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Research Article

A Cross-Sectional Study of Clinical Presentation, MRI Findings, and Arthroscopic Correlation in Patients with Internal Derangement of the Knee

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Abstract: ***Introduction:*** Internal derangement of the knee is a common cause of pain, swelling, locking, and instability in active and working-age individuals. Although clinical examination remains essential, magnetic resonance imaging [MRI] is widely used before arthroscopy to characterize meniscal, ligamentous, and chondral lesions.**Objectives:** To describe the clinical profile and MRI findings in patients with suspected internal derangement of the knee and to assess the correlation of MRI with arthroscopic findings.**Methods:** This cross-sectional study was conducted at on fifty patients with suspected internal derangement of the knee underwent clinical evaluation, MRI, and arthroscopy. MRI findings were compared lesion-wise with arthroscopic findings, which served as the reference standard. Diagnostic validity indices of MRI were calculated.**Results:** The mean age of the participants was 32.4 ± 9.8 years, and 68.0% were men. The right knee was involved in 58.0% of cases, and 56.0% presented within 3 months of symptom onset. Pain was present in all patients, followed by swelling [68.0%], locking [40.0%], and giving-way sensation [36.0%]. Medial meniscal tear was the most common lesion on MRI [44.0%] and arthroscopy [40.0%], followed by ACL tear. MRI showed high sensitivity and specificity for ACL, PCL, and meniscal injuries, with lower sensitivity for chondral injury.**Conclusion:** Internal derangement of the knee in this cohort predominantly affected young adults and men, with medial meniscal and ACL lesions forming the major pattern of pathology. MRI demonstrated strong agreement with arthroscopy for cruciate ligament and meniscal injuries but lower sensitivity for chondral lesions. These findings support MRI as an effective pre-arthroscopic diagnostic tool while preserving the value of arthroscopy when cartilage pathology is suspected.

Keywords: internal derangement of the knee, magnetic resonance imaging, arthroscopy, meniscal tear, anterior cruciate ligament

INTRODUCTION

Internal derangement of the knee refers to a broad spectrum of intra-articular disorders involving the menisci, cruciate ligaments, articular cartilage, synovium, plicae, and related stabilizing structures. These lesions are among the most frequent causes of persistent knee pain, swelling, locking, instability, and activity limitation in orthopedic practice [1-4]. They are particularly relevant in young and middle-aged adults because traumatic sports injuries, falls, road-traffic accidents, and twisting mechanisms commonly affect this age group, while degenerative tears and chondral changes contribute to symptoms in older individuals [5,6]. Accurate diagnosis is clinically important because untreated meniscal and ligamentous injuries can result in recurrent symptoms, reduced functional performance, secondary cartilage damage, and early degenerative joint changes.

The evaluation of suspected internal derangement begins with a careful history and physical examination. Symptoms such as pain, swelling, clicking, locking, and giving-way sensation often provide early diagnostic clues, whereas specific tests including joint line tenderness, McMurray test, Lachman test, and drawer tests help localize the probable lesion [5,9,10]. Even so, clinical assessment alone can be difficult when there is acute pain, joint effusion, muscle guarding, chronic adaptive change, or the coexistence of multiple lesions. Previous comparative studies have shown that well-performed clinical examination is valuable, but its accuracy varies by lesion type and examiner experience [2,5,9,10].

Magnetic resonance imaging [MRI] has become the principal noninvasive imaging modality for suspected internal derangement of the knee because it provides multiplanar assessment of soft tissues, menisci, ligaments, subchondral bone, cartilage, and joint fluid without ionizing radiation [3,4,7]. Several studies have reported high sensitivity and specificity of MRI for medial meniscal tears and anterior cruciate ligament injuries, with diagnostic performance that often approaches arthroscopic findings [4,7,8,11,12]. MRI is also useful for identifying associated abnormalities such as bone marrow edema, collateral ligament injury, plical pathology, and joint effusion, thereby improving preoperative planning and reducing unnecessary diagnostic arthroscopies [2,6,7]. However, the performance of MRI is not uniform across all lesions. Lateral meniscal tears, short peripheral tears, complex tears, and subtle chondral injuries remain relatively more difficult to detect, and false-negative as well as false-positive findings are still encountered [12-14].

Arthroscopy remains the reference standard for direct visualization of intra-articular pathology and allows simultaneous therapeutic intervention when required [2,6,7]. In many real-world settings, the key clinical question is not whether MRI can completely replace arthroscopy, but how reliably MRI reflects the actual intra-articular pathology in patients with symptomatic knees who proceed to surgery. Data from individual institutions are useful because lesion profile, referral pathways, imaging expertise, and case selection can influence observed diagnostic performance. Against this background, the present study was undertaken to evaluate the clinical presentation, MRI findings, and arthroscopic correlation in patients with internal derangement of the knee. The objectives of the study were to describe the demographic and clinical profile of affected patients, determine the spectrum of lesions identified on MRI and arthroscopy, and assess the diagnostic performance of MRI using arthroscopy as the reference standard.

MATERIALS AND METHODS

Study design and setting

This hospital-based cross-sectional study was conducted in the Department of Orthopaedics in collaboration with the Department of Radiodiagnosis at Kanyakumari Medical Mission Research Centre and Hospitals, St.Devasahayam Nagar Muttom, Kanyakumari,Tamil Nadu, India, over a six-month period from May 2025 to October 2025. The study was designed to evaluate the clinical profile of patients with suspected internal derangement of the knee and to compare MRI findings with arthroscopic findings in the same cohort.

Study population

A total of 50 consecutive patients with clinical suspicion of internal derangement of the knee were included. Patients presenting with knee pain, swelling, locking, giving-way sensation, clicking, or restriction of movement and having findings suggestive of meniscal or ligamentous injury on physical examination were considered eligible. Adult patients and older adolescents who were fit for MRI and arthroscopic evaluation were enrolled after clinical screening. Patients with acute fractures around the knee, previous knee surgery, active infection, inflammatory arthritis, advanced osteoarthritis with gross deformity, neoplastic lesions, contraindications to MRI, or unwillingness for arthroscopy were excluded.

Clinical evaluation

All patients underwent a structured clinical assessment that included demographic details, side involved, duration of symptoms, mechanism of injury, and major presenting complaints. General orthopedic examination was followed by local knee examination. Special tests were performed as clinically indicated, including joint line tenderness assessment, McMurray test for meniscal pathology, Lachman test and anterior drawer test for anterior cruciate ligament insufficiency, and posterior drawer test for posterior cruciate ligament injury. Clinical findings were recorded in a predesigned proforma.

MRI evaluation

MRI of the affected knee was performed using standard multiplanar sequences in sagittal, coronal, and axial planes. The examination was used to identify meniscal tears, cruciate ligament tears, collateral ligament injuries, chondral lesions, joint effusion, bone marrow edema or contusion, loose bodies, and associated intra-articular abnormalities. MRI interpretations were documented systematically for each patient. Lesions were categorized on a lesion-wise basis to allow subsequent comparison with arthroscopic findings. MRI was considered the index diagnostic test in the study [7,12].

Arthroscopic assessment

Diagnostic arthroscopy was performed by the treating orthopedic team after clinical and imaging evaluation. Arthroscopy findings were used as the reference standard because of direct visualization of intra-articular structures and its established role in evaluating internal derangement of the knee [2,6,7]. Meniscal tears, cruciate ligament injuries, chondral defects, synovial hypertrophy or plica, loose bodies, and combined lesions were documented.

Statistical analysis and ethics

Data were entered into Microsoft Excel and analyzed descriptively. Categorical variables were expressed as frequency and percentage, and continuous variables were summarized as mean and standard deviation. Using arthroscopy as the reference standard, sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of MRI were calculated for major lesions. Institutional ethical approval was

obtained before commencement of the study, and informed consent was taken from all participants.

RESULTS

A total of 50 patients with suspected internal derangement of the knee were included in the study and underwent clinical evaluation, MRI, and arthroscopic assessment. The mean age of the study population was 32.4 ± 9.8 years. Most patients belonged to the 21-30 years [36.0%] and 31-40 years [34.0%] age groups. Men constituted 68.0% of the study population, and the right knee was more frequently involved than the left [58.0% vs. 42.0%]. More than half of the patients presented within 3 months of symptom onset [56.0%]. Pain was the universal presenting complaint, followed by swelling, locking, and giving-way sensation. Baseline characteristics and presenting symptoms are shown in Table 1.

Table 1. Baseline characteristics and presenting symptoms of the study population [n = 50]

Variable	Category	n	%
Age group [years]	18-20	4	8.0
Age group [years]	21-30	18	36.0
Age group [years]	31-40	17	34.0
Age group [years]	41-50	8	16.0
Age group [years]	>50	3	6.0
Sex	Male	34	68.0
Sex	Female	16	32.0
Side involved	Right knee	29	58.0
Side involved	Left knee	21	42.0
Duration of symptoms	<3 months	28	56.0
Duration of symptoms	3-6 months	14	28.0
Duration of symptoms	>6 months	8	16.0
Presenting symptoms	Pain	50	100.0
Presenting symptoms	Swelling	34	68.0
Presenting symptoms	Locking	20	40.0
Presenting symptoms	Giving-way sensation	18	36.0
Presenting symptoms	Restricted range of movement	16	32.0
Presenting symptoms	Clicking	15	30.0

On clinical examination, joint line tenderness was the most common sign and was present in 60.0% of patients, followed by effusion in 56.0%. McMurray test was positive in 46.0% of cases, while Lachman test and anterior drawer test were positive in 28.0% and 24.0% of patients, respectively. Posterior drawer test positivity was uncommon and seen in only 4.0% of patients. The distribution of clinical examination findings is presented in Table 2.

Table 2. Clinical examination findings in patients with internal derangement of the knee [n = 50]

Clinical examination finding	n	%
Joint line tenderness	30	60.0
Effusion	28	56.0
McMurray test positive	23	46.0
Lachman test positive	14	28.0
Anterior drawer test positive	12	24.0
Posterior drawer test positive	2	4.0

MRI demonstrated medial meniscal tear as the most frequent abnormality, seen in 22 patients [44.0%], followed by ACL tear in 14 [28.0%], lateral meniscal tear in 8 [16.0%], chondral injury in 6 [12.0%], and PCL tear in 2 [4.0%]. Arthroscopy similarly identified medial meniscal tear as the most common lesion [40.0%], followed by ACL tear [26.0%]. MRI also identified associated lesions such as collateral ligament injury, joint effusion, and bone marrow edema or contusion, while arthroscopy additionally documented synovial hypertrophy or plica and loose bodies. Comparative MRI and arthroscopic findings are detailed in Table 3.

Table 3. Comparative distribution of MRI and arthroscopic findings [n = 50]

Lesion/finding	MRI n [%]	Arthroscopy n [%]
Medial meniscal tear	22 [44.0]	20 [40.0]
Lateral meniscal tear	8 [16.0]	7 [14.0]
ACL tear	14 [28.0]	13 [26.0]
PCL tear	2 [4.0]	2 [4.0]
Chondral injury	6 [12.0]	5 [10.0]
Medial collateral ligament injury	5 [10.0]	—
Lateral collateral ligament injury	2 [4.0]	—
Joint effusion	26 [52.0]	—
Bone marrow edema/contusion	10 [20.0]	—
Synovial hypertrophy/plica	—	4 [8.0]
Loose bodies	—	2 [4.0]
Combined/multiple lesions	15 [30.0]	15 [30.0]

Note: Multiple lesions were present in several patients; therefore, percentages exceed 100% in the lesion-wise distribution.

Lesion-wise analysis showed that MRI had high diagnostic validity when compared with arthroscopy. Sensitivity and specificity were 90.0% and 86.7% for medial meniscal tears, 85.7% and 95.3% for lateral meniscal tears, and 92.3% and 94.6% for ACL tears. MRI demonstrated perfect diagnostic performance for the two PCL tears identified in the study. In contrast, although specificity remained high for chondral injury, sensitivity was comparatively lower at 80.0%. The diagnostic performance indices of MRI are summarized in Table 4.

Table 4. Diagnostic performance of MRI using arthroscopy as the reference standard

Lesion	Sensitivity [%]	Specificity [%]	PPV [%]	NPV [%]	Accuracy [%]
Medial meniscal tear	90.0	86.7	81.8	92.9	88.0
Lateral meniscal tear	85.7	95.3	75.0	97.6	94.0
ACL tear	92.3	94.6	85.7	97.2	94.0
PCL tear	100.0	100.0	100.0	100.0	100.0
Chondral injury	80.0	95.6	66.7	97.7	94.0

Overall, medial meniscal tear was the most frequent lesion detected on both MRI and arthroscopy, followed by ACL tear. MRI showed excellent agreement with arthroscopy for cruciate ligament injuries, particularly PCL and ACL tears, and good diagnostic performance for meniscal lesions. However, the sensitivity of MRI for chondral lesions was relatively lower, indicating that arthroscopy remains more reliable for detecting subtle articular cartilage abnormalities.

DISCUSSION

The present study evaluated 50 patients with suspected internal derangement of the knee using structured clinical examination, MRI, and arthroscopy. The study population was predominantly young and middle-aged, with the largest proportions in the 21-30 years and 31-40 years age groups, and a clear male predominance. This demographic pattern is consistent with earlier reports showing that internal derangement commonly affects active adults exposed to sports trauma, twisting injuries, work-related strain, and road-traffic accidents [5,6,10,11]. The higher involvement of men in the present study also agrees with most hospital-based series [8,10].

Pain was present in all patients, while swelling, locking, and giving-way sensation were the next most frequent complaints. These findings align with the usual symptom complex of meniscal and cruciate ligament pathology described in previous comparative studies [2,5,9]. Joint line tenderness, effusion, and positive McMurray and Lachman tests were the commonest examination

findings in our cohort, supporting the continued relevance of detailed clinical evaluation in patients with suspected intra-articular knee lesions. Earlier studies have shown that careful clinical assessment remains highly informative, particularly for meniscal and ACL injuries [5,9,10].

In the present series, medial meniscal tear emerged as the most frequent lesion on both MRI and arthroscopy, followed by ACL tear. This pattern is similar to that reported in classic and contemporary literature, where medial meniscal injury often predominates because of biomechanical load distribution, firm capsular attachment, and its frequent association with rotational instability [4,5,10,13]. MRI also identified associated abnormalities such as collateral ligament injury, joint

effusion, and bone marrow edema, thereby contributing useful preoperative information [7,11]. The coexistence of multiple lesions in 30.0% of patients further highlights the composite nature of internal derangement.

MRI showed strong diagnostic performance in the present study for medial meniscal tear, lateral meniscal tear, ACL tear, and PCL tear, with particularly high accuracy for cruciate ligament injuries. These findings are broadly in agreement with systematic reviews and institutional studies that have demonstrated high sensitivity and specificity of MRI for ACL and medial meniscal lesions [7,12]. The observed performance for lateral meniscal tears was slightly lower than that for medial meniscal tears, which is also consistent with prior evidence suggesting that lateral tears are more easily missed or misclassified, especially when small, peripheral, or morphologically complex [12-14]. In our study, the sensitivity of MRI for chondral injury was lower than that for meniscal and cruciate lesions. This observation parallels earlier work showing that subtle articular surface lesions are less reliably detected on MRI than on direct arthroscopic inspection [2,14].

Overall, the present study supports the practical role of MRI as an effective pre-arthroscopic investigation in symptomatic knee disorders. It refines lesion localization, identifies associated pathology, and demonstrates good concordance with arthroscopy for major internal derangements. At the same time, the findings reinforce that arthroscopy remains indispensable when clinical suspicion persists despite equivocal imaging or when chondral pathology is a major concern.

Limitations

The study was conducted at a single center with a modest sample size of 50 patients, which restricts broader generalization. The cross-sectional design did not permit assessment of long-term functional outcome or postoperative recovery. Arthroscopic documentation depended on routine operative recording, and interobserver variability in MRI interpretation was not separately analyzed. Selection was limited to patients who proceeded to arthroscopy, introducing procedural selection bias.

CONCLUSION

Internal derangement of the knee in the present study was seen predominantly in young adult males and most often involved medial meniscal and anterior cruciate ligament pathology. Pain, swelling, locking, and instability formed the core clinical presentation, while MRI provided a detailed preoperative assessment of meniscal, ligamentous, chondral, and associated intra-articular abnormalities. Arthroscopy confirmed the high diagnostic utility of MRI, particularly for cruciate ligament and meniscal injuries. Diagnostic performance was strongest for ACL and PCL lesions and comparatively lower for chondral defects. MRI therefore serves as a reliable and clinically valuable screening and decision-support tool, whereas arthroscopy remains essential for definitive evaluation when cartilage injury or persistent diagnostic uncertainty exists.

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