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MRI EVALUATION OF MENISCAL AND LIGAMENTOUS INJURIES OF KNEE IN CORRELATION WITH ARTHROSCOPY

Radiodiagnosis

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ABSTRACT

Background - In knee joint injuries, clinical examination, radiographs and CT scan is not enough to diagnose many internal derangements of this joint. MR studies are required to assess the injuries of the menisci, cartilage ligaments or bone. **Materials and methods-** A cross-sectional, analytical–observational study was conducted at the Department of Radiodiagnosis. A total of 65 patients with clinical suspicion of knee ligament injury and were referred for MRI were examined, 41 patients were males and 24 were females, their ages ranging from18 to 60 yrs. **Results-** ACL tear was the most common lesion, presented in 53.84 % cases out of which 29.32% cases were partial tear and 24.62% cases were complete tear. Medial Meniscus tear was the second most common lesion. 25% cases presented with combined injuries and 75% cases presented with isolated injuries. The predominant pattern was ACL and MM tears, followed by ACL tear and LM tears. Correlation between MRI and arthroscopic findings are statistically significant with (88%) of the cases showed good correlation between MRI and arthroscopic findings. **Conclusions-** The study revealed the ability of MRI in evaluation of the various internal derangements, including their detection, types (partial/complete tear) localization, characterization and assessment of extent of damage and the strength of correlation between MRI and arthroscopic helped the orthopaedic surgeons as a conservative approach was indicated in partial tears while a repair/reconstruction was indicated in a complete tear.

KEYWORDS

INTRODUCTION

The knee joint is a compound synovial type of joint and due to the lack of bony support, stability of the joint is highly dependent on its supporting ligamentous structures, therefore injuries of ligaments and menisci are extremely common[1]. Anterior cruciate ligament (ACL) is commonly injured ligament in knee[2] and usually associated with meniscal injuries[3].An accurate diagnosis regarding the involvement of structures and the extent of injuries is essential for early operative or non-operative management and requires an accurate clinical history, a thorough physical examination and complementary diagnostic tools. Most widely used diagnostic modalities are MRI and arthroscopy.

Arthroscopy is considered gold standard for diagnosis of intra articular knee lesions[4]. However, arthroscopy is an invasive procedure that requires hospitalization and anaesthesia, thus presenting all the potential complications of a surgical procedure[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] MRI is non-invasive diagnostic modality and there is no ionizing radiation[9]. The ligaments of knee are divided into intra-articular and extra-articular, the extra-articular ligaments are not visible on routine arthroscopic procedures[10]. MRI plays a most important role in their evaluation with the development of new sequences, improved signal to noise ratio, higher resolution, shorter imaging sequences, better patient tolerance, less motion artifact and improved accuracy. MRI has changed the traditional algorithm for workup of meniscal and cruciate ligamentous tears. Current research aimed to study the spectrum of ligamentous & meniscal injuries in patients with knee trauma and to correlate the MRI findings with arthroscopy.

MATERIALS AND METHODS

A Cross-sectional, Analytical –observational study was conducted at the Department of Radio-diagnosis, Dr. S.N. Medical College & Attached Hospitals, Jodhpur from May 2017 to Dec 2020 after approval from ethical committee. A total of 65 patients were examined, 41 patients were males and 24 patients were females. The examination was done using 1.5 T Phillip's MR and dedicated knee coil with sequences as follow: Sagittal PDW (SPIR), Sagittal T2W, Coronal PDW (SPAIR), Coronal T1W, Axial PDW (SPIR) & Axial T1W with additional sequences depending upon the situation for adequate evaluation.

Patients (18-60 years) with clinically suspected injuries of the knee, willing to undergo MRI scanning and consenting for the same were included in the study.

We excluded patients not consenting for the study, with contraindications to MR, post-operative (Repair of menisci and ligaments) cases and patients with no history of injuries and all patients with inflammatory, degenerative, neoplastic, infective etiologies causing pain, and swelling at knee joint.

Imaging Details:-

- Supine Positioning.
- Slight external rotation.
- Dedicated knee coil– 8 channels.
- 14 to 16 cm field of view depending on patient size.
- 2.5 to 5 mm slice thickness.
- Normal examination time 15minutes.

Image Interpretation:-

The images were interpreted by two qualified radiologists individually. The ACL and PCL were evaluated on sagittal, coronal, and axial images and categorized as intact or torn(complete /partial) avulsion with bony fragment [Fig.1,2].

Signs of ACL rupture included an abnormal horizontal course [Fig. 3], a wavy or irregular appearance, fluid-filled gaps in a discontinuous ligament or hyperintensity in intercondylar notch [Fig. 7] and Buckling of the posterior cruciate ligament [Fig.8]. The collateral ligaments were graded in to partial/complete tear. Associated meniscal tears were taken in to account, a hypointense meniscus without any altered signal intensity was considered normal. The presence of an intra-meniscal high-signal intensity was regarded as a tear [Fig.4] and its grading was done according to whether it reaches to the articular surface or not. Bony contusions, joint effusion, fractures were reported .The results of the MRI imaging were recorded in the proforma and reported to the orthopaedic surgeon.

Out of 65 patients 25 patients underwent arthroscopy [Fig.5,6] by a qualified and experienced arthroscopic surgeon. Prior knowledge of the complete description of the tears would help surgeons to use portal allowing optimal visualization and probing of the area containing abnormal signals. Surgical operative notes or direct discussion with surgeon was used for follow up of all cases.

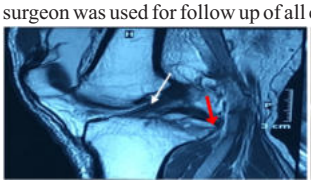

Fig.1- Sagittal T1 sequence showing avulsion of PCL (Red arrow) from its tibial attachment, Intact ACL(White arrow)

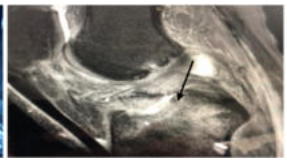

Fig.2-Sag proton density fat suppressed images showing avulsion fracture of anterior cruciate ligament at tibial attachment site (Black arrow)

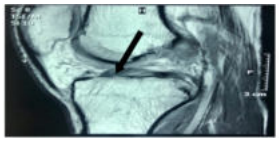

Fig.3-T1-weighted sagittal image shows abnormal, more horizontal orientation of the distal portion of torn anterior cruciate ligament (Black arrow).

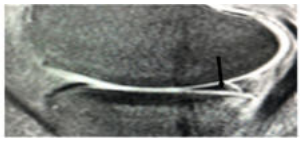

Fig.4-Sag proton density fat suppressed images showing vertical circumferential tear of posterior horn medial meniscus(Black arrow).

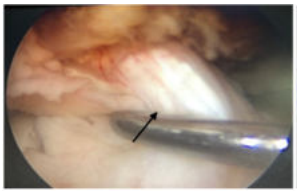

Fig. 5-Arthroscopic view showing intact ACL (Black arrow).

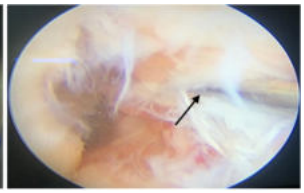

Fig. 6-Arthroscopic view shoving complete tear of ACL (Black arrow).

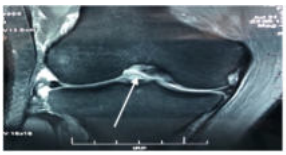

Fig.7-Coronal proton density fat suppressed images showing high-signal-intensity changes, the absence of ACL (White arrow).

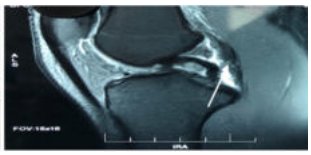

Fig.8-Sag proton-density fat suppressed images showing buckled course of the posterior cruciate ligament (PCL) as an indirect sign of complete ACL tear (White arrow).

RESULTS

In our study, MRI examination was performed on 65 patients with the complaints of knee injury. Regarding the most common age group, 48% affected were between 21and 40 and this is explained by the fact that this age group being the most active group [Fig. 9]. Males had a higher incidence 63% compared to females 37%. Majority(55%) had an injury on the right side **.** 25% cases were up to 1 weeks history Of symptoms, followed by 17% cases were more then 6 months history of symptoms prior to undergoing MRI [Fig. 10]. ACL tears were most common 53.84% (29.32% partial tear and 24.62% complete tear) followed by 35.38% medial meniscus (MM) tears, 18.46% had lateral meniscus (LM) tears,15.38% (13.84% partial tear and 1.54% complete tear) had medial collateral ligament (MCL) tears and bone contusions each, 4.62% (3.07% partial and 1.54% complete) had PCL tears, 3.07% had partial lateral collateral ligament (LCL) [Fig. 11]. 25% cases presented with combined injuries and 75% cases presented with isolated injuries [Fig.13]. 23.08% patients had ACL+ Menisci injuries, 3.08%patients presented with ACL+ Menisci+ Collateral injuries and 1.53% patients had ACL+PCL injuries. 15.38%cases had bony contusions [Fig.12]. The predominant pattern was ACL and MM tears, followed by ACL tear and LM tears. Correlation between MRI and arthroscopic findings are statistically significant with (88%) of the cases showed good correlation between MRI and arthroscopic findings [Fig. 14].

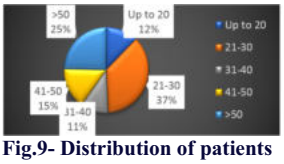

Fig.9- Distribution of patients according to age.

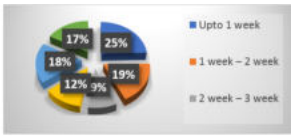

Fig:10 Distribution of patients according to duration of symptoms prior to MRI.

Fig.11-Distribution of patients according to various injuries

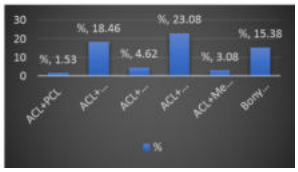

Fig.12-Distribution of patients according to pattern of injuries.

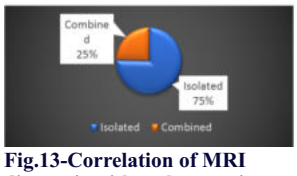

Fig.13-Correlation of MRI diagnosis with arthroscopic findings

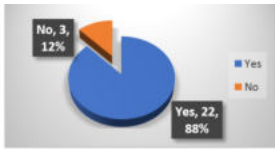

Fig.14-Distribution of patients according to isolated \combined injuries

DISCUSSION:

The role of MRI has steadily increased and now it has become the first line investigation for most of the lesions of knee. Complete evaluation of all the internal structures of the knee is not possible with other modalities like conventional Radiography, Arthrography and Ultrasonography and Computed Tomography. Even with arthroscopy, lesions such as peripheral meniscal tears, inferior surface tears and intra-meniscal tears are most often not detected. Multiplanar MR images provide significant improvement in assessing these structures. In our study 36.92% cases belonged to 21-30yrs age group followed by 24.62% patients were more than 50yrs age group and 12.31% patients in less than 20yrs age group. The commonest age group was 21 to 30 years. The age distribution pattern observed in the present study was comparable to the study of Seshadri BM et al[11] and T Sundara Rajan et al[12] . Kocabey Y et al[13] was also found that most common group was 12-42yrs and this is explained by the fact that this age group being the most active group. In present study 73.08% cases were male and 36.92% cases were female which corresponded with the sex distribution pattern was reported in the study by Seshadri BM et a[11]was found that out of 40 patients, 35 (87.5%) were males and 5 (12.5%) were females. Laundre BJ[14] observed that male were more common than female with male female ratio (4:1). Probably because they are most mobile group. In our study most of the patients had history of trauma with duration of injury ranging from less then 1week to more then 6 months. Maximum cases (24.61%) were upto 1 weeks history followed by 18.46% cases were 1 week – 2 week & 1 month – 6 month respectively, 12.30% cases were 3 week – 4 week. Study conducted Rudresh S Halawar et al[15]also observed that most of the patients had duration of injury ranging from 2 days to 3 years. In this study 53.38% cases involved rt knee and 44.62% cases involved Lt knee. Laundre BJ[14], Seshadri BM et al[11]and Kocabey Y et al[13] were also observed that right knee more commonly affected than left knee joint.

ACL tear was the most common lesion, presented in 53.84 % cases out of which 29.32% cases were partial tear and 24.62% cases were complete tear. Singh JP et al[16] in their series of 173 patients showed that 78 patients (45.08%) had ACL tears and among these 52 (66.67%) had partial, 16 (20.51%) had complete tear. In a similar study by Singh *et al*[14], 45.08% showed ACL tear, and among which, 66.67% were partial and 21.13% were complete ACL tear. The authors concluded ACL tears to be more common than other ligamentous injuries. Rudresh S Halawar et al[15]also observed that partial tear 20(57.1%) was more common than complete tear 15(42.8%). PCL tear was less common finding, presented in 4.62 % cases out of which 03.07% cases were partial tear and 01.54% cases were complete tear. Posterior cruciate ligament injuries were found to be relatively uncommon in our study. Sonnin et al[17] found the incidence of PCL tear to be 3 percent; in a series of study analysing 350 cases of knee injury. The PCL being a stronger ligament has a low incidence of tears.

Medial Meniscus tear was 2ND most common type lesion after ACL affecting 35.38% cases, and 18.46% cases were present with Lateral Meniscus tear. This well correlated with the study done by Singh JP et al[16] in a series of 173 cases, of which they found 57 (38.23%) patients showed MM tear and 28 (29.41%) patients showed LM tear. There was a preponderance of MM over LM in our study which was again correlated with the study done by T Sundara Rajan et al[12] MM tear in 17 (34%) and LM tear seen in 11 patients (22%). This is probably because medial meniscus is more fixed and less mobile then lateral meniscus. MCL tear was affecting 15.38 % cases and among which, 13.84% cases had partial tear and 01.54% cases had complete tears. MCL tears (15.38%) were found to be more common than the LCL tear (3.08%). All these cases had history of trauma and were associated with multiple injuries, which was also observed by Mink JH et al[18]. Out of 25 cases 22(88%)had MRI finding well correlated with arthroscopic findings with 95%confidence interval(70.04- 95.83%)[19,20].

MRI findings in 3 cases not matched arthroscopically, one case of partial tear of ACL found intact on arthroscopy, two cases of false positive Medial Meniscus tear found intact on arthroscopy. Both cases were seen involving posterior horn of the medial meniscus. This area is difficult to examine on arthroscopy. Another reason may be the presence of intra-meniscal tears not communicating with the articular surface. All of these cases had combined injuries. Roberts C et al[21]observed that sensitivity of medial meniscal tear is reduced in the presence of ACL tears. T Sundara Rajan et al[12] observed that biomechanical forces that result in the ACL tear also result in medial meniscal tear. Due to multiple tears, the sensitivity of the medial meniscal tear is reduced. Due to the presence of multiple tears, one peripherally located meniscal tear was over looked on MRI and mis-interpretations are more likely to happen in the case of partial ACL tear where it can be missed or it can be over diagnosed on MRI. Waleed Hetta et al[22] observed that accuracy of MRI decreased in patients with multiple injuries. In present study Osseous lesions were seen in10 patients (15.38%). Most of these were bony contusions involving the femoral and tibial condyles. These findings were correlated with findings described by Thomas H.Berquist[24]. In present study, we found 16 cases of combined injuries and 49 cases of isolated injuries.The predominant pattern is ACL tear and MM tears; followed by ACL tear and LM tear, which is well correlated with a study by Ali Akbar Esmaili Jah et al[23], and Rudresh S Halawar et al[15].

CONCLUSION

MRI is highly sensitive and accurate at the identification of various internal derangements of knee, including their detection, localization, characterization, assessment of extent of damage and description of the type of tears with good strength of correlation between MRI and arthroscopic diagnosis helped the orthopedic surgeons as a conservative approach was indicated in partial tears while a reconstruction was indicated in a complete tear.

SOURCE OF FUNDING

None

CONFLICT OF INTEREST

None

REFERENCES:

1. David K B Li, Mark E Adams, J Pat McConkey. Magnetic Resonance Imaging of Ligaments and Menisci of the Knee. RadiolClin North Am 1986;24(2):209-227.
2. Barber-Westin SD, Noyes FR. Objective criteria for return to athletics after anterior cruciate ligament reconstruction and subsequent reinjury rates: A systematic review. Phys Sportsmed 2011;39:100-10.
3. Muhle C, Ahn JM, Dieke C. Diagnosis of ACL and meniscal injuries: MR imaging of knee flexion versus extension compared to arthroscopy. Springerplus 2013;2:213
4. Vassilios SN, Efstathios C, Christianna S, Spyros P, Peter G, Nicolas E, et al. MRI efficacy in diagnosing internal lesions of the knee: a retrospective analysis. J Trau Mana Outc. 2008;2:4.
5. Sherman OH, Fox JM, Snyder SJ, Del Pizzo W, Friedman MJ, Ferkel RD, Lawley MJ: Arthroscopy--"no-problem surgery". An analysis of complications in two thousand six hundred and forty cases. *J Bone Joint Surg Am* 1986, 68(2):256-265.
6. De Smet AA, Tuite MJ, Norris MA, Swan JS. MR diagnosis of meniscal tears: Analysis of causes of errors. Am J Roentgenol 1994;163:1419-23.
7. El-Khoury GY, Kathol MH, Manning TA, Tomoda K, Mitomo M, Yamamoto T, *et al.* Magnetic resonance imaging in the diagnosis of knee injuries. EmergRadiol 1994;1:150.
8. Harms SE, Flamig DP, Fisher CF, Fulmer JM. New method for fast MR imaging of the knee. Radiology 1989;173:743-50.
9. Polly DW Jr, Callaghan JJ, Sikes RA, McCabe JM, McMahon K. The accuracy of selective magnetic resonance imaging compared with the findings of arthroscopy of the knee. JBJS Am 1988;70:192-8.
10. McNally EG. Knee: Ligaments: In: Vanhoenacker FM, Maas M, Gielen JL, editors. Imaging of Orthopaedic Sports Injuries Springer 2007. p. 284-303.
11. Seshadri BM, Ashwathappa S, Swamy IN. Magnetic resonance imaging evaluation of ligamentous tears of the knee joint and association of meniscal tears with anterior cruciate ligament tears. J. Evolution Med. Dent. Sci. 2016; 5(43): 2664-68, DOI: 10.14260/jemds/2016/624.
12. T SundaraRajan, A Jamal Mohamed Evaluation of Role of Magnetic Resonance Imaging in Knee Joint Injuries in Correlation with Arthroscopy . International Journal of Scientific Study | September 2017 | Vol 5 | Issue 6
13. Kocabey Y, Tetik O, Isbell WM, Atay OA, Johnson DL. The value of clinical examination versus magnetic resonance imaging in the diagnosis of meniscal tears and anterior cruciate ligament rupture. Arthroscopy. 2004 Sep;20(7):696-700
14. Laundre BJ, Collins MS, Bond JR, Dahm DL, Stuart MJ, Mandrekar JN. MRI accuracy for tears of the posterior horn of the lateral meniscus in patients with acute anterior cruciate ligament injury and the clinical relevance of missed tears.AJR Am J Roentgenol. 2009 Aug;193(2):515-23.
15. Rudresh S Halawar, Timmanagouda PN, Arti Chaturvedi1.Occurrence of isolated and combined anterior cruciate ligament injuries in traumatic knee-by MRI. Medica Innovatica December 2014, Volume 3 - Issue 2
16. Singh JP, Garg L, Shrimali R, Setia V, Gupta V. MR Imaging of knee with arthroscopic correlation in twisting injuries. IJRI 2004;14:33-40.
17. Sonin AH, Fitzgerald SW, Friedman H. MR imaging of posterior cruciate ligament; normal, abnormal and associated injury pattern. Radiographics 1995;15(3):551- 61.
18. Mink JH. The cruciate and collateral ligaments, in Mink JH, Reicher MA, Crues JV, (eds): MRI of the Knee. New York, NY, Raven 1993;2nd edn:141-88
19. Hughston JC, Barrett GR. Acute Anteromedial rotatory instability. Long-term results of surgicalrepair. J Bone Joint Surg Am 1983; 65:145–53.
20. Staron RB, Haramati N, Feldman F, et al: O'Donoghue's triad: Magnetic Resonance Imaging evidence. Skeletal Radiol 1994;23(8):633-36.
21. Roberts C, Towers JD, Spangehl MJ, Carrino J, Morisson WB. Advanced MR
22. Imaging of the cruciate ligaments. MagnReson Imaging Clin 2007;148:762-5.
23. Waleed Hetta, Gamal Niazi MRI in assessment of sports related knee injuries. Egyptian Society of Radiology and Nuclear Medicine. The Egyptian Journal of Radiology and Nuclear Medicine. 2014
24. Ali Akbar EsmailiJah, Sohrab Keyhani, Reza Zarei, Ali Kalhor Moghaddam. Accuracy of MRI in comparison with Clinical and Arthroscopic findings in ligamentous and meniscal injuries of the knee: ActaOrthop. Belg., 2005;71:189-96