Section: Radiodiagnosis

Original Research Article

COMPARISON OF MAGNETIC RESONANCE IMAGING AND ARTHROSCOPIC FINDINGS IN PATIENTS WITH INTERNAL DERANGEMENT OF KNEE

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ABSTRACT

Background: Internal derangement of the knee is a common musculoskeletal condition encountered in orthopedic and radiology practice. Accurate diagnosis is essential for early management and prevention of long-term morbidity. Magnetic Resonance Imaging (MRI) has emerged as a non-invasive imaging modality for evaluating ligamentous, meniscal, and cartilaginous injuries, while arthroscopy remains the gold standard for diagnosis and treatment.

Materials and Methods: A hospital-based observational study was conducted in the Department of Radiodiagnosis, Faculty of Medicine and Health Sciences, SGT University, Gurugram, over a period of 18 months. Fifty patients with suspected internal derangement of the knee who underwent both MRI and arthroscopy were included. MRI was performed on a 1.5 Tesla Philips Multiva scanner using T1-weighted, T2-weighted, STIR, PD fat-saturated, and mFFE sequences. MRI findings were compared with arthroscopic findings for evaluation of anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), meniscal injuries, and collateral ligament injuries.

Results: The study population had a mean age of 31.5 ± 11.22 years, with the majority belonging to the 25–34 years age group. Males constituted the predominant population. Pain and instability were the most common presenting complaints. MRI showed high diagnostic accuracy in detecting ACL tears and meniscal injuries when compared with arthroscopy. The sensitivity and specificity of MRI for ACL injuries were found to be high, indicating excellent agreement with arthroscopic findings.

Conclusion: MRI is a sensitive and specific non-invasive modality for diagnosing internal derangement of the knee and demonstrates excellent correlation with arthroscopic findings. MRI can effectively guide clinical management and reduce unnecessary diagnostic arthroscopies.

Keywords: Magnetic Resonance Imaging, Arthroscopy, Internal derangement of knee, ACL tear, Meniscal injury, Knee MRI.

INTRODUCTION

The knee joint is one of the largest and most complex joints in the human body. Because of its weight-bearing function and extensive range of motion, it is particularly vulnerable to traumatic and degenerative injuries. Internal derangement of the knee refers to a spectrum of pathologies involving the menisci,

cruciate ligaments, collateral ligaments, articular cartilage, and surrounding soft tissue structures.[1-4]

Knee injuries are commonly encountered in athletes, road traffic accident victims, and individuals involved in physically demanding activities. Patients usually present with pain, swelling, locking, instability, or restricted movement. Clinical examination plays an important role in diagnosis; however, clinical findings may sometimes be inconclusive because of pain, muscle spasm, or associated injuries.[5-7]

Arthroscopy has traditionally been considered the gold standard for diagnosing internal derangement of the knee. It allows direct visualization of intra-articular structures and offers therapeutic intervention simultaneously. However, arthroscopy is invasive, expensive, and associated with complications such as infection, hemarthrosis, and neurovascular injury.[8-10]

Magnetic Resonance Imaging (MRI) has revolutionized the evaluation of knee pathologies because of its excellent soft tissue contrast, multiplanar capability, and non-invasive nature. MRI accurately demonstrates injuries involving the menisci, ligaments, cartilage, bone marrow, and periarticular soft tissues. It has become the preferred imaging modality for preoperative assessment and treatment planning in patients with suspected internal derangement of the knee.

Several studies have reported excellent sensitivity and specificity of MRI in detecting anterior cruciate ligament tears and meniscal injuries. Despite its widespread use, arthroscopy continues to serve as the reference standard against which MRI findings are compared. Therefore, it is important to assess the diagnostic accuracy of MRI in routine clinical practice.

The present study was conducted to compare MRI findings with arthroscopic findings in patients with internal derangement of the knee and to evaluate the diagnostic efficacy of MRI in detecting ligamentous and meniscal injuries.

MATERIALS AND METHODS

Study Design and Setting: This hospital-based observational study was conducted in the Department of Radiodiagnosis, Faculty of Medicine and Health Sciences, SGT University, Budhera, Gurugram. Patients presenting to the Orthopedics outpatient department with symptoms suggestive of internal derangement of the knee were referred for MRI evaluation.

Study Duration: The study was carried out over a period of approximately 18 months, with active patient recruitment and data collection for one year.

Sample Size: A total of 50 patients with clinically suspected internal derangement of the knee were included in the study. The sample size was calculated based on previous literature demonstrating approximately 90% MRI accuracy in evaluating meniscal and ligamentous injuries.

Inclusion Criteria

1. Patients with suspected internal derangement of the knee.
2. Patients undergoing both MRI and arthroscopy.
3. Patients willing to provide informed consent.

Exclusion Criteria

1. Patients with MRI-incompatible implants.
2. Patients with implants in the distal femur, patella, or proximal tibia.
3. Patients unwilling to participate in the study.

MRI Technique: MRI examinations were performed using a 1.5 Tesla Philips Multiva MRI scanner. Standard knee imaging protocols were followed using dedicated knee coils.

The sequences included:

- T1-weighted images in axial and sagittal planes
- T2-weighted images in axial and sagittal planes
- STIR sequences in axial, coronal, and sagittal planes
- Proton density fat-saturated sequences in axial, coronal, and sagittal planes
- mFFE sequences in sagittal planes

MRI findings were evaluated for:

- Anterior cruciate ligament (ACL)
- Posterior cruciate ligament (PCL)
- Medial meniscus
- Lateral meniscus
- Medial collateral ligament (MCL)
- Lateral collateral ligament (LCL)

Clinical Examination: Detailed clinical history and physical examination were performed in all patients.

Clinical tests included:

- Lachman test
- Anterior drawer test
- Posterior drawer test
- Pivot shift test
- McMurray test
- Valgus stress test
- Varus stress test

Arthroscopy: Diagnostic and therapeutic arthroscopy was performed by experienced orthopedic surgeons. Arthroscopic findings were considered the reference standard for comparison with MRI findings.

Statistical Analysis: Data were analyzed using SPSS version 25. Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of MRI were calculated by comparing MRI findings with arthroscopic findings.

RESULTS

Demographic Distribution: The age of the patients ranged from 15 to 58 years, with a mean age of 31.5 ± 11.22 years. The majority of patients belonged to the 25–34 years age group. Male patients predominated, reflecting increased exposure to trauma and sports-related activities.

Left knee involvement was observed in 52% of patients, while right knee involvement was noted in 48% of cases.

Clinical Presentation: Pain was the most common presenting symptom and was reported in 88% of patients. Instability or "giving way" sensation was present in 68% of patients. Other common symptoms included swelling, locking, and restricted movement. Road traffic accidents and falls were the most common mechanisms of injury, each accounting for 40% of cases. Twisting injuries were also observed in a smaller proportion of patients.

Clinical Examination Findings: The anterior drawer test was positive in 82% of patients, while the Lachman test was positive in 68% of cases, suggesting a high prevalence of ACL injuries.

Posterior drawer test positivity was observed in 26% of patients. Valgus and varus stress tests were positive in 16% and 14% of cases respectively.

MRI Findings: MRI detected a high number of ACL tears, meniscal injuries, and associated ligamentous injuries. ACL injuries were among the most common abnormalities identified.

Medial meniscal tears were more common than lateral meniscal tears. MRI also demonstrated associated bone marrow edema, joint effusion, and collateral ligament injuries in several patients.

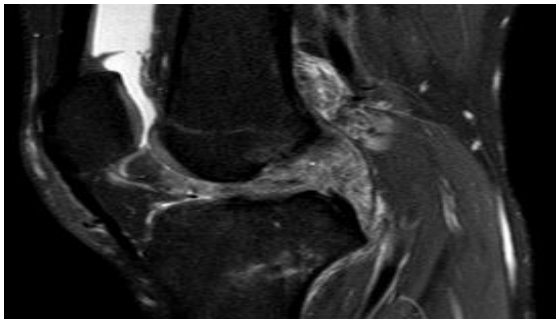

Figure 1: MRI Appearance of ACL Tear

PD fatsat sagittal: ACL complete tear on MRI

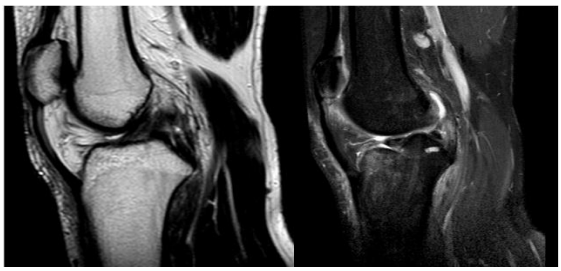

Figure 2: MRI Appearance of PCL Tear

T2 and PD fatsat sagittal: Discontinuity in the PCL fibers – PCL tear

Comparison of MRI with Arthroscopy: MRI showed excellent agreement with arthroscopic findings in detecting ACL tears and meniscal injuries. The sensitivity and specificity of MRI for ACL injuries were high, demonstrating strong diagnostic performance. Similarly, MRI showed good diagnostic accuracy for medial and lateral meniscal tears.

False-positive and false-negative MRI findings were observed in a few cases, particularly in partial tears and degenerative meniscal changes.

Overall, MRI proved to be a reliable diagnostic modality for evaluation of internal derangement of the knee.

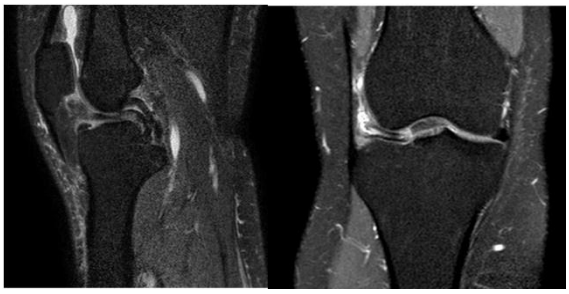

Figure 3: MRI Appearance of Meniscal Tear

SAGITTAL/CORONAL PDfatsat Double PCL sign – Bucket handle tear of the medial meniscus with flipped meniscal fragment lying in the intercondylar region of tibiofemoral joint

Figure 4: MRI appearance of Collateral Ligament Injury

Coronal PD fatsat Medial collateral ligament tear on MRI

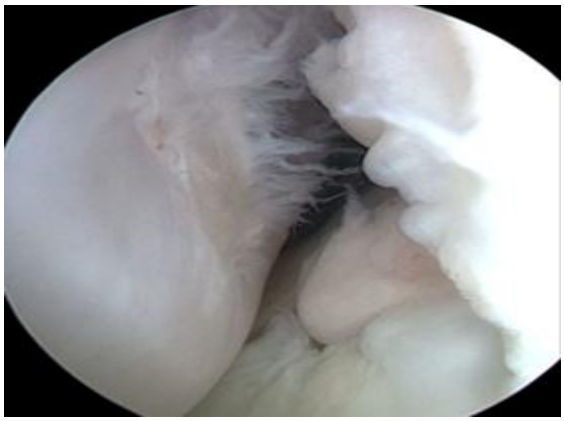

Figure 5: Arthroscopy appearance of ACL Tear

Complete ACL tear on arthroscopy

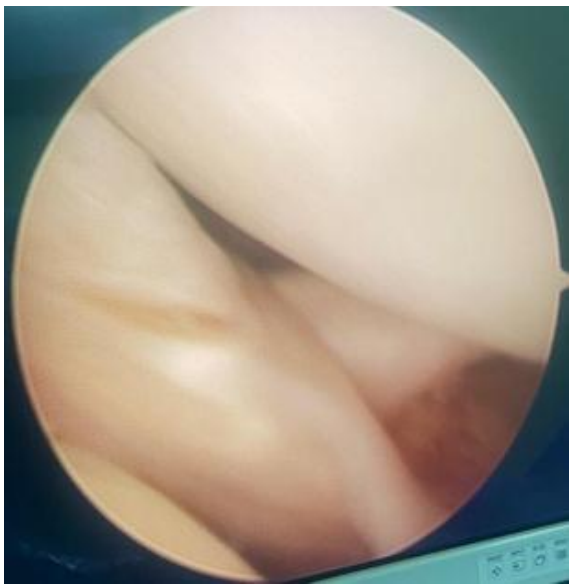

Figure 6: Arthroscopy appearance of meniscal tear

Horizontal tear of lateral meniscus on arthroscopy.

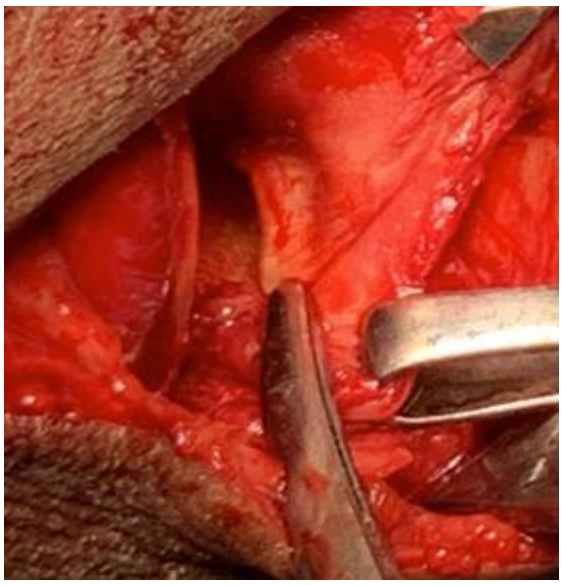

Figure 7: Arthroscopy appearance of MCL Tear

Medial collateral ligament injury on arthroscopy.

Table 1: Demographic Characteristics of Study Population

Variable	Observation
Total patients	50
Mean age	31.5 ± 11.22 years
Age range	15–58 years
Most common age group	25–34 years
Left knee involvement	52%
Right knee involvement	48%

Table 2: Clinical Presentation

Symptom	Percentage
Pain	88%
Instability/Give way	68%
Swelling	Common
Locking	Common

Table 3: Mechanism of Injury

Mechanism	Percentage
Fall	40%
Road traffic accident	40%
Twisting injury	12%
Others	8%

Table 4: Clinical Test Positivity

Clinical Test	Positive Cases
Anterior drawer test	82%
Lachman test	68%
Posterior drawer test	26%
Valgus stress test	16%
Varus stress test	14%

Table 5: MRI and Arthroscopy Correlation

Injury Type	MRI Correlation with Arthroscopy
ACL tear	Excellent
Medial meniscus tear	Good
Lateral meniscus tear	Good
PCL tear	High
Collateral ligament injuries	Moderate to high

DISCUSSION

Internal derangement of the knee represents one of the most common causes of pain, instability, and functional limitation in young and active individuals. Accurate diagnosis of ligamentous and meniscal injuries is essential for early treatment planning and prevention of long-term sequelae such as recurrent instability, secondary osteoarthritis, muscle wasting, and chronic disability. Over the years, 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.

The present study was conducted to evaluate the diagnostic accuracy of MRI in comparison with arthroscopy in patients with suspected internal derangement of the knee. Arthroscopy was considered the gold standard for comparison because it allows direct visualization of intra-articular structures and simultaneous therapeutic intervention.

In the present study, the majority of patients belonged to the younger age group, with a mean age of approximately 31 years. Similar observations have been reported in previous studies by Mackenzie et al. and Singh et al.[3,6]. The increased incidence of knee injuries in younger individuals can be attributed to greater participation in sports, physically demanding occupations, road traffic accidents, and outdoor activities. Male predominance observed in this study is also consistent with previous literature and may be related to increased exposure to trauma and sports-related activities among males.[3,6]

Pain was the most common presenting complaint in the present study, followed by instability and swelling. These findings are in agreement with earlier studies evaluating patients with knee trauma.[6,9] Clinical examination remains an important component in the assessment of knee injuries; however, clinical diagnosis alone may be difficult in acute trauma because of pain, muscle spasm, hemarthrosis, and overlapping symptoms. Hence, imaging plays a crucial role in confirming the diagnosis.

Among ligamentous injuries, ACL tears were the most commonly encountered abnormalities in this study. The ACL is particularly vulnerable to injury during twisting movements, sudden deceleration, and rotational stress. MRI demonstrated excellent sensitivity and specificity for ACL tears, which is consistent with the findings of Rubin et al. and Vahey et al.[5,7] Complete ACL tears were accurately diagnosed on MRI because of characteristic findings such as discontinuity of fibers, abnormal orientation of the ligament, increased intraligamentous signal intensity, and associated secondary signs including anterior tibial translation, bone contusions, and buckling of the PCL.

Partial ACL tears, however, posed a greater diagnostic challenge. Some false-negative and false-positive cases were observed in patients with partial tears or chronic injuries. Chronic ACL tears may show fibrosis and altered morphology, making interpretation difficult. Similar limitations have been discussed in earlier studies.[5,7] Despite these challenges, MRI continues to demonstrate high diagnostic accuracy for ACL evaluation.

Meniscal injuries were another major finding in the present study. Medial meniscal tears were more common than lateral meniscal tears, which correlates with established literature.[1,2] The medial meniscus is relatively less mobile because of its firm attachment to the joint capsule and medial collateral ligament, making it more susceptible to injury. MRI demonstrated high sensitivity and specificity in the detection of meniscal tears, especially when the tear extended to the articular surface.

The diagnostic performance of MRI for meniscal tears in the present study is comparable to that reported by Crues et al. and De Smet et al.[1,2] The "two-slice-touch" rule described by De Smet et al. has significantly improved MRI interpretation of meniscal pathology.[2] MRI was particularly effective in identifying bucket-handle tears, longitudinal tears, and complex tears. However, certain limitations were observed in differentiating degenerative intrasubstance signal changes from true tears. Kaplan et al. also reported that intrameniscal high signal intensity not extending to the articular surface may lead to false-positive diagnoses.[8]

Collateral ligament injuries and PCL injuries were less common in the present study but were identified accurately on MRI. MRI was useful in evaluating the extent of ligament injury, surrounding edema, and associated soft tissue abnormalities. Associated findings such as bone marrow edema, joint effusion, cartilage injury, and soft tissue swelling were also effectively demonstrated on MRI. These associated abnormalities are important because they may influence clinical management and prognosis.

One of the major advantages of MRI over arthroscopy is its ability to evaluate both intra-articular and extra-articular structures simultaneously. While arthroscopy provides direct visualization of the joint cavity, it has limited ability to assess bone marrow edema, occult fractures, collateral ligaments, musculotendinous structures, and periarticular soft tissues. MRI therefore provides a more comprehensive evaluation of knee injuries.

Arthroscopy remains the gold standard for diagnosis because of its direct visualization and therapeutic potential. However, it is invasive and associated with complications such as infection, hemarthrosis, deep vein thrombosis, anesthetic risks, and neurovascular injury. MRI serves as an excellent screening and preoperative planning tool and can reduce unnecessary diagnostic arthroscopies. Fischer et al. and Oei et al. similarly highlighted the significant role of MRI in minimizing invasive procedures.[4,9]

The findings of the present study are comparable with those of previous international and Indian studies evaluating MRI accuracy in internal derangement of the knee.[3,4,6,10] High-resolution multiplanar imaging, dedicated knee coils, and advanced pulse sequences have further improved the diagnostic performance of MRI in modern clinical practice.

The present study had certain limitations. The sample size was relatively small and the study was conducted at a single center, which may limit generalizability of results. In addition, arthroscopy is operator dependent and small stable meniscal tears may occasionally be missed even during arthroscopic evaluation. Interobserver variation in MRI interpretation was also not assessed in the study.

Despite these limitations, the present study confirms that MRI is a highly reliable imaging modality for evaluation of internal derangement of the knee. Its excellent diagnostic performance, non-invasive nature, and ability to identify associated injuries make it indispensable in routine orthopedic and radiological practice.

CONCLUSION

MRI is an excellent non-invasive imaging modality for evaluating internal derangement of the knee. It demonstrates high sensitivity, specificity, and diagnostic accuracy in detecting ACL tears, meniscal injuries, and associated ligamentous abnormalities when compared with arthroscopy.

MRI not only provides detailed assessment of intra-articular structures but also identifies associated bone and soft tissue abnormalities that may not be visualized during arthroscopy. Its multiplanar imaging capability and superior soft tissue contrast make it indispensable in routine knee evaluation.

Because of its accuracy and non-invasive nature, MRI can reduce unnecessary diagnostic arthroscopies and aid in appropriate surgical planning and patient management. Arthroscopy, however, continues to remain the definitive diagnostic and therapeutic modality in selected cases.

REFERENCES

1. Crues JV, Mink J, Levy TL, Lotysch M, Stoller DW. Meniscal tears of the knee: accuracy of MR imaging. Radiology. 1987;164:445-448.
2. De Smet AA, Tuite MJ. Use of the “two-slice-touch” rule for the MRI diagnosis of meniscal tears. AJR Am J Roentgenol. 2006;187:911-914.
3. Mackenzie R, Palmer CR, Lomas DJ, Dixon AK. Magnetic Resonance Imaging of the knee: diagnostic performance studies. Clin Radiol. 1996;51:251-257.
4. Oei EH, Nikken JJ, Verstijnen AC, Ginai AZ, Hunink MG. MR imaging of the menisci and cruciate ligaments: a systematic review. Radiology. 2003;226:837-848.
5. Rubin DA, Kettering JM, Towers JD, Britton CA. MR imaging of knees having isolated and combined ligament injuries. AJR Am J Roentgenol. 1998;170:1207-1213.
6. Singh JP, Garg L, Shrimali R, Setia V, Gupta V. MR imaging of knee with arthroscopic correlation in twisting injuries. Indian J Radiol Imaging. 2004;14:33-40.
7. Vahey TN, Broome DR, Kayes KJ, Shelbourne KD. Acute and chronic tears of the anterior cruciate ligament: differential features at MR imaging. Radiology. 1991;181:251-253.
8. Kaplan PA, Nelson NL, Garvin KL, Brown DE. MR of the knee: the significance of high signal in the meniscus that does not clearly extend to the surface. AJR Am J Roentgenol. 1991;156:333-336.
9. Fischer SP, Fox JM, Del Pizzo W, Friedman MJ, Snyder SJ, Ferkel RD. Accuracy of diagnoses from magnetic resonance imaging of the knee. J Bone Joint Surg Am. 1991;73:2-10.
10. Gyawali B, Shrestha D, Dhakal G. Diagnostic accuracy of MRI in evaluation of meniscal and ligamentous injuries of knee joint. Journal of Institute of Medicine. 2020;42(1):45-50.