MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 2, 2026, Pages 549-553

Magnetic Resonance Imaging in Evaluating Traumatic Knee Joints: A Cross-Sectional Study

Kunal Tyagi[1*],
Department of Allied Health Care Sciences, Radiology,
(PG scholar) Vivekananda Global University, Jaipur 302012, INDIA.
E-mail – kunaltyagihmh@gmail.com, Contact No. - 8824971659
Rukmanee[2],
Department of Allied Health Care Sciences, Radiology,
Faculty of Allied Health Care Professionals, (Supervisor) Vivekananda Global University, Jaipur 302012, INDIA,
E-mail – rukmanee6@gmail.com, Contact No. - 6394892343
Yogita janghu[3],
Department of Allied Health Care Sciences, Radiology,
Faculty of Allied Health Care Professionals, (Co-Supervisor) Vivekananda Global University, Jaipur 302012, INDIA.
Dr. Mahendra Kumar Verma[4],
Allied health care sciences, Professor & Principal,
Vivekananda Global University, Jaipur, Rajasthan INDIA.

Abstract:

Background: Knee pain and injuries are common musculoskeletal problems. They often cause impairment in people of all ages. The knee joint has an anatomy with many soft tissue structures like ligaments, menisci, cartilage and periarticular components. Because of this clinical examination and X-rays alone are often not enough for a diagnosis. Magnetic Resonance Imaging (MRI) has become a sensitive and non-invasive way to evaluate both bone and soft tissue abnormalities.

Objective: This study aimed to assess the utility of MRI in evaluating painful and traumatic knee joints. We also analysed the pattern of MRI-detected pathologies with respect to age and gender.

Methods: We conducted a -sectional observational study at a diagnostic imaging centre in Sri Ganganagar, Rajasthan. A total of 70 patients with knee pain or a history of trauma were examined using a 1.5 Tesla MRI system. We used knee MRI protocols with multiplanar imaging sequences to assess ligamentous injuries, meniscal tears, cartilage defects, bone marrow abnormalities, joint effusion and associated soft tissue changes.

Results: Most patients were young adults with more males than females especially in the 21–30-year age group. Ligamentous injuries were the common findings with anterior cruciate ligament (ACL) tears being the most predominant. Meniscal injuries, especially involving the meniscus were also commonly identified. Additional findings included bone contusions, fractures, joint effusion and patellofemoral abnormalities. MRI demonstrated sensitivity in detecting both isolated and combined injuries.

MRI is an non-invasive imaging modality that provides detailed visualisation of internal knee structures. This enables accurate diagnosis of traumatic and painful knee conditions. Its comprehensive diagnostic capability significantly enhances decision-making and may reduce the need for invasive procedures like diagnostic arthroscopy.

Keywords: Magnetic Resonance Imaging; Knee Trauma; Painful Knee; ACL Injury; Meniscal Tear; Musculoskeletal Imaging.

INTRODUCTION

Knee joint disorders represent a proportion of musculoskeletal complaints encountered in clinical practice. They are a contributor to disability and reduced quality of life. The knee joint is vulnerable to both degenerative conditions. Its complex structural composition makes it highly susceptible to a range of traumatic and degenerative pathologies[(1)].

In years the incidence of knee injuries has increased considerably. This is due to factors such as increased participation in sports activities, road traffic accidents, occupational stress and changing lifestyle patterns.Traumatic knee injuries commonly involve ligament tears, meniscal injuries, bone contusions and cartilage damage. Non-traumatic conditions include osteoarthritis, inflammatory disorders and overuse syndromes. Young and active individuals are frequently affected by acute traumatic injuries. Degenerative conditions are predominantly seen in populations. Gender-based variations have also been reported, with males showing a prevalence of trauma-related knee injuries. Accurate and early diagnosis of knee pathology is essential for appropriate management. It also helps in prevention of long-term complications such as instability and post-traumatic osteoarthritis[(3)(4)].

However clinical examination alone is often insufficient in acute settings due to pain, swelling and limited range of motion[(2)]. Conventional imaging modalities such as radiography and computed tomography (CT) are useful for assessing osseous abnormalities. They have limited sensitivity in detecting soft tissue injuries. MRI has emerged as the imaging modality of choice. This is due to its soft tissue contrast and multiplanar capability and non-invasive nature.MRI enables visualization of ligaments, menisci, cartilage bone marrow and periarticular soft tissues. This allows detection of both acute and chronic abnormalities. It is particularly valuable in identifying findings such as bone marrow oedema, partial ligament tears and early cartilage degeneration[(5)(6)]. These are often missed by imaging techniques. Several studies have demonstrated that MRI has diagnostic accuracy in detecting ligamentous and meniscal injuries.The anterior cruciate ligament (ACL) is reported to be the frequently injured structure in traumatic knee cases. Meniscal injuries, particularly involving the meniscus are common. Additionally, MRI plays a role in identifying associated findings such as joint effusion, bone contusions, and complex multi-structure injuries. This facilitates evaluation in a single examination. The use of MRI not enhances diagnostic confidence but also significantly reduces the need for invasive procedures such as diagnostic arthroscopy[(7)(8)].

Despite limitations such as cost and accessibility MRI continues to be widely accepted as the gold standard imaging modality for evaluating painful and traumatic knee joints. In view of the increasing burden of knee injuries and the pivotal role of imaging in diagnosis the present study aims to evaluate the role of MRI in identifying pathologies associated with painful and traumatic knee joints[(9)(10)].

FIG 1.1: NORMAL KNEE JOINT SEEN IN MRI

Furthermore, the study seeks to analyse the distribution of MRI findings with respect, to age and gender. This will contribute to improved understanding and management of knee joint disorders.

MATERIALS AND METHODS

Study Design and Setting: This research was conducted as a hospital-based cross-sectional observational study in the Department of Radiodiagnosis at a diagnostic centre in Sri Ganganagar, Rajasthan, India. The study was carried out over a defined study period and included patients presenting with symptoms related to knee pain or a history of trauma.

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 2, 2026, Pages 549-553

Study Population: A total of 70 patients with clinically suspected painful or traumatic knee joint pathology were included in the study. Patients of all age groups and both genders were evaluated.

Inclusion Criteria

- Patients presenting with knee pain, swelling, or restricted movement
- History of recent or past trauma to the knee joint
- Patients referred for MRI evaluation of the knee.

Exclusion Criteria

- Patients with contraindications to MRI (e.g., pacemakers, metallic implants incompatible with MRI)
- History of previous knee surgery
- Patients unwilling or unable to undergo MRI examination.

MRI Protocol and Technique

All MRI examinations were performed using a 1.5 Tesla MRI scanner equipped with a dedicated knee coil. Standardised imaging protocols were followed for all patients to ensure consistency.

The imaging sequences included:

- T1-weighted sequences
- T2-weighted sequences
- Proton density (PD) sequences
- Short Tau Inversion Recovery (STIR) sequences.

Images were acquired in multiplanar orientations (sagittal, coronal, and axial planes) to allow detailed visualization of intra-articular and periarticular structures.

Image Analysis

MRI scans were systematically evaluated for the presence of:

- Ligament injuries (anterior cruciate ligament, posterior cruciate ligament, medial collateral ligament, lateral collateral ligament)
- Meniscal abnormalities (medial and lateral menisci)
- Articular cartilage defects
- Bone marrow oedema or contusions
- Joint effusion
- Associated soft tissue and periarticular abnormalities

All findings were categorised and recorded in a structured data collection format.

STATISTICAL ANALYSIS

Data obtained from MRI findings and patient demographics were compiled and analysed using descriptive statistical methods.

- Categorical variables such as gender distribution, type of injury, and anatomical involvement were expressed as frequencies and percentages.
- Continuous variables such as age were summarized using mean and standard deviation (SD) where applicable.
- Data were further stratified according to age groups and gender to evaluate patterns of injury distribution.
- Comparative analysis was performed to assess the relative frequency of different knee pathologies.

Statistical analysis was carried out using standard software such as Microsoft Excel and/or SPSS (Statistical Package for the Social Sciences). A p-value of <0.05 was considered statistically significant wherever inferential analysis was applied.

RESULTS

A total of 70 patients with painful or traumatic knee joints were evaluated using MRI. Most patients were males, with the highest incidence seen in the 21–30 years age group. Ligament injuries were the most common MRI finding, with anterior cruciate ligament (ACL) tears being the predominant injury. Meniscal tears were frequently observed, especially involving the medial meniscus, with Grade III tears seen mainly in traumatic cases. Bone contusions and fractures commonly involved the tibial and femoral condyles, while patellar injuries were less frequent. Overall, MRI proved highly effective in detecting both soft-tissue and bony abnormalities of the knee joint, aiding accurate diagnosis and management.

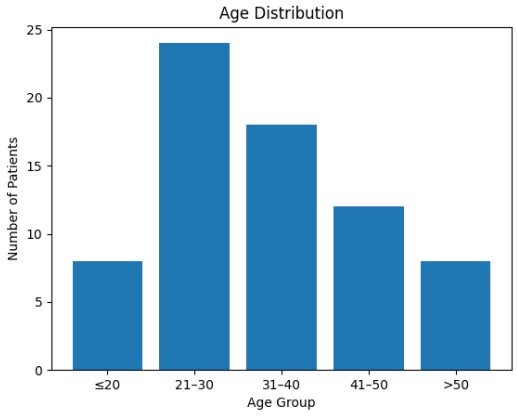
Distribution of Patients According to Age and Gender: The study population consisted of patients aged **16 to 65 years**. Most patients belonged to the **young adult and middle-aged groups**. Male patients were more commonly affected than female patients.

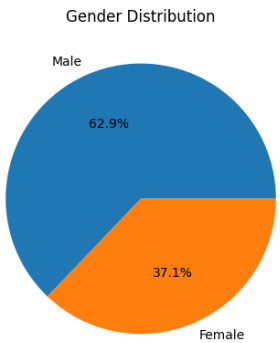
Table 1.1: Age and Gender Distribution of Patients (n = 70)

Age Group (Years)	Male	Female	Total
≤ 20	6	2	8
21 – 30	18	6	24
31 – 40	10	8	18
41 – 50	6	6	12
> 50	4	4	8
Total	**44**	**26**	**70**

Observation:

- Male patients (62.9%) were more commonly affected than females (37.1%).
- Maximum cases were seen in the **21–30 years age group**, reflecting higher trauma-related activity.





Distribution of Patients According to Structural Injury on MRI

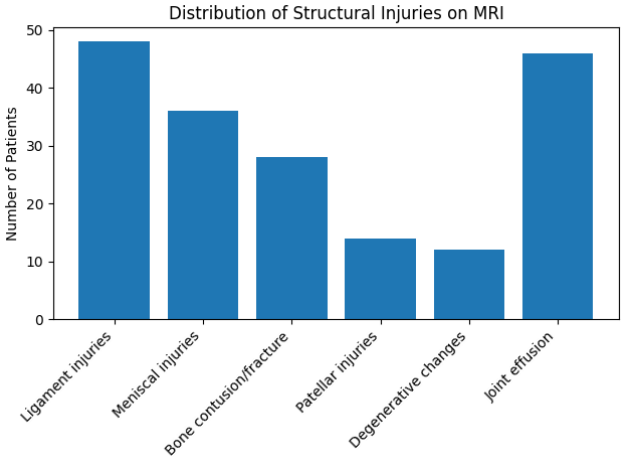
MRI detected a wide range of structural injuries involving ligaments, menisci, cartilage, bone, and patellar structures.

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 2, 2026, Pages 549-553

Table 1.2: Distribution of Patients according to Structural Injuries on MRI

Type of Injury	Number of Patients	Percentage (%)
Ligament injuries	48	68.6
Meniscal injuries	36	51.4
Bone contusion/fracture	28	40.0
Patellar injuries	14	20.0
Degenerative changes	12	17.1
Joint effusion	46	65.7

Observation: Ligamentous injuries were the **most common MRI finding**, followed by meniscal tears and bone injuries.



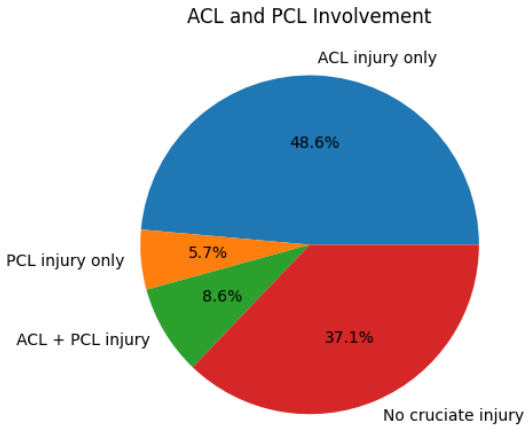
Distribution of MRI Findings of ACL and PCL Involvement: ACL injuries were far more common than PCL injuries.

Table 1.3: Distribution of ACL and PCL Injuries

Ligament Involvement	Number of Patients	Percentage (%)
ACL injury only	34	48.6
PCL injury only	4	5.7
Combined ACL + PCL	6	8.6
No cruciate injury	26	37.1
Total	**70**	**100**

Observation:

- **ACL tears** were the most frequently identified ligament injury.
- PCL injuries were uncommon and usually associated with high-energy trauma or avulsion fractures.



Distribution of Various Grades of Meniscal Tears

Meniscal tears were graded according to MRI grading criteria.

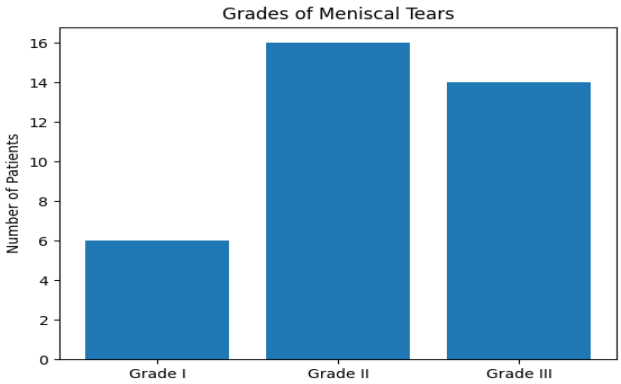
Table 1.4: Distribution of various grades of Meniscal Tear

Meniscal Tear Grade	Medial Meniscus	Lateral Meniscus	Total
Grade I	4	2	6
Grade II	10	6	16
Grade III	10	4	14
Total	**24**	**12**	**36**

Observation:

- **Medial meniscus** was more frequently involved than the lateral meniscus.
- **Grade III tears** were common in traumatic cases.

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 2, 2026, Pages 549-553



Distribution of Patellar Injuries

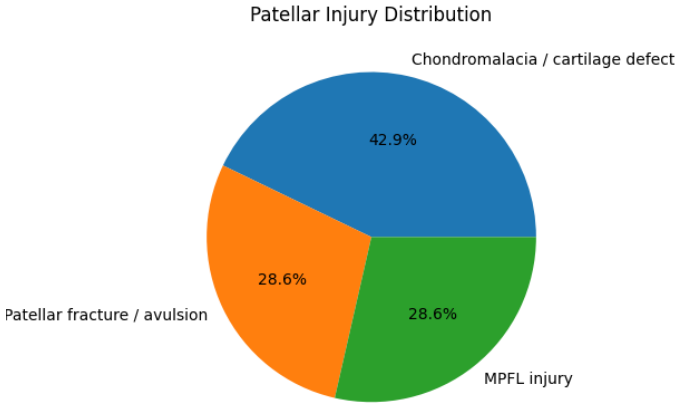
Patellar abnormalities were noted in both traumatic and degenerative cases.

Table 1.5: Distribution of Patellar Injuries

Type of Patellar Injury	Number of Patients
Patellar cartilage defect/chondromalacia	6
Patellar fracture/avulsion	4
Medial patellofemoral ligament tear	4
Total	**14**

Observation:

Patellar injuries were less common but frequently associated with ligamentous trauma and degenerative changes.



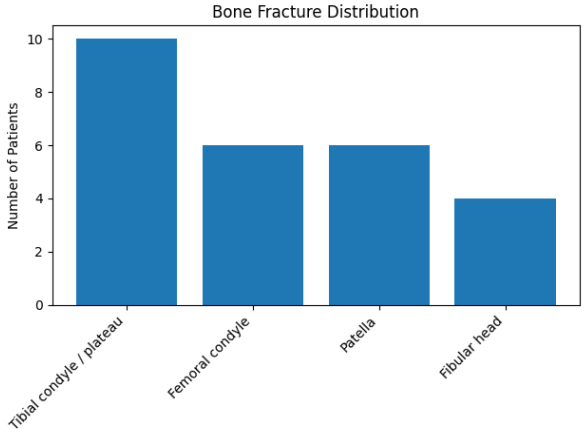
Distribution of Bone Fractures According to Bone Involvement: MRI detected both occult fractures and avulsion injuries.

Table 1.6: Distribution of Bone Fractures

Bone Involved	Number of Patients
Tibial condyle/plateau	10
Femoral condyle	6
Patella	6
Fibular head	4
Total	**26**

Observation: Tibial plateau and femoral condyle fractures were the most common.

- MRI was effective in detecting **occult fractures and marrow oedema** not visible on radiographs.



DISCUSSION

The present study demonstrates the significant role of MRI in the evaluation of traumatic knee injuries. The predominance of injuries in the 21–30-year age group reflects increased exposure to high-impact physical activities, including sports and occupational stress. This finding is consistent with existing literature but also highlights the vulnerability of this age group to ligamentous injuries.

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 2, 2026, Pages 549-553

A clear male predominance was observed, which may be attributed to greater participation in physically demanding activities. However, changing lifestyle patterns suggest that this gap may narrow in future populations.

Ligament injuries, particularly involving the ACL, were the most frequently identified abnormalities. The high incidence of ACL tears can be explained by its biomechanical role in stabilizing the knee during rotational and pivoting movements. The statistically significant association between ACL injury and younger age groups further supports this mechanism.

Meniscal injuries were also commonly observed, with a higher prevalence in the medial meniscus. This can be attributed to its limited mobility and firm anatomical attachments, making it more susceptible to stress-related injuries.

MRI proved highly effective in identifying associated findings such as bone contusions and joint effusion, which are often missed on conventional imaging. The detection of combined injuries underscores the importance of comprehensive imaging, as clinical assessment alone may underestimate the extent of internal derangement.

Compared to radiography and CT, MRI provides superior soft tissue resolution and enables simultaneous evaluation of multiple structures. This significantly enhances diagnostic accuracy and reduces the need for invasive procedures such as diagnostic arthroscopy.

CONCLUSION

This study confirms that magnetic resonance imaging is a highly reliable and effective modality for evaluating traumatic and painful knee joint conditions. MRI enables detailed assessment of ligaments, menisci, cartilage, and bone marrow, facilitating early and accurate diagnosis.

ACL tears were identified as the most common injury, followed by medial meniscus involvement, with a higher prevalence among young adult males. The ability of MRI to detect both isolated and combined injuries significantly improves clinical decision-making.

Given its non-invasive nature and high diagnostic accuracy, MRI should be considered the imaging modality of choice in patients with suspected internal derangement of the knee. Its routine use can lead to timely intervention, improved patient outcomes, and reduced reliance on invasive diagnostic procedures.

REFERENCES

1. Bunt CW, Jonas CE, Chang JG. Knee pain in adults and adolescents: the initial evaluation. Am Fam Physician. 2018;98(9):576–585.
2. Oei EHG, Ginai AZ, Hunink MGM. MRI for traumatic knee injury: a review. Semin Ultrasound CT MR. 2007;28(2):141–157.
3. Elhaj M, Elmorsy A, Ahmed M. Evaluation of traumatic knee joint injuries using magnetic resonance imaging. Int J Biomed. 2023;13(1):115–119.
4. Umap R, Patil A, Kale S. Evaluation of traumatic knee joint injuries with MRI. Int J Contemp Med Surg Radiol. 2018;3(3):17–21.
5. Refaat M, El Shazly E, Elsayed A. Role of MR imaging in evaluation of traumatic knee lesions. Benha Med J. 2020;37(Special Issue):77–86.
6. Khanda GE, Akhtar W, Ahsan H, Ahmad N. Assessment of menisci and ligamentous injuries of the knee on MRI: correlation with arthroscopy. J Pak Med Assoc. 2008;58(10):537–540.
7. Nikolaou VS, Chronopoulos E, Savvidou C, et al. MRI efficacy in diagnosing internal lesions of the knee. J Trauma Manag Outcomes. 2008;2:4.
8. Davies NH, Niall D, King LJ, Lavelle J, Healy JC. MRI of bone bruising in the acutely injured knee. Clin Radiol. 2004;59(5):439–445.
9. Eagle S, Potter HG, Koff MF. Morphologic and quantitative MRI of knee cartilage in post-traumatic osteoarthritis. J Orthop Res. 2017;35(3):412–423.
10. Bencardino JT, Beltran J, Feldman MI, Rose DJ. Traumatic musculotendinous injuries of the knee: diagnosis with MR imaging. Radiographics. 2000;20(Suppl 1):S103–S120..