

	ORIGINAL RESEARCH PAPER MRI PROFILE OF CLINICALLY SUSPECTED INTERNAL DERANGEMENT OF KNEE IN TERTIARY HEALTHCARE CENTRE	Radio-Diagnosis KEY WORDS: Internal derangement of knee, Magnetic Resonance Imaging, Meniscal tear, Ligament injury.
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ABSTRACT	Introduction: Internal derangement of the knee is a common cause of pain and functional limitation, particularly in middle-aged and physically active individuals. While clinical examination and plain radiography are routinely used. Magnetic Resonance Imaging (MRI) has emerged as a reliable, non-invasive modality for detailed evaluation of ligamentous and meniscal injuries. Aim: To evaluate the MRI profile of clinically suspected internal derangement of the knee and to compare MRI findings with clinical examination and plain radiographs. Methodology: This hospital-based descriptive observational study was conducted in the Department of Radio-Diagnosis center from 2023 to 2025. A total of 92 patients aged ≥18 years with clinically suspected internal derangement of the knee were included. All patients underwent MRI of the knee using a 1.5 Tesla scanner. Clinical test findings, X-ray results, and MRI findings were recorded and analyzed using descriptive statistics. Results: Most patients were aged 45 – 60 years, with male predominance. Farmers constituted the largest occupational group. Knee pain with swelling and restricted range of motion were the most common presenting complaints. Plain radiographs were normal in most cases. MRI detected a higher number of ligamentous and meniscal injuries compared to clinical examination, with ACL tears being the most common finding. Discussion: MRI demonstrated superior diagnostic accuracy over clinical examination and radiography, particularly in identifying subtle, partial, and degenerative lesions. It also aided in differentiating traumatic from degenerative pathology. Conclusion: MRI is an indispensable, non-invasive imaging modality and should be considered the investigation of choice for comprehensive evaluation of internal derangement of the knee.	
	INTRODUCTION The knee joint is the largest and one of the most complex joints in the human body. From a functional point of view, the knee joint is mainly a hinge joint that facilitates flexion and extension of the leg, apart from some rotational and translational movements. From an anatomical point of view, the knee joint is a compound synovial joint that comprises two components: the tibiofemoral joint and the patellofemoral joint.¹ The knee joint plays a vital role in facilitating bipedal functions like walking, running, climbing, and jumping. Because of its weight-bearing role and extensive range of motion, the knee joint is also the most prone to injuries. The role of muscular support in maintaining knee joint stability cannot be denied, and training and conditioning are important factors in sports injuries of the knee joint.^{1,2} The knee joint relies on several important structures within and around the joint for stability and function. These structures include the menisci, articular cartilage, ligaments, and tendons. The anterior cruciate ligament and posterior cruciate ligament are important central stabilizers of the knee joint that control the anteroposterior translation and rotational movements of the knee.³ The medial and lateral menisci, which are made of fibrocartilage, are very important in the transmission of loads, shock absorption, joint stability, and congruency. Besides their role in joint stability and function, the menisci are also important in joint lubrication and nutrition of the articular cartilage.^{3,4} Internal derangement of the knee (IDK) refers to a spectrum of intra-articular pathologies involving the menisci, cruciate ligaments, collateral ligaments, and articular cartilage. It represents a major cause of morbidity, particularly among young and physically active individuals such as athletes, laborers, and military personnel. Common etiological factors include sports-related trauma, road traffic accidents, falls, as well as degenerative and inflammatory conditions.^{4,5} Accurate diagnosis of internal derangement is essential for guiding both surgical and conservative management. A detailed clinical history and thorough physical examination	
	form the cornerstone of initial evaluation; however, clinical assessment alone may be insufficient to precisely localize or characterize intra-articular lesions.⁶ Arthroscopy has long been considered the gold standard for diagnosing and treating internal derangement of the knee.⁷ While it offers direct visualization of intra-articular structures, arthroscopy is an invasive procedure associated with significant costs, patient discomfort, and potential complications such as infection, deep vein thrombosis, and neurovascular injury.⁸ These limitations underscore the need for a reliable, non-invasive diagnostic modality that can accurately identify patients who would benefit from surgical intervention while avoiding unnecessary procedures. MRI has emerged as a highly sensitive, specific imaging technique for evaluating knee pathology. The present study aims to evaluate the MRI profile of clinically suspected internal derangement of the knee and to correlate MRI findings with arthroscopic observations, thereby assessing the diagnostic accuracy, clinical utility, and therapeutic relevance of MRI in a tertiary healthcare setting.	
	AIM: To evaluate MRI profile of clinically suspected internal derangement of knee in Tertiary healthcare centre. OBJECTIVES 1. To determine which MRI imaging findings are indicative of internal knee derangement in clinically suspected instances. 2. To compare the results of imaging tests with those of clinical examinations. 3. To recognize and evaluate indirect indicators of lateral meniscal tears and ACL injuries. MATERIAL AND METHODS METHODOLOGY This study is a hospital-based descriptive observational study conducted in the Department of Radio-Diagnosis of a tertiary care hospital, in collaboration with the Department of Orthopaedics, over a period of two years from 2023 to 2025.	
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The target population includes patients presenting with knee pain and positive clinical tests suggestive of ligamentous or meniscal injury.

The sample size was calculated using the formula $n = \frac{Z^2 p(1-p)}{d^2}$, considering a confidence level of 95% ($Z = 1.96$), an estimated proportion of 0.865, and an allowable error of 0.07. Based on this calculation, the required sample size was 92 patients. A convenient sampling technique was employed to recruit eligible participants.

Patients aged 18 years and above with clinical suspicion of internal derangement of the knee and advised MRI of the knee were included in the study after obtaining written informed consent. Clinical suspicion was based on positive findings in standard orthopedic tests such as McMurray's test, Lachman's test, pivot shift test, posterior drawer test, valgus and varus stress tests. Patients below 18 years of age, pregnant women, those unwilling or unable to provide consent, patients undergoing emergency knee surgeries, individuals with contraindications to MRI, history of previous knee surgery, current knee infection, severe osteoarthritis, or other medical conditions likely to affect study outcomes were excluded from the study.

After obtaining approval from the Institutional Ethics Committee, all eligible patients were enrolled following informed consent. A detailed clinical history and examination findings were recorded using a predesigned proforma. MRI examination of the knee was performed using a 1.5 Tesla Siemens MRI scanner with a dedicated knee coil. Imaging was carried out in axial, sagittal, and coronal planes using T1-weighted, T2-weighted, proton density (PD), fat-suppressed, and STIR sequences.



The MRI images were analyzed for the presence or absence of joint effusion, anterior cruciate ligament and posterior cruciate ligament injuries, medial and lateral meniscal tears, collateral ligament injuries, and combined internal derangements of the knee joint. The collected data were entered into a Microsoft Excel spreadsheet and a master chart was prepared. Statistical analysis was performed using descriptive statistics, and results were expressed as frequencies, percentages, tables, and graphical representations.

RESULT & OBSERVATIONS

In the present study, 92 patients with clinically suspected internal derangement of the knee underwent MRI evaluation during the study period.

Demographic And Clinical Characteristics

The study included 92 patients with clinically suspected internal derangement of the knee. Most patients were aged 51–60 years (42.39%), followed by 41–50 years (36.96%), indicating a higher prevalence in middle-aged and older individuals. Males (64.13%) outnumbered females (35.87%).

(Ref. Fig. 1)

Occupationally, farmers formed the largest group (46.74%), followed by those in service occupations (27.17%), reflecting greater physical stress on the knee. The most common presenting complaints were knee pain with restricted range of motion and knee pain with swelling, each seen in 40.22% of patients.

Most participants had no co-morbidities (61.96%); among those affected, hypertension (18.48%) and obesity (14.13%) were the most frequent. Many patients (88.04%) had no significant family history, while 10.87% reported a family history of osteoarthritis.

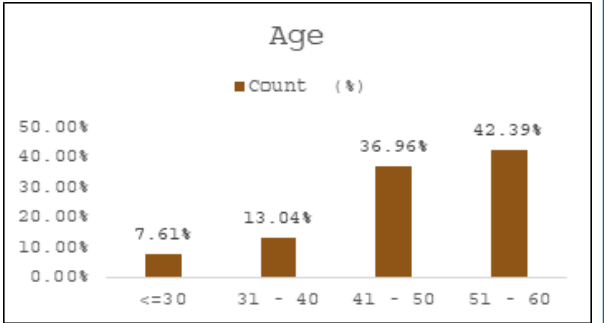


Figure 1 – Age distribution

History Of Physical Activity And Trauma

A history of strenuous physical activity was present in 15.22% of patients, while 9.78% reported a definite history of trauma. Most patients had no history of either strenuous exercise or trauma.

Plain Radiographic Findings

X-ray evaluation of the knee was positive in only 5.43% of cases, whereas 94.57% showed no abnormality, indicating limited usefulness of radiographs in detecting internal derangements.

Correlation Between Clinical Tests And MRI Findings

Clinical examination showed variable positivity for ligamentous and meniscal injuries. ACL tears were suspected clinically in 46.74% and confirmed on MRI in 51.09% of cases. PCL tears were detected clinically in 7.61%, while MRI identified 11.96% cases. Medial meniscal tears were suspected in 21.74% clinically and confirmed in 23.91% on MRI, whereas lateral meniscal tears were clinically suspected in 21.74% but confirmed in only 13.04% on MRI. MCL and LCL tears were clinically suspected in 11.96% and 13.04% of patients, respectively, with MRI detecting 15.22% cases for both ligaments. (Ref Table 1, Fig. 2)

Table 1 Clinical Tests Vs MRI Profile Of Tear Test

Test	Positive (Count (%))	
	Clinical tests	MRI findings
ACL tear	43 (46.74%)	47 (51.09%)
PCL tear	7 (7.61%)	11 (11.96%)
Medial meniscal tear	20 (21.74%)	22 (23.91%)
Lateral meniscal tear	20 (21.74%)	12 (13.04%)
MCL tear	11 (11.96%)	14 (15.22%)
LCL tear	12 (13.04%)	14 (15.22%)

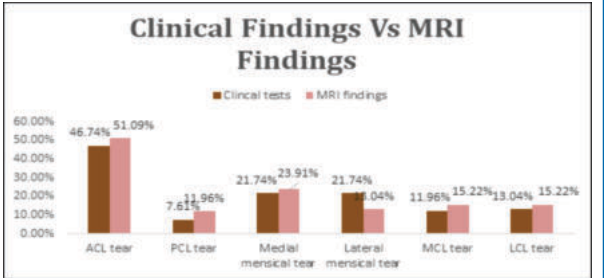
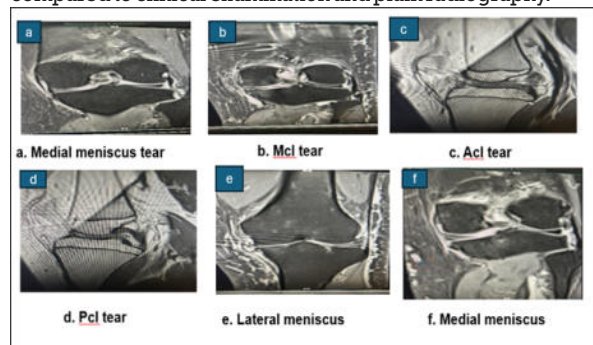


Figure 2 - Clinical Findings Vs MRI Findings

Joint Effusion

Joint effusion was present in 7.61% of patients on MRI and absent in the majority (92.39%). MRI demonstrated a higher detection rate for ligamentous and meniscal injuries compared to clinical examination and plain radiography.



DISCUSSION

The present study evaluated the MRI profile of clinically suspected cases of internal derangement of the knee and correlated imaging findings with clinical examination. The results highlight the demographic trends, clinical presentation, and diagnostic value of MRI in comparison with clinical tests and conventional radiography.

In this study, most patients belonged to the 51–60 years age group, followed by those aged 41–50 years, indicating a higher prevalence of knee derangements among middle-aged and older individuals. This finding suggests that degenerative changes and age-related weakening of ligamentous and meniscal structures play a major role in internal derangement of the knee. Similar observations were reported by Gupta et al. and Sharma et al., who noted an increasing incidence of degenerative meniscal and ligamentous tears beyond the fourth decade of life.^{9,10}

A clear male predominance was observed in the present study. This trend has been consistently reported in earlier studies by Solanki et al. and Khandelwal et al., who attributed the higher incidence in males to increased participation in physically demanding occupations, outdoor work, and sports activities.^{11,12} Occupational analysis in the current study further supports this, as nearly half of the patients were farmers, followed by individuals in service occupations. Gujjar et al. also reported a higher risk of knee derangements among individuals involved in manual labor due to repetitive stress, squatting, and heavy workload.¹³

Clinically, the most common presenting symptoms were knee pain associated with swelling and restriction of range of motion, which are classical features of internal derangement. These findings agree with Sanjay et al., who reported pain, swelling, and restricted movement as the most frequent complaints in patients with intra-articular knee pathology.¹⁴

Analysis of comorbidities revealed that hypertension and obesity were the most common associated conditions. Obesity increases mechanical stress on the knee joint, accelerating degenerative changes, while metabolic conditions may impair tissue healing. Similar associations were noted by Sharma et al. and Solanki et al., emphasizing the role of metabolic factors in degenerative knee disorders. A family history of osteoarthritis was present in a small proportion of patients, supporting the contribution of genetic predisposition, as described by Whitesides et al.^{10,11,15}

A relatively small proportion of patients reported trauma or strenuous exercise, suggesting that most internal derangements in this cohort were degenerative rather than traumatic. This observation is consistent with findings by Gupta et al., who reported a predominance of degenerative tears in older populations, while traumatic injuries were more

common in younger patients.⁹

MRI findings demonstrated that ACL tears were the most common ligamentous injury, particularly in traumatic cases, followed by PCL and MCL tears. Similar injury patterns were reported by Gupta et al. and Gujjar et al., who highlighted the vulnerability of the cruciate ligaments to high-energy trauma.^{9,15} The study also reaffirmed the limited role of plain radiographs, which were positive in very few cases. This aligns with reports by Solanki et al. and Khandelwal et al., who emphasized that X-rays are inadequate for evaluating soft tissue injuries and serve mainly to exclude fractures or advanced osteoarthritis.^{11,12}

Correlation between clinical tests and MRI showed good agreement for ACL injuries, particularly with the Lachman test, supporting its high sensitivity as noted by Gupta et al. and Khandelwal et al.^{9,12} However, MRI detected additional cases, especially partial tears, which may be missed clinically, as observed by Solanki et al.¹¹ For meniscal injuries, McMurray's test showed better correlation for medial meniscal tears than lateral tears, a finding consistent with previous studies by Sharma et al. and Gujjar et al. Posterior drawer, varus, and valgus stress tests showed moderate correlation with MRI, indicating that while clinical examination is useful, MRI provides superior accuracy and grading of ligamentous injuries.^{10,15}

Joint effusion was detected in a small number of patients, reflecting the predominance of chronic degenerative lesions rather than acute trauma. Overall, MRI demonstrated a higher detection rate and better characterization of internal derangements compared to clinical examination and radiography.

CONCLUSION

The present study confirms that MRI is a highly sensitive and specific, non-invasive imaging modality for the evaluation of internal derangements of the knee. While plain radiographs have limited value in assessing soft tissue injuries, and clinical examination shows good but variable correlation, MRI provides a comprehensive and accurate assessment of ligamentous, meniscal, and associated intra-articular pathologies. MRI is particularly valuable in detecting partial, complex, and degenerative lesions that may be missed clinically. Therefore, MRI should be regarded as the imaging modality of choice for accurate diagnosis and effective management of knee internal derangements, leading to improved patient care and outcomes.

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