

# MRI - A Critical Tool in Evaluation of Internal Derangements of Knee Joint

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## A B S T R A C T

**Introduction:** The knee joint is the largest and most weight bearing joint in the human body. Knee joint is a complex joint consist of lower end of the femur, the upper end of the tibia and the patella, which moves in a groove on the end of the femur. It has three parts, the lateral tibio-femoral, medial tibio-femoral and patella-femoral joints. The joint consist of the anterior and posterior cruciate ligaments, and the medial and lateral collateral ligaments connect the femur and the tibia and provide joint stability.<sup>1</sup> Study of different types of MRI findings in a case of knee joint injuries

**Materials and Methods:** Source of Data: Patients who undergo MR imaging of the knee on the advice of the referring doctor on his suspicion of internal derangement of the knee at the department of Radio-Diagnosis, Tertiary care centre.

**Results:** According to the present study maximum number of patients (40%) belongs to age group of 31-40 years, followed by 21-30 year (34), maximum numbers of patients (32 cases) were male followed by female (18 cases), duration of symptoms vary from 1 month-6 month and in some cases a few weeks, joint effusions were the most common finding affecting 80% patients. In the ligamentous and meniscal injuries, anterior cruciate ligament tear is most common, seen in 36 patients (72%), to be followed by the Medial Meniscal injuries seen in 18 patients (36%).

**Conclusion:** Acute knee injuries are a common source of morbidity in athletes and if overlooked may result in chronic functional impairment. Magnetic resonance (MRI) imaging of the knee has become the more commonly used musculoskeletal examination and is an important tool in the correct management of the injured patient.

**Keywords:** MRI, Knee Injury, Ligament Injury, Meniscus Injury

## INTRODUCTION

The knee joint is the largest and most weight bearing joint in the human body. Knee joint is a complex joint consist of lower end of the femur, the upper end of the tibia and the patella, which moves in a groove on the end of the femur. It has three parts, the lateral tibio-femoral, medial tibio-femoral and patella-femoral joints. The joint consist of the anterior and posterior cruciate ligaments, and the medial and lateral collateral ligaments connect the femur and the tibia and provide joint stability.<sup>1</sup>

The internal derangements of the knee can be classified into:

- i) Cruciate ligaments
- ii) Collateral ligaments
- iii) Menisci
- iv) Extensor mechanism and the patellar tendon
- v) Osseous and osteochondral injuries

MRI is an advanced imaging modality in the diagnostic field. MRI was first used in the medical field in the year 1980s, and then it has completely replaced diagnostic arthroscopy for diagnosing IDK. MRI has become the more reliable tool compare to diagnostic arthroscopy, which is now considered as the most standard tool for the diagnosis of internal derangements of the knee.<sup>2</sup>

MRI of knee is done by transmit / receive general purpose extremity surface coil. Quadrature and phase array coils are also available. Increased spatial resolution and decreased signal to noise ratio are significant advantages of these coils. Imaging is done with full extension in neutral position. A 14 to 16 cm field of view and a 3-4mm slice thickness. MRI is obtained in the Axial, Sagittal and coronal views.

A wide variety of MRI pulse sequences can be performed to produce diagnostic quality images. These include spin echo, fast (turbo) spin-echo, and gradient echo sequences, which all have been proven suitable for knee imaging. T1 or proton density-weighted sequences are most suitable for visualizing the ligamentous anatomy. T2 or STIR sequences with fat saturation are essential to demonstrate bone marrow oedema. Typically, a routine scanning protocol would consist of a combination of one or more of these sequence types performed in the axial, sagittal, and coronal planes using thin sections (maximum 3 mm with an inter-slice gap of 0.5 to 1 mm). A field-of-view of 12 to 16 cm depending on patient size is commonly used with a high-resolution matrix of at least 140 steps in the phase-encoding direction and 256 steps in the frequency encoding direction.<sup>3</sup>

**Objective**

Study of different types of MRI findings in a case of knee joint injuries

**MATERIAL AND METHODS**

Patients who undergo MR imaging of the knee on the advice of the referring doctor on his suspicion of internal derangement of the knee at the department of Radio-Diagnosis, Tertiary care centre. Study period start from January 2017 to December 2017 and total sample size is 50 cases.

**Inclusion Criteria:**

1. Patients with history of pain in the knee with or without swelling where MRI was used as a modality in diagnosing the cause.
2. Patients with clinically suspected tears.
3. Patients with restriction of movement at the knee joint following trivial trauma.

**Exclusion Criteria:**

1. Patients with acute traumatic fractures on x-ray
2. Patients diagnosed as having osteochondritis on plain x-ray
3. Patients with cardiac pacemakers and metallic implants were not subjected to MRI

**RESULTS**

According to the present study maximum number of patients (40%) belongs to age group of 31-40 years, followed by 21-30 year (34%). (Table 1)

In the present study maximum numbers of patients (32 cases) were male followed by female (18 cases). (Table 2)

In the present study duration of symptoms vary from 1 month-6 month and in some cases a few weeks. (Table 3) and joint effusions were the most common finding affecting 80%

Age in years	Number	%
< 20	4	8
21-30	17	34
31-40	20	40
41-50	7	14
>50	2	4
Total	50	100.0

**Table-1:** Age wise distribution of cases

Number of cases	Male	Female
50	32	18

**Table-2:** Sex wise distribution of cases

Duration of symptoms	Number	%
Upto 1 week	9	18
1 week – 2 week	10	20
2 week – 3 week	4	8
3 week – 4 week	5	10
1 month – 6 month	15	30
> 6 months	7	14
Total	50	100.0

**Table-3:** Duration of symptoms

MRI findings	Positive findings	%
Joint effusion	40	80
ACL tear	36	72
PCL tear	4	8
MCL tear	18	36
LCL tear	1	2
MM tear	10	20
Osseous/Osteochondral lesions	32	64

**Table-4:** MRI findings

patients. In the ligamentous and meniscal injuries, Anterior cruciate ligament tear is most common, seen in 36 patients (72%), to be followed by the Medial Meniscal injuries seen in 18 patients (36%). (Table 4)

**DISCUSSION**

The clinical presence of a new knee joint effusion following trauma is an indication of internal derangement of the knee. It is important to determine how quickly the effusion has developed. A rapid onset effusion, within the first hour of injury, indicates a haemaethrosis. MRI is the only radiology modality that can adequately assess the knee injuries.

In the present study maximum number of patients (40%) belongs to age group of 31-40 years, followed by 21-30 year (34), maximum numbers of patients (32 cases) were male followed by female (18 cases), duration of symptoms vary from 1 month-6 month and in some cases a few weeks, joint effusions were the most common finding affecting 80% patients. In the ligamentous and meniscal injuries, anterior cruciate ligament tear is most common, seen in 36 patients (72%), to be followed by the Medial Meniscal injuries seen in 18 patients (36%).

According to a study of 6.6 million knee joint injuries presenting to orthopedics departments during a ten-year period, around 50% of injuries were related to sports activities and soft-tissue injuries accounting for the majority of knee joint injuries.

Singh JP et al in their study consist of 173 patients, 78 patients (45.08%) showed Anterior cruciate ligament tears, among these 52 (66.67%), are partial, 16 (20.51%) are complete and 10 (12.82%) cases showed non visualization of anterior cruciate ligament. They finally concluded that anterior cruciate ligament tears are more common than other ligamentous injuries with partial tears being commoner.<sup>4</sup> Sonnet al found the incidence of PCL tear to be 3% in a series of study analyzing 350 case of knee injury only 10 patients had PCL tear.<sup>5</sup>

In a study by Grover et al out of 510 consecutive Magnetic resonance index of knee joints with an emphasis on posterior ligament tear; 11 (2%) patients had different grades of tear on Magnetic resonance index which was confirmed correctly by arthroscopy. Totally 202 patients who had undergone MRI and arthroscopy for internal derangement of knee no patient had posterior cruciate ligament injury as diagnosed correctly by Magnetic resonance index.<sup>6</sup>

Mink JH et al, observed on MRI and arthroscopy of 11 patients who had tear of LCL, 7 patients had tear of MCL, 4 patients had tear of lateral meniscus and 1 patient had tear

of medial meniscus.<sup>7</sup>

MR imaging enables the most comprehensive imaging assessment of the knee and when performed early after injury, MR imaging is both cost-effective and can aid in predicting which patients require further treatment.<sup>8,9</sup>

According to a study by THOMAS, Osseous lesions were observed in 32 patients (64%). Many of these were bony contusions involving the femoral and tibial condyles. Osteochondral lesions were seen in nine patients. In our study we observed a case of Comminuted bicondylar fracture of proximal end of Tibia with intra-articular and intra-condylar extension. There is also a fracture of medial tibial condyle in postero-lateral aspect which was displaced antero-medially. A case of Segond fracture of the lateral tibial rim with bony contusion of the lateral femoral condyle was seen. These findings were compared with findings saw by Thomas H. Berquist.<sup>10</sup>

A study by Ali Akbar Esmaili Jah et al, observed 17 cases of concomitant injuries at MRI and arthroscopy study. The main pattern was anterior cruciate ligament rupture and medial meniscus tear (in 5 patients), followed by anterior cruciate ligament and lateral meniscus (in 4 patients), or anterior cruciate ligament, medial meniscus and lateral ligament (in 4 patients).<sup>11</sup>

## CONCLUSION

Knee injuries are a common and acute cause of concern among athletes, invariably leading to morbidity if overlooked often resulting in chronic functional impairment. Sports injuries involving ligament and meniscal derangements are the most common indications for various types of surgical interventions which require a critical understanding of the anatomical arrangements and variations, biomechanics, mechanism and pattern of injury. Accurate diagnosis and apparent management of acute IDK commonly rests on radiological imaging (MRI) along with understanding of above mentioned factors. Acute knee injuries are a common source of morbidity in athletes and if overlooked may result in chronic functional impairment. Magnetic resonance (MRI) imaging of the knee has become the more commonly used musculoskeletal examination and is an important tool in the correct management of the injured patient.

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