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Original Research Article

Comparison between clinical examination and magnetic resonance imaging in accurately diagnosing meniscal tears

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ABSTRACT

Background: The primary goal of this study was to examine the correlation between clinical results, MRI scans, and Arthroscopic findings in the case of meniscal injury. We compared various parameters between clinical findings and MRI findings in case of suspected meniscus injury cases keeping Arthroscopy findings as the gold standard.
Methods: Patients coming to our OPD with complaints of knee pain were examined by an experienced orthopaedic surgeon. The sample size of our study was 60 cases. All suspected meniscal tear cases underwent clinical examination, MRI scanning and Arthroscopic examination to assess the relationship between clinical findings and MRI findings, keeping Arthroscopy findings as a gold standard.
Results: For the diagnosis of medial and lateral meniscus tears, a clinical evaluation carried out by an experienced orthopaedic surgeon exhibited greater sensitivity, specificity, precision, and negative and positive predictive values than MRI.
Conclusions: A clinical evaluation by an experienced orthopaedic surgeon yielded superior outcomes than an MRI for diagnosing meniscal injuries. MRI is indicated in case of complex knee injuries.

Keywords: Meniscus injury, Arthroscopy findings, Sensitivity, Specificity, Positive predictive value, Negative predictive value

INTRODUCTION

Meniscal lesions are one of the most common intra-articular knee injuries. These lesions are a common reason for orthopaedic surgeons to perform surgical processes. These types of injuries are more likely to occur in men than in women with a female to male incidence ratio between 4:1 and 2.5:1, and the peak occurrence age for both sexes being 20-29 years old.[1-3] Meniscal lesions are most frequently observed in the right knee and can affect people of any age with the main pathophysiological and etiological causes vary greatly and are largely dependent on the age of the patient.[4,5] Meniscal lesions are most often caused by sports related injuries in young patients, particularly those people playing soccer, skiing, baseball, basketball, and football. These injuries account for more than a 1/3 of all cases.[1,2] The majority of these injuries are caused by actions involving hyperextension, twisting, or cutting movements, as well as actions involving high amounts of force. In around 80% of instances, meniscal tears during athletic activities are occurring with the anterior cruciate ligament tears. The occurrences of meniscus lesions are increased in this specific age group due to meniscal tears caused by automotive vehicle accidents.[1] Most meniscal lesions in middle-aged and older people are caused by gradual wear

and tear over time. These meniscal lesions result in joint swelling, discomfort along the joint line, and mechanical obstruction. It is crucial to make a proper diagnosis regarding meniscus injury so that accurate treatment can be given. Thorough history and physical examination are important to differentiate patients who have knee pain due to meniscus injury from the other conditions.[6,7] Magnetic resonance imaging is considered as the gold standard investigation to confirm meniscal tears.[8,9] It is routinely used to support the diagnosis of meniscus injuries prior to recommending diagnostic arthroscopy and surgery. Furthermore, history alone is inadequate as a diagnostic tool, and the diagnostic accuracy of the clinical tests for meniscus injuries have often been questioned. Available literature reveals conflicting results regarding their usefulness.[10,11]

Objectives

Objective of current study was to evaluate and compare sensitivity, specificity, accuracy, positive predictive value and negative predictive value of clinical examination, and MRI in the diagnosis of meniscal tears, considering arthroscopic findings as the gold standard.

METHODS

This is a prospective study done in patients coming to our Sahasra ortho and nuero-center, Guntur OPD during the period of November 2021 to July 2022 with complaints of knee pain, locking, instability. Patients who are having above complaints were thoroughly explained about the study in their own language and who were gave acceptance was selected into the study. A valid written consent was taken from the patients who gave acceptance to the study. Thorough history was taken regarding the complaints. Clinical examination was done to diagnose medial and lateral meniscal injuries in suspected cases (site of tenderness, MC Murray test, Apley's test), radiological investigation in form of MRI was done in suspected cases of meniscal tears and finally arthroscopy was done as diagnostic and therapeutic management in required cases. Keeping arthroscopy findings as gold standard, clinical examination and MRI findings were noted and their sensitivity, specificity, accuracy, positive and negative predictive values in diagnosing the meniscal injuries were calculated and compared. Approval was taken from Institutional ethical committee regarding this study. Following are the inclusion and exclusion criteria for this study.

Inclusion and exclusion criteria

Inclusion criteria for current study were; male and female patients between 18-50 years of age group, patients who were willing to participate in the study, there should not be any past history of knee surgery and there should not be any past history of knee fractures. Exclusion criteria for current study were; patients below 18 years and above 50 years, patients who were not willing to participate in the study, patients having past history of knee surgeries, trauma and fractures and further knee injury between the time of clinical diagnosis or MRI and arthroscopy.

Procedure

In our study convenient sampling technique was used. Data was collected and entered in excel sheet. Data was analysed with SPSS Version 21. In order to assess the degree of tenderness along the knee joint line, the patient was positioned supine, and the knee was bent about 90-degree angle on both the medial and lateral sides. Further, McMurray's test has been carried out by first bending the knee more than 90 degrees, followed by rotation of the tibia on the femur into full internal rotation, in order to examine the lateral meniscus. In the meantime, full external rotation of the tibia on the femur was performed so that the medial meniscus could be inspected. These manoeuvres were carried out with the knee bent to varying degrees in order to examine the various components of the meniscus. During the procedure, the palpation will be performed on the medial as well as the lateral aspect of the joint line. A positive test result was deemed to be either a "click" or "pain" at the joint line.[12] Apley's test was carried out on the patient while they were laying on an examination table in the prone position with their knees bent to a 90-degree angle. This position was chosen because it allows for a more accurate assessment of the patient's posture. The examiner's knee was placed over the posterior aspect of the patient's thigh, and the tibia was rotated both externally and internally while being compressed against the knee joint. This was done while the examiner's knee was positioned across the patient's thigh. If the patient experienced pain during the external rotation test for medial involvement as well as the internal rotation test for lateral involvement, the test was determined to be positive.

Meniscal tare was suspected whenever at least two of the three tests administered had positive results. Crues et al and Lotysch et al grading systems were used to score the meniscal injuries on MRI.[13,14] Meniscal signal changes of grades 1 and 2 that fall well short of the articular surface are not regarded to be tears. On the MRI, a grade 3 signal intensity was described as an abnormal signal in the meniscus that extended to the articular surface. The diagnosis of a tear shouldn't be made until definitive observations of high-signal intensity are found reaching the articular surface. A single abnormal image was adequate for identifying a torn meniscus using MRI technology. The imaging protocol included sagittal T1, T2, GRE; coronal T2, PD; and axial T2 and GRE sequences. With T2 and PD sequences, fat suppression was attained in every case. An experienced musculoskeletal radiologist reviewed the MRI scans without knowledge of the results of the orthopaedic clinical evaluation. The arthroscopy procedure was performed on the knee of each patient. An orthopaedic surgeon with more than fifteen years of expertise in the field of knee arthroscopy carried out all arthroscopy

procedures. Standard anterolateral and anteromedial portals were deployed. The patient was given spinal anesthesia before the surgery commenced. A knee examination was also performed while the patient was under anesthesia. A record of the clinical findings, as well as those from the MRI and arthroscopy, were recorded and compared. A number of factors, including specificity, sensitivity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were regarded considering arthroscopy as the gold standard.

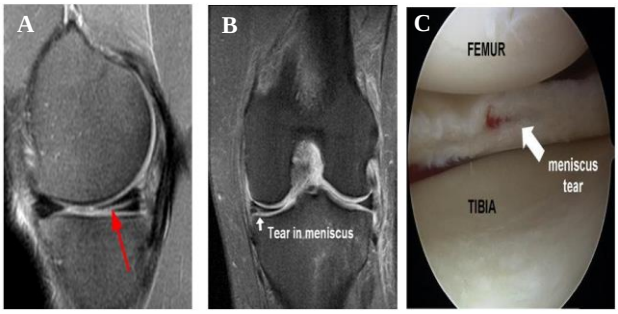

Figure 1: Images showing MRI sagittal view; A) coronal view, B) of meniscal tear, C) Arthroscopic image of meniscal tear.

RESULTS

There were a total of 60 patients who took part in our study; 39 of them were male, and 21 of them were female. (Figure 2).

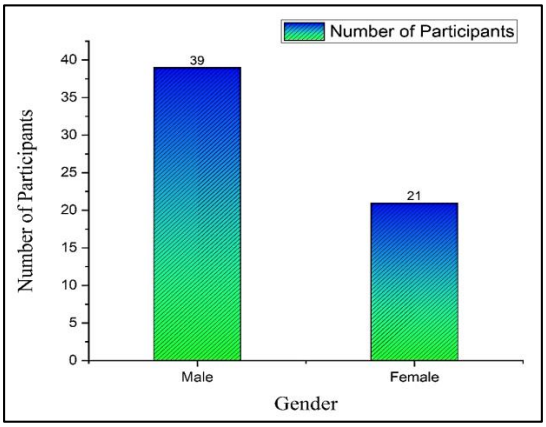

Figure 2: Number of participants in this study.

Age group was between 18 to 50 years. In our study, Males are more in number than females who sustained meniscal injuries. In our study Right side involvement is most commonly seen than the left side (Figure 3). There were a total of 39 individuals who had a possible diagnosis of a tear in the medial meniscus. Among them, there were 25 true positive cases (clinical diagnoses confirmed with arthroscopy). 3 cases were false negative (one positive clinical test with meniscal tear confirmed during Arthroscopy). 3 were false positive (positive clinical exam with no meniscal tear at arthroscopy). 8 were true negative.

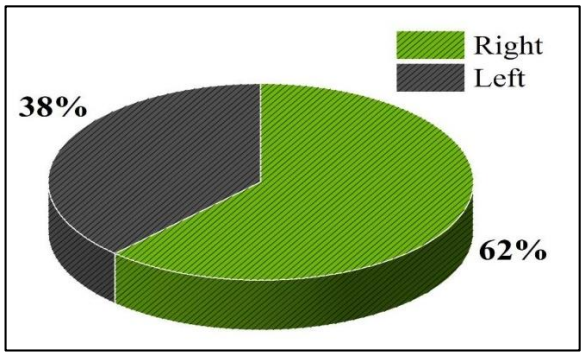

Figure 3: Side involvement.

Table 1: Comparison of clinical examination and MRI parameters for diagnosing medial meniscus tears.

Factors	Clinical investigation (%)	MRI (%)
Specificity	73	58
Sensitivity	89	85
Accuracy	85	77
PPV	89	82
NPV	73	64

The results of the MRI examination showed that there were 7 true negative patients, 5 false positive patients, 4 true positive patients, and 23 true positive patients. It was understood that, in comparison to MRI, clinical evaluation demonstrated better specificity, sensitivity, accuracy, and positive and negative predictive values (Table 1). In the meantime, there were 21 cases where it was suspected that the lateral meniscus had been torn. Out of these 21 cases, the clinical examination found a true positive result in 15 of them. 1 case was false negative, 1 case was false positive, 4 were true negative. MRI exhibited 7 true negative, 3 false positive, 1 false negative and 10 true positive. MRI was found to have a lower specificity, sensitivity, accuracy, and positive and negative predictive values when compared to clinical evaluation, as shown in (Table 2).

Table 2: Comparison of clinical examination and MRI parameters for diagnosing lateral meniscus tears.

Factors	Clinical investigation (%)	MRI (%)
Specificity	80	70
Sensitivity	94	91
Accuracy	90	81
PPV	94	77
NPV	80	87

DISCUSSION

In cases of suspected meniscal tears, we aimed to examine and compare the diagnostic accuracy of clinical examination and MRI. Sensibility, specificity, accuracy,

PPV, NPV were measured for MRI scan and clinical evaluation for medial and lateral meniscus taking Arthroscopy of the knee joint as gold standard. A study done by Sweigart et al on-tissue engineering on knee meniscus showed right side involvement more than left side.

Table 3: Various studies showing diagnostic accuracy of clinical investigation.

Study	Diagnostic accuracy of clinical investigation (%)
Mohan et al[16]	88
Antinolfi et al[18]	90
Abdon et al[17]	61
Current study	85

In our study also we got the same right-side involvement more common. Review of literature showed conflicting results regarding diagnostic accuracy of clinical examination and MRI scan. Rose et al. observed that clinical evaluation provides greater diagnostic accuracy than MRI scans.[15] Mohan et al studies showed 88% of diagnostic accuracy for clinical examination in case of medial meniscus tears and 92% for lateral meniscus. Our study results also showed diagnostic accuracy for meniscal tears is better with clinical examination than MRI. Our study results are correlating with the above studies.[16] Studies done by Abdon et al showed clinical examination had diagnostic accuracy of 61% for meniscal tears.[17] Study done by Antinolfi et al showed clinical examination had better sensibility, specificity, accuracy, PPV and NPV for medial meniscus tears than MRI scan.[17,18]

Studies done by Rangger et al, Abdon et al concluded that an MRI should be performed before an arthroscopic evaluation of the knee in every single instance in which the clinical diagnosis was narrowed down to a suspected meniscus tear.[17-20] MRI scan is routinely used because various knee pathologies had common symptoms. As a result of this, many orthopaedic surgeons recommend MRI testing as a method of diagnosis for confirming a suspected tear in the meniscus. Based on the results in this study, authors believe that proper clinical examination done by an experienced orthopaedic surgeon in case of suspected meniscal tear had a better diagnostic accuracy. We can avoid MRI scans as a routine diagnostic tool in every case. Using only MRI findings without conducting a clinical evaluation could result in the inappropriate treatment. MRI scans did not prevent "unnecessary surgery" in any case.[18] Our study had the following limitations like small sample size, small study period. Moreover, patients who underwent MRI are only considered, which presents a bias in the study. All patients were affected by inherent verification bias because they had all undergone an MRI scan prior to arthroscopy, which may have influenced the choice to conduct arthroscopy.

CONCLUSION

Clinical examination done by well experienced orthopaedic surgeons can accurately diagnose meniscal injuries. When clinical examination findings are most in favour of meniscal injuries, we can avoid performing MRI Scan routinely in every case. Relying on MRI without proper clinical assessment will land the surgeon in trouble. This expensive diagnostic technique should only be utilized in cases of difficult, dubious, equivocal, and complicated knee injuries.

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REFERENCES

1. Baker BE, Peckham AC, Pupparo F, Sanborn JC. Review of meniscal injury and associated sports. Am J Sports Med. 1985;13:1-4.
2. Steinbruck K. Epidemiology of sports injuries-25-year-analysis of sports orthopedic-traumatologic ambulatory care. Sportverletz Sportschaden. 1999;13:38-52.
3. Steinbruck K. Epidemiology of sports injuries-A 15 year analysis of sports orthopedic ambulatory care. Sportverletz Sportschaden. 1995;11:35-9.
4. Salata MJ, Gibbs AE, Sekiya JK. A systematic review of clinical outcomes in patients undergoing meniscectomy. Am J Sports Med. 2010;38:1907-16.
5. Noble J, Hamblen DL. The pathology of the degenerate meniscus lesion. J Bone Jt Surg Br. 1975;57:180-6.
6. Mohan BR, Gosal HS. reliability of clinical diagnosis in meniscal tears. int Orthop. 2007;31(1):57-60.
7. Nickinson R, Darrah C, Donell S. Accuracy of clinical diagnosis in patients undergoing knee arthroscopy Int Orthop. 2010;34(1):39-44.
8. Crawford R, Walley G, Bridgman S, Mafulli N. MRI versus Arthroscopy in the diagnosis of knee pathology, concentrating on meniscal lesions and ACL tears; a systematic review. Br Med Bull. 2007;84(1):5-23.
9. Rubin DA, Paletta GA. Current concepts and controversies in meniscal imaging. Magn Reson Imaging Clin N Am. 2000;8(2):243-70.
10. Esmailijah AA, Keyhani S, Zarei R, Moghaddam AK. Accuracy of MRI in comparison with clinical and arthroscopic findings in ligamentous and meniscal injuries of the knee. Acta Orthop Belg. 2005;71(2):189-96.
11. Scholten RJ, Deville WL, Opstelten W, Bijl D, Van der plas CG, Bouter LM. The accuracy of physical diagnostic tests for assessing meniscal lesions of the knee: a meta-analysis. J Fam Pract. 2001;50(11):938-44.
12. Hing W, White S, Reid D, Marshall R. Validity of McMurray"s test and modified version of the test: a

systematic Literature Review. J Manual Manip Ther. 2009:17(1):22-35.
13. Lotysch M, Mink J, Crues JV, Schwartz SA. MRI in detecting the meniscal injuries. Magn Reson Imaging. 1986:4;185.
14. Crues JV III, Mink J, Levy TL, Lotysch M, Stoller DW. Meniscal tera of the knee: accuracy of MRI imaging. Radiology. 1987;164(2):445-8.
15. Rose NE, Gold SM. A comparison of accuracy between clinical examination and MRI in the diagnosis of meniscal and ACL tears. Arthroscopy. 1996;12(4):398-405.
16. Mohan BR, Gosal HS. Reliability of clinical diagnosis in meniscal tear. Int Orthop. 2007;31(1):57-60
17. Abdon P, Lindstrand A, Throngren KG. Statistical evaluation of the diagnostic criteria for meniscal tears. Int Orthop. 1990;14(04):341-5.
18. Antinolfi GK. A prospective study comparing the accuracy of the clinical diagnosis of the meniscus tear with MRI and its effect on clinical outcome. Arthroscopy. 1996;12(4):406-13.
19. Rangger C, Klestil T, Kathrin A, Inderster A, Hamid L. Influence of MRI on indications for arthroscopy of the knee. clin orthop Relat Res. 1996;330:133-42.

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