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MRI EVALUATION IN KNEE JOINT INJURIES RELATED TO BIKE TRAUMA

Radiodiagnosis

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ABSTRACT

Background: The knee joint is one of the most commonly injured joints in day-to-day setting following motor bike related road traffic accidents as it has complex anatomical configuration & joint articulation. Current research aimed to study efficacy of magnetic resonance imaging [MRI] presentations of various traumatic knee joint injuries following motor bike accidents in a referral trauma centre & tertiary hospital in Mumbai. Additional aim is to establish common patterns of injury, to highlight ligamentous injuries and to study the correlation between clinical presentations and radiological findings.

Materials &Methods: From March 2018 to March 2019, sixty-three patients referred for symptoms following knee joint injury related to motor bike trauma have been included after they were subjected to a dedicated MRI knee study with standard protocol of our institute.

Results: A total of 63 patients were studied in which majority were male patients & most common age group was 21-30 years. Most commonly injured ligament was Anterior Cruciate Ligament (90 %) followed by Medial Collateral Ligament (31.7%). Lateral meniscus tear was marginally more common than medial meniscus tear. 76 % of patients had bone contusions while 71 % out of these patients had fractures with associated bone contusions.

Conclusions: Multiplanar MRI imaging is a practical, well accepted, cost effective and accurate noninvasive imaging technique in patients presenting with knee joint injury and modality of choice for clinically suspected cases of soft tissue injury with excellent soft tissue resolution.

KEYWORDS

Motor bike accidents, ACL (Anterior cruciate ligament), knee joint injury, lipohaemarthrosis, bone contusion.

INTRODUCTION:

Knee joint is synovial hinge joint type with complex anatomical configuration & joint articulation which provides stability for its functioning. It is one of the most commonly and frequently injured joint in day-to-day setting following trauma. [1,2,3] In our developing country, motor bikes (two-wheeler) are one of the most common mode of transport with lesser available knowledge for patterns of knee injury following motor bike related road traffic accident. The influence of factors such as age, motor vehicle involvement and speed of vehicle at time of crash on severity of knee injury is largely unknown from available literature.

AIMS & OBJECTIVES:

Current research is aimed to study magnetic resonance imaging [MRI] presentations of various traumatic injuries of knee joint those occurring in motor bike accidents in mixed Indian population in a referral trauma centre & tertiary hospital in Mumbai. Additional aim is to establish common patterns of injury in motor bike accidents, to highlight ligamentous injuries and to study the correlation between clinical presentations and radiological findings.

MATERIALS AND METHODS:

From March 2018 to March 2019, sixty-three patients referred for symptoms following knee joint injury related to motor bike trauma have been included in this observational study. Patients were subjected to a dedicated MRI knee study with standard protocol of our institute. The typical parameters in standard protocol included a field of view of 14 -16 cm, and section thickness of 3–4 mm, matrix 560 x 1024.

The sequences included in our standard protocol are:

- Sagittal: PD FS (PD: Proton Density, FS: Fat Saturation)
- Sagittal: PD TSE (TSE: Turbo Spin-Echo)
- Coronal: T1 TSE
- Coronal: STIR (STIR: Short Tau Inversion recovery
- Axial: PD SPAIR (SPAIR: Spectral Attenuated Inversion Recovery)

Inclusion Criteria:

- All the patients referred to our department for MRI imaging with knee complaints following motor bike trauma (two-wheeler).

Exclusion Criteria:

- Patient having history of claustrophobia.
- Patient having history of cardiac pacemakers, metallic foreign body and cochlear implants in situ
- All other traumatic injuries excluding bike injuries

RESULTS:

In present study, there were more number of male patients (n=58) as compared to female patients (n=5) with male to female ratio of 11.6. The range of age varied from 15 years to 58 years (mean age– 31.6 years) with peak incidence between 21 to 30 years as depicted in figure 1. Right knee joint was more commonly injured (56 %) than left knee joint (44 %) as shown in figure 1.

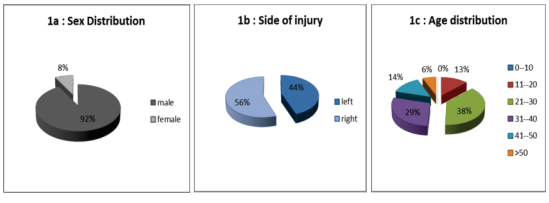


Figure 1: Distribution of patients according to sex (1a), side injured (1b) & age (1c)

Abnormal MRI findings were found in all the patients. Among ligamentous knee injuries, the most commonly injured structure was anterior cruciate ligament (90.4%), followed by medial collateral ligament (31.7%).

Cruciate ligaments:

Among 63 patients, 57 patients (90.4%) had Anterior Cruciate Ligament [ACL] injuries & 9 (14.2%) had Posterior Cruciate Ligament [PCL] injuries respectively. Out of all patients, 32 patients (51%) had full thickness tear of ACL and avulsion injuries (Grade-III), 2 patients (3 %) had partial thickness tear of ACL (Grade-II) and 23 patients (36 %) had ACL sprain (Grade-I) as shown in Fig.2a.

Out of all patients, 8 patients (12.7%) had full thickness tear of PCL (Grade-III), 0 patients had partial thickness tear (Grade-II) and 1 patient (1.5 %) had PCL sprain (Grade-I) as shown in Fig.2b.

Collateral ligaments:

Among 63 patients, 20 patients (31.7%) had Medial Collateral

Ligament [MCL] injuries & 13 (20.6%) had Lateral Collateral Ligament [LCL] injuries. Distribution of MCL injuries & LCL injuries is depicted in Fig. 2c & Fig. 2d respectively.

Grading of MCL & LCL injuries:

I. Periligamentous high signal intensity without discontinuity of fibers.

II. Partial discontinuity of fibers

III. Complete tear

Meniscal Tear:

In our study, tear was considered when high signal intensity in meniscus reached upto one of the articular surface of meniscus.15 patients (23.8%) had lateral meniscus tear & 14 (22.2%) had medial meniscal tear respectively with most common location of tear being posterior horn of medial meniscus. Some of the tears located in one part were noted extending to other parts of meniscus. Distribution of Medial meniscus tear & lateral meniscus tear according to location is depicted in Fig. 3a & Fig. 3b respectively.

Morphological distribution of meniscal tears as (radial, horizontal, root tear, bucket handle tear) was not attempted.

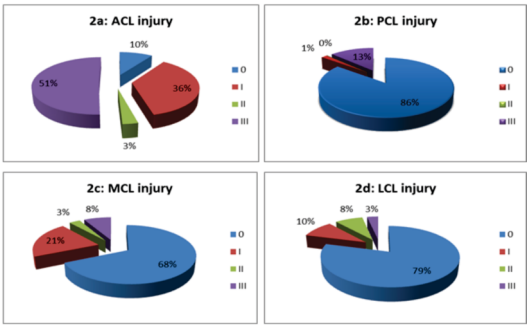


Figure 2: Pie Chart depicting distribution of ACL (2a), PCL (2b), MCL (2c) & LCL (2d) injuries respectively.

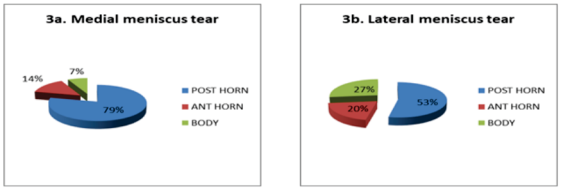


Figure 3: Pie Chart depicting location wise distribution of medial meniscus tear (3a) & lateral meniscus tear (3b) respectively.

BONE INJURIES:

In our study, 76 % (n=48) patients had bone contusions. Out of these 48 patients, 71 % (n=34) patients had fracture with associated bone contusions. Lipohaemarthrosis was seen in 10 % (n=6) of total patients & all cases of lipohaemarthrosis had an intra-articular fracture. Distribution of bone contusions was most common in tibia followed by femur followed by fibula & lastly patella. Distribution of bone contusions in tibia & femur is depicted in figure 5.

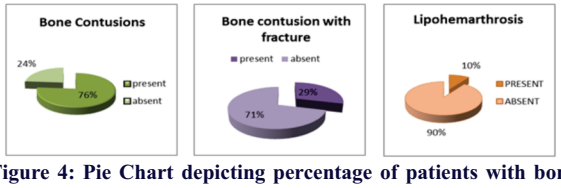


Figure 4: Pie Chart depicting percentage of patients with bone contusions, bone contusion with fracture and lipohemarthrosis.

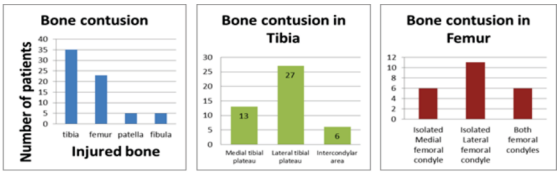


Figure 5: Column bar diagram depicting distribution of bone contusions in respective bones.

DISCUSSION:

The most common indication of performing a knee MRI is to diagnose internal derangements in an injured knee. MRI is less invasive, cost-effective technique and has very high sensitivity and specificity for evaluation of anatomical structures including the menisci, bone marrow, tendons, and ligaments which can be sources of pain following acute intra-articular, ligamentous injuries and internal derangements, with resultant reduction in unnecessary surgical and arthroscopic interventions [4]. In addition, MRI provides excellent spatial and soft tissue contrast resolution of both intra- articular and extra-articular structures [5]. Another study done by Zairul Nizam has already established role of MRI for assessment of injuries of knee joint. [6] At present MRI of the knee has become the most commonly performed musculoskeletal MRI examination and is an indispensable tool in the appropriate management.

Our findings related to demographics have been similar to study done by Umap et al. [7] with a major difference being that their study included all types of knee joint injuries whereas ours was limited to motor bike (two-wheeler) trauma related. The commonest finding in Umap et al. [7] study and ours is same i.e anterior cruciate ligament injury. However, second most common ligament injured in our study is medial collateral ligament (31.7%).

Also there exists a difference from Jeevika Mu et al. [8] & D S Shetty et al. [9] in relation to meniscal tears, with both of these studies showing medial meniscus tears were more common than lateral meniscal tears. Umap et al. [7] also has similar conclusion with respect to meniscal tears. In present study, lateral meniscus tear was marginally more common than medial meniscus tear but most common site of meniscal tear is posterior horn of medial meniscus.

Anil Madurwar et al. [10] noted that 42% patients had bone contusion & 14 % patients had fractures in their study which aimed to correlate MRI findings in knee joint injuries with arthroscopy. Similarly bone contusions were present in 46 % of patients in study by Umap et al. [7] In present study, 76 % patients had bone contusions & 71 % of these patients with bone contusions had associated fracture which is quite high. But it can be explained considering primary criteria for inclusion is trauma in motor vehicle accident. Bone contusions were more common in tibia than femur & lateral compartment was most commonly affected in both tibia & femur than medial compartment. Combined injuries were more common than isolated ligamentous or osseous injuries.

CONCLUSION:

MRI is a practical, well accepted and accurate noninvasive imaging technique in patients presenting with injury to knee joint and is the modality of choice for clinically suspected cases of soft tissue injury with excellent soft tissue resolution and multiplanar imaging planes for optimal assessment. The results of our study are unique as it attempts to further categorize MRI findings in a subset of trauma specific to the motorcycle trauma related injuries in mixed Indian population.

MRI images:

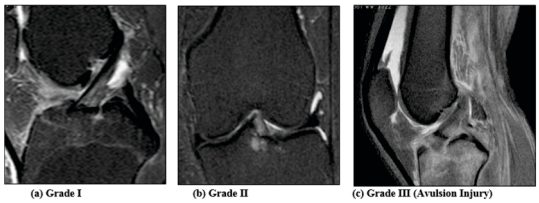


Figure 6: PDFS Sagittal (a. & c.) & STIR coronal (b.) MRI images showing grades of ACL injury respectively

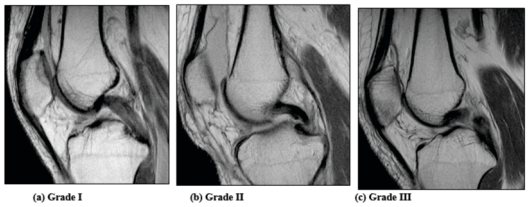
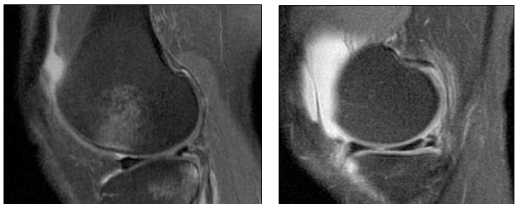
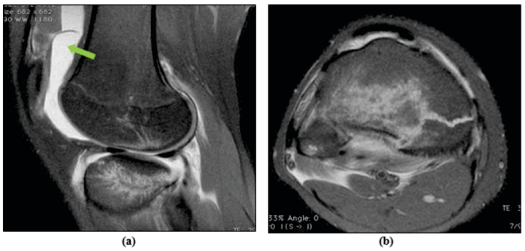


Figure 7: PD sagittal MRI images showing grades of PCL injury respectively.



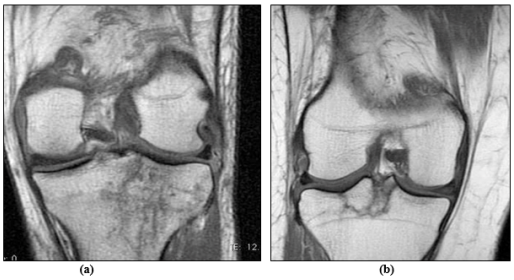
(a) (b)

Figure 8: PDFS sagittal images showing posterior root tear of lateral meniscus with marrow contusions in lateral femoral condyle & lateral tibial plateau (a) & posterior root tear of medial meniscus in (b).



(a) (b)

Figure 9: PDFS sagittal (a) and axial (b) images showing lipohemarthrosis (green arrow) with intra-articular fracture and adjacent bone contusions.



(a) (b)

Figure 10: T1 coronal images showing (a) medial tibial plateau contusion with fracture & (b) intercondylar eminence fracture.

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