

Study of internal derangements of knee joint using MRI

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Abstract

Background: To study internal derangements in traumatic and degenerative knee. **Materials and Methods:** One hundred patients with knee complains referred from orthopaedic department after clinical examination, suspected to have meniscal, ligamentous and intra-articular pathologies were studied using GE Signa 1.5 T MR machine. Images were obtained in sagittal, axial and coronal planes using T1, T2 and PD sequences. Slice thickness of 4mm, FOV of 19 x 19 and NEX of 4 were used. **Results:** Anterior cruciate ligament (ACL) tears accounted for the major cases (63%) followed by Medial meniscal tears (57%), lateral meniscal tear (36%), PCL tears (15%), MCL tears (10%) and least common LCL tears (7%). Hyperintensity, discontinuity and non-visualisation were primary signs of ACL tear. Meniscal tears seen commonly are grade II in both medial and lateral meniscus. **Conclusion:** Because of its better soft tissue delineation, non-invasiveness and radiation free imaging, MRI is the best investigation for the assessment of ligamentous, meniscal and intra-articular knee pathologies. It provides an accurate preoperative anatomic assessment, thus aids clinical examination and arthroscopy. **Key Words:** MR Imaging Knee, meniscal tears, cruciate ligament

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INTRODUCTION

The 'knee joint', also known as the tibio-femoral joint, is the largest and complex joint of the body, which is one of the most frequently injured joint as the bony articular surface alone are inherently unstable. The stability of the joint is highly dependent on its supporting ligamentous structures and the injuries of ligaments and menisci are extremely common. Injury to the knee joint is the significant cause of morbidity in both young and old individuals.¹ To evaluate pathologic conditions of the knee, multiple imaging modalities are used including

conventional radiography, fluoroscopy, ultrasonography, nuclear medicine and Magnetic Resonance Imaging (MRI)². MRI heralds a new age in the management of internal knee disorders. It has now established itself as fast and non-invasive imaging alternative complementing physical examination in the evaluation of injuries of the knee.³ MRI because of its much better soft tissue contrast remains the main imaging modality of excellence for accurately depicting abnormalities of articular cartilage and soft tissue injuries of tendons, ligaments, and the menisci. Injuries to menisci and ligaments detected with MRI can also aid orthopaedic surgeon in surgical planning leading to decreased procedural time. MRI is an excellent non-invasive modality in imaging of the knee and is useful in conditions like detection of peripheral meniscal tears, inferior surface tears, osteochondritis without apparent damage to cartilage. Increased soft tissue contrast coupled with multiplanar slice capability has made magnetic resonance imaging ideal modality for imaging complex anatomy^{4,5}. MRI has made it possible to look into the injured knee non-invasively, thereby avoiding invasive procedures and further morbidity.⁶ Another advanced modality in the management of internal derangement of

the knee joint is arthroscopy, which can be used in its dual mode, either as diagnostic or as a therapeutic tool. Arthroscopy, though accurate, is invasive and can cause complications.^{7,8} This cross-sectional study was undertaken to study the internal derangements in traumatic as well as degenerative etiologies of knee and to evaluate the types and incidence of pathologies of knee joint by MRI.

MATERIALS AND METHODS

100 patients, 74 males and 26 females, aged 14-72, mean age 36.7 years, were examined with 1.5T MRI with suspected internal derangements of knee joint referred by orthopaedic department. Each patient was introduced into the study in detail, and an informed consent was obtained. In each patient, meniscal pathology, collateral and cruciate ligament tear were analysed. The patient was placed in supine position on the MRI table and dedicated knee coil was applied. The knee was kept in the coil in extension, 10-15 degree externally (in order to facilitate the visualization of ACL completely on sagittal images). The knee is flexed slightly 5-10 degree, to increase the accuracy of assessing the patellofemoral compartment and patellar alignment. The sequences used were PDFS sequences in axial, sagittal and coronal planes, T2- W in the sagittal plane, T1- W in the coronal plane with 4mm thin sections. Data was subjected to statistical analysis using Statistical package for social sciences. Descriptive statistics like frequencies and percentage for categorical data, Mean and SD for numerical data has been depicted. For all the statistical tests, $p < 0.05$ was considered to be statistically significant, keeping α error at 5% and β error at 20%, thus giving a power to the study as 80%.

RESULTS

In this study, the mean age of the study patient population was 36.7 ± 13.6 years. 68% of the patients had road traffic accidents which was the most common mode of injury, 14% had degenerative injury and 6% patients had sports injury. Of all the pathologies, 83 % of the patients had joint effusion, which is the most common MRI finding. 63% of patients had ACL tear and 57% patients had MM tear. ACL was more commonly injured than PCL. Medial meniscus was more commonly injured than Lateral Meniscus. MCL was more commonly affected than LCL. Among ACL tears, 47.62% were complete ACL tear, 41.27% were partial tear and 11.11% were ACL avulsion fracture. 42.86% were mid-substance ACL tear which was commonest of all, 33.33% were tibial side ACL tear and 23.81% were femoral side of ACL tear. Among 63 patients with ACL tear, associated medial meniscus injury was seen in 46% of patients. Among PCL tears, 46.67% were complete PCL tear and 20% were partial PCL tear. 46.67% were tibial side PCL tear, 33.33% had mid-substance PCL tear and 20% were femoral side of PCL tear. Among medial meniscus tears, 56.14 % were grade II tear, which was the most common, 38.6% were grade III tear and 5.26% were grade I tear. 87% of patients had posterior horn tear of MM which was the commonest site. 61.4 % were horizontal tear of MM, 31.6% were vertical tears and 7% were complex tears. Among lateral meniscus tear, 63.9% were grade II tear and 27.8% were grade III tear. 63% of patients had anterior horn tear of LM which was the commonest site. 72.2% were horizontal tear of LM, 19.4% were vertical tears and 8.4% were complex tears. Among 10 patients with MCL tear, 40% had Grade I tear and 30% patients had grade II and grade III tear each. Among 7 patients having LCL tear, 42.8% patients had Grade I tear and 28.6 % had grade II and grade III tear each.

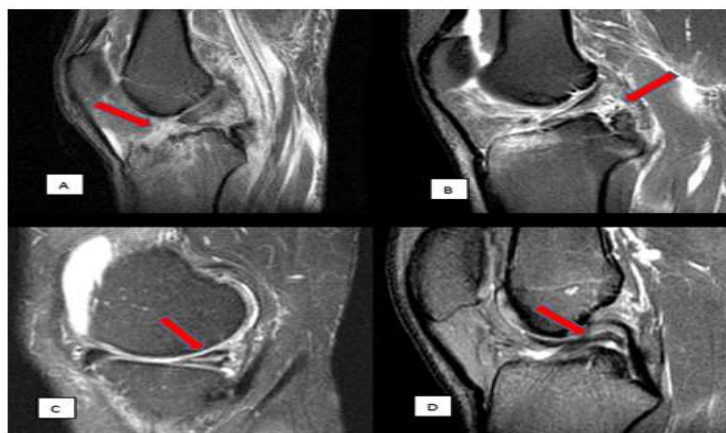


Figure1: A- diffuse PD hyperintense signal within ACL with complete discontinuity of fibers near tibial attachment (complete ACL tear); B- diffuse hyperintense signals in PCL with complete discontinuity of fibres in midpart (complete PCL tear); C- horizontal tear of posterior horn of the medial meniscus.; D- displaced meniscal fragment of medial meniscus below and in front of the PCL, giving double PCL sign.



Figure 2: E- partial discontinuity of MCL fibres at femoral attachment (grade II MCL tear); F- Complete discontinuity of fibers of LCL in its midpart (grade III LCL tear)

TABLE 1: SPECTRUM OF MRI FINDINGS IN KNEE INJURIES

MRI Findings	Number of patients	Percentage
ACL injury	63	63%
PCL injury	15	15%
MCL injury	10	10%
LCL injury	7	7%
MM injury	57	57%
LM injury	36	36%

TABLE 2: DISTRIBUTION OF ACL AND PCL TEARS ACCORDING TO TYPE AND SITE OF TEARS

Type of tear	ACL TEAR	PCL TEAR
Partial	26 (41.27 %)	03 (20%)
Complete	30 (47.62%)	07 (46.67%)
Avulsion	07 (11.11%)	05 (33.3%)
Total	63 (100%)	15 (100%)
Site of tear		
Femoral	15 (23.81%)	03 (20%)
Mid Substance	27 (42.86%)	05 (33.3%)
Tibial	21 (33.33%)	07 (46.67%)
Total	63 (100%)	15 (100%)

TABLE 3: DISTRIBUTION OF MEDIAL AND LATERAL MENISCI TEARS ACCORDING TO GRADE AND TYPE OF TEARS

Grade of tear	MM	tears	LM	tears
Grade I	03	(5.26%)	03	(8.3%)
Grade II	32	(56.14%)	23	(63.9%)
Grade III	22	(38.6%)	10	(27.8%)
Total	57	(100%)	36	(100%)
Site of tear				
Horizontal	35	(61.4%)	26	(72.2%)
Vertical	18	(31.58%)	07	(19.4%)
Complex	04	(7.02%)	03	(8.4%)
Total	57	(100%)	36	(100%)

TABLE 4: DISTRIBUTION OF MCL AND LCL TEARS ACCORDING TO GRADE

	MCL Tear (%)	LCL Tear (%)
Grade I	04 (40%)	03 (42.8%)
Grade II	03 (30%)	02 (28.6%)
Grade III	03 (30%)	02 (28.6%)
Total	10 (100%)	7 (100%)

DISCUSSION

Multiple imaging modalities are currently used to evaluate pathologic conditions of the knee. Over the past several years, the role of MRI in knee imaging has steadily

increased and is often the main or only imaging tool for evaluation of suspected internal derangements ⁹. It is highly sensitive and specific, and has supplemented diagnostic arthrography in defining meniscal lesions ¹⁰⁻¹⁷.

In addition to differentiating well meniscal tears and other meniscal pathology, synovitis and cruciate ligament lesions can also be clearly demonstrated¹⁸⁻²¹. Advances in hardware and software technology, with the development of dedicated pulse sequences, have improved the results of viewing and diagnosis. In our study ACL tear was the commonest condition accounting for 63 patients (63%). Complete tear of the ACL was more commonly encountered (47.2%) as compared to the partial tear (41.2%) which correlated with study by which is in agreement with the previous study by Chavadaki RH *et al.*²² who studied 50 patients and found ACL to be the most commonly injured ligament with 15 (68%) complete ACL tears and 7 (31%) partial ACL tears. However, Singh JP *et al.* studied 173 patients and found ACL tear in 78 patients (Partial tear- 66.6% and complete tear -33%). Similar study by Josey Verghese *et al.*²³ on 69 patients found ACL tear in 49 patients (53.06% were partial tears and 46.93% were complete tear). Our study result is in contrary to most of the previous studies where they have found the incidence of partial tear more as compared to complete tear. The difference in the result can be attributed to lack of awareness about knee symptoms of instability among the population to which our hospital caters since most of the patients belong to low income group labourers and farmers and not high performance athletes with skilled complex activity. PCL tear accounted for only a small percentage of patients (15%). Josey Verghese *et al.*²³ found PCL injuries in only 10.15% and Chavadaki RH *et al.*²² found only 8% of posterior cruciate ligament injuries. In our study, MM tears were found in 57% patients with Grade II tear in 56.14% patients similar to the study by Chavadaki RH *et al.*²² who studied 50 patients, and found Grade II medial meniscus tear (52.6%) as the most common. The MM tear was more common (57%) than LM tears (36%) in our study which corresponded with study by La Prade *et al.*²⁴ who reported that medial meniscal tears are twice as common as lateral meniscal tears. MCL tear was observed in 10% patients similar to the study by Josey Verghese *et al.*²³ who found MCL tear in 13% patients, however, the incidence of grades of MCL tear was different in all studies which may be attributed to less number of patients with MCL tear. In our study, MCL tears (10%) were found to be more common than the LCL tear (7%). This finding are consistent with study done by Saurabh Chaudhuri *et al.*²⁵ found the incidence of MCL injury (15%) was higher than LCL injury (12%)

CONCLUSION

Currently, because of its better soft tissue delineation, non-invasiveness and radiation free imaging, MRI is the best investigation for the assessment of ligamentous, meniscal and intra-articular knee pathologies. In conditions where

the clinical examination is difficult due to pain or is not possible and in peripheral tears or inferior surface tears of menisci where arthroscopy has limitations, it is extremely useful. It provides an accurate preoperative anatomic assessment, thus aids clinical examination and arthroscopy. Its multiplanar slice capability helps in imaging the complex knee anatomy, therefore helps to avoid unnecessary invasive procedures like arthroscopy and further morbidity.

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