Original Research Paper

Volume - 13 | Issue - 06 | June - 2023 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Radio-Diagnosis

INTERNAL DERANGEMENT OF KNEE - MRI EVALUATION

Dr Nikithabanu. N. Bagwan	Post Graduate
Dr P. Suresh	Professor And Head Of Department
Dr Lakshmeesha. M.T	Assistant Professor
Dr Teja Sai kollu*	Post Graduate *Corresponding Author

ABSTRACT Knee is one of the major joints involved in kinesis. It also bears the consequences of increased mobility. Due to its mobility it has more tendency to instability. Instability is most commonly seen in young adults especially who is related to sports due to its wide range of motion. MRI is an excellent modality for imaging of ligaments, cartilage, menisci and other structures around the knee joint. MRI has superseded already available modalities like radiograph and CT, over last two decades.

Aim

- To recognize the MRI imaging findings in clinically suspected cases of internal derangement of knee.
- To correspond the imaging findings with clinical examination findings.
- To recognize and assess indirect signs of ACL and lateral meniscal tears.

Method : This is a prospective study of 50 patients in oxford medical college referred from orthopaedic department over a period of twelve months Patients were evaluated with clinical examinations and were subsequently subjected to imaging of knee using 1.5 T MRI ,Axial, sagittal and coronal PD Fat Sat; sagittal, axial and coronal T2 FSE and sagittal T1 FSE imaging protocol where used . **Conclusion:** MRI is a beneficial and non-invasive modality which possesses higher diagnostic accuracy, better sensitivity and their negative predictive value which makes it a very consistent screening test for the diagnosis of internal derangements at the knee joints. It might be advantageous in the clinical conditions where the arthroscopy may not useful for the inferior surface and peripheral meniscus tears. The results of this present study support that MRI can be very helpful in diagnosing the cruciate and meniscal ligament injuries. It can accurately detect, localize and distinguish various internal derangements of the knee joint with excellent soft tissue delineation and help in arriving at an accurate anatomical diagnosis thereby helping further management of the patients

KEYWORDS : kee, MRI, ACL, PCL, Meniscal injury, derangement of knee joint.

INTRODUCTION

Knee is one of the major joints involved in kinesis. It also bears the consequences of increased mobility. Due to its mobility it has more tendency to instability. Instability is most commonly seen in young adults especially who is related to sports due to its wide range of motion.

MRI is an excellent modality for imaging of ligaments, cartilage, menisci and other structures around the knee joint. MRI has superseded already available modalities like radiograph and CT, over last two decades.

It is a non invasive diagnostic modality that lacks the radiation issues associated with radiograph and CT and is non-operator dependent unlike ultrasound.

AIMS & OBJECTIVES

1. To recognise the MRI imaging findings in clinically suspected cases Of internal derangement of knee.
2. To correspond the imaging findings with clinical examination findings.
3. To recognise and assess indirect signs of ACL and lateral meniscal tears.

Exclusion Criteria

1. Patients who has been underwent surgeries previously on same
2. Any contraindication for MRI.

Inclusion Criteria

1. Patients with unstable or painful knee

Source Of Data

This study was performed in the department of radiodiagnosis The Oxford medical college hospital and research centre.

Sample Size: 50

Type Of Study: Prospective study

They were evaluated with clinical examinations and were subsequently subjected to imaging of knee using 1.5 T MRI.

Imaging Protocol Used

Sequences used were axial, sagittal and coronal PD Fat Sat; sagittal, axial and coronal T2 FSE and sagittal T1 FSE.

50 patients were analysed in this study.

Age And Sex Distribution Of Patients:

There were 13 females and 37 males in this study. Males comprised 74% and female 26% .

The age group ranged from 15 to 64 years with mean age of 33.2 years. Maximum patients (50%) were in the age group of 15-30 years and only 14% were more than 45 years.

So it was mostly young adult male who underwent MR for clinicallysuspected internal derangement of knee.

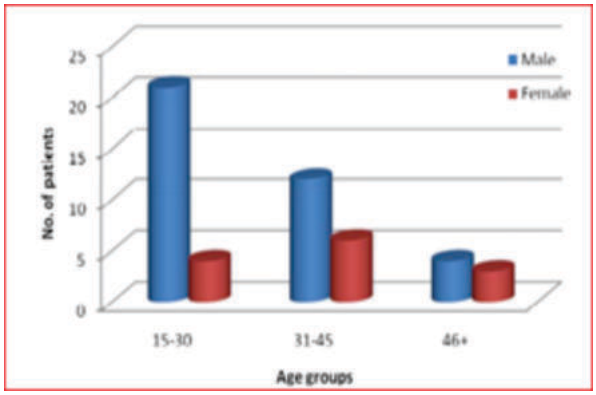

Figure 1: Age and sex distribution of patients with suspected internal derangement of knee

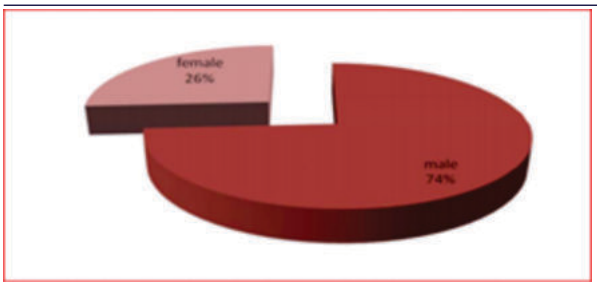

Figure 2 : Distribution of ligamentous tears around knee joint Various ligamentous tear around the knee were identified, either a single ligament or combination of ligaments. ACL tear was seen in 29 (45.3%), PCL tear in 5 (7.8%), MCL tear in 16 (25%) and LCL tear in 14 (21.8%) of cases.

Joint effusion was noticed in 67%.

Bone contusion was noted in 72% of ACL ears.

Bony contusions of lateral compartment structures were noted in 20 cases (69%).

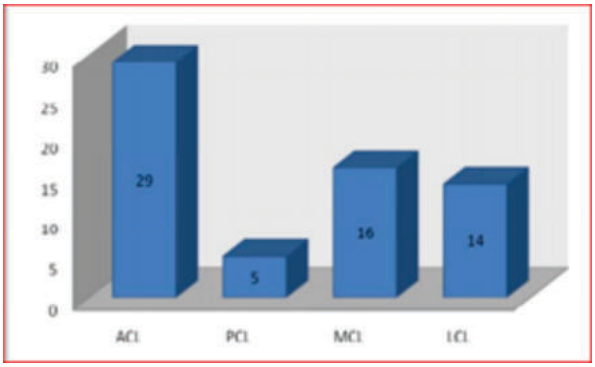

Table 3: Frequency of ACL Tears

ACL TEAR	NUMBER	PERCENTAGE
Complete	19	65.5%
Partial	10	34.5%

29 cases showed ACL tear.
19 cases with Complete tear of ACL
10 cases of partial tear.

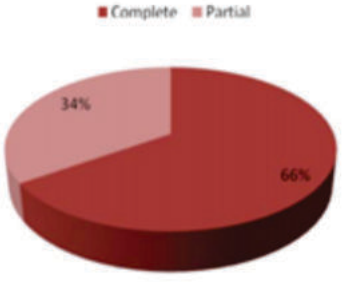

Figure 4: Pie chart depicting types of ACL tear

Indirect signs of ACL tear in the form of Objective criteria such as Sagittal

ACL –Blumensaat line , Tibial angle– ACL angle, PCL angle and anterior tibial displacement were used.

The mean Sagittal ACL – Tibial angle was 41º in case of partial ACL tear while the mean was only 23º in complete ACL tears.

The mean Blumensaat line – ACL angle was + 3º in partial ACL tear and was + 27º in complete ACL tears.

The mean PCL angle was 123º in partial ACL tear and more acute angled with a mean angle of 106º in complete ACL tears.Mean anterior tibial displacement measured 6mm in partial ACL tear and 9mm in complete ACL tears.

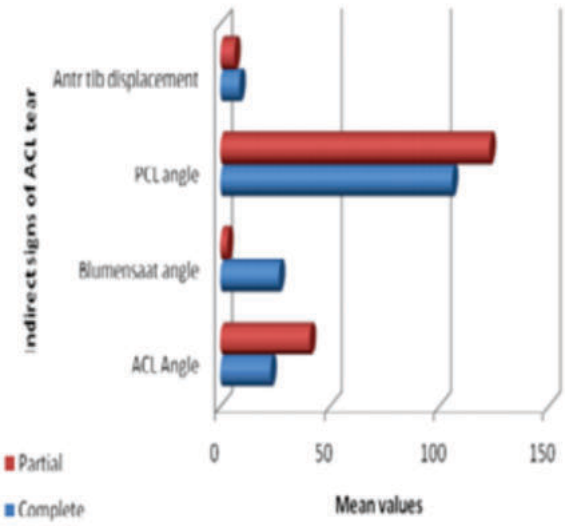

Figure 5: Indirect signs of ACL tear

PCL TEAR
5 cases showed PCL tear.
3 cases showed Complete tear and 2 cases showed partial tear.
4 cases showed bone contusions (80%) and involved lateral aspect of tibia in all cases.

Joint effusion was seen 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.

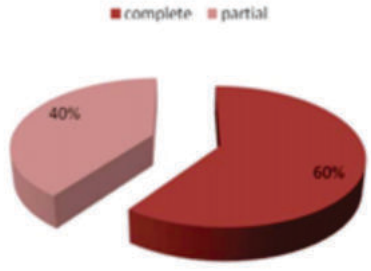

Figure 6 : Pie chart depicting types of PCL tear

MENISCAL TEARS
Meniscal tears were found in 50 cases with medial meniscus involved in 31 and lateral meniscus in 19.

Of the total cases with meniscal tears, 17 (47%) were isolated medial meniscal, 5 (14%) were isolated lateral meniscal and 14 (39%) involved both menisci.

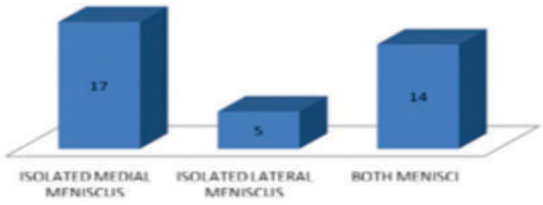

Figure 7: Distribution of tears in medial meniscus, lateral meniscus and both Site and type of tear-medial meniscus

20 (65%) involved Medial Meniscus, Posterior horn and the predominant type of tear in posterior horn was oblique tear that occurred in 10 (50%).

Most common type of tear involving anterior horn was also oblique tear.

Most common type of tear to involve the whole of meniscus was bucket handle tear.

13 cases (42%) showed Grade III tear and 29 % showed grade II tear.

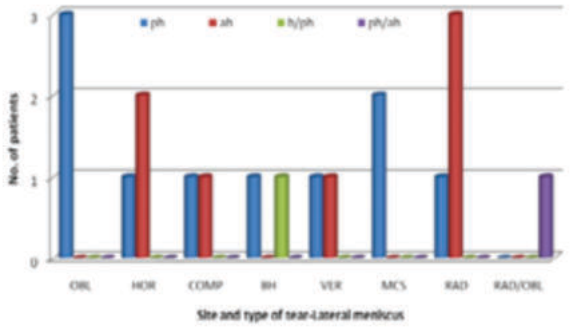

Figure 8: Site and type of tear-medial meniscus

-Posterior horn of meniscus; obl-Oblique tear; b -Body of meniscus; hor-Horizontal tear; ah-Anterior horn of meniscus; rad-Radial tear; ver-vertical tear; comp-Complex tear; mcs-Meniscocapsular separation; bh-Bucket handle tear

Grades Of Medial And Lateral Meniscal Tear

GRADES OF TEAR	MEDIAL MENISCUS	LATERAL MENISCUS	TOTAL PERCENTAGE
GRADE I	5	1	12%
GRADE II	9	6	30%
GRADE III	13	9	44%
GRADE IV	4	3	14%

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.

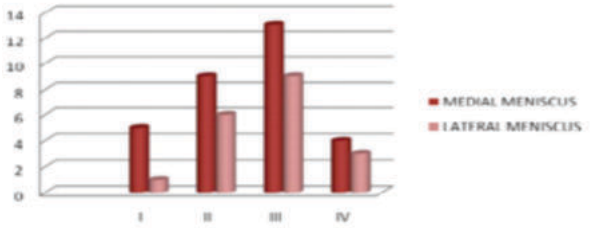

Figure 10: Grades of medial and lateral meniscal tear

CLINICAL TESTS

In 86% of cases lachman test was conclusive for ACL tear, posterior drawer test in 60%, Mcmurray's test in 68% of medial meniscal tear, 79% of lateral meniscal tear, valgus. Stress test in 75% of MCL tear and varus stress in 100% of LCL tears.

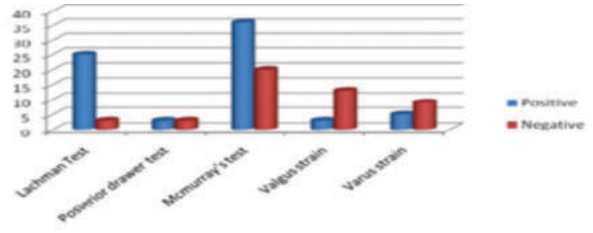

Figure 11: Clinical examinations for internal derangement of knee

FIG 11: Radial tear of anterior horn of lateral meniscus – Ghost meniscus sign

Figure 12: Grade II Oblique tear of posterior horn of medial meniscus

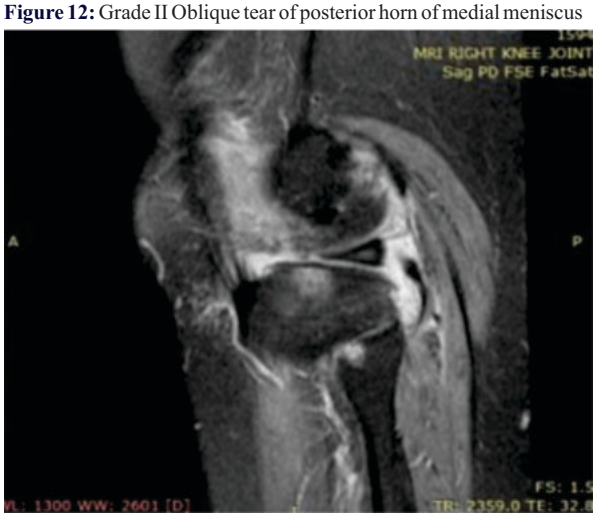

Figure 13: Bony contusions of lateral tibial plateau and fibular head

Figure 14: Oblique tear of posterior horn of lateral meniscus

Figure 15: Displaced meniscal fragment in intercondylar notch-fragment in notch sign

Figure 16 : Double PCL sign – Bucket handle tear

Figure 17: Complete tear of PCL with tibial avulsion fracture

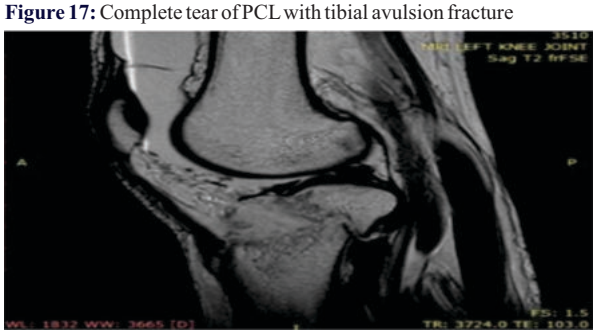

Figure 18 : Sagittal image showing tibial plateau fracture with lipohemarthrosis

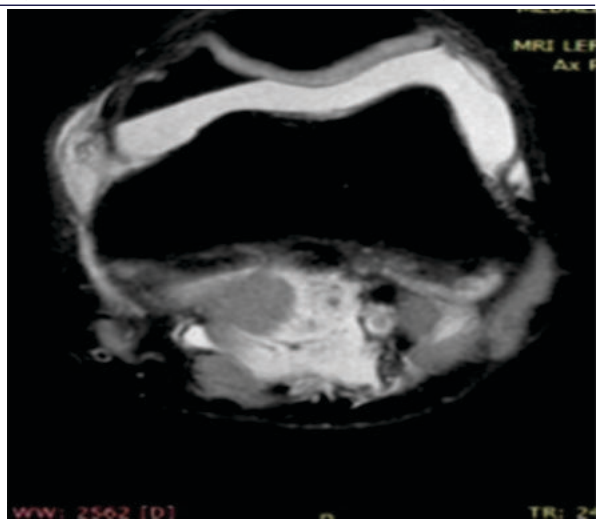

Figure 19 : Axial and sagittal fat saturated image depicting saturation of signals in superficial layer of lipohemarthrosis.

Figure 20 : Complete mid substance tear of ACL

Figure 21: Bone contusion lateral femoral condyle

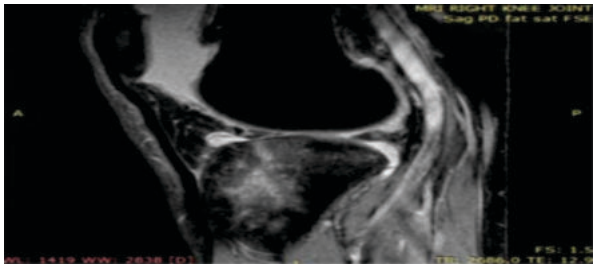

Figure 22: Complex tear of lateral meniscus

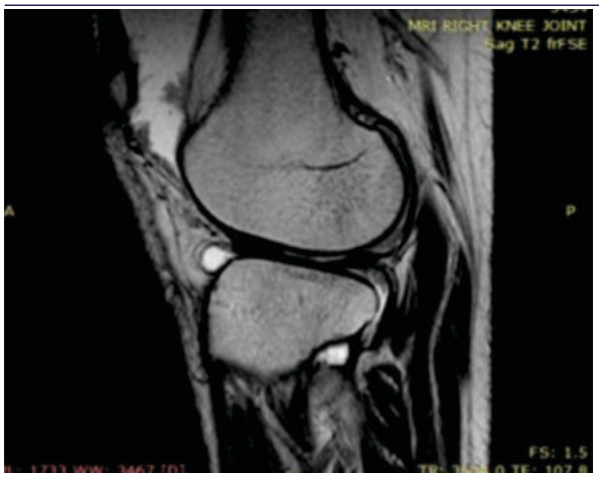

Figure 23: Meniscal cyst – lateral meniscus

DISCUSSION

ACL Tear

Specific signs of ACL injury are discontinuity, irregular contour, focal or diffusely increased intrasubstance signal intensity.

Angles Used In ACL Assessment

Blumensaat line–ACL angle is the angle created between a line drawn along the edge of the intercondylar roof (i.e. Blumensaat line) and the anterior-most margin of the ACL on the sagittal view which best depicts ACL.

Sagittal ACL-tibial Angle

This is the angle between a line paralleling the midlateral tibial plateau and a line demarcating anterior most margin of ACL, drawn on midline image best depicting the ACL. Measurement of this angle is the technique used by Gentili et al.The mean measurement was 55.5° ± 6.7 for all female patients versus 53.9° ± 5.8 for all male patients.

PCL Angle

The angle between a line connecting the origin site of the PCL on the femur to a point placed at the point of directional change of the PCL and a line drawn from the same point to the distal most point of PCL insertion on the tibia, as described by Gentili et al. PCL angle changes according to physeal patency, with mean values of 113.9°±8.1 in the open physes group and 121.9° ± 8.7 in the closed physes group. The PCL angle did not differ between the sexes.

PCL Tear

The normal appearance of the PCL on MR images is a well-defined continuous band of low signal intensity in all pulse sequences.

A normal PCL usually measures not more than 6 mm in antero-posterior diameter on sagittal T2-weighted images, with the measurement perpendicular to the fibers of the vertical segment. This is best imaged on sagittal T2-weighted sequence.

Acutely torn PCL usually maintains continuity as a single structure and is typically injured as a result of stretching deformity. Proton-density (short TE) sequence is extremely important in the diagnosis of PCL injuries. This is due to the fact that PCL tears rarely have intrasubstance fluid signal intensity on T2-weighted images but show increased intrasubstance signal intensity on proton-density images.

MCL Tear

The three grades of MCL injury described clinically correspond to three appearances of the MCL seen with T2W coronal images.

Grade 1, sprain, shows high signal in the soft tissues medial to the MCL.

Grade 2, severe sprain or partial tear, shows high signal in the soft tissues medial to the MCL, but also has high signal or partial disruption of the MCL itself.

Grade 3, complete tear, shows disruption of the MCL. Medial meniscal injuries may be associated with MCL tears and should be carefully looked for. The MCL is usually injured with a valgus force applied to the flexed knee

LCL Tear

Tears of the lateral collateral ligament are mostly associated with damage to posterolateral knee structures: capsular tears, detachment fracture of the superior rim of the tibia (Segond fracture), biceps femoris tendon tears, popliteus tendon lesions and cruciate Ligament tears.

At MR imaging, complete disruption of the ligament appears as an interruption of its normal contour, whereas a partial tear appears as thickening and high signal intensity within its midsubstance.

Grading Of Meniscal Tears

Grade 1- Meniscal signal change is globular and do not communicate with articular surface.
Grade 2- Meniscal signal change is linear, intrasubstance and do not communicate with articular surface.
Grade 3 - Meniscal signal change that extends to the articular surface.
3a – linear intrameniscal signal intensity abutting articular surface.
3b – irregular signal intensity abutting articular surface.
Grade 4 - Menisci are distorted in addition to signal changes similar to grade 3.

Types Of Meniscal Tears

Bucket Handle Tear

These are vertical longitudinal tears with displaced fragment. It occurs in about 10% of meniscal tears. Few characteristic signs are seen in this type of tear which are described below.

Absent bow tie sign: Only one body segment is seen instead of the normal two body segments present on the outermost sagittal images through the meniscus.

Fragment in notch sign: A displaced meniscal fragment should always be found, most often in the intercondylar notch. It is seen more often in lateral bucket_x0002_handle tears,51 and it has a sensitivity of 60% to 98% and specificity of 73% to 82% for detecting bucket-handle tears.
Double PCL sign: The displaced meniscal fragment can lie in front of the posterior cruciate ligament.

Anterior flipped meniscus sign: The displaced fragment may flip over the anterior horn of the affected meniscus.

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 in traumatic settings. Post-traumatic pre-arthroscopic MR imaging evaluation has proved to be cost-effective. Although arthroscopy has revolutionized the diagnosis and treatment of knee disorders, most orthopedists acknowledge the invasiveness of the procedure; limitations in evaluation of extra-articular pathology; cost and uncommon but potential complications associated with the procedure. They acknowledge the accurate diagnostic imaging complementing their clinical evaluation and providing a global intra-articular and extra-articular assessment of the knee.

REFERENCES

1. Yao L, Pitts JT, Thomasson D. Isotropic 3D fast spin-echo with proton-density-like contrast: a comprehensive approach to musculoskeletal MRI. AJR Am J Roentgenol 2007;188:W199 –W201.
2. Mink JH, Levy T, Crues JV 3rd. Tears of the anterior cruciate ligament and menisci of the knee: MR imaging evaluation. Radiology 1988;167:769 –774
3. Lim D, Lee YH, Kim S, Song HT, Suh JS. Clinical value of fat-suppressed 3D volume isotropic spinecho (VISTA) sequence compared to 2D sequence in evaluating internal structures of the knee. Acta Radiol 2016; 57:66–73