Correlation between magnetic resonance imaging and arthroscopic findings of meniscus injuries of the knee joint

Dhan Bahadur Karki,[1] Pratap Babu Bhandari,[2] Bipan Shrestha,[1] Kishor Man Shrestha,[1] Shreshal Shrestha,[1] Subash Pandey,[1] Anil Kumar Chaudhary,[1] Sanjeeb Rijal[3]

ABSTRACT

INTRODUCTION

Magnetic Resonance Imaging (MRI) findings of meniscal injuries may not always match the arthroscopic finding. Thus, the aim of this study was to evaluate the correlation between MRI findings and arthroscopic findings of meniscal injuries of the knee joint.

MATERIAL AND METHODS

This was cross-sectional study conducted in Universal College of Medical Science Teaching Hospital in which the MRI findings of the patients undergoing arthroscopic knee surgery over a period of 6 months are studied and compared with arthroscopic findings for meniscus injury. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy of MRI findings in the diagnosis of meniscus injuries by comparing with arthroscopic findings are calculated. Chi square test will be used to find the association between different selected variables, p value <0.05 was considered significant.

RESULTS

The sensitivity and specificity of both meniscuses were 88.2% and 91.3% with accuracy 90.00%. PPV 88.2% and NPV 91.3%, Chi square=0.125, p=0.72. The sensitivity, specificity, accuracy, PPV and NPV were 85.7%, 88.5%, 87.5%, 80.0% and 92.0% respectively for lateral meniscus whereas for medial meniscus were 90%, 95%, 92.5% 94.7% and 90.5% respectively

CONCLUSION

MRI is a highly useful, non-invasive diagnostic tool for the evaluation of meniscal injuries. Its diagnostic accuracy is consistently higher for medial meniscus tears compared to lateral tears. This study found no evidence of a statistically significant association between MRI findings and arthroscopy findings.

KEYWORDS

Meniscal injuries, Knee joint, Arthroscopy

1. Department of Orthopaedics, Universal College of Medical Sciences, Bhairahawa, Nepal
2. Department of Orthopaedics, Bharatpur Hospital, Chitwan, Nepal
3. Department of Orthopaedics, Chitwan Medical College, Bharatpur, Nepal

https://doi.org/10.3126/jucms.v14i01.92715

For Correspondence
Dr. Dhan Bahadur Karki
Department of Orthopedics
Universal College of Medical Sciences
Bhairahawa, Nepal
Email: dhankarki017@gmail.com

INTRODUCTION

Meniscal tears are among the most frequent sports-related injuries, with a reported prevalence of approximately 60 cases per 100,000 population, a figure that continues to rise due to increased sports participation and advances in diagnostic techniques.[1] They are observed across all age groups and represent a common source of knee pain.[2] By impairing the meniscus's functions in load transmission, shock absorption, and joint stabilization, such injuries can accelerate the development of knee osteoarthritis.[3] Therefore, accurate diagnosis is essential to ensure timely and appropriate management.[4] Diagnosing meniscal tears through clinical tests is often challenging, as acute and sub-acute presentations may produce inconsistent findings. The complex anatomy of the knee and overlapping pathologies further limit their accuracy, leading to variable sensitivity and poor reliability.[5,6] Consequently, the diagnostic value of clinical tests for meniscal injuries has been debated, with literature showing conflicting evidence regarding their effectiveness.[4] Magnetic resonance imaging (MRI) is regarded as the useful non-invasive technique for detecting meniscal tears, providing detailed visualization of the meniscus and surrounding soft tissues to support accurate diagnosis and treatment planning.[7-9] However, its sensitivity and specificity are limited in certain meniscal tear patterns.[10,11] Arthroscopy, while minimally invasive, continues to serve as the definitive method for direct visualization and diagnosis.[12] Since MRI findings do not always align with arthroscopic results,[13] this study aimed to assess the correlation between MRI and arthroscopy in the evaluation of knee meniscal injuries.

MATERIAL AND METHODS

This was a cross-sectional study conducted at Universal College of Medical Sciences-Teaching Hospital from January 28, 2025 to July 28, 2025 after taking ethical clearance from IRC (UCMS/IRC/13/25). 40 patients were included in study. The inclusion criteria was all patients with knee injuries undergoing arthroscopic knee surgery in UCMS over a period of 6 months. The exclusion criteria were previously operated cases for ligament or meniscus injuries.

The patients who met the inclusion criteria were informed about the study and written informed consent was taken. Data was collected using preformed proforma. MRI scans were conducted using a 3 Tesla machine, which was available in our institute. The MRI findings of the meniscus was given by radiologist was noted in the proforma and the arthroscopic findings were correlated. The arthroscopy was done using TEKNO 30° endoscope and light source from Storz image 1 S connect. The documented data then verified by the consulting orthopedic surgeon and evaluated.

The data was entered using Microsoft Excel. Statistical Package for the Social Sciences for Windows (SPSS Inc., version 24, Chicago, IL) was used for statistical analysis. Analysis of the obtained data was done using descriptive statistics such as frequencies, means, and standard deviation. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MRI was calculated. Chi square test was used to find the association between different selected variables. *P*-value <0.05 was considered significant.

RESULTS

Out of 40 patients, majority were males of (65%) with mean age of 30.7±5 years. Right knees (60%) were commonly involved than left knee. Most common mechanism is sports (45%) related followed by RTA (35%).

Out of 40 cases, MRI finding with tears were in 32 patients with lateral meniscus tear in 12 patients, medial meniscus tears in 15 patients and both meniscal tears in 6 patients whereas in arthroscopy findings tears were seen in 34 patients with lateral meniscus tears in 14 patients, medial meniscus tears in 15 and both meniscal tears in 6 patients. The comparison of MRI and arthroscopy findings of medial meniscus are given below in table 1.

Table 1. Comparison of MRI and arthroscopy findings of medial meniscus

Comparison of MRI and arthroscopy findings of medial meniscus			
	arthroscopy finding		Total
MRI finding	18 (TP)	1 (FP)	19
	2 (FN)	19 (TN)	21
Total	20	20	40

The sensitivity, specificity and accuracy were 90% ,95% and 92.5% respectively. PPV and NPV were 94.7% and 90.5% respectively for medial meniscus. The comparison of the frequency of medial meniscus tear between MRI and arthroscopy are given in table 2.

Table 2. Frequency of medial meniscus tear in MRI and arthroscopy

Types of tear	MRI findings	Arthroscopy findings
Anterior horn tear	1	1
Bucket handle tear	3	3
Complex tear	3	3
Flap tear	1	1
Horizontal tear	1	1
Longitudinal tear	2	3
Oblique tear	1	0
Posterior horn tear	2	2
Root tear	1	1
Both meniscal tear	6	6
No medial meniscus tear	19	19

The comparison of MRI and arthroscopy findings of lateral meniscus are given below in table 3.

Table 3. Comparison of MRI and arthroscopy findings of lateral meniscus

Comparison of MRI and arthroscopy findings of lateral meniscus			
	Arthroscopy finding		Total
MRI finding	12 (TP)	3 (FP)	15
	2 (FN)	23 (TN)	25
Total	14	26	40

The sensitivity, specificity and accuracy were 85.7% , 88.5% and 87.5% respectively. PPV and NPV were 80% and 92% respectively for lateral meniscus. The comparison of frequency of lateral meniscus tear between MRI and arthroscopy are given in table 4.

Table 4. Frequency of lateral meniscus tear in MRI and arthroscopy

Types of tear	MRI findings	Arthroscopy findings
Anterior horn tear	2	2
Bucket handle tear	0	0
Complex tear	3	3
Flap tear	1	1
Horizontal tear	1	1
Longitudinal tear	1	1
Oblique tear	2	2
Posterior horn tear	1	2
Root tear	1	2
Both meniscus tear	6	6
No lateral meniscus tear	22	20
Total	40	40

The sensitivity and specificity of both menisci were 88.2% and 91.3% with accuracy 90%. PPV 88.2% and NPV 91.3%. (Chi square =0.125, p=0.72.)

DISCUSSION

Meniscal tears represent one of the most frequently encountered injuries in athletes.[1] For selecting appropriate treatment strategies and improving patients outcomes precise diagnosis is essential.[4] Magnet resonance imaging (MRI) is widely used as a non-invasive modality for assesing knee pathologies, including meniscal injuries.[13] Despite this, diagnostic arthroscopy continues to be regarded as the gold standard for the definitive identification of intra-articular knee lesions.[12] This study aimed to evaluate diagnostic performance of MRI by correlating its findings with arthroscopic findings in patients with suspected meniscal tears.

In this study, the MRI findings were compared with the arthroscopy findings for meniscal injuries. The sensitivity and specificity of both meniscus were 88.2% and 91.3% with accuracy 90%. PPV 88.2% and NPV 91.3%.The accuracy, sensitivity, and specificity of MRI for lateral meniscus tears were 87.5%, 85.79%, and 88.5% respectively, while for medial meniscus tears, these values were higher at 92.5%, 90% and 95% respectively.

In the present study, males constituted 65% of the knee injury cases, reflecting a clear gender disparity. This observation is in line with the findings of Joshi et al (2019), who likewise reported a higher incidence among male patients. Furthermore, the distribution of laterality in our series, with the right knee affected in 60 % of cases, differ from the results documented by Joshi et al (2019).[2]

Gyawali et al (2016) reported an overall accuracy of 94% and sensitivity of 95.4%, which were slightly higher than the values observed in our study, while their specificity of 88.3% was comparatively lower.[14] In their series, the accuracy for lateral meniscal tears was somewhat lower (86%), whereas the accuracy for medial meniscus injuries (92%) was comparable to our findings.[14] Wong et al. (2016), also observed a low sensitivity of 88% for medial meniscus tears and a lower accuracy of 74.3% for lateral meniscus tears.[15] Similarly, Uppin et al (2017) reported lower sensitivity and specificity values for both medial and lateral meniscus tears, with lateral meniscal tears presenting greater diagnostic challenges.[13] In contrast, Kulkarni et al (2018), reported a lower accuracy rate results for MM tears 86% and LM tears 83% than our study.[16]

The study done by Chambers et al (2014) found similar results like our study with sensitivity of 90.5%, specific of 89.5% and accuracy 90.1% with MRI for both meniscus tears.[17] Their conclusion that MRI is an accurate, non-invasive tool for diagnosing meniscal injuries aligns with the findings of our study, even though the performance for lateral tears remains a challenge.

The variation in MRI sensitivity and specificity between medial (MM) and lateral meniscus (LM) tears highlights the need for cautious interpretation of MRI findings, particularly when LM injury is suspected. In our study, the sensitivity for LM tears was only 80.0%, a figure consistent with much of the existing literature, indicating that MRI may fail to detect certain lateral meniscal lesions most notably those involving the posterior horn or complex tear patterns. As a result, depending solely on MRI could contribute to underdiagnosis of LM tears, emphasizing the importance of thorough clinical assessment and, when uncertainty remains, the use of diagnostic arthroscopy.

In our study, for lateral meniscus tears, the PPV and NPV were 80.0% and 92.0%, respectively, while for medial meniscus tears, these values were higher at 94.7% and 90.5%. When compared to several studies, these values offer both corroboration and points of divergence, particularly in relation to PPV and NPV for both medial and lateral meniscal tears.

Khandelwal et al (2018), reported higher diagnostic performance for MM tears, with PPV and NPV values for MM tears at 88.09% and 96.42%, respectively, and for lateral meniscus tears at 86.04% and 88.09%. Their values for lateral meniscus

tears are notably higher than our observed PPV of 80%, but the NPV is slightly lower than our study (92%). Lateral meniscus aligns well with their findings, suggesting that MRI is more reliable in ruling out lateral meniscus tears than in correctly identifying them.[18]

Kim et al. (2021), reported a NPV 90.9% similar to our study and PPV of 81.8% which was lower than our study for medial meniscus. For lateral meniscus, PPV (84.5%) higher than our study and NPV (81.8%) lower than our study.[19]

Comparison of PPV and NPV values across studies highlights the variability in MRI's diagnostic performance for meniscal tears, with greater inconsistency observed in lateral meniscal (LM) injuries. The relatively modest PPV of 80% for lateral meniscus tears in our study, consistent with reports from other authors, indicates that MRI may be prone to false positives in this subgroup. This underlines the importance of cautious interpretation of MRI findings when lateral meniscus pathology is suspected.

For medial meniscus tears, the consistently elevated PPV and NPV values, both in our series and in previous literature, suggest that MRI provides reliable confirmation of true positives while effectively minimizing false negatives.

MRI is a highly accurate, non-invasive diagnostic modality for evaluating meniscal tears, with excellent sensitivity, specificity and predictive values in clinical practice. These findings confirm that MRI can reliably aid in the detection and exclusion of meniscal injuries, thereby serving as an effective screening and preoperative planning tool. This study was limited by its relatively small sample size, short study duration, and the potential for interobserver variability in MRI interpretation. Consequently, the results may not be fully representative of the wider population. Future research with larger sample size is required.

CONCLUSION

MRI is a highly useful, non-invasive diagnostic tool for the evaluation of meniscal injuries. Its diagnostic accuracy is consistently higher for medial meniscus tears compared to lateral tears. Our study found no evidence of a statistically significant association between MRI finding and arthroscopy finding.

CONFLICT OF INTEREST

None

REFERENCES

1. Luvsannyam E, Jain MS,Leitao AR,Maikawa N,Leitao AE,Meniscus Tear:Pathology,incidence,and management. Cureus,2022 may;14(5):1-1
2. Terry GC, Tagert BE, Young MJ. Reliability of the clinical assessment in predicting the cause of internal derangements of the knee. Arthroscopy 1995;11(05):568–76
3. Ozeki N, Koga H, Sekiya I. Degenerative meniscus in knee osteoarthritis: From Pathology to Treatment. Vol. 12, Life. MDPI; 2022.
4. P.Antinolfi1 R.Cristiani2 F.Manfreda2 S.Bruè3 V.Sarakatsianos4 G.Placella5 M.Bartoli5 A.Caraffa1, Relationship between Clinical, MRI, and Arthroscopic Findings: A guide to correct diagnosis of meniscal tears, Joints2017;5:164–67.
5. Gillquist J, Hagberg G, Oretorp N. Arthroscopic visualization of the posteromedial compartment of the knee joint. Orthop Clin North Am. 1979 Jul; 10(3):545-7. PMID: 460830.
6. Dzoleva-Tolevska R, Poposka A, Samardziski M, Georgieva D. Comparative analysis of diagnostic methods in meniscal lesions. Pril (Makedon Akad Nauk Umet Odd Med Nauki). 2013; 34(3):79–83
7. CrawfordR,WalleyG,BridgmanS,MaffulliN.Magnetic resonance imaging versus arthroscopy in the diagnosis of knee pathology, concentrating on meniscal lesions and ACL tears: a systematic review. Br Med Bull 2007;84(01):5–23
8. Rubin DA, Paletta GA Jr. Current concepts and controversies in meniscal imaging. Magn Reson Imaging Clin N Am 2000;8(02): 243–70
9. Huysse WCJ, Verstraete KL, Verdonk PC, Verdonk R. Meniscus imaging. Vol. 12, Seminars in musculoskeletal radiology. Semin Musculoskelet Radiol; 2008. p. 318–33.
10. Sajjanshetty R, Ranjolkar R. MRI vs arthroscopy in the diagnosis of meniscal tears: A comparative study. Indian Journal of Orthopaedics Surgery. 2024 Jun 15;10(2):135–9.
11. Joshi S, Pandit SP, Sherchan B. Pattern of menisci and cruciate ligaments injury of knee Joint in MRI and arthroscopy. Nepal Medical Journal. 2019 Aug 1;2(1):15–20. 12.
12. Behairy NH, Dorgham MA, Khaled SA. Accuracy of routine magnetic resonance imaging in meniscal and ligamentous injuries of the knee: comparison with arthroscopy. International Orthopaedics. 2008 May 28;33(4):961–7.

13. RB Uppin, Srinath M Gupta, Saumya Agarwal VH. Comparison of clinical examination, MRI and arthroscopy findings in internal derangement of the knee: A Cross-Sectional Study. International Journal of Anatomy, Radiology and Surgery. 2017;6(1):40–5.

14. Gyawali B, Joshi A, Kayastha N. Knee injuries: Correlation of MRI with arthroscopic findings.Journal of Patan Academy of Health Sciences. 2020;7(3):35–40.

15. Wong KPL, Han AXY, Wong JLY, Lee DYH.Reliability of magnetic resonance imaging in evaluating meniscal and cartilage injuries in anterior cruciate ligamen -deficient knees. Knee Surgery, Sports Traumatology, Arthroscopy. 2017 Feb 1;25(2):411.

16. 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 Feb 23;4(2):198.

17. Chambers S, Cooney A, Caplan N, Dowen D, Kader D.The accuracy of magnetic resonance imaging (MRI) in detecting meniscal pathology. J R Nav Med Serv. 2014;100(2):157-60.

18. Khandelwal K, Chaturvedi VC,Mishra V,Khandelwal G.Diagnostic accuracy of MRI knee in reference to arthroscopy in meniscal and anterior cruciate ligament injuries. Egypt J Radiol Nucl Med.2018;49(1):138-45.

19. Kim SH, Lee HJ,Jang YH, Chun KJ, Park YB. Diagnostic Accuracy of Magnetic Resonance Imaging in the detection of type and location of meniscal tears: Comparison with arthroscopic findings.J Clin Med.20121;10(4):606