ORIGINAL RESEARCH PAPER
Volume - 12 | Issue - 04 | April - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ROLE OF MRI IN EVALUATION OF TRAUMATIC KNEE INJURIES

Radio-Diagnosis

Dr Deep Kumar Roy Professor and Head of the Department of Radiodiagnosis, Jorhat Medical College and hospital, Jorhat, Assam.

Dr Antara Dutta Post Graduate Trainee, Jorhat medical college and hospital, Jorhat, Assam.

ABSTRACT

Introduction: The knee joint is a large joint of the human body with complex articulation characterized by the presence of various ligaments and menisci that play an important role in the stability and mobility. MRI due to its excellent soft tissue contrast resolution and multiplanar imaging capabilities provides significant advantages over other imaging techniques in the evaluation of traumatic injuries of knee joint. Study aimed to study the role of MRI in the evaluation of traumatic injuries of knee joint. **Material and methods:** A total number of 50 patients referred with history of knee injury were imaged with 1.5 Tesla (GE Signa HDxt®; General Electric) machine in the department of radiology over a period of 12 months. **Results:** Commonest injuries detected in the study are anterior cruciate ligament tear, tear of posterior horn of medial meniscus, bone contusions and joint effusions. Clinical presentation and radiographs of the patient did not help in diagnosis in most of the cases of acute knee injury, especially in multiple ligament and bone injuries. MRI detected soft tissue injuries very well in addition to the bony injuries. **Conclusion:** Magnetic resonance imaging is the excellent non invasive investigation tool for knee injury due to excellent soft tissue contrast resolution and multiplanar imaging capabilities which provides the most detailed evaluation in cases of various soft tissue injuries of knee joint.

KEYWORDS

Knee joint, MRI, trauma, injury, ligament, meniscus, tear.

INTRODUCTION

The knee joint is a biggest joint of the human body with complex articulation characterized by the presence of various ligaments and menisci that play an important role in the stability and mobility[1] . This articulation is subject to very high mechanical stresses. Various injuries of these ligaments and menisci injuries, especially in the young and sportsmen, associated with significant morbidity, frequently need surgical treatment and extensive rest. There has been enough evidence that joint injury is a potent risk factor for the early onset of osteoarthritis[2] . Although clinical examination is important for the diagnosis of ligament and meniscal injury, patients are subjected to painful stress examinations, which are not always accurate in the acute phase of the injury. In cases of knee joint trauma, clinical examination along with radiographs and even CT scan is not enough to diagnose many internal derangements of this joint[3]. MRI, due to its excellent soft tissue contrast resolution and multiplanar imaging capabilities provides significant advantages over other imaging techniques in the evaluation of traumatic injuries of knee which provide significant advantages over other imaging techniques. It is a a non-invasive and radiation-free technique that provides significant detail in reaching the accurate diagnosis and thus helps the treating doctor to plan the further management. MRI has also been demonstrated as a cost effective technique by reducing unnecessary surgical and arthroscopic interventions[4] . Current research aimed to study the normal anatomy of knee joint on MRI, to study efficacy of MRI in the evaluation of traumatic injuries of knee joint, to study MRI presentations of various traumatic injuries of knee joint and to study the correlation between clinical presentations and radiological findings. MRI also provides excellent soft tissue contrast and is capable of evaluating the soft tissue and bony structures in multiple imaging planes.

MATERIAL AND METHODS

A total number of 50 patients referred with history of knee injury were imaged with 1.5 Tesla (GE Signa HDxt®; General Electric) machine in the department of radiology over a period of 12 months. It was a observational study and a total of 50 patients fulfilling the selection criteria were studied. Source of data:- Patients referred from outpatient department of Jorhat Medical College and Hospital with history of knee injury.

Selection criteria Inclusion criterion:

Patients referred with history of knee injury. Exclusion criteria 1. All patients who did not give consent to be a part of the study. 2. Patients with ferromagnetic implants, pacemakers, cochlear implants and aneurismal clips. 3. Degenerative arthritis, infection, neoplasm and any previous surgery to the knee. Patients fulfilling the selection criteria were informed about the purpose and nature of the study and were enrolled after obtaining a written informed consent. The examination was done using 1.5 Tesla (GE Signa HDxt®; General Electric) MRI machine using routine MRI knee sequences, ie, T1, T2, STIR, GRE, PDFS with coronal, axial and sagittal images with a slice thickness of 3mm and FOV of 16cm. Super conductive magnet with a useful aperture of 60 cm in diameter and dedicated eight-channel knee coil. The overall length of the system was 160 cm. The imaging system is enclosed in a radio frequency room.

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

This was a prospective study of 12 months duration, done at department of Radiodiagnosis, Jorhat medical college and hospital, Jorhat aiming at evaluating the role of MRI in all types of knee injuries. A total of 50 patients with history of injury to knee joint referred for MRI scan of knee joint were studied. Majority of the patients were male (80%) and (20%) patients were female with the male to female ratio is 4:1. The commonest age group was 21 to 30 years for both males and females with mean age of 36.64 years for male and 29.17 years for female. Clinical presentation of the patient did not help in diagnosis in most of the cases of acute knee injury, especially in multiple ligaments injuries. Among the knee injuries, the most commonly injured structure was anterior cruciate ligament (70%), followed by medial meniscus (34%), lateral meniscus (20%), lateral collateral ligament (16%), posterior cruciate ligament(10%) and medial collateral ligament (10%), medial patellar retinaculum (4%), lateral patellar retinaculum (2%), patellar tendon (2%) and popliteus tendon (2%) (graph-1). Out of total 35 ie 70% ACL injuries, low grade partial ACL tear was commonest (57.14%), followed by complete tear (14.28%), high grade partial tear (17.14%) and grade I sprain (11.42%). The most common location of complete tear was midsubstance (86.2%), followed by femoral attachment (6.89%) and tibial attachment (6.89%). Commonest location of tear in menisci was posterior horn of medial meniscus (58.8%) followed by posterior horn of lateral meniscus (50%), anterior horn of lateral meniscus (30%), body of medial meniscus (29.41%), body of lateral meniscus (20%) and anterior horn of medial meniscus (11.76%).

Some of the tears located in one part were noted extending to other parts of meniscus. Horizontal tear was commonest (52.94%) followed by complex tear (23.52%), bucket handle tear (11.76%), radial tear (5.88%) and longitudinal tear (5.88%) in medial meniscus. Commonest type of tear in lateral meniscus was horizontal tear (40%) followed by complex tear (20%), longitudinal tear (20%), vertical radial tear (10%) and oblique tear (10%). MCL injury was associated with ACL and medial meniscus injuries. Similarly LCL tear showed a relationship with lateral meniscus tear (figure 1).

Patellar dislocation was noted in one patient. 42.85%, 60%, 29.41% and 30% of ACL, PCL, medial meniscus and lateral meniscus injuries were associated with bone contusions. Injuries of PCL were noted commonly associated with bone contusions. From the present study, it was noted that Magnetic Resonance Imaging is most comprehensive, non invasive and safe modality in radiological evaluation of knee injury.

Various MRI findings	Number of cases
Anterior cruciate ligament injury	35
Posterior cruciate ligament injury	5
Medial meniscal injury	17
Lateral meniscal injury	10
Medial collateral ligament injury	5
Lateral collateral ligament injury	8
Medial patellar retinaculum injury	1
Lateral patellar retinaculum injury	1
Patellar tendon injury	1
Popliteus tendon injury	1
Bone contusion	25
Fracture	8
Dislocation of patella	1
Haemarthrosis	8
Joint effusion	39

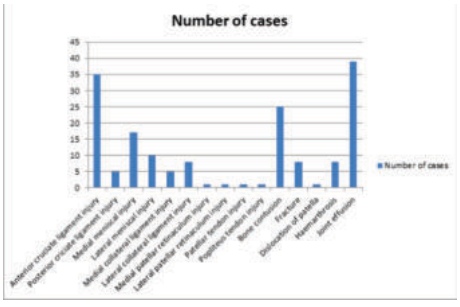
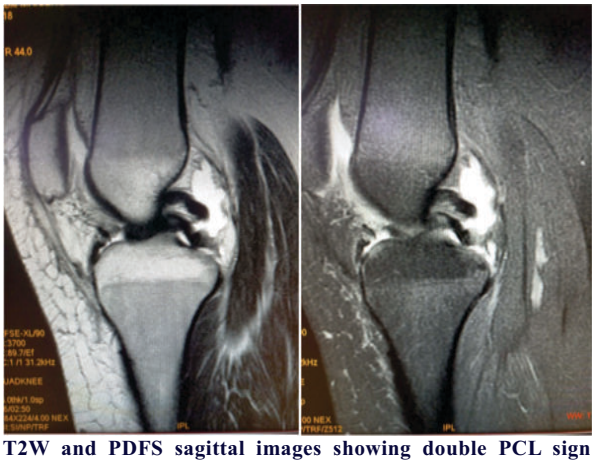
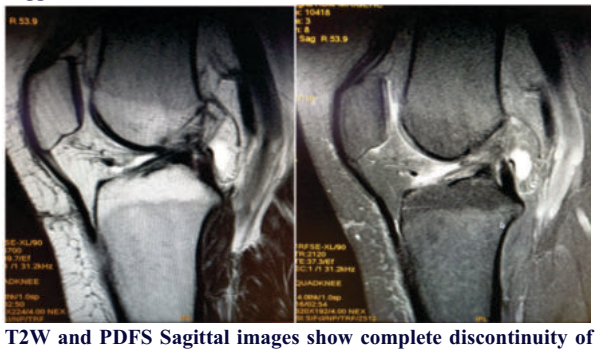


Fig 1.

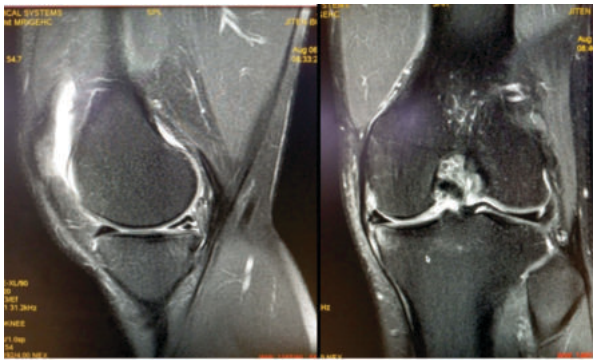
Cases:



T2W and PDFS sagittal images showing double PCL sign suggestive of bucket handle tear of medial meniscus.



T2W and PDFS Sagittal images show complete discontinuity of fibers of ACl with hyperintensity along the fibers-suggestive of Complete ACL tear.



PDFS coronal and sagittal images show fluid signal in the posterior horn of medial meniscus extending to inferior articular surface-suggestive of complex medial meniscal tear.

DISCUSSION

The knee is an anatomically and biomechanically complex joint. The single most common indication of performing a knee MRI is to diagnose internal derangements in an injured knee. Out of total 50 patients, major cause of knee joint trauma was road traffic accident (26%), followed by fall (13%), sports injury (14%) and twisting injury (6%). Pain (100%), followed by instability (40%), joint stiffness/ abnormal locking/decreased range of motion (30%) and swelling (20%) are the common presenting complaints of knee joint trauma. In the present study, there was wide variation in the MRI diagnosis and patient presented with clinical complaints. The clinical diagnosis of anterior cruciate ligament injury was noted in (55%) of the study population, followed by meniscal injury (30%). The MRI findings noted were anterior cruciate ligament injury (70%), followed by medial meniscal injury (34%), lateral meniscus (20%), lateral collateral ligament (16%), posterior cruciate ligament (10%), medial collateral ligament (10%), medial patellar retinaculum (4%), lateral patellar retinaculum (2%), patellar tendon (2%) and popliteus tendon (2%). We found clinical presentation did not helped in diagnosis in most of the cases of acute knee injury and is inconclusive in cases with injuries of multiple ligaments/menisci, which corresponded with study done by Li DK et al[5]. In the present study, male outnumbered female, as 80% of the patients were male and 20% were female with male to female ratio 4:1 with mean age for male is 36.64 years and 29.17 years for female which corresponded with the sex distribution pattern was reported in the study by Anil Madurwar et al where authors noted, out of 50 patients of knee trauma examined, 42 patients (76%) were males and 8 of them were females and Singh et al where authors noted 113 men (65.31%) and 60 women (34.69%) out of the 173 patients with history of knee injuries. The sex distribution pattern in our study also corresponded to study by D S Shetty et al in which out of the 115 patients, 70 (60.86%) were men and 45 (39.14%) were women with male to female ratio of 6.4:1. The study by Jeevika Mu et al in 2017 found that out of 43 patients the males (84%) are commonly affected than females (16%). In this study the patients with age 0 to 70 years with history of knee injury included. Different age group included i.e. 0 to 10 years, 11 to 20 years, 21 to 30 years, 31 to 40 years, 41 to 50 years, 51 to 60 years and 60-70 years. The commonest age group was 31 to 40 years in male with the mean age was 36.64 years. The commonest age group was 21 to 30 years in female. The mean age was 29.17 years for female. The age distribution pattern observed in the present study was comparable to the study of D S Shetty et al in which commonest age group was 21 to 30 years for female. Singh et al also found that majority of the patients with knee injury were in third decade. The commonest finding on MRI scanning was anterior cruciate ligament tear (partial and complete) and was present in 70% of the patients in our study which corresponded to study by Anil Madurwar et al in which authors noted 36 (76%) ACL tears in total 50 knees examined on MRI. Midsubstance tear is commonest accounting 86.2% followed by femoral attachment 6.89% and tibial attachment 6.89%. Low grade partial ACL tear was observed in 57.14% of patients and high grade partial ACL tear in 17.14% of patients with ACL injuries. Furthermore grade I sprain was observed in 11.14% ACL injuries. Similar ACL injury pattern observed in the present study was comparable to the study of D S Shetty et al in which commonest knee injury is ACL injury with midsubstance tear is the commonest location of ACL tear. Singh et al also found that major knee injury is ACL tear and the commonest complete ACL tear is midsubstance tear. Out of total 50 patients, percentage of PCL injuries detected was 10%. Out of total 5 PCL

injuries, partial and complete tear were noted in 2 and 1 patient respectively, total 3 PCL tears detected. Grade I sprain comprised 2 patients. In complete PCL tears, midsubstance and avulsion tear are commonest (66.66%) followed by femoral and tibial end (33.33%) which corresponded to study done by Anil Madurwar et al[6] , D J Singh et al[8] and Shetty et al[9] where authors noted 6%, 5.0% and 4.4% PCL tear respectively. Out of total 50 patients, Grade III signal was most common in both menisci followed by grade II and grade I which corresponded to study done by Jeevika Mu et al[7] and D S Shetty et al[9] . Among menisci, medial meniscus is commonly injured (62.9%), followed by lateral meniscus (37.1%). Posterior horn of medial meniscus was commonly injured structure among menisci noted in 10 cases against 27 meniscal tears. Horizontal tear was commonest (52.94%) followed by complex tear (23.52%), bucket handle tear (11.76%), radial tear (5.85%) and longitudinal tear (5.85%) in medial meniscus. Commonest type of tear in lateral meniscus was horizontal tear (40%) followed by complex tear (20%), longitudinal tear (20%), vertical radial tear (10%) and oblique tear (10%). Similar meniscal injury pattern observed in the present study was comparable to the study of D S Shetty et al in which commonest meniscal injury is posterior horn of medial meniscus. Singh et al also found that commonest meniscal injury is posterior horn of medial meniscus. Jeevika Mu et al also found that among meniscal injuries medial meniscal tears (46.5%) were more common than lateral meniscus (37.2%) and the posterior horn of medial meniscus (55%) is commonest site of involvement. Out of total 50 patients MCL injury is noted in 1 patient, partial tear in 3 patients and grade I sprain noted in 1 patient. Similarly partial LCL tear noted in 5 patients with complete tear in 1, partial tear in 2 and grade I sprain in 3 patients. It was found that MCL injury is associated with ACL and medial meniscus injuries. Out of 5 MCL injuries, ACL and medial meniscus injuries were noted in 3 and 2 patients respectively. “O Donoghue's triad” was noted in 1 patient. Out of 8 LCL tears, 2 ie 25% were found to be associated with lateral meniscal tears. LCL tear showed a relationship with lateral meniscus tear (25%) which corresponded to the study done by Anil Madurwar et al. Grade I sprain of medial patellar retinaculum was found in 1 patient. Patellar dislocation was noted in 1 patient. Out of 50 patients with knee injury, bone contusions are noted in 25 patients which corresponded to the study done by Anil Madurwar et al where author noted 42% bone contusion in their study. 42.85%, 60%, 29.41% and 30% of ACL, PCL, medial meniscus and lateral meniscus injuries were associated with bone contusions. Injuries of PCL is noted commonly associated with bone contusions which corresponds to study done by Scott D Mair et al[10]. where author found posterior cruciate ligament injuries mostly occur with osseous and some degree of associated ligamentous injury. Knee joint MRI improved the diagnosis of ligament and meniscal tears, muscles and tendons injuries. Bone contusions, osteochondral injuries, traumatic chondromalacic changes, joint effusion and haemarthrosis are also diagnosed well on MRI. MRI provides important clinical information that guides patient management and treatment planning. Overall the present study showed that, MRI of the knee joint has wide approach for the diagnosis of traumatic knee injuries. This makes it as a practical, well accepted and accurate non invasive imaging technique in patients presenting with injury to knee joint and is the modality of choice in clinically suspected cases of soft tissue injury where plain radiographs are normal. Furthermore, excellent soft tissue and multiplanar planes imaging provides optimal assessment of ligaments, menisci, muscles, tendons, fibrous cartilage, joint capsule, fat bursae and bone marrow. The results of our study support the use of early MRI in case of knee injuries to guide further surgical management.

CONCLUSION

Magnetic resonance imaging of the knee is the excellent non invasive investigation tool for knee injury due to excellent contrast resolution and multiplanar imaging capabilities which provides the most detailed evaluation in cases of various soft tissue injuries of knee joint. Clinical features may suggest the soft tissue injury, but for further evaluation, MRI is necessary. MRI is unique in its ability to evaluate the ligaments, menisci, articular cartilage, articular capsule and bone marrow. Even though anatomical variants and technical artefacts can mimic a tear on MRI, it is still considered as the primary imaging tool for optimal depiction of internal derangement of knee injury. Commonest injuries detected in our study are- anterior cruciate ligament tear, tear of posterior horn of medial meniscus, bone contusions and joint effusions.

REFERENCES

1. Sanches Vaz CE, Pires De Camargo O, José De Santana P, Valezi AC. Accuracy of magnetic resonance in identifying traumatic intraarticular knee lesions. Clinics. 2005;60(6):445–50.
2. Kijowski R, Roemer F, Englund M, Tiderius CJ, Swärd P, Frobell RB. Imaging following acute knee trauma. Vol. 22, Osteoarthritis and Cartilage. 2014. p. 1429–43.
3. Gupta K, Sandhu P, Galhotra R, Guleria M. Correlation of clinical, MRI and arthroscopic findings in diagnosing meniscus and ligament injuries at knee joint: A prospective study. J Orthop Allied Sci [Internet]. 2013;1(1):2.
4. Prickett WD, Ward SI, Matava MJ. Magnetic resonance imaging of the knee. Sports Med 2001;31(14):997– 1019.
5. Li DK, Adams ME, McConkey JP. Magnetic resonance imaging of the ligaments and menisci of the knee. Radiologic clinics of North America. 1986;24(2):209– 27.
6. Mu J, Reddy DLVB. Role of Mri in Meniscal Tears dr. IOSR J Dent Med Sci 2017;16(3):111–7.
7. Scientist V, Road HM. International Journal of Research and Review. 2017;4(6):50–2.
8. J.P. S, L. G, R. S, V. S, V. G. MR imaging of knee with arthroscopic correlation in twisting injuries. Indian J Radiol Imaging. 2004;14(1):33–40.
9. Shetty, Lakhkar B, Krishna G. Magnetic resonance imaging in pathologic 138 conditions of knee. Indian J Radiol Imaging. 2002;12(3):375.
10. Scott D. Mair, MD, Theodore F. Schlegel, MD, Thomas J. Gill, MD in 2004, Incidence and Location of bone Bruises after Acute Posterior Cruciate Ligament Injury.