

Magnetic Resonance Imaging Validates the Clinical Accuracy of the McMurray's Test in Diagnosing Medial Meniscal Tears

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ABSTRACT

Background: A physical examination method to find medial meniscal tears is the McMurray's test. The purpose of this research was to evaluate how effectively the McMurray's test can identify medial meniscal tears in a clinical situation that have been verified by MRI. However, arthroscopic evaluation is now replacing the traditional methods.

Aim: To determine diagnostic accuracy of McMurray's test is in diagnosing Medial Meniscal knee injuries.

Methods: This prospective case series study was conducted in the department of Orthopedic MTI Lady Reading Hospital Peshawar on 100 consecutive patients who received an MRI for suspected medial meniscal tears between August 2022 and July 2023. Each patient underwent the McMurray's test, and the findings were compared to those of the MRI scans. Positive and negative predictive values, as well as the sensitivity and specificity of the McMurray test, were calculated. The McMurray test was performed on all patients to check for meniscal tears, and arthroscopy was then performed on the affected knees to evaluate the accuracy of the test.

Results: Overall, one hundred patients took part in the study. There were 65 males and 35 females among the patients. There was a wide range of ages represented in the group, from 18 to 75. A total of 45 out of the 100 cases were young adults. The mean age was 31.46, while the standard deviation was 9.12 years. Participants of all ages were involved in the study. Forty-seven patients (47%) were in the 18-30 age range, 25(25%) were in the 31-45 age range, 19(19%) were in the 46-60 age range, and 9(9%) were in the 61-75 age range. In 100 patients MRI and McMurray tests can diagnose medial meniscal abnormalities. According to the study, the sensitivity of McMurray's test is 62.9%, the specificity is 81.6%, the positive predictive value is 84.8%, and the negative predictive value is 57.4%.

Practical Implication: McMurray's Test is a good alternative to MRI for diagnosis of medial meniscus in areas where the facility of imaging is not available.

Conclusion: The McMurray's test is a good clinical method for detecting medial meniscal tears that has been verified by magnetic resonance imaging (MRI).

Keywords: McMurray test, meniscal tears, Magnetic Resonance Imaging, arthroscopy, accuracy.

INTRODUCTION

Several bones, ligaments, tendons, and menisci that work together to form the knee joint. Two fibrous cartilaginous structures called menisci may be seen in the knee, between the tibia and femur. They assist in dispersing the load throughout the joint and serve as shock absorbers. One of the most common knee injuries, medial meniscal tears, may result in discomfort, swelling, and instability.

The McMurray test is frequently utilized to determine medial meniscal tears during a physical examination. While the patient is supine, a valgus force is applied to the knee in this procedure. A medial meniscal tear is considered to be detected by a positive McMurray test. Meniscal tears are the most significant in soft tissue injuries and may result in irreversible damage¹.

Early diagnosis is required for the treatment associated with these injuries to inform the most effective action². As more people participate in sports and other similar activities, meniscus injuries increase daily. These injuries occur 60–70 times out of every 100,000 people each year³. Any delay in obtaining proper care may result in permanent damage to the knee joint, including irreparable loss of articular cartilage⁴. Meniscus pain impairs daily living. Meniscal injuries may be traumatic or degenerative. Athletes are the most likely to get acute traumatic meniscal injuries. It produces swelling in the knees, severe discomfort, and limb paralysis. Knee twisting is the most common. Time helps to reduce swelling and pain. Symptoms of late presenters include locking,

catching, irregular soreness, and knee bending problems. Degenerative tears are shared among the elderly⁵. These injuries can be identified by taking a patient's medical history and physical examination. Still, this diagnosis requires additional confirmation through an MRI and, ideally, an arthroscopy because the clinical features of meniscal injuries are undefined, and many other knee conditions can also produce the same parts⁶. Magnetic resonance imaging is an appropriate study for meniscal damages, with a diagnostic accuracy ranging from 72% to 98%⁷. MRIs are expensive and not widely accessible worldwide.

Furthermore, it depends on the operator and the technology. Another very accurate diagnostic technique is arthroscopy, a surgical procedure^{8,9}. Many clinical tests are used to rule out and diagnose meniscal knee disorders. These clinical assessments include some controversial ones. One of these assessments is the McMurray test. The most frequent noninvasive test is this one. Several studies have been carried out to determine the diagnostic value of the McMurray test, but its reliability is still uncertain¹⁰.

This study aims to determine how practical the McMurray's test is in diagnosing medial meniscal knee injuries.

MATERIALS AND METHODS

This prospective case series study was conducted in the department of Orthopedic of MTI Lady Reading Hospital Peshawar on 100 consecutive patients who received an MRI for suspected medial meniscal tears between August 2022 and July 2023. After the Institutional Review Board approval, all those patients who were 18 or older, and had a history of suspected medial meniscal

Received on 08-08-2023

Accepted on 25-11-2023

tears with positive McMurray's Test were included while all other patients having a history of knee surgery, trauma, or other knee pathology were excluded from the study.

After taking a clinical history, every patient had an in-depth physical exam and investigation. McMurray's test comprised a single element. This test was considered positive for a medial or lateral meniscus tear if the patient complained of pain in the medial or lateral knee joint line while the examiner passively moving the knee joint of the patient from full flexion to full extension or if the examiner felt a palpable or audible click in the medial or lateral knee joint line. The knee was subjected to valgus or varus stress to assess medial and lateral meniscal injuries.

After doing the McMurray's test, the results of the test and MRI findings were compared (Table-I). Calculations were made to determine the McMurray test's sensitivity, specificity, and positive and negative predictive values.

Then all the data were collected with the help of a proforma and entered into SPSS version 25.0 for analysis. Calculations were made to determine descriptive statistics, the McMurray test's sensitivity, specificity, and positive and negative predictive values.

RESULTS

The study included 100 patients in total. Out of the patients, 65% were males and 35% were females. The average age of the participants was 31.46 years, with a standard deviation of 9.12 years. The majority of patients (47%), were between the ages of 18 and 30, followed by 31-45 (25%), 46-60 (19%), and 61-75 (9%). The age range was from 18 to 75. McMurray test and MRI were also examined.

The sensitivity of the McMurray's Test is 62.9% and the specificity is 81.6%. The positive predictive value was 84.7%, with a 57.4% negative predictive value. The MRI Test sensitivity was 69.2%, suggesting that positive cases were correctly identified. Specificity, which evaluates the ability to identify negative cases, was 75%. The positive predictive value of the MRI Test was 66.7%, while the negative predictive value was 64.2%, confirming its dependability and accuracy (Table-II). These results indicate the diagnostic effectiveness of the McMurray's Test and MRI Test for the medical condition under discussion. The study results on the sensitivity, specificity, and predictive values of various tests assist doctors in understanding their effectiveness.

Ninety-seven out of 100 patients (97%) had a history of knee joint trauma. The right knee was affected in 57 of them (57%), whereas the left knee was involved in 40 patients (40%). Of 100 patients, 62% had medial meniscus tears, and 25% had lateral ones. 9% did not have any meniscal tears. Of all the patients, 4% had Anterior Cruciate Ligament (ACL) tears that appeared to be similar to meniscal tears. On the other hand, 10% of the patients were normal (Table III).

Figure-1: Age-wise Chart distribution

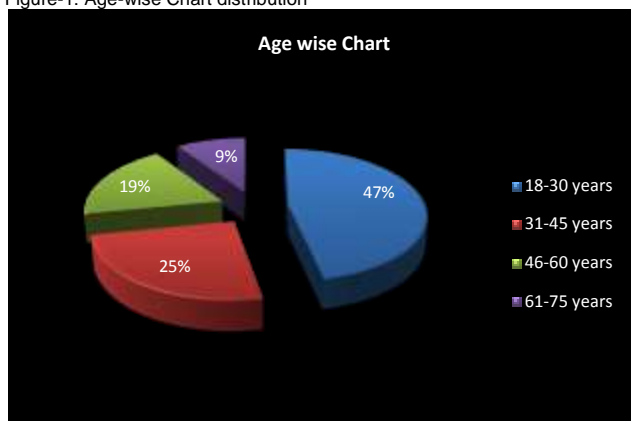


Table-I: Sensitivity and Specificity of McMurray test

	MRI Positive	MRI Negative
McMurray test Positive	True Positives (TP)	False Positives (FP)
McMurray test Negative	False Negatives (FN)	True Negatives (TN)

Table II: Characteristics of Gender, Age Distribution of Study Population

Characteristics	n%
Gender	
Male	65(65%)
Female	35(35%)
Mean age (31.46 ± 9.12 years)	
Age	
18-30 years	47(47%)
31-45 years	25(25%)
46-60 years	19(19%)
61-76 years	9(9%)
Total	100%
Age range (18-75 years)	
Test	
Sensitivity	62.9%
Specificity	81.6%
Positive predictive value negative	84.7%
Predictive value	57.4%

Table III: Patients with a History of Trauma to Knee Joint

Characteristics	n%
Right Knee Involved	57(57%)
Left Knee Involved	40(40%)
Medial Meniscus Tears	62(62%)
Lateral Meniscus Tears	25(25%)
No Meniscal Tears	9(9%)
ACL Tears Simulating Meniscal Tea	4(4%)
Normal	10(10%)

DISCUSSION

The data offered here gives a full overview of the patient population's characteristics and diagnostic test results in the context of a particular medical condition. This discussion will go further into the results' consequences and significance, focusing important conclusions and possible therapeutic applications. Meniscal tears are more common among athletes, accounting for 15% of all sports injury incidents¹¹. When it comes to patient age distribution, meniscal tears have a distinctive bimodal peak pattern, with acute injuries more prevalent in young, active patients between the ages of 18 and 30 and chronic degenerative change-related injuries more prevalent in elders. Due to severe discomfort at the time of the incident, these patients come directly to the emergency department. For routine therapy, specialists will be consulted for follow-ups and as necessary. The Specificity and Sensitivity in several previous studies have examined the McMurray test's diagnostic accuracy since it originally appeared by Zeb A et al study¹¹.

The results of studies varies like a retrospective study of 116 patients conducted by Karachalios Tetal¹². The McMurray's and MRI tests are useful diagnostic techniques in this investigation. The McMurray's Test, which diagnoses knee problems, has 62.9% sensitivity. This shows that it may detect actual positive instances, improving medical diagnosis. This test's high specificity of 81.6% shows that it can properly categorize those without the disease as genuine negatives. The McMurray's Test may be beneficial for initial screening or evaluation due to these traits. However, the MRI Test has a sensitivity of 69.2%, suggesting reliable positive case detection. Its 75% specificity shows its ability to detect negative situations. These measurements show that the MRI Test might be a viable follow-up or confirmatory diagnostic technique following McMurray's Screening. The McMurray Test has an 84.7% positive predictive value and the MRI Test 66.7%. These numbers indicate that a positive test result indicates a significant medical condition risk. The lower negative predictive values (57.4% for the McMurray's Test and 64.2% for the MRI Test) show that a negative

test result does not rule out the disease. This emphasizes clinical judgment and utilizing many tests for a more complete evaluation.

The results showed that the specificity was 97% and the sensitivity was 91%. Janda S et al. had a comprehensive review and meta-analysis in 2010¹³. It has been shown that using the McMurray's test during a physical examination may increase both the accuracy of the examination and the likelihood of making the right diagnosis. This indicated the McMurray test's most significant range of test quality in assessments. To compare the diagnostic efficacy of the McMurray test with an arthroscopic examination in patients with a suspected meniscal tear, Hing W et al. conducted a second study in 2015¹⁴.

According to our findings, the majority of patients with meniscal knee injuries were under the age of 30. In situations with solely meniscal injuries, this test is more accurate. Similarly, in situations of associated ACL injury, the McMurray's test was more accurate than in cases of associated PCL injury^{15,16}. The study also indicated that when performed alone, the McMurray's test is an accurate and effective test for identifying meniscal injuries. According to the study, the McMurray's Test is a useful diagnostic examination tool that may be used instead of MRI for screening of suspected meniscal knee injuries that can be further investigated. Our findings indicate that in the hands of experienced musculoskeletal medical professionals, If applied indiscriminately, the McMurray's test for meniscal tears has a high value^{17, 18}.

But it's important to recognize the importance of clinical evaluation in identifying meniscal tears. Although the separate tests have shown shortcomings, when combined into a single composite test, the diagnostic value may be significantly increased, on par with MRI scans¹⁹. A precise clinical diagnosis procedure is required in developing nations, especially Pakistan, where the economy is less advanced than in other regions of the globe. The surgeon may then choose whether to undertake an MRI scan within this framework, somewhat lowering the cost to the patient^{20,21}.

CONCLUSION

The utilization of the McMurray's test as a screening tool for patients presenting with suspected meniscal tears offers a viable alternative to the utilization of magnetic resonance imaging (MRI), which not only incurs significant costs but may also be limited in terms of accessibility across various regions. Future investigations should consider the inclusion of individuals with a larger sample size and a medical history encompassing knee surgery, trauma, or other knee pathology. Future investigations ought to evaluate the dependability of the McMurray's test across diverse demographic cohorts and encompassing both athletic individuals

Authorship and contribution declaration: Each author of this article fulfilled following Criteria of Authorship:

1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
3. Final approval of the version for publication.

All authors agree to be responsible for all aspects of their research work.

Conflict of interest: None

Funding: None

REFERENCES

1. Gupta Y, Mahara D, Lamichhane A. McMurray's Test and Joint Line Tenderness for Medial Meniscus Tear: Are They Accurate? *Ethiop J Health Sci.* 2016; Nov;26 Available from : 10.4314/ejhs.v26i6.10.

2. Dogrul BN, Kiliccalan I, Asci ES, Peker SC. Blunt trauma related chest wall and pulmonary injuries: An overview. *Chin J Traumatol.* 2020 Jun;23(3). Available from: 10.1016/j.cjtee.2020.04.003.
3. Luvsannyam E, Jain MS, Leitao AR, Maikawa N, Leitao AE. Meniscus Tear: Pathology, Incidence, and Management. *Cureus.* 2022 May 18;14(5):e25121. doi: 10.7759/cureus.25121. PMID: 35733484; PMCID: PMC9205760.
4. Falah M, Nierenberg G, Soudry M, Hayden M, Volpin G. Treatment of articular cartilage lesions of the knee. *IntOrthop.* 2010 Jun;34(5):621-30. doi: 10.1007/s00264-010-0959-y. Epub 2010 Feb 18. PMID: 20162416; PMCID: PMC2903160.
5. Bhan K. Meniscal Tears: Current Understanding, Diagnosis, and Management. *Cureus.* 2020 Jun 13;12(6):e8590. doi: 10.7759/cureus.8590. PMID: 32676231; PMCID: PMC7359983.
6. Ryzewicz M, Peterson B, Siparsky PN, Bartz RL. The diagnosis of meniscus tears: the role of MRI and clinical examination. *ClinOrthopRelat Res.* 2007 Feb; 455:123-33. doi: 10.1097/BLO.0b013e31802fb9f3. PMID: 17279041.
7. Yaqoob J, Alam MS, Khalid N. Diagnostic accuracy of Magnetic Resonance Imaging in assessment of Meniscal and ACL tear: Correlation with arthroscopy. *Pak J Med Sci.* 2015 Mar-Apr;31(2):263-8. doi: 10.12669/pjms.312.6499. PMID: 26101472; PMCID: PMC4476323.
8. Christian D, von Schulze P C, Ammar A, Ficklscherer HM. Primary Synovial Chondromatosis of the Hip – Is Arthroscopy Sufficient? A Review of the Literature and a Case Report'. *1 Jan. 2014:* 667 – 675.
9. Carr AJ, Price AJ, Glyn-Jones S, Rees JL. Advances in arthroscopy indications and therapeutic applications. *Nat Rev Rheumatol.* 2015 Feb;11(2):77-85. doi: 10.1038/nrrheum.2014.174. Epub 2014 Oct 28. PMID: 25348038.
10. Hing W, White S, Reid D, Marshall R. Validity of the McMurray's Test and Modified Versions of the Test: A Systematic Literature Review. *J Man ManipTher.* 2009;17(1):22-35. doi: 10.1179/106698109790818250. PMID: 20046563; PMCID: PMC2704345.
11. Zeb A, Khan F, Husain A, Khan MS, Khan S, Iqbal K. Accuracy of McMurray's Test in Diagnosis Meniscal Injury. *Pak J Med Health Sci* 2022 ;16(4) :877-880, Available from: 10.53350/pjmhs22164878.
12. Karachalios T, Hantes M, Zibis AH, Zachos V, Karantanas AH, Malizos KN. Diagnostic accuracy of a new clinical test (the Thessaly test) for early detection of meniscal tears. *J Bone Joint Surg Am.* 2005 May;87(5):955-62. doi: 10.2106/JBJS.D.02338. PMID: 15866956.
13. Janda, S., Swiston, J. Diagnostic accuracy of pleural fluid NT-pro-BNP for pleural effusions of cardiac origin: a systematic review and meta-analysis. *BMC Pulm Med* 10, 58 (2010). <https://doi.org/10.1186/1471-2466-10-58>
14. Hing W, White S, Reid D, Marshall R. Validity of the McMurray's Test and Modified Versions of the Test: A Systematic Literature Review. *J Man ManipTher.* 2009;17(1):22-35. doi: 10.1179/106698109790818250. PMID: 20046563; PMCID: PMC2704345.
15. Gupta Y, Mahara D, Lamichhane A. McMurray's Test and Joint Line Tenderness for Medial Meniscus Tear: Are They Accurate? *Ethiop J Health Sci.* 2016 Nov;26(6):567-572. doi: 10.4314/ejhs.v26i6.10. PMID: 28450773; PMCID: PMC5389077.
16. Shantanu K, Singh S, Srivastava S, Saroj AK. The Validation of Clinical Examination and MRI as a Diagnostic Tool for Cruciate Ligaments and Meniscus Injuries of the Knee Against Diagnostic Arthroscopy. *Cureus.* 2021 Jun 17;13(6):e15727. doi: 10.7759/cureus.15727. PMID: 34290922; PMCID: PMC8289396.
17. Krakowski, P.; Nogalski, A.; Jurkiewicz, A.; Karpiński, R.; Maciejewski, R.; Jonak, J. Comparison of Diagnostic Accuracy of Physical Examination and MRI in the Most Common Knee Injuries. *Appl. Sci.* 2019, 9, 4102. <https://doi.org/10.3390/app9194102>
18. Duong TD, Tran DT, Do BNT, Tran HT, Le SM, Vu TT. Diagnostic value of clinical tests and Mri for meniscal injury in patients with anterior cruciate ligament injury: Case series study. *Int J Surg Case Rep.* 2021 Nov; 88:106492. doi: 10.1016/j.ijscr.2021.106492. Epub 2021 Oct 13. PMID: 34655974; PMCID: PMC8551519.
19. Shekarchi B, Panahi A, Raeissadat SA, Maleki N, Nayebabbas S, Farhadi P. Comparison of Thessaly Test with Joint Line Tenderness and McMurray Test in the Diagnosis of Meniscal Tears. *Malays Orthop J.* 2020 Jul;14(2):94-100. doi: 10.5704/MOJ.2007.018. PMID: 32983383; PMCID: PMC7513660.
20. Konan S, Rayan F, Haddad FS. Knee Do physical diagnostic tests accurately detect meniscal tears? *Surg Sports TraumatolArthrosc.* 2009 Jul;17(7):806-11. doi: 10.1007/s00167-009-0803-3. Epub 2009 Apr 28. PMID: 19399477
21. Reep NC, Leverett SN, Heywood RM, Baker RT, Barnes DL, Cheatham SW. The Efficacy of the Mulligan Concept to Treat Meniscal Pathology: A Systematic Review. *IntJSportsPhysTher.* 2022 Dec 1;17(7):1219-1235. doi: 10.26603/001c.55540.eCollection 2022. PMID: 36518834

This article may be cited as: Ahmad Z, Farid MI, Khalil Mt, Wajid F, Khan a, Abidi SAR, Nayyer Z, Ullah N, Inam M: Magnetic Resonance Imaging Validates The Clinical Accuracy Of The McMurray's Test In Diagnosing Medial Meniscal Tears. *Pak J Med Health Sci,* 2024;18(1):68-70.