinical Correlation of Ligamentous and Meniscal Injuries of Knee Joint

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Abstract: ***Introduction: Internal derangement of knee joint constitutes a major source of morbidity in Orthopedic outpatients department of our hospital. MRI would be a noninvasive non operator dependent effective modality for early detection of these pathologies and has very high negative predictive value. The purpose of this study was to evaluate the usefulness of MRI in early and precise diagnosis of ligamentous and meniscal injuries of knee. Methodology: Sixty patients with clinically suspected ligamentous and meniscal injuries of knee were included in this prospective study. They were evaluated with detailed clinical history and clinical examinations and were subsequently subjected to imaging of knee. Results: MR examination is a non-invasive and precise diagnostic technique to evaluate ligamentous and other soft tissue structures around the knee. Appropriate sequences and analysis of images in all three planes increases the diagnostic yield. Most of the injuries to ligaments and menisci can be diagnosed with increased level of confidence. Conclusion: MR examination is a non-invasive and precise diagnostic technique to evaluate ligamentous and other soft tissue structures around the knee. Appropriate sequences and analysis of images in all three planes increases the diagnostic yield. Most of the injuries to ligaments and menisci can be diagnosed with increased level of confidence. Currently, MR imaging has evolved as the most commonly performed radiologic test in the assessment of intra-articular knee abnormalities especially intraumatic settings. Post-traumatic pre-arthroscopic MR imaging evaluation has proved to be cost-effective. MR imaging when done in conjunction with clinical examination would thus be the best pre-arthroscopic diagnostic modality. It has replaced unnecessary diagnostic arthroscopy and complements therapeutic arthroscopy***

Keywords: MRI, Meniscal Injuries Of Knee Joint, Diagnostic Arthroscopy

1. Introduction

Knee being one of the major joints involved in kinesis, also bears the consequences of increased mobility. The price of its mobility is a tendency to instability. With increasing involvement in sports related activities especially in young people, trauma related knee pathologies have increased.[1]

MRI has emerged as an excellent modality for imaging of ligaments, cartilage, menisci and other structures around the knee joint. This is due to the combination of multilane capability and superior soft tissue characterization. This modality has superseded already available modalities like radiograph and CT, over last two decades. It is a noninvasive diagnostic modality that lacks the radiation issues associated with radiograph and CT and is non-operator dependent unlike ultrasound.

2. Objectives

1) To identify the various MRI imaging findings in clinically suspected cases of internal derangement of knee.
2) To correlate imaging findings with clinical examination findings.

3. Methodology

Study was conducted in Civil hospital surat in the department of radiodiagnosis as patient was referred from orthopedic department. Sample size for the study was 60 patients. It was a prospective study.

Inclusion criteria:
1) Age group: 18-60 years.
2) Both male and female patients
3) Patients with clinically suspected meniscal and ligamentous injuries of the knee presenting with complaints of pain, swelling, difficulty in walking and stiffness of joints.
4) Patient in home clinically data was available for correlation.

Exclusion Criteria:
1) Patients with known pre existing knee joint pathologies were excluded.
2) Any absolute contraindication for MRI (Metal implant, Pacemakers)

Patients with clinically suspected meniscal and ligamentous injuries of the knee presenting with complaints of pain, swelling, difficulty in walking and stiffness of joints within the age group of 18-60 years were included in this prospective study. They were evaluated with detailed clinical history and clinical examinations and were subsequently subjected to imaging of knee using 1.5 T MRI 8 channel GE Brivo MRI machine[2]. Sequences usedwere axial, sagittal and coronal PD Fat Sat; sagittal, axial and coronal T2 FSE and sagittal T1 FSE. Patients with known preexisting knee joint pathologies are excluded.

4. Results

ACL tears were imaged in total of 35 cases. Complete tear of ACL was detected in 23 cases and partial tear in 12.

Associated LCL tears were identified in 16 cases (45%) and MCL tears in 12 cases (35%). ACL tears were associated with tear of posterior cruciate ligament in 4 cases. All of these had history of significant trauma. PCL tear was found in 6 cases. Complete tear was found in 4 and partial tear in 2 cases. Associated ACL tear was found in 5 cases (80%). MCL injury was found in 3 and LCL injuries in 3.Bone contusions were seen in 5 cases (80%) and involved lateral aspect of tibia in all cases. Joint effusion was present in all the case of PCL tear. Posterior drawer test was positive in all the case of complete tear and was not demonstrated in 2 cases of partial tears.

Type of ligament tear	Frequency	Percentage
ACL	35	80%
PCL	6	80%
MCL	19	35%
LCL	17	45%

Distribution of Ligamentous Tears around Knee Joint

60 incidents of meniscal tears were noted with medial meniscus tear noted in 37 and lateral meniscus in 23.Of the total cases with meniscal tears, 20 (47%) were isolated medial meniscal, 6 (14%) were isolated lateral meniscal and 17 (39%) involved both menisci.

Meniscal injury	Frequency	Percentage
Isolated Medial Mensiscus	20	47
Isolated Lateral Mensiscus	6	14
Both Mensicus	17	39

Figure: Distribution of tears in medial meniscus, lateral meniscus and both menisci

In Medial Meniscus, Posterior horn was involved in 24 (65%) and the predominant type of tear in posterior horn was oblique tear that occurred in 13 (50%).Also the commonest type of tear involving anterior horn was also oblique tear. The commonest type of tear to involve the whole of meniscus was bucket handle tear. Grade III tear were the commonest seen in 16 cases (42%) followed by Grade II in 29%.

In lateral meniscus, also posterior horn was commonest site of involvement, occurring in 12 (53%). Predominant type of tear was radial and was seen in 5 (21%).

Two cases of meniscocapsular separation were seen and involved posterior horn of lateral meniscus. Horizontal tears involved the anterior horn more than posterior horn.Grade III tears were common in both medial and lateral menisci followed by Grade II tears. 44% of meniscal tear were of Grade III and 30% were Grade II. Least common grades of tear were Grade IV tear in medial meniscus and Grade I tear in lateral meniscus.

	Grade	Frequency	Percentage
Medial meniscus	1	6	45
Lateral meniscus	1	2	16
Medial meniscus	2	11	29
Lateral meniscus	2	6	30
Medial meniscus	3	16	42
Lateral meniscus	3	9	53
Medial meniscus	4	4	12
Lateral meniscus	4	5	21

Figure: Medial and lateral meniscal injuries

In our study, there was an association found between ACL and medial meniscal injuries. Out of 35 ACL tears, 20 had associated medial meniscus injury. (57 %)

5. Discussion

This study included 60 patients who were clinically suspected as having some form of ligamentous and meniscal injuries of knee joint. The subjects of this study belonged to the age range of 18 to 60 years with mean age of 33.8 years. 74% of subjects of this study were male and male outnumbered females in all age groups of this study.73% of males and 61.5% of female belonged to acute traumatic group. In this study ligamentous injury was seen in 72%. Of them 58% had ACL injury[3], 10% had PCL injury, 32% had MCL injury and 28% had LCL injuries.

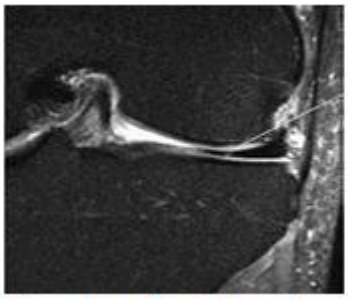
Of the 35 cases of ACL tears, 66% was complete tear and 88% of them involved the mid substance. 86% of cases with Positive Lachman's test had complete ACL tears on MR. Inonly 14% of cases, ACL tear were not suspected clinically on Lachman's test but was detected on MR. These were all cases of partial disruption of a bundle of Bone bruise[4] was found in 80% of PCL tears and predominantly involved the anterior and lateral tibial surface. Posterior drawer test was positive in all the case of complete tear and was not demonstrated in 2 cases of partial tears. Knee effusion was found in all cases of PCL tears.

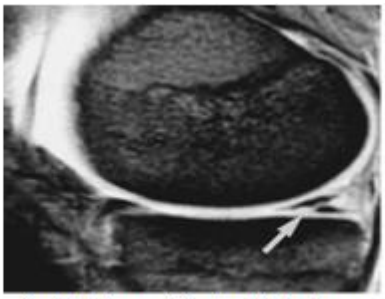
32% of ligamentous injuries involved the MCL. Grade I tear was found in 12(65%), Grade II tear in 2(12%) and Grade III tear in 4(23.5%). Concomitant ACL tear was found in 59% of cases. Lateral compartment injuries are less common than medial compartment injuries. LCL injuries were found in 28% of cases in our study. Associated tear of capsule was found in 1 case and popliteus myotendinous[5] injury in 2 cases. Varus and valgus stress tests were used to test for

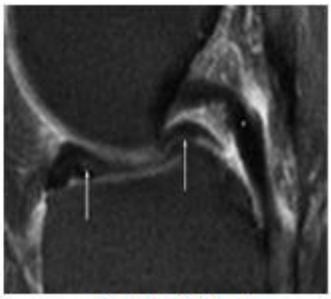
LCL and MCL respectively. Valgus stress test was positive in 75% of cases with MCL injury and varus stress test was present in 100% of cases with LCL injury. Various types of medial meniscal tears detected in this study were – horizontal tear (26%), oblique tear (42%), bucket handle (9.5%), radial tear (3%) and complex tears (19%).All the 3 cases of bucket handle tear of medial meniscus showed double PCL sign, where the displaced fragment was seen as a hypointense structure parallel to PCL onall sequences. MR has a sensitivity of 27% to 44% and a specificity of 98% to 100%in detecting bucket-handle tears. Lateral meniscal tears also commonly occurred in posterior horn (53%), as in medial meniscus. But anterior horn of lateral meniscus was more commonly torn (37%)than that of medial meniscus. Various types of lateral meniscal tears detected in this study were oblique tears (16%), horizontal tears (16%), radial tear (21%), bucket handle tear (10.5%), vertical tear (10.5%), meniscocapsular[6] separation (10.5%) and complex tear (16%). Grade I tear was found in 5%, Grade II in 31.5%, Grade III in 47% and Grade IV in (16%).

In both medial and lateral menisci Grade III tear were most common type of tear. Superior menisco-popliteal fascicle was assessed in cases of lateral meniscalinjuries. Disruption of superior menisco-popliteal fascicle was noted in 82% of lateral meniscal tear and in 18% without lateral meniscal injury. Root tear was found in 1 case of medial meniscal tear. In our study 17% of radial tears occurred in medial meniscus and 83% in lateral meniscus. In this study, 60% of Bucket handle[7] tears involved medial meniscus and 40%the lateral meniscus McMurray test was positive in 68% of medial meniscal tear and 79% of lateral meniscal tear.

O'Donoghue's triad[8] (combination of ACL, MCL and medial meniscus tear) was seen in 9 cases.


Oblique tear of medial meniscus


Radial Tear of Lateral Meniscus


Double PCL sign

Meniscal cysts were seen in 3 cases. 2 were associated with horizontal tear of medial meniscus and 1 was associated with complex lateral meniscal tear. In our study, double PCL sign was seen in 3 cases and fragment in notch was seen in 2 cases. Flipped meniscus sign was not seen. The double PCL[9] sign is a highly specific indicator of a bucket handle tear, with a specificity range of 98%–100% and a positive predictive value of93%.

6. Conclusion

MR examination is a non-invasive and precise diagnostic technique to evaluate ligamentous and other soft tissue structures around the knee. Appropriate sequences and analysis of images in all three planes increases the diagnostic yield. Most of the injuries to ligaments and menisci can be diagnosed with increased level of confidence. Currently, MR imaging has evolved as the most commonly performed radiologic test in the assessment of intra-articular knee abnormalities especially intraumatic settings. Post-traumatic pre-arthroscopic MR imaging evaluation has proved to be cost-effective. MR imaging when done in conjunction with clinical examination would thus be the best pre-arthroscopic diagnostic modality. It has replaced unnecessary diagnostic arthroscopy and complements therapeutic arthroscopy

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