

## Original Research Article

# Clinical, magnetic resonance imaging and arthroscopic findings in diagnosis of meniscal tears: a prospective study

Akshay Tegginamath\*, Channabasava Patil

Department of Orthopaedics, The Oxford Medical College Hospital and Research Centre, Bengaluru, Karnataka, India

**Received:** 07 July 2019

**Revised:** 22 July 2019

**Accepted:** 23 July 2019

**\*Correspondence:**

Dr. Akshay Tegginamath

E-mail: [akshay.tm@gmail.com](mailto:akshay.tm@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

**Background:** In developing countries like India the need for cost conscious medical practice has a major role in the economy of the country. The extensive use of costly investigative modalities puts huge burden on the patient needing proper medical care. This study is undertaken to assess the role of different diagnostic tools like clinical diagnosis, magnetic resonance imaging (MRI) and arthroscopy in diagnosis of meniscal tears.

**Methods:** A prospective study was conducted among 90 individuals with knee injuries due to various causes attending orthopaedic department of The Oxford Medical College and research centre, Bangalore from October 2018 to May 2019. All patients aged 18 to 60 years with history of knee injury who underwent clinical examination, radiographic examination, MRI and arthroscopy. The data was entered in MS Excel and analysed using SPSS.

**Results:** The study consisted of patients aged between 18-60 years (mean age 32.5 years). Out of which 59 were male and 31 were female. There were 54 patients with suspect diagnosis of medial meniscal tear and 36 with lateral meniscal tear. The difference in diagnostic values between the clinical and MRI findings in diagnosing the medial and lateral meniscal injuries were minimal.

**Conclusions:** Ligament injuries of knee are more common with sports injuries and high velocity trauma. A well-trained surgeon can be more reliable than MRI in diagnosing the ligament injuries. Since MRI is expensive, it can be skipped and used only in more doubtful and complex knee injuries.

**Keywords:** Arthroscopy, Clinical diagnosis, Meniscal tear, MRI

### INTRODUCTION

Knee is a complex joint with many components, making it vulnerable to a variety of injuries. The knee joint is commonly involved due to road traffic accidents and sport activities. One of the most common knee injuries is meniscal tears. The menisci are essential and play a fundamental role in the knee joint. These are responsible for lubrication, increase the contact area between femur and tibia, decrease the load bearing on the articular cartilage, and increase the stability of the knee.<sup>1,2</sup> Tears in the meniscus can occur when twisting, cutting, pivoting or even as a result of arthritis or aging. Hence it is

essential to make accurate diagnosis of meniscal tear for appropriate management.

Magnetic resonance imaging (MRI) and clinical examination are tools commonly used in the diagnosis of meniscus tears. While arthroscopy and open surgery are the gold standard to diagnose the intra-articular knee pathology. But in today's era of cost-conscious medical environment MRI is considered the most accurate non-invasive method to diagnose meniscal tears and the routine use of MRI before arthroscopy will reduce the incidence of unnecessary invasive procedures but on the other hand, some of the clinicians suggest that a thorough

clinical history and examination by well trained and an experienced orthopaedician is sufficient for diagnosis. If the findings of history and physical examination are sufficiently predictive, then an additional imaging study may not be necessary before proceeding with a therapeutic arthroscopy. Thus, patient can be saved of time and expense.<sup>3</sup>

Hence this study was undertaken considering arthroscopy as gold standard and comparing the sensitivity, specificity, accuracy, positive predictive value (PPV) and negative predictive value (NPV) of clinical examination, and MRI in the diagnosis of meniscal tears.

## METHODS

A prospective study was conducted among 90 individuals with knee injuries due to various causes attending orthopaedic department of The Oxford Medical College and research centre, Bangalore from October 2018 to May 2019.

### Inclusion criteria

All patients aged 18 to 60 years with history of knee injury who underwent clinical examination, radiographic examination, MRI and arthroscopy after written informed consent.

### Exclusion criteria

Patients with non-traumatic internal derangement of knee, bony intraarticular knee joint injuries, combined cruciate or collateral ligament injuries, previous knee surgeries, added knee injuries that are occurring between the time of MRI/clinical examination and arthroscopy, those unfit for anaesthesia and patients with contraindications to MRI.

All the patients attending Orthopaedic OPD with history of injury to the knee were thoroughly examined clinically by an experienced orthopaedician. Detailed history was obtained prior to clinical examination. Clinical assessment was based on medial and lateral joint line tenderness which was assessed with the patient in supine position and the knee flexed at 90 degrees on lateral and medial sides, McMurray's test was done in standard fashion by placing the knee beyond 90 degrees of flexion, rotating the tibia on the femur into full internal rotation to test lateral meniscus or full external rotation to test medial meniscus by gradually extending the knee with valgus and varus tests. Positive test was considered to be a click or pain along the joint line. And Apley's test was done with the patient in prone position and knee flexed to 90 degrees. The leg was held by the examiner and compressed while being externally and internally rotated. The test was considered positive if it produced pain with external rotation for medial meniscus and internal rotation for lateral meniscus. Other specific tests were performed to rule out other associated injuries to the

knee. Diagnosis with respect to meniscal injuries were made when at least two of the three tests were positive.

MRI of the affected knee was performed on a 1.5 Tesla scanner. The imaging protocol included sagittal T1, T2, GRE; coronal T2, PD; and axial T2 and GRE sequences. Fat suppression was obtained in all cases with T2 and PD sequences. Diagnosis of a tear was made only when definitive findings of high-signal intensity are seen reaching the articular surface.

All the patients underwent arthroscopy. The surgery was conducted under spinal anaesthesia with patient in supine position. The interval between MRI and arthroscopy was from a minimum of 25 days to a maximum of 50 days.

Clinical findings, MRI and arthroscopy findings were compiled and compared for analysis. The data was entered in MS excel and the statistical analysis was done using SPSS.

The composite data was tabulated and grouped into four categories:

- True-positive (TP) if the clinical/MRI diagnosis were confirmed by arthroscopy.
- True-negative (TN) when clinical/MRI were negative for lesion and confirmed by arthroscopy.
- False-positive (FP) when clinical/MRI shows lesion but the arthroscopy was negative.
- False-negative (FN) result when arthroscopy was positive but the clinical/MRI showed negative finding.

The results of clinical and MRI findings were presented in terms of sensitivity, specificity, positive predictive value, negative predictive value and accuracy considering arthroscopy as the gold standard.

## RESULTS

The study consisted of 90 patients aged between 18-60 years (mean age 32.5 years). Out of which 59 were male and 31 were female.

There were 54 patients with suspect diagnosis of medial meniscal tear and 36 with lateral meniscal tear.

**Table 1: Clinical and arthroscopy findings for medial meniscal tear.**

	Arthroscopically positive	Arthroscopically negative	Total
Clinically positive	33 (TP)	3 (FP)	36
Clinically negative	4 (FN)	14 (TN)	18
Total	37	17	54

**Table 2: Clinical and arthroscopy findings for lateral meniscus.**

	Arthroscopically positive	Arthroscopically negative	Total
<b>Clinically positive</b>	20 (TP)	2 (FP)	22
<b>Clinically negative</b>	5 (FN)	9 (TN)	14
<b>Total</b>	25	11	36

**Table 3: Medial and lateral meniscal tear findings (clinical).**

Test	MMT (%)	LMT (%)
<b>Sensitivity</b>	89	80
<b>Specificity</b>	82	82
<b>PPV</b>	92	91
<b>NPV</b>	78	64
<b>Accuracy</b>	87	81

As shown in Table 3, the sensitivity, specificity, PPV, NPV and accuracy of clinical diagnosis in medial meniscal tear were 89%, 82%, 92%, 78% and 87% respectively. In lateral meniscal tear the values observed for the sensitivity, specificity, PPV, NPV were 80%, 82%, 91%, 64% and 81% respectively.

The difference in diagnostic values between the clinical and MRI findings in diagnosing the medial and lateral meniscal injuries was found to be minimal (Table 4 & 5).

As given in Table 6, the sensitivity, specificity, PPV, NPV and accuracy of MRI in medial meniscal tear were

**Table 7: Diagnostic values of clinical and MRI for medial and lateral meniscal injuries.**

Test	Medial meniscal injury		Lateral meniscal injury	
	Clinical	MRI	Clinical	MRI
<b>Sensitivity</b>	89	83	80	83
<b>Specificity</b>	82	72	82	85
<b>PPV</b>	92	86	91	90
<b>NPV</b>	78	68	64	73
<b>Accuracy</b>	87	80	81	83

**DISCUSSION**

Historically many meniscal tears have been diagnosed and treated even before the advent of MRI. Nevertheless, MRI is a powerful diagnostic tool in diagnosing Meniscal Injuries but because of its high cost there is an increase in medical expenditure. Therefore, this study aimed at evaluating and comparing the diagnostic accuracy of clinical examination and MRI in diagnosing meniscal tears.

83%, 72%, 86%, 68% and 80% respectively. In lateral meniscal tear the values were 83%, 85%, 90%, 73% and 83% respectively.

**Table 4: MRI and arthroscopy findings for medial meniscal tear.**

	Arthroscopically positive	Arthroscopically negative	Total
<b>MRI positive</b>	30 (TP)	5 (FP)	35
<b>MRI negative</b>	6 (FN)	13 (TN)	19
<b>Total</b>	36	18	54

**Table 5: MRI and arthroscopy findings for lateral meniscus.**

	Arthroscopically positive	Arthroscopically negative	Total
<b>MRI positive</b>	19 (TP)	2 (FP)	21
<b>MRI negative</b>	4 (FN)	11 (TN)	15
<b>Total</b>	23	13	36

**Table 6: Medial and lateral meniscal tear findings (MRI).**

Test	MMT (%)	LMT (%)
<b>Sensitivity</b>	83	83
<b>Specificity</b>	72	85
<b>PPV</b>	86	90
<b>NPV</b>	68	73
<b>Accuracy</b>	80	83

In the present study there was no much difference observed in diagnostic accuracy of clinical examination and MRI. Therefore, when an expert orthopaedic surgeon diagnoses the meniscal injuries it is as reliable as MRI. The results of our study matched the sensitivity and specificity, and accuracy of clinical examination and MRI for detection of meniscal injuries of other studies. Antinolfi et al in their study conducted among 80 patients mentioned the diagnostic accuracy of clinical examination for MMT and LMT was 90% and 87% respectively.<sup>4</sup> Another retrospective study among 130

patients done by Mohan et al observed that the diagnostic accuracy of clinical examination was 88% for MMT and 92% for LMT.<sup>5</sup> Rose et al also showed that diagnostic accuracy was better with clinical examination than with MRI scan.<sup>6</sup> In another study conducted by Ercin et al among 30 patients found that clinical examination performed by an experienced knee surgeon had better specificity (90% vs. 60%), positive predictive value (95% vs. 83%), negative predictive value (90% vs. 86%), and diagnostic accuracy (93% vs. 83%) than MRI for medial meniscal tears.<sup>7</sup> Kocabey et al in their study among 50 subjects observed that clinical examination is at least as accurate as MRI in the skilled orthopaedic surgeon's hand.<sup>8</sup>

On the contrary, Kulkarni et al in their study among 100 individuals proved high sensitivity and specificity and high accuracy for meniscal injuries.<sup>9</sup> Abdon et al in their prospective study among 145 patients concluded that clinical examination had only 61% accuracy for meniscal tears.<sup>10</sup> MRI still remains the first choice for diagnosing the meniscal injuries and a routine pre-operative measure by many surgeons. But in a developing country like India, where people are unable to meet the medical expenditure, it is ideal not to use MRI in all the cases of meniscal injuries. And also relying only on MRI without clinical assessment have led to inappropriate treatment. In any case, MRI did not prevent "unnecessary surgery".<sup>11,12</sup>

Hence it would be wise to rely on clinical diagnosis made by an expert orthopaedic surgeon and MRI to be used only in complicated cases where arriving at a diagnosis is difficult.

## CONCLUSION

Ligament injuries of knee are more common with sports injuries and high velocity trauma. For effective management, there is need for accurate diagnosis in a cost-effective manner. In our study there was no much difference observed in the diagnostic value/accuracy between clinical and MRI findings. A well-trained surgeon can be more reliable than MRI in diagnosing the ligament injuries. Since MRI is expensive, it can be skipped and used only in more doubtful and complex knee injuries.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the institutional ethics committee*

## REFERENCES

1. Aagaard H, Verdonk R. Function of the normal meniscus and consequences of meniscal resection. *Scand J Med Sci Sports*. 1999;9(3):134–40.
2. Fox AJ, Wanivenhaus F, Burge AJ, Warren RF, Rodeo SA. The human meniscus: a review of anatomy, function, injury, and advances in treatment. *Clin Anat*. 2015;28(2):269–87.
3. Ryzewicz M, Peterson B, Siparsky PN, Bartz RL. The Diagnosis of Meniscus Tears: The Role of MRI and Clinical Examination. *Clin Orthop Relat Res*. 2007;455:123-33.
4. Antinolfi P, Crisitiani R, Manfreda F, Bruè S, Sarakatsianos V, Placella G. Relationship between Clinical, MRI, and Arthroscopic Findings: A Guide to Correct Diagnosis of Meniscal Tears. *Joints*. 2017;5(3):164–7.
5. Mohan BR, Gosal HS. Reliability of clinical diagnosis in meniscal tears. *Int Orthop*. 2007;31(1):57–60.
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(4):398–405.
7. Ercin E, Kaya I, Sungur I, Demirbas E, Ugras AA, Cetinus EM. History, clinical findings, magnetic resonance imaging, and arthroscopic correlation in meniscal lesions. *Knee Surg Sports Traumatol Arthrosc*. 2012;20(5):851–6.
8. 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;20(7):696–700.
9. Kulkarni OP, Pundkar GN, Sonar SB. A comparative study of MRI versus arthroscopic findings in ACL and meniscal injuries of the knee. *Int J Res Orthop*. 2018;4:198-202.
10. Abdon P, Lindstrand A, Thorngren KG. Statistical evaluation of the diagnostic criteria for meniscal tears. *Int Orthop* 1990;14(04):341–5.
11. Gupta K, Kulkarni PN, Patil N. Comparison of MRI Findings with Arthroscopy Findings in Internal Derangement of Knee. *Int J Recent Trends Sci Technol*. 2013;9(2):159-63.
12. Miller GK. A prospective study comparing the accuracy of the clinical diagnosis of meniscus tear with magnetic resonance imaging and its effect on clinical outcome. *Arthroscopy*. 1996;12(4):406-13.

**Cite this article as:** Tegginamath A, Patil C. Clinical, magnetic resonance imaging and arthroscopic findings in diagnosis of meniscal tears: a prospective study. *Int J Res Orthop* 2019;5:792-5.