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Dr. Aji Rajan
Assistant Professor,
Department of Radiodiagnosis,
Mount Zion Medical College,
Adoor, Pathanamthitta,
Kerala, India

Dr. Vandana Sudheer
Consultant Radiologist,
Ernakulam, Kerala, India

Corresponding Author:
Dr. Vandana Sudheer
Consultant Radiologist,
Ernakulam, Kerala, India

Various subtypes of ligamental and meniscal injuries in knee trauma: MRI based study

Dr. Aji Rajan and Dr. Vandana Sudheer

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Abstract
MRI has been proved by numerous studies as a noninvasive modality of choice for the evaluation of knee pathology. Its accuracy is comparable to the gold standard; diagnosticarthroscopy [3]. In the case of meniscal pathology, MRI has been shown in some studies to be more accurate than physical examination, which increases diagnostic confidence in those patients for whom surgery is being contemplated. Unlike arthroscopy, it also allows for the assessment of the internal architecture of the region of interest. The study population includes all the patients presenting with history of and /or clinical findings suggestive of knee trauma a and use MRI for evaluation. The MRI is done on the advice of the referring doctor and no patient is made to undergo MRI knee for the sole purpose of this study. Mean age: 31.26 (standard Deviation: 10.6). Most of the patients were in the age range of 20 – 39 years. Since most of the cases were associated with poly trauma, the majority of the cases had acute history of trauma, as shown in the table above. The percentage of individuals with chronic trauma and acute on chronic trauma were almost same, percentage of chronic trauma being marginally high.

Keywords: ligamental, meniscal injuries, knee trauma

Introduction
The knee joint is a synovial joint, the largest in the body. It's a modified hinge joint. In addition to flexion and extension a small amount of rotation of the leg is possible in the flexed position of the knee.
The knee is formed by the femoral and tibial condylar articulations. The tibio fibular articulation, though often considered a part of the knee, is in fact not a portion of the true knee joint. The knee joint is a synovial, modified hinge joint, which is protected anteriorly and posteriorly with special ligamentous attachments to the capsule. The articular surfaces of both the femoral and tibial condyles are covered with hyaline cartilage.
Magnetic resonance imaging provides a digital representation of tissue characteristics based on the chemical composition of the various tissue types. It takes advantage of the abundant supply of hydrogen atoms (protons) in the body, and their interaction with the magnetic fields. The basic technique involves the application of a strong magnetic field to the region of interest and imaging the resultant effect on nuclear hydrogen ions [1].
The protons of the human body align themselves parallel to the strong, homogenous, static magnetic field produced within the bore of the magnet. Thus, the body acquires a slight magnetization that can be indirectly perturbed by application of a radiofrequency (RF) pulse that reorients the protons. Upon removal of the perturbing magnetic field, there is oscillation or resonance of the protons. This is detected as a small current by a surface coil that acts as an antenna. The voltage induced in the coil is measured and stored as digitalized information in the MRI computer. A mathematical technique called 3D Fourier transformation allows the data to be converted to an anatomical image [2].
MRI has been proved by numerous studies as a noninvasive modality of choice for the evaluation of knee pathology. Its accuracy is comparable to the gold standard; diagnosticarthroscopy [3]. In the case of meniscal pathology, MRI has been shown in some studies to be more accurate than physical examination, which increases diagnostic confidence in those patients for whom surgery is being contemplated. Unlike arthroscopy, it also allows for the assessment of the internal architecture of the region of interest.
Potentially, the most clinically relevant characteristic of MRI is its low false negative rate and resultant high negative predictive value. Accordingly, a negative MRI of a painful knee

allows the physician to manage the patient conservatively with a very high level of confidence that pathology has not been missed. Similarly negative MRI in a case of trauma also helps the surgeon to take the decision to give rest to the joint or to open it up [4].

Undoubtedly this high sensitivity rate may lead to a high false positive rate. This is often secondary to image artefacts which may be machine related (focal field inhomogeneity), patient related (motion), or signal processing related partial volume averaging or ring artefact (Gibbs phenomenon)]. Nevertheless, this may result in the false assumption that a pathological process exists. Therefore, as with any diagnostic test the interpretation of the MRI must be correlated with a thorough history and physical examination [5, 6].

Methodology

The study population includes all the patients presenting with history of and /or clinical findings suggestive of knee trauma a and use MRI for evaluation. The MRI is done on the advice of the referring doctor and no patient is made to undergo MRI knee for the sole purpose of this study.

- Sample size: 144 (For an expected proportion of ACL injury of 60% and a tolerable error of 8%, sample size was calculated as 144)
- Study design: Descriptive study
- Material: SIGNA HDXT 1.5T MRI, GE Health care

Inclusion criteria

- All cases with history of and/or clinical findings suggestive of having sustained knee trauma within 6 months of presentation

Exclusion criteria

- Patient who had no history and clinical findings of trauma but underwent MRI of the knee (for any other cause).
- Patients with known history of degenerative changes of the knee.
- Post-operative cases.

Results

Injury to knee was observed to be more among males (72.9%) when compared to females (27.1%)

Table 1: Age distribution

Age	Male	Female	Total
10-19	9	3	12
20-29	46	16	62
30-39	33	7	40
40-49	12	6	18
50-59	5	7	12
Total	105	39	144

Mean age: 31.26 (Standard deviation: 10.6)

Most of the patients were in the age range of 20 – 39

Since most of the cases were associated with poly trauma, the majority of the cases had acute history of trauma, as shown in the table above. The percentage of individuals with chronic trauma and acute on chronic trauma were almost same, percentage of chronic trauma being marginally high.

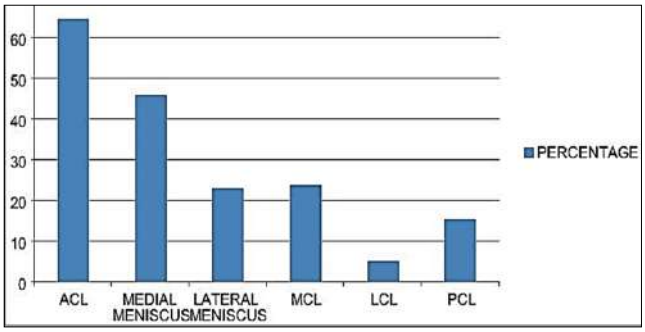

Fig 1: Statistical representation of various subtypes of ligaments & meniscal Injury

Discussion

All the relevant findings of the cases for analysis were studied and tabulated using Microsoft Excel. This is depicted in the master chart which has been added in the Annexure. Few of the representative cases have been provided in detail, in the following section, along with their representative images. Imaging findings of injury to each ligament, menisci and associated findings were individually assessed. The purpose of the study was to identify the frequency of injury to the individual internal structures of the knee joint which had underwent acute or chronic trauma and thus to tabulate the most common structure involved and also to identify the most common combination of injury [7].

The form of trauma seen in the study population was predominantly related to road traffic accident. The study population predominantly consisted of patients hailing from middle and upper socio economic class where the addiction to alcohol was found to be extremely common. The geographic distribution of the study population also consisted predominantly central part of state of Kerala where the consumption of alcohol was considered to be highest. Being one of the most thickly populated township, Tiruvalla, is also notorious for the increased amount of road traffic accidents. The habit of using vehicle under the influence of alcohol has resulted in poly trauma. Knee has been consistently injured in all these cases of poly trauma especially because of the flexed attitude at which it is at the time of accident and the close proximity at which the knee joint is with the oncoming vehicle (mechanism of injury: flexion with valgus and external rotation, flexion with varus and internal rotation, flexion with posterior tibial translation, patellar dislocation flexion, valgus, and internal rotation of femur on fixed tibia, direct trauma). When considering the risk factors mentioned above, since it is more common for male population to get affected by those, the incidence of poly trauma and thus trauma to the knee were common in men [8, 9].

Second most common cause of knee injury in our population was sports injuries, most commonly seen in individuals coming in the age group of 20 – 29, however, most of these individuals had taken symptomatic treatment for the same. At the most, some of the individuals, who had significant trauma necessitating loss of working days, had done plain x-ray of the knee [10].

Conclusion

MRI is an accurate, non-invasive technique for examination of the soft tissues and osseous structures of the knee. It is a very good modality to diagnose full thickness and intrasubstance tear of the anterior cruciate ligament. It has great capability in diagnosing meniscal tears and classifying them into grades.

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