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MRI Evaluation of Internal Derangement of the Knee: A Prospective Study

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ABSTRACT

Background: Internal derangement of the knee (IDK) encompasses injuries involving the menisci, cruciate ligaments, collateral ligaments, cartilage, and other intra-articular structures. MRI has emerged as the preferred non-invasive modality for evaluating these injuries.
Objective: To evaluate MRI findings in clinically suspected cases of internal derangement of the knee and correlate them with clinical examination findings.
Materials and Methods: A prospective study was conducted between September 2024 and April 2025 on 50 patients with suspected internal derangement of the knee.
Results: ACL tears were the most common ligament injuries. Meniscal tears predominantly involved the medial meniscus. Joint effusion and bone contusions were frequent associated findings.
Conclusion: MRI is an accurate and non-invasive modality for comprehensive evaluation of internal derangement of the knee.

Keywords: Internal derangement of knee, MRI, ACL tear, Meniscal tear, Knee trauma.

INTRODUCTION

The knee joint is one of the most complex and frequently injured joints in the human body. It is a major weight-bearing articulation composed of osseous structures, menisci, ligaments, cartilage, tendons, and synovial components that function together to provide stability and mobility. Owing to its anatomical complexity and exposure to rotational and translational forces during routine activities and sports, the knee is particularly susceptible to traumatic and degenerative injuries. Internal derangement of the knee (IDK) refers to a spectrum of pathological conditions involving the menisci, cruciate ligaments, collateral ligaments, articular cartilage, and other intra-articular structures that result in pain, instability, locking, and limitation of movement.[1]

Clinical examination remains the initial step in the assessment of knee injuries; however, the accuracy of physical examination may be limited in acute trauma because of pain, swelling, muscle spasm, and associated injuries. Conventional radiography is useful in detecting fractures and osseous abnormalities but provides limited information regarding soft tissue structures. Arthroscopy has traditionally been regarded as the gold standard for diagnosing internal derangement, but it is invasive, expensive, and associated with potential complications.[2]

Magnetic resonance imaging (MRI) has emerged as the imaging modality of choice for evaluating internal derangement of the knee because of its excellent soft tissue contrast, multiplanar capability, and non-invasive nature. MRI provides detailed visualization of menisci, cruciate ligaments, collateral ligaments, articular cartilage, bone marrow, and periarticular soft tissues without exposure to ionizing radiation. Numerous studies have demonstrated high sensitivity and specificity of MRI in detecting meniscal and ligamentous injuries, making it a valuable tool in preoperative planning and reducing unnecessary diagnostic arthroscopies.[3–6]

Anterior cruciate ligament (ACL) tears are the most common ligamentous injuries encountered following sports-related trauma and road traffic accidents, frequently accompanied by meniscal tears and bone contusions. Medial meniscal tears are more common than lateral meniscal tears because of the relative immobility and firm attachment of the medial meniscus to the joint capsule and medial collateral ligament. Associated findings such as joint effusion, osteochondral injuries, and bone marrow edema can also be accurately identified with MRI, thereby providing a comprehensive assessment of the injured knee.[7–9]

With advances in MRI technology and widespread availability of high-field scanners, MRI has become indispensable in the diagnostic evaluation of knee injuries. Accurate diagnosis facilitates appropriate management, helps avoid unnecessary invasive procedures, and improves functional outcomes. Therefore, the present study was undertaken to evaluate the spectrum of MRI findings in clinically suspected cases of internal derangement of the knee and to correlate these findings with clinical examination.

MATERIALS AND METHODS

Prospective study conducted in the Department of Radiodiagnosis, Sri Siddhartha Medical College, Tumakuru, from September 2024 to April 2025. Fifty patients underwent MRI using a 1.5 Tesla scanner. Standard T1, T2 and PD Fat Saturated sequences were acquired.

RESULTS

Among 50 patients, 74% were males and 26% females. ACL tears were identified in 29 cases, PCL tears in 5 cases, MCL tears in 16 cases, and LCL tears in 14 cases. Medial meniscal tears were more common than lateral meniscal tears.

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Table 1. Demographic Profile

Variable	Value
Male	37 (74%)
Female	13 (26%)
Mean Age	33.2 years
Age Range	15–64 years

Table 2. Distribution of Ligament Injuries

Ligament	Cases
ACL	29
PCL	5
MCL	16
LCL	14

Graphs

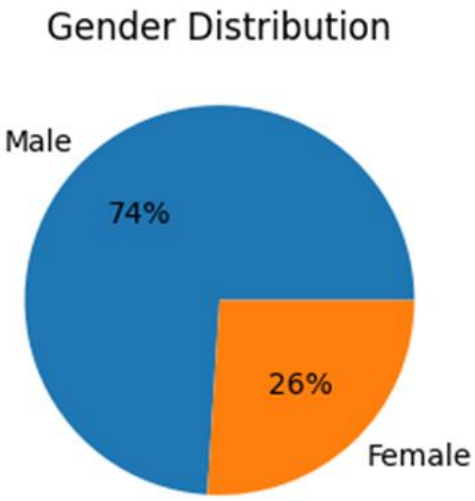

Figure 1. Gender Distribution

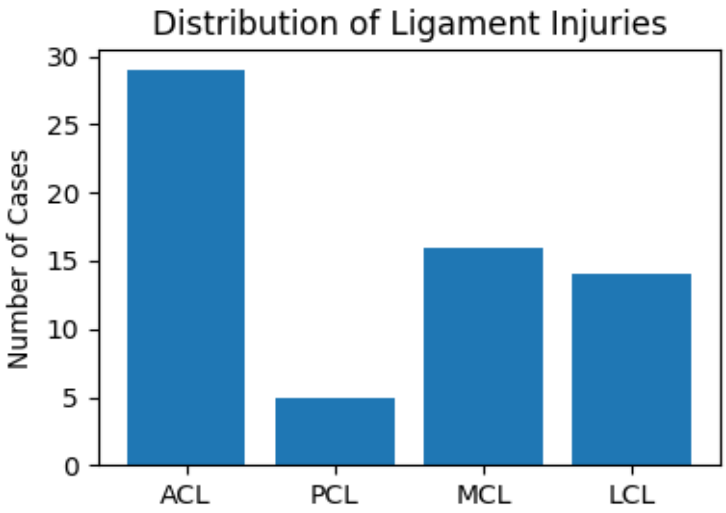

Figure 2. Distribution of Ligament Injuries

Case 1

FIG 1: Radial tear of anterior horn of lateral meniscus – Ghost meniscus sign

Figure 2: Oblique tear of posterior horn of lateral meniscus

Figure 3: Grade II Oblique tear of posterior horn of medial meniscu

Figure 4: Bony contusions of lateral tibial plateau and fibular head

Case 2:

Displaced meniscal fragment in intercondylar notch-fragment in notch sign

Case 3

Double PCL sign – Bucket handle tear

Case 4

Complete tear of PCL with tibial avulsion fracture

Case 5

Complete mid substance tear of ACL

Bone contusion lateral femoral condyle

DISCUSSION

MRI demonstrated excellent diagnostic capability in identifying ligamentous and meniscal injuries. Findings were comparable with previously published studies and showed strong correlation with clinical examination.

CONCLUSION

MRI is a highly accurate, non-invasive diagnostic modality for evaluating internal derangement of the knee and aids in treatment planning while reducing the need for diagnostic arthroscopy.

Declarations

Ethics Approval and Consent to Participate: Obtained.

Conflict of Interest: None.

Funding: No external funding.

Availability of Data: Available from the corresponding author upon reasonable request.

Author Contributions: Dr. Siva Abisheak V contributed to conceptualization, methodology, data collection, MRI interpretation, analysis, manuscript preparation and final approval.

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