

MR Imaging In Traumatic Knee: Spectrum Of Meniscal Injury

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Abstract:

Background: The knee joint is major weight bearing joint, supported by multiple ligamentous and meniscal structures that play an important role in the mobility and stability of the joint¹. As this joint undergoes high mechanical stress; prevalence, variety, and severity of meniscal injuries are particularly common. Physical examination coupled with MR Imaging is highly recommended for appropriate management of traumatic knee injury.

Materials and Methods: This prospective observational study was carried out in the Department of Radio-diagnosis, SGT Medical College, Hospital & Research Institute, Gurugram over a period of 6 months. All data were evaluated using standard statistical methods and analyzed by SPSS software.

Results: Males in age group of 20 – 30 years were found to be the most vulnerable population for traumatic knee injury and athletic injury being the common mechanism. In our study medial meniscal tears have preponderance over lateral meniscal tears with horizontal tear being the most common type.

Conclusion: MRI is the first line of investigation for traumatic knee injury. Meniscal injury must be assessed by MR imaging, which provides vital information for planning the first repair or reconstruction, as needed.

Key Word: Traumatic knee, Medial meniscus, Lateral meniscus, Meniscal tear.

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I. Introduction

Stability of knee joint is accomplished by various soft tissue structures- Anterior cruciate ligament, Posterior cruciate ligament, Medial collateral ligament, Lateral collateral ligament, lateral and medial menisci, joint capsule and the muscles.¹⁻² Internal derangements are also very common which is a common cause of morbidity in young athletes.³ Early diagnosis of meniscal and ligamentous pathologies is essential for early management to stop further degradation.⁴

Joint damage has been identified as a significant risk factor for the development of early osteoarthritis.

Because pain during the acute phase of an injury makes it difficult to accurately diagnose ligament and meniscal injury clinically, MR evaluation is essential.⁶

MRI is a noninvasive test for assessing meniscal injuries.⁷⁻⁹ MRI is free of ionizing radiation and offers multiplanar imaging of periarticular soft tissue, ligaments, tendons, and articular cartilage. It also offers higher soft-tissue contrast resolution. If an MRI indicates a meniscal lesion, arthroscopy should be performed as the diagnostic and treatment option.¹⁰⁻¹¹ It has been found that when physical examination and MRI are used together, it has high sensitivity for meniscal injuries.¹² Accuracy in diagnosing meniscal tears on MRI has been reported to be as high as 98%.¹³

II. Material And Methods

This prospective observational study was carried out on patients of Department of Radio-diagnosis, SGT Medical College, Hospital & Research Institute, Gurugram over a period of 6 months. A total 40 subjects (both male and females) irrespective of age were included in this study.

Study Design: Prospective observational study

Study Location: This was a tertiary care teaching hospital based study done in Department of Radio-diagnosis, SGT Medical College, Hospital & Research Institute, Gurugram.

Study Duration:6 months.

Sample size: 40 patients.

Sample size calculation: The sample size was estimated on the basis of a single proportion design.

Subjects & selection method: The study population was drawn from consecutive patients who presented to Department of Radio-diagnosis, SGT Medical College, Hospital & Research Institute, Gurugram with traumatic knee and were referred for MR knee Imaging.

Inclusion criteria:

1. Patients with traumatic knee injury, irrespective of age and gender.

Exclusion criteria:

1. Patients who were already diagnosed and surgically treated for internal derangement of the knee.
2. Patients having metallic implants (non-MRI compatible) & pacemakers.
3. Extremely obese patients.
4. Patients with claustrophobia.

Procedure methodology

After written informed consent was obtained, a well-designed questionnaire was used to collect the data of the recruited patients. The questionnaire included socio-demographic characteristics such as age, gender,height, weight, physical activity and mode of injury.

The MR examination was performed on all patients who had a clinical suspicion of meniscal damage to the knee.MRI was carried out using a specialized knee coil for the best signal capture on a 1.5 Tesla MR Unit: Philips Multiva.In order to diagnose a meniscal tear, two criteria were applied: Abnormal meniscal morphology and an intra substance area of intermediate or high signal intensity that unambiguously extend to the articular surface.⁹

Statistical analysis

Data was analyzed using SPSS version 20 (SPSS Inc., Chicago, IL). All data were evaluated using standard statistical methods. Descriptive statistics like-Tabulations, graphs & charts, proportions, percentages etc were formulated.

III. Result

In our study maximum number of patients were in the age group of 20-30 years (52.5% of the participants had Age: 20-30 Years, 35.0% were 31-40 Years, 12.5% were >40 Years). In our study, 80 per cent of participants were male and 20 per cent were female. The present study showed that Sports injuries accounted for the highest number of patients (50 %) followed by RTA (42.5 %) followed by falls/slipping.

In present study, 85 percent of the cases showed abnormal medial meniscus. Out of which, horizontal tear was most common (42.5 %), followed by bucket handle tear (27.5%), oblique tear (10%) with radial and complex tears being 2.5% each. 15 percent of the cases showed abnormal lateral meniscus. Out of which, 10 % cases showed horizontal tear followed by bucket handle tear and oblique tear being 2.5% each. In both menisci, horizontal tears occurred more frequently and Medial meniscal tears outnumbered Lateral meniscal tears.

Table 1: Age distribution of patients with traumatic knee

Age	Frequency	Percentage
20- 30 years	21	52.5
31- 40 years	14	35
>40 years	5	12.5

Age Distribution

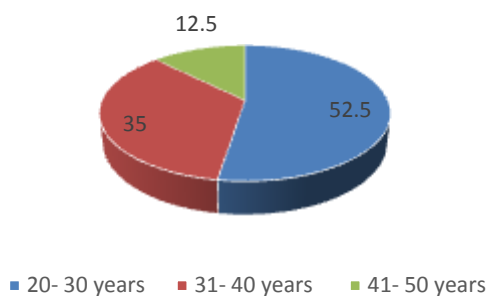


Table 2:- Gender distribution of patients with traumatic knee

Gender	Frequency	percentage
Male	32	80
Female	8	20

Gender Distribution

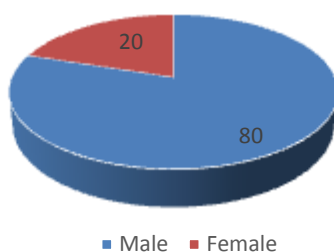


Table 3: - Distribution of patients in terms of mechanism of knee injury

Mechanism of injury	Frequency	Percentage
Road traffic accident	17	42.5
Sports	20	50
Fall/Slipping	3	7.5

Distribution of Mechanism of injury

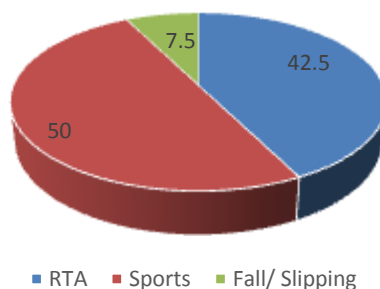


Table 4: - Distribution in terms of types of menisci tear(n= 40).

Type of menisci injury	Medial Meniscus frequency	Lateral meniscus frequency
Horizontal	17	4
Buket Handle	11	1
Oblique	4	1
Radial	1	0

Complex	1	0
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Distribution in terms of types of menisci tear

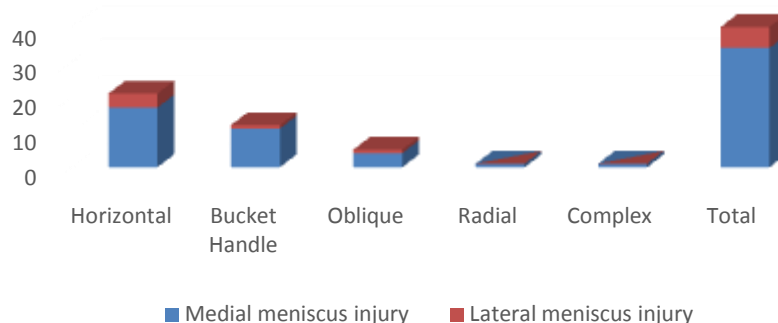
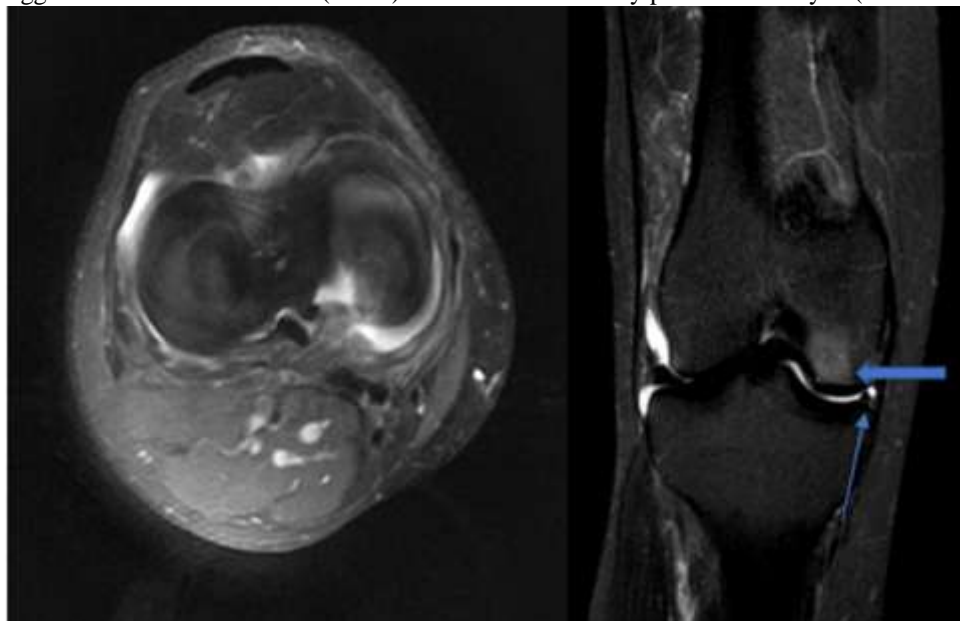


Figure 5:- MRI left knee in a 30yr old patient following trauma. Axial and coronal PD-FS images show radial tear of medial meniscus with knee joint effusion. Hyperintense signal is seen involving lateral condyle of femur suggestive of bone contusion. (arrow) Note is made of a tiny parameniscal cyst. (thin arrow)



IV. Discussion

A thorough clinical examination is necessary to evaluate for instability resulting from injury, especially the meniscus-injured knee. MR imaging is vital in the evaluation of meniscal injury and provides critical information in planning primary repair or reconstruction when needed. Being non-invasive and a highly sensitive tool of investigation, early and subtle changes in the soft tissues are often picked up by MRI.

In our study, Males in age group of 20 – 30 years were found to be the most vulnerable population for traumatic knee injury in concordance with the studies done by Clayton et al, La Prade et al and Incest et al¹⁴⁻¹⁶. Males (84%) are more frequently affected than females (16%), according to a 2017 study by Jeevika Mu et al¹⁸. All the subjects of our study were of active age group involved in various kinds of day-to-day physical activities making them prone to knee injuries in concordance with the study done by Umap Ret al. In this study, athletic/sports injury being the most common mode of mechanical stress causing knee trauma. In our study medial meniscal tears have preponderance over lateral meniscal tears which is consistent with Singh JP et al.'s investigation of 173 cases, in which they discovered 57 (38.23%) patients had MM tears and 28 (29.41%) patients had LM tears¹⁹; with horizontal tear being the most common type, followed by bucket handle tear and oblique tear.

The menisci are crescentic fibro-cartilaginous shock absorbers within the joint. The lateral meniscus is a smaller, thinner ring-shaped structure, while medial meniscus is bigger and C-shaped. Either of the menisci have thickened periphery extending into normally thinning center. The functions of menisci include the distribution of stress over the articular cartilage, shock absorption during axial loading, stabilization of the joint in flexion and extension.⁷

Meniscal tears have two distinct groups of causes, increased force on a normal meniscus, which typically causes longitudinal or radial tears, or normal forces on a degenerating meniscus, which typically results in horizontal tears in the posterior half of the meniscus.⁸

There are 3 basic shapes of meniscal tears: longitudinal, horizontal and radial. Complex tears are a combination of these three basic shapes. Longitudinal tears parallel the long axis of the meniscus dividing the meniscus into an inner and outer part. Bucket handle tear occurs due to displaced longitudinal tear. Horizontal tears divide the meniscus in a top and bottom part. If horizontal tear goes all the way from the apex to the outer margin of the meniscus, it may result in the formation of a meniscal cyst. Radial tears are perpendicular to the long axis of the meniscus.

The role of Magnetic Resonance Imaging has steadily increased and it has now become the first line of investigation for knee injuries. It is also being used as a primary investigation for pre and post-operative evaluation. Other modalities such as conventional radiography, arthrography, computed tomography and ultrasonography were not able to completely diagnose the meniscal injury of the knee. Multiplanar MRI images provide significant improvement in the assessment of these structures.

V. Conclusion

MRI is a non-invasive first line of investigation for most knee pathologies. It has high accuracy in the diagnosis of meniscal tears and aids in clinical management and treatment.

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