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Original Research

Demographic and clinical characteristics of Magnetic Resonance Imaging of Various injuries in knee joint trauma

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ABSTRACT

Introduction: MRI has a great effect on the management of internal derangement of the knee and is increasingly available to hospital specialists. Access to MRI by specialists for patients with knee problems could result in early diagnosis. The aim of the present study is to evaluate the Demographic and clinical characteristics of Magnetic Resonance Imaging of Various injuries in knee joint trauma. **Materials and Methods:** The patients was subjected to pulse sequences such as spin echo and fast spin echo technique, gradient echo (TIRM), and both slice selective and 3D Fourier transformation. Short Tau Inversion Recovery (STIR/FS) & FSE STIR was used. The patients were evaluated in sagittal, coronal and axial imaging planes. **Results:** MRI examination was performed on 130 patients with the complaints of knee injury. Regarding the most common age group, the affected were between 10 and 60 and this is explained by the fact that this age group being the most active group. From 130 patients examined in this study, 87 patients were males, and 43 of them were females. Of them, 44 (34%) had ACL tears, 7 (5%) had posterior cruciate ligament (PCL) tears, 25 (19%) had medial meniscus (MM) tears, and 18 (14%) had lateral meniscus (LM) injuries. **Conclusion:** Knee injuries showed a definitive male preponderance with male to female ratio of 72:28. Right side was seen injured more frequently as compared to left side. Pain was the most common presenting symptom in various knee injuries.

Keywords: Knee injuries, Magnetic Resonance Imaging.

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INTRODUCTION:

The stability of knee joint hence depends upon the supporting soft tissue structures including the joint capsule, the ligaments, the menisci and the myotendinous unit. The knee joint is one of the most frequently injured joint because of its anatomical structure, it's exposure to external forces, and the functional demand placed on it. Apart from injuries involving osseous structure, the understanding of injuries related to extra articular structures (tendons & ligaments) and intra articular structures (menisci and cruciates) are of great importance. These internal derangements of knee, resulting due to trauma, are severely disabling unless diagnosed promptly and treated efficiently.[1-3] Anterior cruciate ligament (ACL) is commonly injured ligament in knee and usually associated with meniscal injuries.[4] in 1980's, used magnetic resonance imaging (MRI) in the knee.[5] The accuracy of MRI is very high in diagnosing knee lesions and has a sensitivity of 80-100%.6 MRI of the knee is currently the diagnostic procedure of choice for the diagnosis of injuries to the menisci, ligaments, and tendons as well as bone bruises and occult fractures in the knee,[7] and in most centers, it has replaced arthrography and diagnostic arthroscopy.[8]

Failure to recognize and properly manage knee injuries can result in diminished lifestyle, time of work, and premature osteoarthritis. Accurate assessment of the nature of these injuries is a prerequisite for appropriate therapy.

MRI has a great effect on the a management of internal derangement of the knee and is increasingly available to hospital specialists. Access to MRI by specialists for patients with knee problems could result in early diagnosis. Negative result could allow specialists to

reassure patients, treat them conservatively and avoid unnecessary hospital referrals and associated costs. Positive results could confirm orthopaedics clinical diagnosis and get urgent cases treated more quickly with reduce average waiting times, increase efficiency, and even improve patient prognosis and quality of life. MRI is safer and less expensive than arthroscopy. MRI is very sensitive for meniscus and cruciate lesions. MRI has decreased the arthroscopy rate following clinical examination.[9]

However MRI too have few limitations[9, 10]

Young children usually require deep sedation or anaesthesia for MRI, but none is required for USG. Patients having claustrophobia, any metallic implants or intra orbital foreign body can't undergo MRI examination. In comparison to USG, MRI is costlier and not available frequently in periphery or small scale set up.

In this study, all the selected patients on the basis of suggestive clinical features of soft tissue injury around knee (except for those coming under the criteria for exclusion) will be subjected to sonography and MRI followed by arthroscopy after proper counselling and consent.

MATERIALS & METHODS:

In this prospective interventional comparative study patients of all age group of either sex attending the orthopaedic OPD of .features suggestive of soft tissue around knee were included in the study during the period of March 2017 to September 2018.

MRI Examination: Instrument

The examination is done using 1.5 Tesla GE Signa HDxt scanner, with dedicated extremity coils (surface coils) as both transmitter and receiver of radio frequency waves were applied. The imaging system is enclosed in a radio frequency room.

Inclusion Criteria

Patients of the adult population (10-60 years) willing to undergo MRI scanning with clinically suspected injuries of the knee and consenting for the same were included in the study.

Exclusion Criteria

- All patients who present with pain and/swelling at the knee joint without any history of injury and inflammatory, degenerative, neoplastic, infective etiologies causing pain, and swelling at knee joint were excluded from the study. Patients who had previously undergone arthroscopy with repair of menisci and ligaments.
- Patients not consenting for the study
- Patients on cardiac pace maker
- Patients on metal implants
- Patients on neurostimulators

The patients were subjected to pulse sequences such as spin echo and fast spin echo technique, gradient echo (TIRM), and both slice selective and 3D Fourier transformation. Short Tau Inversion Recovery (STIR/FS) & FSE STIR was used. The patients were evaluated in sagittal, coronal and axial imaging planes. The parameters used were:

T1 W images: TR 512.0, TE-11.0, with a slice thickness of 3 mm and a matrix of 512x640.

T2 W images-TR-4000, TE-77, with a slice thickness of 5 mm and a matrix of 358x512

PD TSE FS images- TR-2140, TE-30.0, with a slice thickness of 3 mm and matrix of 512 x 512

3D Fourier transformation- TR 11, TE-4.8, with a slice thickness of 5 mm and a matrix of 238 x 56

T2 STIR image- TR-4500, TE-28, TE-160, with a slice thickness of 5 mm and a matrix of 512 x 512

RESULTS:

In the present study 130 cases of knee evaluated based on the clinical history and examination a provisional diagnosis was made. Then these patients were subjected to USG and MRI. If there is indication for arthroscopy (intra-articular injuries) arthroscopy done. Their age was ranged from 15 to 49. Maximum number of patients belonged to 20-30 age group, which was comprised 39% of the whole study group. The average age of the study group was 32. Male subjects were showing definite male preponderance. In 61% of cases right knee joint was involved. This may be due to overuse or overdependence of the right knee joint in sports and daily activities [Table 1].

Table 1: Demographic and clinical characteristics of study participants

Characteristics	No. of patients [%]
Age group [Yrs]	
0-10	0
11-20	38 [29]
21-30	44 [34]
31-40	28 [22]
41-50	20 [15]
51-60	0

Male	87 [67]
Female	43 [33]
Side effected	
Right	79 [61]
Left	51 [39]

In our study, MRI examination was performed on 130 patients with the complaints of knee injury. Regarding the most common age group, the affected were between 10 and 60 and this is explained by the fact that this age group being the most active group. From 130 patients examined in this study, 87 patients were males, and 43 of them were females. Of them, 44 (34%) had ACL tears, 7 (5%) had posterior cruciate ligament (PCL) tears, 25 (19%) had medial meniscus (MM) tears, and 18 (14%) had lateral meniscus (LM) injuries as shown in [Table 2.]

Table 2: Various injuries in knee joint trauma

Type of tear	**Number of cases *n* (%)**
ACL	44 (34)
PCL	7 (5)
MM	25 (19)
LM	18 (14)
MCL	21 (16)
LCL	15 (12)
BC	29 (22)
Fractures	16 (12)
Joint effusion	32 (25)

ACL: Anterior cruciate ligament, PCL: Posterior cruciate ligament, MCL: Medial collateral ligament, LCL: Lateral collateral ligament

Correlation MRI findings with arthroscopic findings In our study, arthroscopy had been taken as gold standard but arthroscopy is useful for intraarticular structures and its injuries only. So the correlation of intraarticular structures i.e. meniscus & cruciates can be done only. Out of 130 patients, 60 cases showed ACL tears, 32 patients showed PCL tear arthroscopically. Out of 60 ACL tears confirmed by arthroscopy the diagnosis by MRI was 60 [Table 3, Figure 1-3].

Table 3: Injuries diagnosed by MRI and confirmed by arthroscopy

MRI Findings	**Injury to ACL confirmed by arthroscopy**		
	Present	**Absent**	**Total**
Positive	60	5	65
Negative	0	65	65
Total	60	70	130

Figure 1: Normal anterior cruciate ligament (ACL) in the sagittal plane. Sagittal T1-weighted MRI shows a ruler-straight hypointense ACL. The normal ACL occasionally demonstrates a mild smoothly convex contour inferiorly, but sharp angulation is abnormal.

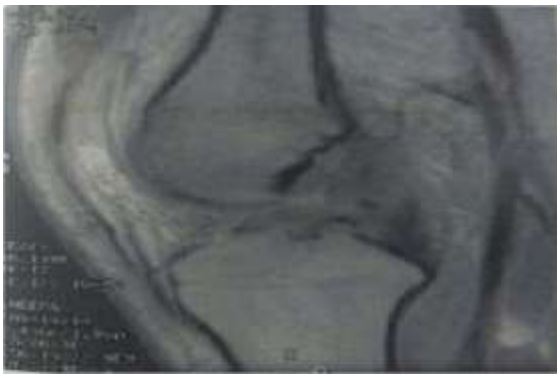

Figure 2: Nonvisualization as primary sign of anterior cruciate ligament (ACL) tear. Sagittal image shows complete (or near complete) nonvisualization of the ACL with ill defined edema and hemorrhage in the usual location of the ACL in the intercondylar notch. This is very common presentation of an acute ACL tear.

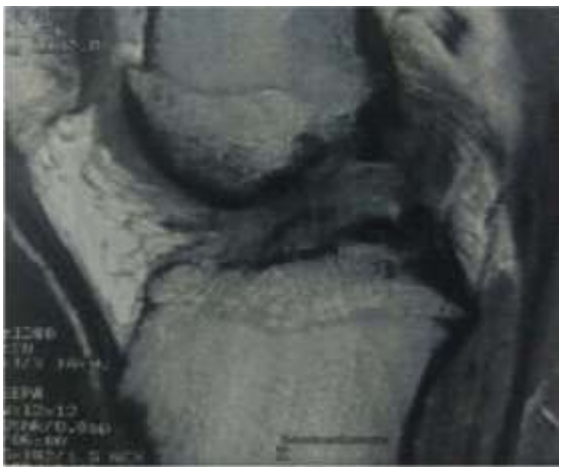

Figure 3: Partial tear of the anterior cruciate ligament. T1-weighted sagittal MRI image shows disrupted ACL fibers proximally compatible with an ACL tear.

DISCUSSION:

The observations show that patients having soft tissue injuries around the knee joints fall in the reproductive age group. The male-female ratio shows a wide variation with that of some studies, but at the same time it is similar to other studies. The high male-female ratio in our study may be because of the fact that males are more involved in outdoor activities, sports, travelling, industrial works etc, which make them vulnerable to knee injuries and other knee joint problems. Social obligations are more towards the female in this part of the country, which may also contribute to this high male-female ratio. The right/left ratio is not mentioned in other studies, may be due to its less importance in diagnostic point of view. The high incidence of right side may be due to the fact that our study group is small or may be due to overuse or overdependence of right knee joint in sports and daily activities. The deep meniscocapsular and superficial ligamentous fibers simultaneously develop tension during valgus force and, therefore often are injured together during excessive valgus force besides this anatomic synergism, the medial collateral ligament and medial meniscus are functionally related through the posterior oblique ligament at the psoteriomedial corner of the knee. These structures are both stressed by external rotation, with or without valgus force.[11-13] Hayes CW et al gave mechanism based pattern to classify complex injuries of the knee depicted at MR imaging on the basis of information from the injury patterns. We have classified complex knee injuries into 10 categories, according to the knee position (flexion, extension), direction of force and presence or absence of rotation (a) pure hyperextension; (b) hyperextension with varus; (c) hyperextension with valgus; (d) pure valgus; (e) pure varus; (f) flexion with valgus, external rotation; (g) flexion with varus, internal rotation; (h) flexion with posterior tibial translation; (i) patellar dislocation (flexion, valgus, internal rotation of femur on tibia; and (j) direct trauma. Recognition of these patterns may help assess the full extent of knee injury, particularly at the posterolateral and posteromedial corners of the knee.[14] In our study we found that medial collateral ligament injury were

frequently associated with medial meniscus injury seen in 20 out of 24 cases (83%) of MCL injury, which can be explained on the basis of intimate natomical relation and functional synergism between two. Both are anatomically related through the deep capsular fibres, which attach to meniscus at the meniscocapsular junction. Both simultaneously develop tension during excessive valgus force and, therefore, often are injured together during excessive valgus force besides anatomical functional synergism is seen related through the posterior oblique ligament at the posteromedial corner of the knee. These structures are both stressed by external rotation, with or without valgus force hence often injured together.[15,16]

CONCLUSION:

Knee injuries showed a definitive male preponderance with male to female ratio of 72:28. Right side was seen injured more frequently as compared to left side. Pain was the most common presenting symptom in various knee injuries. Medial menisci was the most common structure being injured seen in about 64 percent of cases.

MR is highly specific and highly sensitive in detection of cruciate ligament injuries in patients with acute as well as chronic injury. MR is more sensitive in detection of multiple meniscal tear that may be overlooked on sonography or arthroscopy. MR as well as sonography is advantageous in conditions where arthroscopy in detection of grade I and II intra-substance tear, precursors to formation of meniscal tears. MR is less sensitive than arthroscopy in detecting partial ACL tears. Bone injuries are a frequent association with various types of knee injuries and occur at predictable site. Clinical and radiological correlation is necessary for accurate diagnosis of most knee injuries. Understanding mechanism of injury and kinematics is crucial for accurate diagnosis.

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