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Original Research Paper

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STUDY ON ROLE OF MAGNETIC RESONANCE IMAGING IN THE EVALUTION OF POST TRAUMATIC KNEE JOINT INJURIES

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ABSTRACT

Background: The knee being the largest joint in the human body withstands complex forces which are exerted during various activities, rendering it prone to a number of acute and chronic injuries. It is also one of the most frequently injured joints, whether as an isolated injury or as a component in a multiple trauma patient. Aim and. **Objectives:** The objective of the present study was to evaluate the incidence of various ligamentous and meniscal injuries of post-traumatic knee joint. **Materials and Methods:** Demographic characteristics of the study population such as age, sex were obtained through an interview. The patients were then briefed about the procedure i.e. about the noise of the gradient coils and need to control the body movements for successful image acquisitions. The patient is asked to lie in supine position with the knee in close relation to the knee coil. The knee is then externally rotated 15-20° and is also minimally flexed 5-10°. **Statistical Analysis:** The data obtained was coded and entered into Microsoft Excel Worksheet. The categorical data was expressed as rates, ratios, proportions and percentages. Results: We found that the Anterior cruciate ligament was the most commonly torn ligament, 77.5 % among the menisci the medical menisci (MM) tears were more common as compared to lateral menisci (LM). **Discussion & Conclusion:** Magnetic resonance imaging is valuable non-invasive, radiation free tool with multiplanar capabilities which not only provides precise information in localizing and characterizing the internal derangements among the patients with trauma around the knee joint but is also helpful in identifying the exact extent of the injury and any other associated findings thus helping in the further management of the patient. We found that the Anterior cruciate ligament (ACL) was the most commonly torn ligament, among the menisci the MM tears were more common as compared to LM.

KEYWORDS : post traumatic knee joint, ligament injuries, magnetic resonance imaging, meniscal injuries

INTRODUCTION

Knee joint is the largest joint in the human body [1]. It is a synovial hing joint type which allows different types of movement; flexion, extension, external and internal rotation [2,3]. Knee joint responsible for movement and weight-bearing. It consists of bones (femur, tibia and patella), ligaments (anterior cruciate ligament, posterior cruciate ligament, medial and lateral collateral ligament), tendons (patellar tendon is the largest), and meniscus (medial and lateral meniscus act as cushion) [4]. Recreational sport activities are risk factors for knee injury and serious injury caused by direct blow to the knee requires immediate medical attention [4]. The anterior cruciate ligament is frequently injured by trauma and victims athletes. In the United States, there are between 100,000 and 200,000 ACL ruptures per year [5,6]. The estimated incidence of meniscal tears in some Northern European countries is 2 per 1000 person-years [7]. A study by England et al., found that 35% of enrolled patients older than 50 years old had imaging evidence of a meniscal tear, with of these patients being asymptomatic [8]. Medial collateral ligament injuries often happen in sports, it represents 60% of skiing knee injuries [9].

Early detection of knee injuries is extremely important to prevent long-term consequences of delayed treatment [10]. The primary imaging modality for traumatic injuries is Radiography, it is used to detect the onset of joint degeneration post trauma [11,12]. Computed tomography arthrography (CTA) of the knee is a safe technique that provides an accurate diagnosis of meniscal and cartilage injuries in patients with contraindication to MRI [13]. Magnetic resonance imaging is the less invasive method and most accurate for diagnosing meniscal lesions and eliminates unnecessary arthroscopies [14,15].

The present study was an attempt to assess the types and incidence of injuries in traumatic knee joint by MRI.

AIM & OBJECTIVES:

The objective of the present study was to evaluate the incidence of various ligamentous and meniscal injuries of post-traumatic knee joint.

MATERIALS & METHODS

Sample Size:

A total of 200 patients fulfilling the selection criteria were studied. Patients who present with the history of trauma around the knee coming for MRI examination during the study period were enrolled.

Sampling Procedure:

A minimum sample of 160 patients who fulfill the selection criteria and advised to undergo MRI knee joint for evaluation of internal derangements of the knee during the study period was planned. However, 160 patients fulfilled the selection criteria and were enrolled in the study.

Inclusion Criteria:

All patients, of different age groups presenting with history of trauma to the knee joint, who are sent for magnetic resonance imaging of the knee.

Exclusion Criteria:

- Post-operative cases.
- Patients with ferromagnetic implants, pacemakers and aneurysm clips.
- Patients with major injuries like liver / splenic rupture and flail chest and patients with unstable vital parameters especially in the setting of trauma.

Informed Consent:

Patients fulfilling the selection criteria were informed about

the purpose and nature of the study and were enrolled after obtaining a written informed consent.

Data Collection:

Once a patient fulfilled the inclusion criteria for this study he / she was administered the predesigned / pretested proforma. Demographic characteristics of the study population such as age, sex were obtained through an interview. The patients were then briefed about the procedure i.e. about the noise of the gradient coils and need to control the body movements for successful image acquisitions. The patient is asked to lie in supine position with the knee in close relation to the knee coil. The knee is then externally rotated 15-20° (for better evaluation of ACL on sagittal images) and is also minimally flexed 5-10° (for better visualization of the patella-femoral compartment).

Imaging:

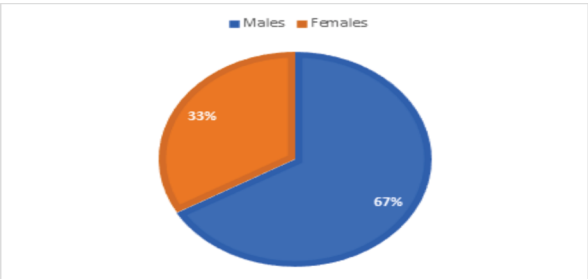
All patients underwent MRI of the knee joint using a using a dedicated knee coil on a Siemens 1.5 Tesla Symphony Magnetom class-MRI. An axial acquisition through the patella-femoral joint is used as the localizer. The field of view is variable ranging from 14 to 16cms depending on patient's size. All the images were acquires with a slice thickness of 3.0mm.

Statistical Analysis:

The data obtained was coded and entered into Microsoft Excel Worksheet. The categorical data was expressed as rates, ratios, proportions and percentages.

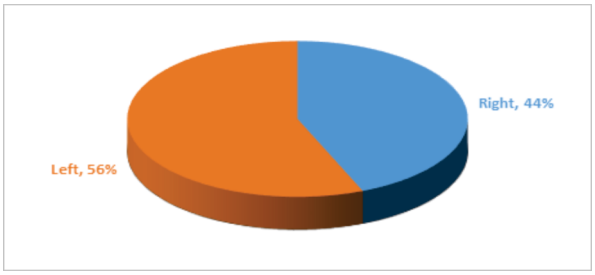
RESULTS:

We included a total of 160 patients based on inclusion and exclusion criteria were enrolled.

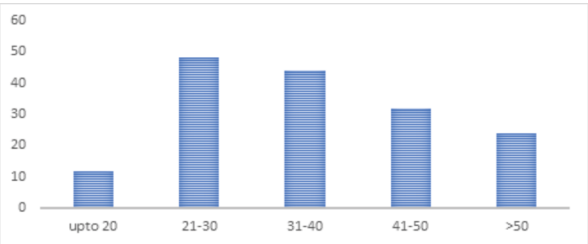


Graph 1: Shows Gender wise distribution of subjects

In the present study, out of 160 subjects 120 were males 67 % and 60 were females 33%.



Graph 2: Shows Side wise distribution of Subjects



Graph 3: Shows Age wise distribution of Subjects

In this study, the maximum number of patients were in the age group between 21-30 years followed by age group 31-40 years. The mean age was 33.8 ± 8.4 years.

Table 1: Shows spectrum of MRI findings

MRI finding	Number (Positive)	Percentage (%)
Joint Effusion	140	87.5
ACL	124	77.5
PCL	6	3.75
MM	74	46.25
LM	22	13.75
MCL	28	17.5
LCL	24	15
Osseous/ Osteochondral Lesion	88	55

In the present study, we see that the tear of anterior cruciate ligament was most frequently encountered, n= 124 followed by the tear of medial meniscus n=74. The medial meniscus is also the more commonly torn / injured menisci of the two.

Table 2: Shows Combined / Multiple Injuries

Number of injuries	Number	Percentage (%)
One	62	38.75
Two	40	25
Three	36	22.5
Four	14	8.75
Five	8	5

In the present study, single ligamentous injury was most commonly encountered 38.75% (n=62) followed by injury two structures 25% (n=40). The least common injury was simultaneous injury to five structures 5% (n=8).

DISCUSSION

Injury to the knee joint is an important cause of morbidity in the population affecting particularly the young active individuals. Hence, a precise diagnosis concerning the type and extent of the injuries is mandatory for early operative or non-operative intervention. This essentially requires a comprehensive clinical history coupled with a thorough physical examination and a complementary imaging tool.

Conventionally, the injuries around the knee joint were assessed clinically, and were subjected to radiographs. In modern times, MRI with or without a subsequent arthroscopic procedure has become the state of the art imaging modality. The knee can be imaged with many different imaging modalities: radiography, ultrasound, bone scintigraphy, CT scan, arthroscopy & MRI. The MRI is being used as both a pre and post-operative evaluative method. Since the 1990's MRI has been the modality of choice for imaging the internal derangements of the knee joint. MRI has become a valuable tool in the determining the treatment plan in 18% of patients and therefore permitting earlier surgical intervention based on the diagnosis obtained. Development of newer sequences have contributed to an improved SNR (signal to noise ratio) along with higher resolution and reduced artefacts as well as shorter imaging times, accentuating the diagnostic accuracy. The traditional algorithm for diagnosis of knee joint pathology has been changed by the use of MRI. Because of MRI it is possible to visualize into the injured knee noninvasively hence evading invasive procedures and additional morbidity.

In the present study, out of 160 subjects 120 were males 67 % and 60 were females 33%. In this study, the maximum number of patients were in the age group between 21-30 years followed by age group 31-40 years. The mean age was 33.8 ± 8.4 years. In the present study, we see that the tear of anterior cruciate ligament was most frequently encountered, n= 124 followed by the tear of medial meniscus n=74. The medial meniscus is also the more commonly torn / injured menisci of the two. In the present study, single ligamentous injury was

most commonly encountered 38.75% (n=62) followed by injury two structures 25% (n=40). The least common injury was simultaneous injury to five structures 5% (n=8).

In the present study, males outnumbered females this finding is similar to the study conducted by Clayton et al.[16] The probable reason for male predominance over the females can be credited to increased tendency of road traffic accidents and more sports related activities. The left knee joint was more commonly affected 56.5% whereas the right knee was affected in 43.5% of the study group. The age distribution analysis showed a wide range with the youngest patient 17 years of age and the eldest of 65 years of age. The maximum numbers of patients were ranging between 21 to 30 years of age while the second largest group of patients belonged to the age group between 31 - 40 yrs. The age distribution in our study is similar to the results of previously carried out studies by LaPrade et al[17], Incesu et al[18] with a mean age of 24 - 36 years. This can be attributed to the fact that young individuals have a relatively more active life style and hence have a higher risk of sustain an injury to the knee joint.

Joint effusion was the most common finding, with as many as 87.5% of the study group being affected by it. Of the ligamentous and meniscal injuries, the anterior cruciate ligament was the most commonly injured (76.25%) and medial meniscus was the second most commonly injured (46.25%) with grade III injury being the most common subtype.

Cruciate ligament Injury:

The ACL was the most commonly injured ligament in our study (77.5%) sustaining ACL tear which is consistent with a study by Singh JP et al. In our study, partial tear of the ACL was more commonly encountered 53.25% as compared to the complete tear 47.6% which is in accordance to the previous studies conducted by Singh JP et al[19] and Berquist et al[2] which had 66.6% and 90.0%, respectively, of partial ACL tears in all the patients sustaining ACL tear in their studies. The higher ratio of complete ACL tear in our study could be attributed to the increased severity of the injury from the road traffic accidents. The posterior cruciate ligament injury is less common as compared to the ACL because it is the stronger and thicker of the two.

Collateral ligaments injury: In our study, MCL tears (17.5%) were found to be more common than the LCL tear (15%). All but two cases were supplementary with multiple musculo-tendinous injuries which recommends presence of a solitary injury ought to prompt the examiner to evaluate for other delicate associated injuries, which is in accordance to the findings made by Mink JH et al.

Menisci Lesions:

In our study, there is preponderance of medial meniscal tears, 46.25% over lateral meniscal tears, 13.75% which is well correlated with the study conducted by Singh JP et al, in a series of 173 cases of which they found 57 (38.23%) patients having MM tear and 28 (29.41%) patients having LM tear.

Osseous and Osteochondral Injuries:

Our study showed Osseous/Osteochondral lesions in 55% patients. Majority of the lesions were bony contusions involving the femoral and tibial condyles. Osteochondral lesions are seen in 24 patients. Hemarthrosis and lipohemoarthrosis was associated in ten cases, six of with had comminuted fractures. These findings are in correlation with the findings described by Thomas H. Berquist.

Combined Injuries:

In our study, we observed 98 cases of combined injuries and 62 cases of isolated injuries. The leading pattern is ACL tear with MM tears (22); trailed by ACL tear with LM tear (11), which is well in correlation with a study by Ali Akbar Esmaili Jah et al, in a series of 34 cases of concomitant injuries at MRI and arthroscopy. The predominant pattern was anterior cruciate ligament rupture and medial meniscus tear (10 patients), followed by anterior cruciate ligament and lateral meniscus (8 patients), or anterior cruciate ligament + medial meniscus + lateral ligament (8 patients). The present study showed the capability of magnetic resonance imaging in assessment of the various internal derangements, together with their detection, localization, characterization and evaluation of extent of damage, hence, confirming the value of MRI in assessing internal knee structures.

CONCLUSION:

Magnetic resonance imaging is valuable non-invasive, radiation free tool with multiplanar capabilities which not only provides precise information in localizing and characterizing the internal derangements among the patients with trauma around the knee joint but is also helpful in identifying the exact extent of the injury and any other associated findings thus helping in the further management of the patient. We found that the Anterior cruciate ligament was the most commonly torn ligament, among the menisci the MM tears were more common as compared to LM.

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