



E-ISSN: 2395-1958  
P-ISSN: 2706-6630  
IJOS 2020; 6(2): 212-215  
© 2020 IJOS  
[www.orthopaper.com](http://www.orthopaper.com)  
Received: 03-01-2020  
Accepted: 08-02-2020

**Dr. Sumit Kumar**  
Maharaja Agrasen Hospital,  
Punjabi Bagh, New Delhi, India

**Dr. Arvind Aggarwal**  
Senior Consultant, Department  
of Orthopedics, Maharaja  
Agrasen Hospital, New Delhi,  
India

**Dr. Atul Garg**  
Consultant, Department of  
orthopedics, Maharaja Agrasen  
Hospital, New Delhi, India

## Comparative study of clinical examination and MRI in relation to arthroscopy in ligamentous and meniscal knee injuries

**Dr. Sumit Kumar, Dr. Arvind Aggarwal and Dr. Atul Garg**

**DOI:** <https://doi.org/10.22271/ortho.2020.v6.i2d.2040>

### Abstract

**Objective:** To determine sensitivity, specificity and accuracy of clinical examination and MRI in detecting ligamentous and meniscal knee injuries in relation to arthroscopy.

**Material and methods:** It was a prospective, study conducted on 30 patients who presented to the department of Orthopaedics, with suspected ligamentous/ meniscal knee injuries, and underwent detailed clinical examination followed by MRI and arthroscopy of the knee. Patients with injuries less than 2 weeks, degenerative lesions of the knee and patients with contraindications to MRI were excluded.

**Results:** Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of clinical examination for anterior cruciate ligament injuries was 91.6, 83.3, 95.6 71.4 and 90 percent respectively and of MRI was 95.8, 66.6, 92, 80 and 90 percent respectively. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of clinical examination for medial meniscal injuries was 61.5, 88.2, 80, 75 and 76.6 percent respectively and MRI was 92.3, 94.1, 92.3, 94.1 and 93.3 percent respectively. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of clinical examination for lateral meniscal injuries was 50, 95.8, 75, 88.5 and 86.6 percent respectively and of MRI was 83.3, 95.8, 83.3, 95.8 and 93.3 percent respectively. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of both clinical examination and MRI for posterior cruciate ligament injuries was 100 percent.

**Conclusion:** In cases of suspected ACL injuries, carefully performed clinical examination can give equally reliable diagnosis as MRI. MRI is more sensitive than clinical examination in diagnosing meniscal injuries and reduces number of missed tears. Negative MRI scans in meniscal injuries is useful in ruling out an injury thus minimizing the number of unnecessary arthroscopies.

**Keywords:** Arthroscopy, knee injuries, MRI

### 1. Introduction

The knee joint is one of the most commonly injured joint because of its anatomical structure, its exposure to external forces and the functional demands placed on it. Physical trauma in the form of sports injury, road side accidents or occupational stress is the cause of vast majority of ligamentous and meniscal knee injuries<sup>[1]</sup>. An accurate diagnosis, grading and extent of injuries are essential for further management of the patient. Undiagnosed and untreated injuries cause a significant morbidity to the patients. Thoroughly performed clinical examination and MRI can diagnose these injuries with great accuracy. MRI is non-invasive and provides excellent soft tissue contrast<sup>[2]</sup>. MRI is an expensive modality and puts a financial burden on the patient. Thus, it becomes important to determine the role of MRI in detecting and reducing the number of missed tears and to prevent unnecessary arthroscopies. Arthroscopy offers direct visualization of all the intrarticular structures with high diagnostic accuracy and currently considered gold standard<sup>[3]</sup>. This study was undertaken to determine and compare the sensitivity, specificity and accuracy of clinical examination and MRI in diagnosing ligamentous and meniscal knee injuries in relation to arthroscopy.

### 2. Material and Methods

Thirty patients of all ages and both sex presenting to the department of Orthopedics, Maharaja

**Corresponding Author:**  
**Dr. Sumit Kumar**  
Maharaja Agrasen Hospital,  
Punjabi Bagh, New Delhi, India

Agrasen Hospital, New Delhi from April 2015 to May 2016 with suspected ligamentous/ meniscal knee injury were included in this prospective study after obtaining permission from ethics committee.

### 2.1 Exclusion Criteria

1. Patients presenting within 2 weeks of injury.
2. Patients with contraindication to MRI like intracerebral aneurysmal clips, cardiac pacemaker, metallic foreign body in eye, implants in middle ear.
3. Patients who had prior arthroscopy or surgical intervention to knee joint.
4. Patients with previous degenerative diseases of the knee.

A detailed history of the patient was taken that included mode of injury, duration since injury and symptoms. Clinical tests included Anterior drawer test, Lachman test and pivot shift test for detection of anterior cruciate ligament (ACL) injuries, Posterior Drawer test for posterior cruciate ligament injuries (PCL), joint line tenderness, McMurray's test and Apley's Grinding test for meniscal injuries.

After ruling out fractures with X-ray, patient was subjected to 1.5 T MRI. T1 & T2 weighed proton density and fat suppressed T2 weighted serial sections were done in axial, coronal and sagittal planes and type and location of cruciate ligaments and meniscal tears was noted.

Patients subsequently underwent arthroscopic surgery under spinal anesthesia and the findings, as the criterion for diagnosis, were recorded and appropriate intervention was done. All the arthroscopies were performed by a single orthopedic surgeon after obtaining informed written consent. Considering arthroscopic findings as definitive, findings of clinical testing and MRI were analyzed as,

- true positive when clinical tests or MRI diagnosis of tear

- was confirmed on arthroscopic evaluation,
- true negative if the diagnosis of no tear was confirmed on arthroscopy,
- false positive if clinical test or MRI a tear but arthroscopy was negative and
- false negative if clinical tests or MRI images were negative but arthroscopy showed a tear.

Based on the above categories, sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of clinical examination and MRI were tested and compared. All the data was tabulated and appropriate statistical tests were applied.

### 3. Results

The youngest patient in our study was 15 years old and the oldest was 51 years old. Mean age of the patients in our study was 27.4 years. There were 23 males (76.7%) and 07 (23.3%) females.

Out of 24 cases of ACL injuries detected on arthroscopy, clinical examination and MRI correctly detected 22 and 23 cases each. Out of 13 cases of MM injuries detected on arthroscopy, clinical examination and MRI correctly detected 08 and 12 cases each. There were 06 cases of LM injuries on arthroscopy out of which clinical examination and MRI correctly detected 03 and 05 cases each. Only 2 cases of PCL injuries were detected on arthroscopy and both cases were correctly diagnosed by clinical examination and MRI.

Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of clinical examination and MRI for anterior cruciate ligament injuries, posterior cruciate ligaments, medial meniscal injuries and lateral meniscal injuries is tabulated below. (Table 1 and 2 respectively)

**Table 1:** Clinical examination and MRI in Cruciate ligament injuries

Parameter	ACL		PCL	
	Clinical examination (%)	MRI (%)	Clinical examination (%)	MRI (%)
Sensitivity	91.6	95.8	100	100
Specificity	83.3	66.6	100	100
Positive predictive value	95.6	92	100	100
Negative predictive value	71.4	80	100	100
Diagnostic accuracy	90	90	100	100

MRI, Magnetic Resonance Imaging; ACL, Anterior Cruciate Ligament; PCL, Posterior Cruciate Ligament

**Table 2:** Clinical examination and MRI in meniscal injuries

Parameter	Medial meniscus		Lateral meniscus	
	Clinical examination (%)	MRI (%)	Clinical examination (%)	MRI (%)
Sensitivity	61.5	92.3	50	83.3
Specificity	88.2	94.1	95.8	95.8
Positive predictive value	80	92.3	75	83.3
Negative predictive value	75	94.1	88.5	95.8
Diagnostic accuracy	76.6	93.3	86.6	93.3

MRI, Magnetic Resonance Imaging

### 4. Discussion

Ligamentous and meniscal injuries of the knee are well diagnosed by physical examination, with complementary aid from MRI. In this study, the accuracy of clinical examination and MRI was analysed and compared keeping arthroscopy as gold standard.

There was no significant difference in diagnostic accuracy of clinical examination and MRI in ACL injuries, although the specificity of clinical examination was higher than MRI in our study. These results were similar to those by Orlando N *et al.*

<sup>[4]</sup> who evaluated 72 patients and demonstrated a sensitivity of 88.67, specificity of 94.73 and diagnostic accuracy 90.27 percent for clinical examination as compared to 86.79, 73.68 and 83.33 percent respectively for MRI. Rayan F *et al.* <sup>[5]</sup> and Rose *et al.* <sup>[6]</sup> analyzed patients with ACL injuries and demonstrated that there is marginal difference between clinical examination and MRI and thus concluded that MRI is not necessary preoperatively as it helps little in changing treatment decision and preventing negative arthroscopies.

Navali *et al.* <sup>[7]</sup> studied 120 patients and reported that both

physical examination and MRI scans are very sensitive and accurate in the diagnosis of knee injuries, with a mild preference for physical examination. MRI should be reserved for doubtful cases or complicated injuries.

Yoon YS *et al.* [8] in a prospective study of knee injuries undertaken from January to the end of December, 1994 on 213 knees reported a sensitivity, specificity and diagnostic accuracy of 76, 97 and 92 percent respectively in ACL injuries. The specificity of clinical examination in these studies was higher than in our study. This difference may be due to the small sample size and a few number of true negative patients.

Nikolaou *et al.* [9] and Ruwe *et al.* [10] concluded that the diagnostic power of physical examinations in knee injuries was substantially less than MRI results. Munk *et al.* [11] also concluded that MRI is an important diagnostic tool and must be carried out before arthroscopy to reduce the number of unnecessary arthroscopies.

Literature regarding the diagnostic accuracy of clinical examination and MRI in posterior cruciate ligament injuries is insufficient. Since there were only two cases in above study no conclusion can be drawn and further research is needed.

In our study, Sensitivity of MRI was higher than clinical examination in medial meniscus (61.5% vs 92.3%) as well as lateral meniscus injuries (83.3% vs 50%). Overall diagnostic accuracy of MRI in diagnosing medial and lateral meniscus injuries was higher than clinical examination.

In agreement with our study, Schurz *et al.* [12], on comparing the results of the clinical examination and MRI in meniscal injuries demonstrated that the accuracy, specificity, sensitivity, and the positive and negative predictive values are higher in MRI vs arthroscopy group than in the group of the clinical examination versus arthroscopic results. Boeree *et al.* [13] concluded that an MRI is necessary to complete an exact clinical diagnosis in meniscus tears and that preoperative MRI can prevent unnecessary arthroscopy in 50% of the patients due to high negative predictive value of MRI.

The objective of evaluating the accuracy of physical examination in comparison with arthroscopy and MRI was the topic of a study by Venu *et al.* [14]. They stated that physical examination alone was unsatisfactory for diagnosing knee injuries and reported that MRI and arthroscopy were concordant in 94% of the patients evaluated. Similar conclusions were drawn by Jackson *et al.* [15] who concluded that negative MRI for meniscus injuries can discourage diagnostic arthroscopy even if clinical examination is positive.

Sharma UK *et al.* [16] demonstrated that sensitivity, specificity, diagnostic accuracy of clinical examination were 96.1%, 38.4%, 96.4% and 78.1% respectively for lateral meniscal tear. The sensitivity, specificity, diagnostic accuracy of MRI were 84.6%, 96.4% and 92.6% respectively for lateral meniscal tear making MRI an important diagnostic modality.

In a prospective series by Abdon *et al.* [17], clinical examination had only 61% accuracy for meniscal tears. Rangger *et al.* [18], and Yan *et al.* [19] also determined MRI as a very important tool before arthroscopies.

Rose *et al.* [6] in their series of 100 patients found that clinical examination is as accurate as MRI in diagnosing meniscal tears. Diagnostic accuracy in their series was 82% vs 75%. They concluded that MRI because of its high cost is not necessary in patients with clinical suspicion. Ercin *et al.* [20] and Kocabay *et al.* [2] reported that physical examinations that were performed well, by experienced surgeons using multiple maneuvers, were sufficient for making the diagnosis of

meniscal injuries and MRI should be reserved for more complicated cases. Boden *et al.* [21] who stated that when clinical examination sets the diagnosis of meniscal damage, MRI will not change treatment decisions in contrast to our study which demonstrated that negative MRI is very important in ruling out a lesion even if clinical examination depicts a tear and thus preoperative MRI can help in preventing unnecessary arthroscopies. These differences may be attributed to the fact that many patients in our study had co-existing ACL injuries as compared of studies which included isolated meniscal injuries.

Rayan *et al.* [5] analysed 87 patients with meniscal injuries and determined that for lateral meniscus, sensitivity (56% vs 61%), specificity (95% vs 92%) and diagnostic accuracy of clinical examination and MRI were same (85% vs 85%).

## 5. Conclusion

Both clinical examination and MRI are highly accurate in diagnosing ligamentous and meniscal knee injuries. In cases of suspected ACL injuries, carefully performed clinical examination can give equally reliable diagnosis as MRI. MRI in ACL injuries is needed when clinical examination is inconclusive as or in acute injuries. Partial ACL tears may pose a diagnostic challenge and requires a combination of physical examination and MRI with definitive diagnosis by arthroscopy, when indicated.

MRI has higher sensitivity and accuracy in detecting meniscal injuries. Thus, routine use of MRI in conjunction with clinical examination in meniscal injuries minimizes that number of missed tears especially in cases of co-existent ligamentous injuries. Negative MRI scans in meniscal injuries is useful in ruling out an injury thus minimizing the number of unnecessary arthroscopies. However, clinical correlation is must before denying arthroscopy on the basis of MRI alone.

**6. Conflicts of interest:** The authors declare no conflicts of interest.

## 7. References

1. Miller RH, Azar FM. Knee injuries. In: Canale ST, Beaty JH, editors. Campbell's operative Orthopaedics. 12th ed. Philadelphia: Mosby Elsevier, 2013.
2. Kocabay 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; 20:696–700.
3. B.P. Barry. General principles of arthroscopy. In: S.C. Terry, editor. Campbell's operative Orthopaedics. 9th ed. Philadelphia: Mosby Inc, 1999.
4. Orlando N, Lea O, De Souza MG, Nelson HC. Diagnosis of knee injuries: comparison of the physical examination and magnetic resonance imaging with the findings from arthroscopy. *Rev bras Ortop*. 2015; 50:712-9.
5. Rayan F, Bhonsle S, Shukla DD. Clinical, MRI, and arthroscopic correlation in meniscal and anterior cruciate ligament injuries. *Int Orthop*. 2009; 33:129-32.
6. Rose NE, Gold SM. A comparison of accuracy between clinical examination and magnetic resonance imaging in the diagnosis of meniscal and anterior cruciate ligament tears. *Arthroscopy*. 1996; 12:398-405.
7. Navali AM, Bazavar M, Mohseni MA, Safari B, Tabrizi A. Arthroscopic evaluation of the accuracy of clinical examination versus MRI in diagnosing meniscus tears and cruciate ligament ruptures. *Arch Iran Med*. 2013;

- 16:229-32.
8. Yoon YS, Rah JH, Park HJ. A prospective study of the accuracy of clinical examination evaluated by arthroscopy of the knee. *Int Orthop*. 1997; 21:223-7.
  9. Nikolaou VS, Chronopoulos E, Savvidou C, Plessas S, Giannoudis P, Efstathopoulos N *et al*. MRI efficacy in diagnosing internal lesions of the knee: a retrospective analysis. *J Trauma Manag Outcomes*. 2008; 2:4.
  10. Ruwe PA, Wright J, Randall RL, Lynch JK, Jokl P, McCarthy S. Can MR imaging effectively replace diagnostic arthroscopy? *Radiology*. 1992; 183:335-9.
  11. Munk B, Madsen F, Lundorf E, Staunstrup H, Schmidt SA, Bolvig L, *et al*. Clinical magnetic resonance imaging and arthroscopic findings in knees: a comparative prospective study of meniscus anterior cruciate ligament and cartilage lesions. *Arthroscopy*. 1998; 14:171-5.
  12. Schurz M, Erdoes JT, Platzer P, Petras N, Hausmann JT, Vécsei V *et al*. The value of clinical examination and MRI versus intraoperative findings in the diagnosis of meniscal tears. *Scripta Medica*. 2008; 81:3-12.
  13. Boeree NR, Watkinson AF, Ackroyd CE, Johnson C. Magnetic resonance imaging of meniscal and cruciate injuries of the knee. *J Bone Joint Surg Br*. 1991; 73:452-7.
  14. Venu KM, Bonnici AV, Marchbank NDP, Chipperfield A, Stenning M, Howlett DC. Clinical examination, MRI or arthroscopy: which is the gold standard in the diagnosis of significant internal derangement in the knee? *J Bone Joint Surg Br*. 2003; 85:167.
  15. Jackson DW, Jennings LD, Maywood RM, Berger PE. Magnetic resonance imaging of the knee. *Am J Sports Med*. 1988; 16:29-38.
  16. Sharma UK, Shrestha BK, Rijal S, Bijukachhe B, Barakoti R, Banskota B *et al*. Clinical, MRI and arthroscopic correlation in internal derangement of knee. *Kathmandu Univ Med J*. 2011; 9:174-8.
  17. Abdon P, Lindstrand A, Thorngren KG. Statistical evaluation of the diagnostic criteria for meniscal tears. *Int Orthop*. 1990; 14:341-5.
  18. Rangger C, Klestil T, Kathrein A, Inderster A, Hamid L. Influence of MRI on indications for arthroscopy of knee. *Clin Orthop Relat Res*. 1996; 330:133-42.
  19. Yan R, Wang H, Yang Z, Ji ZH, Guo YM. Predicted probability of meniscus tears: comparing history and physical examination with MRI. *Swiss Med Wkly*. 2011; 14:141.
  20. Ercin E, Kaya I, Sungur I, Demirbas E, Ugras AA, Cetinus EM *et al*. History, clinical findings, magnetic resonance imaging, and arthroscopic correlation in meniscal lesions. *Knee Surg Sports Traumatol Arthrosc*. 2012; 20:851-6.
  21. Boden SD, Labropoulos PA, Vailas JC. MR scanning of the acutely injured knee: sensitive, but is it cost effective? *Arthroscopy*. 1990; 6:306-10.