

Magnetic Resonance Imaging Evaluation of Knee Joint in Traumatic Conditions with Correlation to Arthroscopy

Dr. S. C. Gupta¹, Dr. Ripudaman Singh^{2*}, Dr. Sunil K. Agrawal³,
Dr Mahendra Yadav⁴

1- Professor, Dept of Radiodiagnosis, Mahama Gandhi Hospital, Jaipur

2- Junior Resident, Dept of Radiodiagnosis, Mahatma Gandhi Hospital, Jaipur

3-Professor, Dept of Radiodiagnosis, Mahama Gandhi Hospital, Jaipur

4- Junior Resident, Dept of Radiodiagnosis, Mahatma Gandhi Hospital, Jaipur

*Corresponding Author: Dr. Ripudaman Singh, Junior Resident Dept of Radiodiagnosis, Mahatma Gandhi Hospital, Jaipur.

Abstract

Background: To assess the applications of Magnetic Resonance Imaging in evaluating the Knee Joint in various Traumatic conditions along with grading of the various ligamentous and meniscal injuries based on laid criteria and Comparison of MRI findings with Arthroscopy. **Material & Method:** 50 patients with painful traumatic knee joint that are referred to Department of Radiodiagnosis from various departments. **Results:** joint effusion was seen in majority i.e., 44patients (88%). ACL tear was noted in more than two-third patients (34/50), with more than 50% among them having partial tears. Only few (5/50-10%) cases of posterior cruciate ligament injury was found in our study, out of which majority (80%) i.e., 4/5 were partial and only one patient had complete tear. **Conclusion:** MRI is an excellent, noninvasive, radiation-free imaging modality to achieve correct diagnosis with high sensitivity & specificity thereby helping in optimal management and avoiding unnecessary arthroscopies unless surgical management is contemplated.

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I. Introduction

Trauma to knee joint is a significant cause of morbidity in the young, active individuals especially amongst sportsman, military recruits and trained soldiers. With the advent of minimally invasive operative procedures, imaging of knee joint becomes more important. The most widely used modalities for assessing knee joint injuries are arthroscopy and magnetic resonance imaging (MRI). Arthroscopy is invasive and may cause complications.^[1,2] MRI is not only reliable & safe except in cases of suspected foreign bodies but also offers following advantages over diagnostic arthroscopy which is gold-standard for diagnosis of internal derangements of knee.^[3,4,5]

In traumatic knee, post-traumatic limited range of motion and mechanical symptoms MRI is generally considered a valuable diagnostic tool.^[5] MRI allows evaluation of injured knee non-invasively in majority of cases avoiding invasive procedures and related morbidity.^[6,7]

Arthroscopy is considered as “the gold standard” for the diagnosis of traumatic intraarticular knee lesions, having accuracy as high as 95% to 98%. However, arthroscopy is an invasive and expensive tool that requires hospitalization and regional or general anesthesia, thus presenting all the potential complications of an open surgical procedure. Today, knee arthroscopy is the commonest procedure performed among orthopedic surgeons. Initially, knee arthroscopy was used as a diagnostic technique. With the advent of MRI and other non-invasive techniques, knee arthroscopy is now used for the treatment of various knee pathologies.

The knee is a compound synovial joint with lack of bony support. Knee joint stability is highly dependent on ligamentous structures hence injuries of ligaments and menisci are extremely common.^[8,9]

Because of the above advantages, MRI knee has become an alternative to diagnostic arthroscopy in the last decade. It is good for identifying patients that may need arthroscopic management. MRI can help avoid up to 35% arthroscopies thus influencing patient outcome and societal costs.

II. Aims and Objectives

The aim of the study is to assess the applications of Magnetic Resonance Imaging in evaluating the Knee Joint in various Traumatic conditions with the following objectives:

- 1) Study of the spectrum of MRI finding in all consecutive case of knee trauma referred from other departments of MGMCH.
- 2) Grading of the various ligamentous and meniscal injuries based on laid criteria.
- 3) Comparison of MRI findings with Arthroscopy.

III. Material And Methods

TYPE OF STUDY: It is a hospital-based, observational study.

PERIOD OF STUDY: January 2020 to June 2021.

PLACE OF STUDY: Department of Radiodiagnosis, Mahatma Gandhi Medical College and Hospital, Jaipur

PLAN OF STUDY: Our study included patients with traumatic knee joint that are referred to Department of Radiodiagnosis from various departments at Mahatma Gandhi hospital from January 2020 to June 2021. Institute Ethics Committee approval was obtained before the initiation of study. Written and inform consent was obtained from all participants before being enrolled into the study.

SAMPLE SIZE: The study included 50 patients with painful knee joint referred to our department subjected to the strict inclusion and exclusion criteria. All patients were be subjected to clinical assessment including detailed history. The diagnosis of painful knee joint was solely based on clinical examination.

Inclusion Criteria

- 1) Patients with knee trauma referred from various departments willing to undergo MRI.
- 2) All the patients who give consent for study.

Exclusion Criteria

1. Previous surgery of knee joint.
2. Patients with pacemakers, metallic implants, or foreign bodies in their body.
3. Uncooperative or unstable patient.
4. Patients having claustrophobia.

IV. Result

Table 1: Distribution of study participants according to presence of Joint Effusion

Joint Effusion	Frequency(n)	Percentage (%)
No	6	12
Yes	44	88

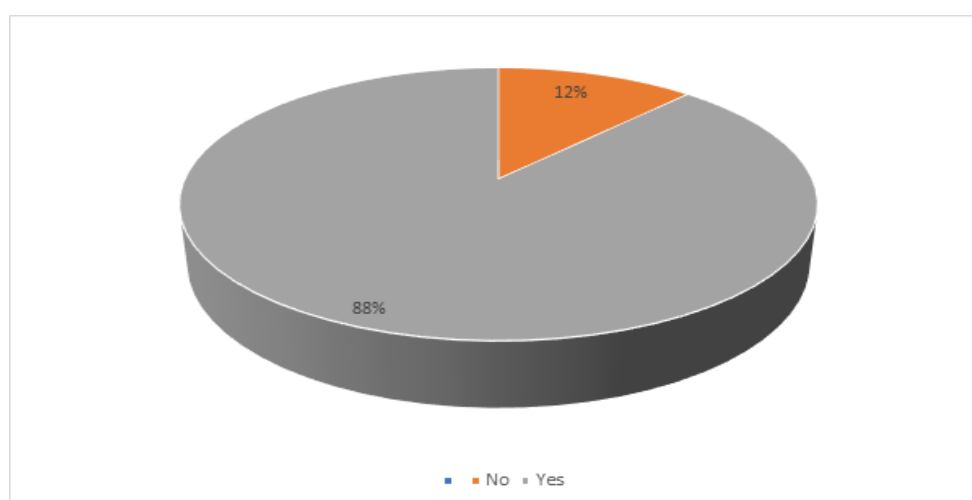


Figure 1: Graphical representation of participants according to Joint Effusion

Joint effusion was commonly seen in 88% of knee injuries study subjects. Only 12% of subjects did not have joint effusion.

Table 2: Distribution of study participants according to ACL Injury

ACL	Frequency(n)	Percentage (%)
No	16	32
Yes	34	68
Complete	16	32
Partial	18	36

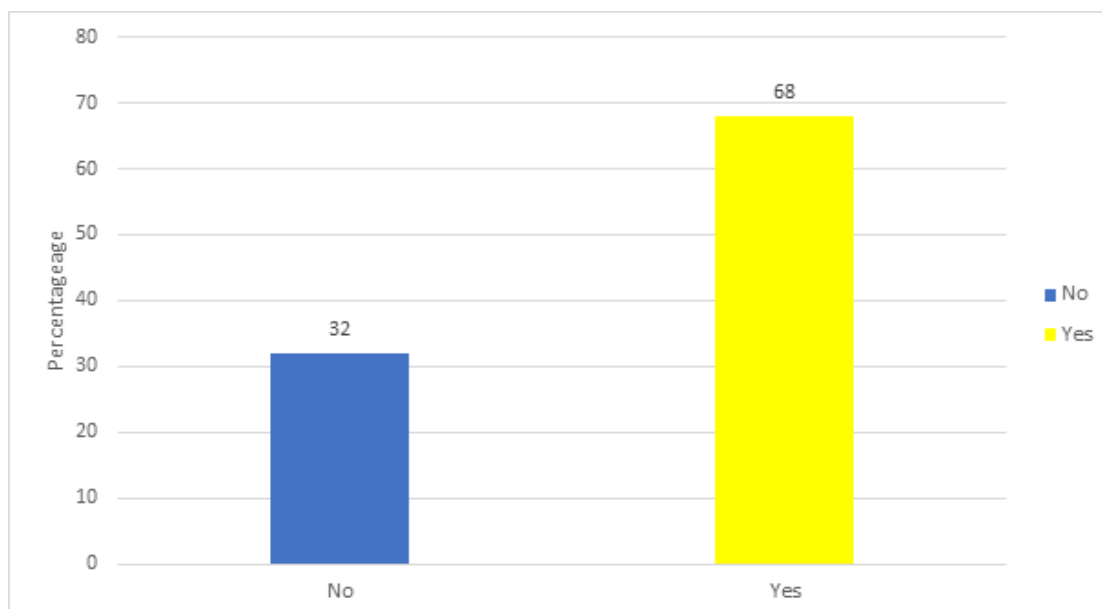


Fig 2: Graphical representation of participants according to ACL Injury

ACL tear was the most common injury seen in 68% of study subjects with complete tear in 47.1% subjects and partial tear in 52.9% subjects.

Table 3: Distribution of study participants according to PCL tear

PCL tear	Frequency(n)	Percentage (%)
No	45	90
Yes	5	10
Complete	1	2
Partial	4	8

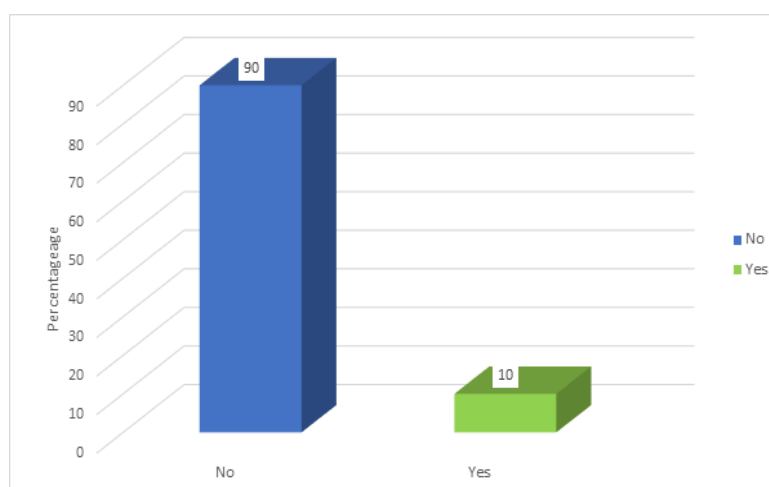


Fig 3: Graphical representation of participants according to PCL tear

PCL tear was seen in only 10% of study subjects with complete tear in 20% of subjects and partial tear in 80% subjects.

Table 4: Distribution of study participants according to MCL tear

MCL tear	Frequency(n)	Percentage (%)
No	42	84
Yes	8	16
Grade1	5	10
Grade3	3	6

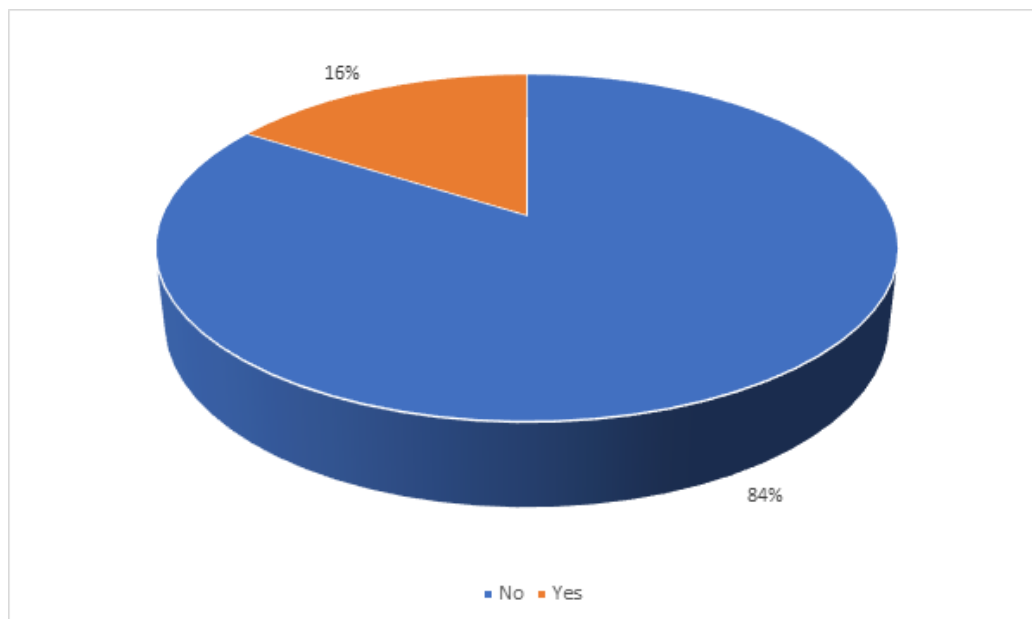


Fig 4: Graphical representation of participants according to MCL tear

MCL tear was seen in 16% of study subjects with Grade 1 tear in 62.5% of subjects and Grade 2 tear in 37.5% subjects.

Table 5: Distribution of study participants according to MRI Findings

MRI Findings	Positive Findings (n)	Percentage (%)
Joint Effusion	44	88
ACL tear	34	68
PCL tear	5	10
MCL tear	8	16
LCL tear	2	4
MM tear	31	62
LM tear	10	20
Osseous/Osteochondral lesions	27	54

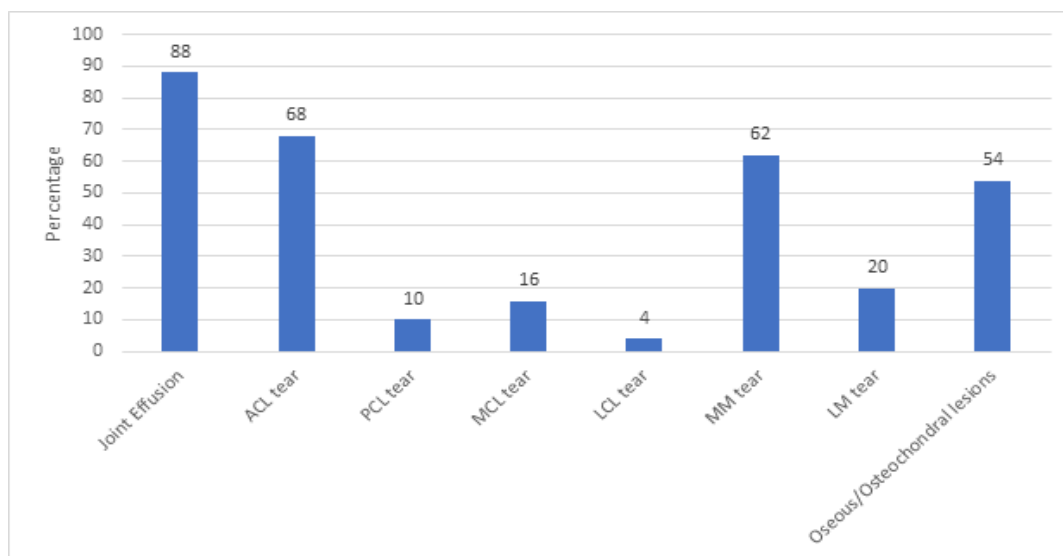


Fig 5: Graphical representation of participants according to MRI Findings

As shown in above table, joint effusion was the most common finding (88%) followed by ACL tear (68%), MM tear (62%), Osseous/ Osteochondral lesions (54%), LM tear (20%), MCL tear (16%), PCL tear (10%) and LCL tear (4%).

Table 6: Distribution of study participants according to MRI and Arthroscopy / Surgical Correlation

MRI and Arthroscopy/surgical Correlation	Frequency(n)	Percentage (%)
No	6	12
Yes	44	88

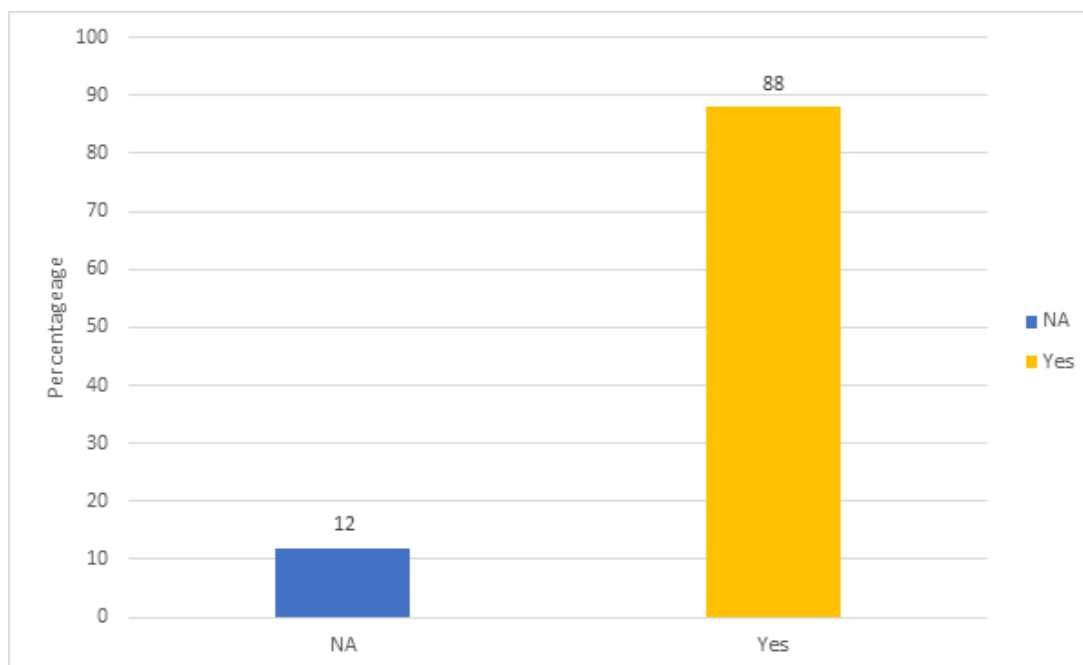


Fig 6: Graphical representation of participants according to MRI and Arthroscopy / Surgical Correlation

Table 7: Correlation between MRI and Arthroscopic Diagnosis for ACL Tear

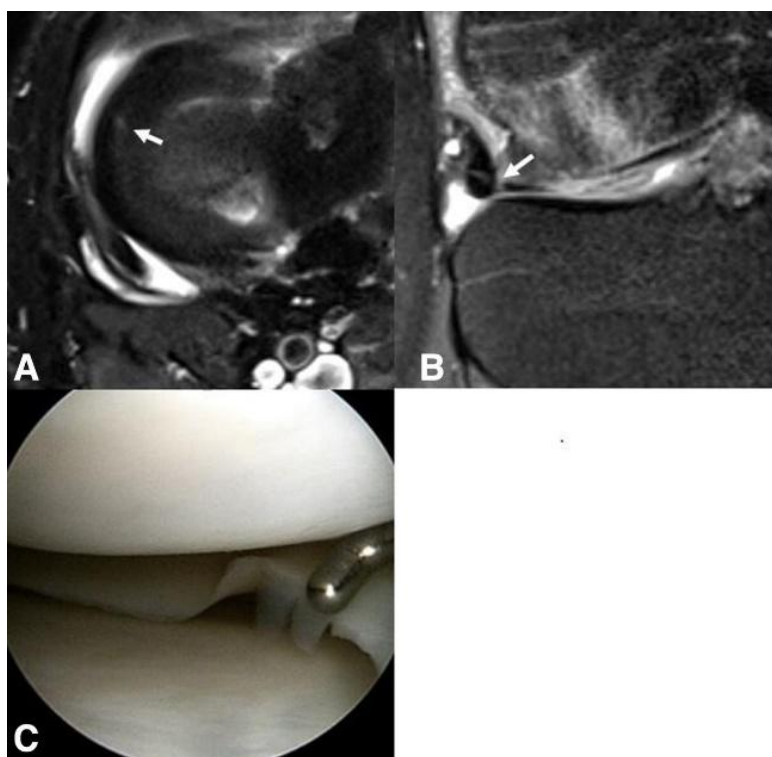
ACL tear		Arthroscopy Diagnosis		
		Present	Absent	Total
MRI Diagnosis	Present	34	0	34
	Absent	0	16	16
	Total	34	16	50

With respect to ACL tear, the sensitivity and specificity of MRI was 100% with Arthroscopic diagnosis as gold standard.

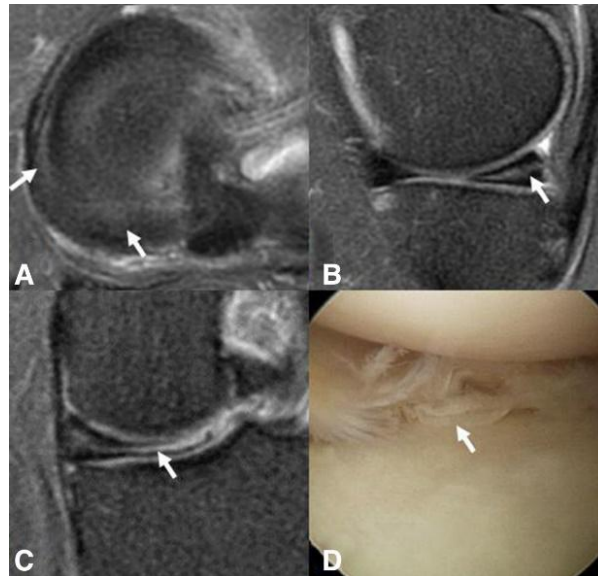
Table 8: Correlation between MRI and Arthroscopic Diagnosis for all Knee Injuries

Total Injuries		Arthroscopy Diagnosis		
		Present	Absent	Total
MRI Diagnosis	Present	93	1	94
	Absent	5	199	204
	Total	98	200	50

With respect to all injuries, the sensitivity and specificity of MRI was 94.9% and 99.5% respectively with Arthroscopic diagnosis as gold standard. Overall, one case was wrongly diagnosed as having PCL tear and five cases were missed by MRI.



Patient with a radial tear. MRI axial and coronal planes (A,B) show a radial tear of the middle body of the lateral meniscus (arrows). Later confirmed on arthroscopy (C).



Patient with a horizontal tear. MRI axial, sagittal and coronal planes (A–C) show a horizontal tear of the middle body and posterior horn of the medial meniscus (arrows). Later confirmed on arthroscopy (D).

V. Discussion

Evaluation of knee similar to that of MRI is not possible with any other modality including arthrography, ultrasonography or computed tomography. Lesions such as peripheral meniscal tears, inferior surface tears & osteochondritis dissecans without articular cartilage damage can escape detection even on arthroscopy.

In our study, joint effusion was seen in majority i.e., 44 patients (88%). ACL tear was noted in more than two-third patients (34/50), with more than 50% among them having partial tears.^[6] Only few (5/50-10%) cases of posterior cruciate ligament injury was found in our study, out of which majority (80%) i.e., 4/5 were partial and only one patient had complete tear.^[10,11]

MCL tears were noted in 8/50 (16%) patients, out of which 3 (37.5%) were complete. Similarly, only 2/50 (4%) patients had LCL injury in our study with all of them having intrasubstance injuries. This shows that the incidence of MCL injuries in our study is four times that of LCL injuries.^[12,13]

MM tears were found in 31/50(62%), out of which 11 each of Grade I & III tear (35.5% each) and only 9/31 (29%) with Grade 2 tear. On the other hand, only 10/50 (20%) had LM tear with majority 6/10 (60%) being Grade 3 and rest 20% each of Grade I & II. This shows that among the two menisci, MM is more commonly injured (62% vs 20%) while LM tears are more likely to be complete (60% vs 35.5%). MRI knee could detect 93 injuries correctly while falsely diagnosed one case thus giving MRI knee, high overall sensitivity & specificity of 94.9% & 99.5% respectively in detection of knee injuries compared to arthroscopy as gold standard.^[14-17]

Thus, the present study revealed high ability of MRI in evaluation of injuries of various internal structures of knee joint including their detection, localization, characterization & extent of damage with correlation between MRI and arthroscopic findings.

VI. Summary

The present study aimed to determine the role of magnetic resonance imaging in the evaluation of injuries of the knee joint as this is the largest and complex weight bearing joint in human body with high susceptibility to complex forces.

Magnetic resonance imaging has emerged as the first line investigation for evaluation of internal derangements of the knee joint as it is not only noninvasive but also due to its radiation-free nature and multiplanar capability with excellent soft tissue contrast resolution. Arthroscopy, which is gold standard procedure for evaluation of knee joint is invasive and can evaluate only surface abnormalities of intraarticular structures.

VII. Conclusion

MRI is an excellent, noninvasive, radiation-free imaging modality with multiplanar capabilities and excellent soft tissue contrast differentiation. It can accurately detect, localize, and characterize lesions responsible for various types of internal derangements in the knee joint, helping to achieve correct diagnosis

with high sensitivity & specificity thereby helping in optimal management and avoiding unnecessary arthroscopies unless surgical management is contemplated.

References

- [1]. Polly DW, Callaghan JJ, Sikes RA, McCabe JM, McMahon K, Savory CG. The accuracy of selective magnetic resonance imaging compared with the findings of arthroscopy of the knee. *J Bone Joint Surg Am.* 1988 Feb;70(2):192–8.
- [2]. Vaz CES, Camargo OP de, Santana PJ de, Valezi AC. Accuracy of magnetic resonance in identifying traumatic intraarticular knee lesions. *Clinics (Sao Paulo).* 2005 Dec;60(6):445–50.
- [3]. Winters K, Tregonning R. Reliability of magnetic resonance imaging of the traumatic knee as determined by arthroscopy. *N Z Med J.* 2005 Feb 11;118(1209):U1301.
- [4]. Oei EHG, Nikken JJ, Verstijnen ACM, Ginai AZ, Myriam Hunink MG. MR imaging of the menisci and cruciate ligaments: a systematic review. *Radiology.* 2003 Mar;226(3):837–48.
- [5]. Oei EHG, Ginai AZ, Hunink MGM. MRI for traumatic knee injury: a review. *Semin Ultrasound CT MR.* 2007 Apr;28(2):141–57.
- [6]. Singh J, Garg L, Shrimali R, Setia V, Gupta V. MR imaging of knee with arthroscopic correlation in twisting injuries. *Indian Journal of Radiology and Imaging.* 2004 Feb 1;14:33–40.
- [7]. Li DK, Adams ME, McConkey JP. Magnetic resonance imaging of the ligaments and menisci of the knee. *Radiol Clin North Am.* 1986 Jun;24(2):209–27.
- [8]. Bryan S, Weatherburn G, Bungay H, Hatrick C, Salas C, Parry D, et al. The cost-effectiveness of magnetic resonance imaging for investigation of the knee joint. *Health Technol Assess.* 2001;5(27):1–95.
- [9]. Langer JE, Meyer SJ, Dalinka MK. Imaging of the knee. *Radiol Clin North Am.* 1990 Sep;28(5):975–90.
- [10]. Sonin AH, Fitzgerald SW, Hoff FL, Friedman H, Bresler ME. MR imaging of the posterior cruciate ligament: normal, abnormal, and associated injury patterns. *Radiographics.* 1995 May;15(3):551–61.
- [11]. Grover JS, Bassett LW, Gross ML, Seeger LL, Finerman GA. Posterior cruciate ligament: MR imaging. *Radiology.* 1990 Feb;174(2):527–30.
- [12]. Hughston JC, Barrett GR. Acute anteromedial rotatory instability. Long-term results of surgical repair. *J Bone Joint Surg Am.* 1983 Feb;65(2):145–53.
- [13]. Staron RB, Haramati N, Feldman F, et al: O'Donoghue's triad: magnetic resonance imaging evidence. *Skeletal Radiol* 1994; 23(8):633-636.
- [14]. Khan KM, Bonar F, Desmond PM, Cook JL, Young DA, Visentini PJ, et al. Patellar tendinosis (jumper's knee): findings at histopathologic examination, US, and MR imaging. *Victorian Institute of Sport Tendon Study Group. Radiology.* 1996 Sep;200(3):821–7.
- [15]. Berquist TH. Osseous and myotendinous injuries about the knee. *Radiol Clin North Am.* 2007 Nov;45(6):955–68, vi.
- [16]. Department of Radiodiagnosis, Government Medical College, Alppuzha, Kerala, Verghese DJ. MRI Evaluation of Internal Derangements of Knee Joint. *jmscr.* 2017 Mar 8;05(03):18641–7.
- [17]. Mohi JK, Bhatnagar S, Kaur N, Bansal N. Spectrum of MRI findings in traumaticknee. *International Journal of Medical Research and Review.* 2018 Feb 28;6(2):85–92.

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