



A CROSS-SECTIONAL STUDY OF MAGNETIC RESONANCE IMAGING IN THE EVALUATION OF ANTERIOR AND POSTERIOR CRUCIATE LIGAMENT INJURIES OF THE KNEE.

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ABSTRACT

Background: The knee joint is complicated, having a multitude of components, and any of the signs or symptoms of a knee injury might be caused by any of them. The greatest significant improvements in knee joint imaging were accomplished during the reign of Magnetic Resonance Imaging (MRI). It has replaced conventional arthrography in the assessment of the menisci and cruciate ligaments, reducing both the morbidity and cost associated with arthroscopic examinations that provide negative results. **Aim:** The present study was performed on MRI for evaluation of ligamentous knee injuries. **Material:** This research was performed in 100 subjects, who has come to department of radiodiagnosis with suspected ligamentous injuries to the knee. **Results:** The findings obtained in our study showed that medial meniscal tears/degeneration (64%) followed by anterior cruciate ligament tear (49%) were the most frequently found pathology of all subjects. **Conclusion:** Magnetic resonance imaging is highly sensitive, precise and accurate method of imaging modality in the identification of posterior cruciate ligament and full length anterior cruciate ligament tears; however, it has no adequate sensitivity in the detection of partial anterior cruciate tears.

KEYWORDS : Magnetic resonance imaging (MRI), Anterior cruciate ligament (ACL), Posterior cruciate ligament (PCL)

INTRODUCTION

Magnetic resonance imaging has proven helpful in subject identification, preoperative preparation, diagnosis, and improved patient-doctor communication.¹ The cost of MRI knee studies has decreased, allowing the orthopaedic community to accept them as a non-invasive alternative to arthrography and non-therapeutic arthroscopy.^{2,3} MRI provides a superior anatomic and pathologic interpretation of soft tissue, ligaments, fibrocartilage, and articular cartilage than computed tomography (CT).^{4,5,6} The use of fast spin-echo imaging in conjunction with the MR fat suppression approach has improved the sensitivity and precision of MR in detecting articular cartilage lesions. Furthermore, three-dimensional (3D) volume approaches have demonstrated the versatility of MR imaging in evaluating meniscal tears. These may be used to reformat images of meniscal tears in orthogonal and non-orthogonal planes.

AIMS AND OBJECTIVES:

Evaluation of ligamentous injuries of the knee in MRI

MATERIAL AND METHODS

Selection criteria:

Patient referred to department of radiodiagnosis with suspected ligamentous injury to the knee and consenting to report.

Exclusion criteria:

Subjects with cardiac pacemakers, metallic implants in the body, foreign body in the eye or with claustrophobia.

MRI scanner:

MRI was performed with a 1.5 T Siemens Magnetom Sempra MR Scanner using a dedicated knee coil.

Imaging protocol:

After getting ethical clearance from the institutional ethical committee, informed consent patient was subjected to MRI imaging. In subsequent sagittal and coronal plane sequences, an axial acquisition by patella-femoral joint was used as an initial localiser. The coronal plane tests the menisci collateral ligaments and body in an ideal manner. The

sagittal plane exposes particularly the suprapatellar notch, the cruciate ligaments, menisci and synovial anatomy. Through the incorporation of all three planes the bones, muscles, tendons, neurovascular structures have been thoroughly assessed.

RESULTS

There were 63 males and 37 women in this sample of 100 people. The study's youngest patient was 12 years old, while the oldest patient was 73 years old. The majority of the individuals were between the ages of 21 and 50, with those between the ages of 41 and 50 being the most senior. Out of 100 participants, 52 had right knee derangements and 48 had left knee derangements. ACL tears were found in 49 of the study's 100 participants, whereas PCL tears were found in nine.

Table 1: Distribution of Knee Pathologies

Sr. No	Pathology	No. of Subjects
1	Medial Meniscal Tears	64
2	Lateral Meniscal Tears	31
3	Anterior Cruciate Ligament Tears	49
4	Posterior Cruciate Ligament Tears	9
5	Medial Collateral Ligament Tears	5
6	Lateral Collateral Ligament Tears	2
7	Patellar Subluxations &/or Patellar Retinaculum Tears	5
8	Popliteal Cysts	22
9	Osteochondral Fractures	12
10	Marrow Contusions At Condyles	29

Anterior cruciate ligament (ACL) tears:

Out of 49 patients with ACL tears, 29 of them (59.2%) had partial thickness tear followed by 20 (40.8%) had full-thickness tears. In that, 29 subjects (59.2%) had tear at mid substance, followed by 13 (26.5%) had tears at the femoral attachment and 7(14.3%) at the tibial attachment.

Table 2: Location of ACL Tear

ACL Tear	Number	Percentage
Midsubstance	29	59.2%
Femoral Attachment	13	26.5%
Tibial Attachment	7	14.3%

Associated injuries with ACL:

Out Of the 49 patients with ACL tears, 42 patients have been associated with meniscal Tears. Of these, 22 were found to have association with medial meniscal tears and 20 with lateral meniscal tears. Hence, the medial meniscal tears were seen to have associated with ACL tears more frequently. In 22 (44.8%) cases of an ACL tear, Marrow contusions and Bone Edema of the femoral condyle and tibial plateau were seen. In combination with ACL, chondral and osseous fractures in both medial and lateral compartments were also noted for 4 (8 %) cases. Collateral Ligament Tears accounted for ACL injuries in 4(8 %) cases. In our study, meniscal tears with marrow oedema and contusions of femoral and tibial condyles were most commonly associated with ACL tears.

Table 3: Distribution of Associated Injuries with ACL Tear

Sl. No.	ACL Tear Associated Injuries	Number	Percentage
1	Meniscal Tears	42	85.7%
2	Marrow Contusions and Bone Edema of Femoral Condyle and Tibial Plateau	22	44.8%
3	Fractures Of Femoral Condyles &/or Tibial Plateau	4	8%
4	Collateral Ligament Tears	4	8%
5	Tibial Spine Avulsion	1	2.77%

Posterior cruciate ligament tears:

PCL tears were seen comparatively less in number of cases 9(9%) out of 100 subjects. All 9 subjects had partial-thickness tears along with 5 having low-grade partial-thickness tears mean while 4 subjects having high-grade partial-thickness tears. Strain in PCL was also found in other 9 subjects.

Associated injuries with PCL:

Out of 9 cases of PCL tears, 3(33.33 %) was associated with ACL tears. Meniscal injuries were only associated with 2 cases (22.22%) of PCL tears. Collateral ligament tears were associated with 2 cases (22.22%) of PCL tears. Out of 9 patients of PCL tear, 1(11.11%) patient also had an avulsion fracture of the tibial plateau. Bone contusion existed in 1 (11.11%) of the case of PCL injuries.

Table 4: Distribution of Associated Injuries with PCL Tear

Sl No.	PCL Tear associated Injuries	Number	Percentage
1	ACL Tears	3	33.33%
2	Meniscal Tears	2	22.22%
3	Collateral Ligament Tears	2	22.22%
4	Avulsion Tear off Tibial Plateau	1	11.11%
5	Bone Contusions	1	11.11%

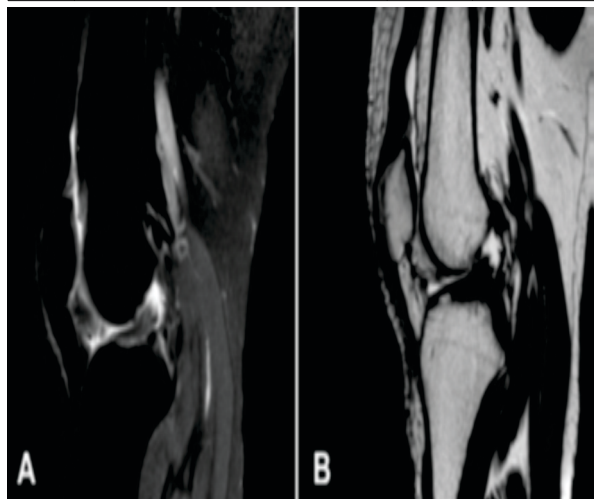


Figure 1 and 2: Sagittal PDFS(A) and T2W(B) images showing bulky ACL with hyperintense signal and loss of Continuity s/o Acute ACL tear.

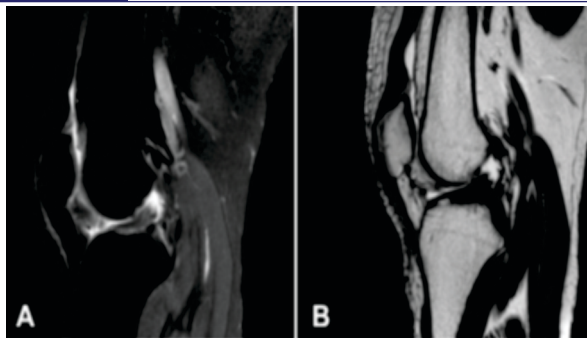


Figure 3: Sagittal PD FS images showing bulky ACL with hyperintense signal and loss of continuity in its mid-substance s/o complete ACL tear (A) & (B) partial ACL tear showing hyperintense signal in ACL on PDFS and laxity of the ligament on arthroscopy.

DISCUSSION

In our study, we discovered that the optimal position for the knee was 5–10 degrees of flexion and 15–20 degrees of external rotation. When ACL is observed in a partially replicated state, oblique pictures are obtained. T2WI and PDW FS images were preferred, as acute lesions were interpreted as high signal strength with high precision.

Anterior cruciate ligament tears:

Anterior cruciate ligament (ACL) tears were more prevalent than posterior cruciate ligament (PCL) injuries in our study (PCL). In a study of 173 people, Lakhar et al.1 discovered that ACL tears are more prevalent (45.08 percent) than PCL tears (5.78 percent). The most typical location for tears was in the middle of the material. The most prevalent form of tear, according to Lakhar et al.7, is a mid-substance tear. Berquist et al.8 found a similar outcome in another study.

Associated injuries with ACL:

In our study, meniscal tears were the most prevalent finding related with ACL tears. Meniscal tears were related with 42 (85.7%) of the 49 cases of ACL tears. There were 22 cases of medial meniscal tears and 20 cases of lateral meniscal tears among the 42 cases of meniscal tears. In their study, McDaniel et al.9 found that meniscal tears are present in 85 % to 91 % of chronic ACL-deficient knees. Marrow contusions and bone oedema of the lateral femoral condyle and lateral tibial plateau were found in 22 (44.8 %) cases with ACL injury. Subchondral bone impactions posterolateral tibial plateau (94%) and lateral femoral condyle (91%) were deemed moderately common markers of an acute ACL tear by Murphy et al.10. In 4 (22.22 %) of the ACL instances, fractures in both the medial and lateral compartments were observed. Indelicato et al.11 discovered that erosions and chondral fractures in both the medial and lateral compartments were related with ACL tears, however they only identified these chondral fractures in 23% of acute and 54% of chronic injuries.

In our study, the triad of typical O'Donoghue, MCL, and medial meniscus injury to the ACL was less severe in only one (2.77 %) instance. In any instance, there was no evidence of an ACL injury in Segond's fracture. In ACL injury case 1, avulsion of the tibial spine was seen (2.77 %). Segond's fracture is related with ACL rupture in 75 percent to 100% of cases, according to Kezdi-Rogus et al.12, and tibial spine avulsion is an uncommon but common finding for ACL damage. They further stated that avulsion injuries are frequently associated with distal ACL injuries due to the relative strength of distal ACL fibers compared to adjacent tissue.

Posterior cruciate ligament tears:

PCL tears accounted for 9(9 %) of small cases. D S Shetty et al.13 observed PCL tears in only a small percentage of subjects in

their sample of 115 subjects (4.34 %) and the symptoms were hyperintensity in 3 subjects and discontinuity in 2 subjects. In their analysis, Sonnin et al.¹⁴ found a 2-23 % occurrence as PCL injury. ACL tears 49 (49 %) were much more common in our sample of 100 subjects than the PCL tears 9 (9 %). Chernye et al.¹⁵ reported that PCL is twice as strong as ACL, with a wider cross-sectional area and higher tensile strength resulting in lower PCL rupture incidence.

Associated injuries with PCL:

PCL tear were responsible for 9(9%) of all minor instances. PCL tear were found in just a number of the 115 patients (4.34 percent) studied by D S Shetty et al.¹³, and the symptoms were hyperintensity in three subjects and discontinuity in two others. Sonnin et al.¹⁴ discovered a 2-23 % incidence of PCL damage in their study. In our sample of 100 people, ACL tears were far more prevalent (49%) than PCL tears (9%). (9 %). According to Chernye et al.¹⁵, PCL is twice as strong as ACL, with a greater cross-sectional area and better tensile strength, resulting in a decreased incidence of PCL rupture.

CONCLUSION

On FSE T2W and PDW FS, the key symptoms of ACL tear, such as discontinuity, non-visualisation, and irregular elevated signal intensity, were well established, and the most common rip site for the anterior cruciate ligament was mid-body. Secondary symptoms such as lateral femoral condyle and lateral tibia bone contusions, anterior tibial translation, lateral meniscus rear horn uncovering, and PCL buckling were often reported. FSE T2 and PD FS sequences are most prone to the spectrum of meniscal and cruciate ligament tears and related injuries such as osteochondral fractures, according to previous studies, but SE T1 sequence was effective to link pathologies other than ligament tears. The PD FS sequences were helpful in determining the extent of concomitant bone contusions. The high level of accuracy in MRI examination in several planes, as well as situating the knee in 15-20 degrees of external rotation and 5-10 degrees of flexion, helped to identify the site and range of lesions. In the diagnosis of meniscal, posterior cruciate ligament, and full anterior cruciate ligament tears, magnetic resonance imaging has a good sensitivity, precision, and accuracy; however, it has insufficient sensitivity to identify partial anterior cruciate ligament tears.

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Conflict of Interest- Nil.

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