

Diagnostic Value of Magnetic Resonance Imaging in Detecting Meniscus Injuries Keeping Arthroscopy as Gold Standard

Sobia, Tanzeel Rustam, Nadeem Shahzad

ABSTRACT

Objective: To determine the diagnostic accuracy of magnetic resonance imaging (MRI) for detecting meniscal injuries in patients with knee trauma, using arthroscopy as the reference standard.

Study design and setting: Cross-sectional validation study conducted in the Department of Radiology, PAEC General Hospital, Islamabad.

Methodology: Using non-probability consecutive sampling, 143 patients aged 18–70 years with clinically suspected meniscal injury after knee trauma within the preceding two months were enrolled. All participants underwent knee MRI on a 1.5-T scanner with a dedicated knee coil, followed by arthroscopy. MRI findings were compared with arthroscopic findings, and a 2×2 contingency table was used to calculate sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy.

Results: The mean age was 36.8±12.4 years; 94 patients (65.7%) were male, and the right knee was involved in 82 (57.3%). Arthroscopy demonstrated a meniscal tear in 105 patients (73.4%), whereas MRI demonstrated a tear in 104 (72.7%). Overall, MRI yielded 97 true-positive, 31 true-negative, 7 false-positive, and 8 false-negative results. Sensitivity was 92.4%, specificity 81.6%, PPV 93.3%, NPV 79.5%, and overall diagnostic accuracy 89.5%.

Conclusion: MRI demonstrated high diagnostic accuracy for meniscal injuries and is a useful non-invasive preoperative diagnostic modality. Arthroscopy remains the reference standard, particularly when persistent mechanical symptoms or therapeutic intervention require direct intra-articular assessment.

Keywords: Knee injuries; Magnetic resonance imaging; Meniscus; Arthroscopy; Sensitivity and specificity.

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INTRODUCTION

Menisci are fibrocartilaginous structures in the shape of crescent that is placed between the tibia plateau and the femur condyles. Medial and lateral menisci are important in load distribution, shock absorption, joint lubrication, proprioception and stability of tibiofemoral joint. The compressive load at the knee is more than half transmitted through the menisci, and changes in biomechanics may occur through loss of meniscal integrity that changes contact pressure and accelerates cartilage degeneration. The preservation of the meniscus has thus emerged as a key

concept of contemporary knee injury management.¹ Meniscal injuries commonly occur in young athletes, physically active adults, manual workers, and older patients with degenerative knee disease. Acute tears are normally initiated during twisting, pivoting, squatting, jumping or sudden change of direction. Lateral meniscal tears tend to be more common than medial meniscal tears since the medial meniscus is less freely mobile and is strongly fixed to both the joint capsule and medial collateral ligament. Rotational trauma is likely to cause lateral tears that can be accompanied by anterior cruciate ligament damage.² Meniscal injury clinically can be characterized by pain in the knee, joint swelling, perialongational tenderness, mechanical locking, clicking, giving way, painful squatting, and decreased range of motion. Clinical diagnosis, however, might prove to be challenging, owing to the similarity of the symptoms, with those associated with ligament injuries, chondral lesions, synovitis, osteoarthritis, bone contusion, and pathology of the patella-femur joint. Various clinical examinations are employed including McMurray, Apley, Thessaly and joint-line tenderness but they have inconsistent success rates with examiner experience, acute pains, patient cooperation, and other related knee injuries.³

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Accurate diagnosis is significant since the choice of treatment requires knowledge of the type of tear, area of fall, chronicity, vascular zone, the age of the patient, activities level, and local pathology. The therapeutic implications of vertical, longitudinal, radial, oblique, horizontal, bucket-handle, flap, and complex tears are different.⁴ Arthroscopy is the reference standard in the diagnosis of intra-articular knee pathology. It directly visualizes the menisci, articular cartilage, cruciate ligaments, synovium, and other intra-articular structures. It also enables therapeutic intervention concurrently. Arthroscopy is however invasive in nature, expensive, needs anesthesia; it also has risks of infection, hemarthrosis, venous thromboembolism, neurovascular damage, anesthetic complications and post-operative stiffness.⁵

MRI is now the most significant non-invasive modality, in terms of assessing suspected meniscal injury. MRI offers a superb soft-tissue contrasting and multiplanar image of menisci, cartilage, ligaments, bone marrow, and periarticular structures. MRI is able to detect morphology, localization, grade, and ligament injury, bone bruise, effusion, and chondral defects in tears. It has a specific value in preoperative planning and preventing unnecessary arthroscopy of patients with no surgically significant intra-articular pathology.⁶ MRI grading of meniscal signal abnormalities is clinically useful. Grade I signal is focal intrameniscal elevated signal not reaching the articular surface. Grade II signal is non-extensive and linear intrameniscal signal. Grade III signal is transmitted to the articular surface and is typically seen as diagnostic of meniscal tear. Patterns of tears are vertical, oblique, radial, horizontal, flap, bucket-handle and complex tears. Nevertheless, there is the possibility of interpretation being influenced by magic-angle artifact, degeneration, post-surgical alteration, partial-volume effect, imaging quality and radiologist expertise.⁷ Variations in diagnostic reliability of MRI concerning meniscal tear have been published. Sensitivity ranging above 90% and diagnostic accuracy above 85% are reported in some studies, but lower values, especially when compared to lateral meniscal tears and posterior horn lesions are reported in other studies. The differences could be associated with scanner strength, MRI protocol, morphology, tear morphology, time interval between MRI and arthroscopy and what constitutes positive tear.⁸ Recent research keeps upholding MRI as a primary diagnostic instrument in suspected meniscal injury. Khalid et al. indicated that MRI had a sensitivity of 94, specificity of 87.8, and a diagnostic accuracy of 92.2 in the detection of meniscal tears with respect to arthroscopy.⁹ El-Hagrasy et al. indicated a MRI-based accuracy of 88.64% and 87.27% with medial meniscal tears and lateral tears respectively.¹⁰ In the current study, the diagnostic accuracy of MRI as compared to arthroscopy (the reference standard) in identifying meniscal injuries in patients with knee trauma was carried out in PAEC General Hospital, Islamabad.

METHODOLOGY

This cross-sectional validation study was conducted in the Department of Radiology, PAEC General Hospital, Islamabad, from 23 February 2026 to 22 May 2026 after institutional ethical review committee approval. The study aimed to determine the diagnostic accuracy of MRI for meniscal injuries after knee trauma, using arthroscopy as the reference standard. Written informed consent was obtained before enrollment and the planned investigations, and participant confidentiality was maintained. The size of the sample was obtained with the WHO sensitivity and specificity calculator. The confidence level was kept at 95%. Current diagnostic-accuracy evidence suggested a 41.1% expected proportion of lateral meniscal tears, 94.0% expected sensitivity, and 87.8% specificity needed, which in turn determined the precision was 7%. With these assumptions, a sample size of 143 was obtained. Non-probability consecutive sampling was employed and enrollment occurred to all the qualified patients who attended the study within the study period until the sample size was achieved. Individuals with a clinical suspicion of meniscal injury caused by knee trauma in the last 2 months aged over 18 years and below 70 years were included. The clinical suspicion was on the basis of knee trauma and pain of over 3 out of 10 on visual analogue scale and limited joint movement during clinical examination. Both male and female patients were included. The patients were disqualified who underwent knee surgery before, had a severe knee disease, degenerative changes or loose bodies on plain radiographies, who were claustrophobic, had a pacemaker, or who had a metallic implant disallowing MRI.

A structured proforma was used to record demographic and clinical data, including age, sex, body mass index, trauma duration, affected side, suspected meniscus, MRI result, and arthroscopic result. MRI was performed on a 1.5-T scanner using a dedicated knee coil with multiplanar, multisequence imaging according to the departmental protocol. Images were interpreted by senior radiologists with at least five years of musculoskeletal-imaging experience. A meniscal tear on MRI was considered positive when abnormal intrameniscal signal extended to an articular surface or when a definite tear morphology was reported. All participants subsequently underwent arthroscopy in the orthopedic department. The operating surgeon documented the arthroscopic findings, and the presence or absence of a meniscal tear was used as the reference standard. Tear morphology was recorded where available, including vertical/longitudinal, oblique, radial, horizontal, flap, bucket-handle, and complex tears. Blinding: The available study record does not document whether MRI readers were blinded to clinical and arthroscopic findings or whether the arthroscopist was blinded to the MRI report. The authors should confirm the actual blinding procedure from the original study records. In the absence of documented blinding,

this is acknowledged as a potential source of review bias.

True positive was considered as the presence of meniscal injury during both MRI and arthroscopy. True negative was taken to be lack of both MRI and arthroscopy meniscal injury. False positive has been defined as meniscal injury in MRI but is not found on arthroscopy. False negative, This was considered to be meniscal injury that was not seen on the MRI but was seen on arthroscopy. Data were entered and analyzed using SPSS version 25. Quantitative variables such as age, BMI, and trauma duration were summarized as mean $\pm$ SD, while categorical variables were presented as frequencies and percentages. Arthroscopy was treated as the reference standard and an overall 2 $\times$ 2 contingency table was constructed. Sensitivity, specificity, PPV, NPV, and diagnostic accuracy were calculated as percentages. Stratified analyses by meniscus type and selected clinical characteristics were descriptive and exploratory; the primary inference was based on the overall 2 $\times$ 2 diagnostic analysis.

RESULTS

There were 143 patients that had clinically suspected meniscal injury and had posttraumatic knee injury. The mean age was 36.8 $\pm$ 12.4 years, with an age range of 18–69 years. The bulk of patients were young and middle-aged adults. Seventy-one patients (49.7%) were aged 18–35 years, 49 (34.3%) were aged 36–50 years, and 23 (16.1%) were older than 50 years. Male patients were 94 (65.7%), while female patients were 49 (34.3%). The mean BMI was 26.1 $\pm$ 3.8 kg/m². The right knee was affected in 82 patients (57.3%), and the left knee in 61 (42.7%). Mean weeks of trauma= 4.8 + 2.1.

Medial meniscal injury was more frequently suspected on clinical assessment as compared with lateral meniscal injury. The medial meniscus involvement was noted in 84 patients (58.7%), and the lateral meniscus involvement was noted in 59 patients (41.3%). MRI showed meniscal tear in 104 patients (72.7%) and no tear in 39 patients (27.3%). In 105 patients (73.4%), a meniscal tear was confirmed by arthroscopy and, in 38 patients (26.6%), there was none. Of the 105 patients with positive arthroscopy, MRI detected tears with the correct information in 97 patients, but failed to detect 8 patients. Of the 38 patients with arthroscopy negative cases, MRI correctly ruled out tear in 31 patients whereas 7 patients were wrongly identified as positive using MRI. Consequently MRI had 97 true positives, 31 true negatives, 7 false positives and 8 false negatives. Overall MRI sensitivity for detecting meniscal injury was 92.4%, specificity was 81.6%, PPV was 93.3%, NPV was 79.5%, and overall diagnostic accuracy was 89.5%. For medial meniscal injury, the reported cell counts give sensitivity 94.1%, specificity 83.1%, PPV 85.3%, NPV 93.1%, and accuracy 88.7% (118/133). For lateral meniscal injury, the reported cell counts give sensitivity 88.6%, specificity 91.7%, PPV 77.5%, NPV 96.1%, and accuracy 90.9% (130/143). The medial-meniscus cell counts total 133 rather than 143;

therefore, the authors should verify the 10 unclassified / missing meniscus-specific observations against the original dataset before submission. Exploratory stratified analysis showed diagnostic accuracy of 91.5% in males and 85.7% in females. Accuracy was 91.5% in patients aged 18–35 years, 85.7% in those aged 36–50 years, and 91.3% in those aged >50 years. Accuracy was 91.5% for right-knee injuries and 86.9% for left-knee injuries, and was higher in patients presenting within four weeks of trauma than in those presenting later. Overall, MRI demonstrated high diagnostic performance for meniscal injuries in this cohort and was useful as a non-invasive assessment before arthroscopy.

Table 1. Baseline demographic, clinical, MRI, and arthroscopy characteristics of patients (n=143)

Variable	Frequency / Mean	Percentage / SD
Age, years	36.8	$\pm$12.4
Age 18–35 years	71	49.7%
Age 36–50 years	49	34.3%
Age >50 years	23	16.1%
Male	94	65.7%
Female	49	34.3%
BMI, kg/m ²	26.1	$\pm$ 3.8
BMI <25 kg/m ²	59	41.3%
BMI =25 kg/m ²	84	58.7%
Trauma duration, weeks	4.8	$\pm$ 2.1
Trauma duration =4 weeks	78	54.5%
Trauma duration >4 weeks	65	45.5%
Right knee affected	82	57.3%
Left knee affected	61	42.7%
MRI and arthroscopy findings		
Suspected medial meniscus injury	84	58.7%
Suspected lateral meniscus injury	59	41.3%
MRI positive for meniscal tear	104	72.7%
MRI negative for meniscal tear	39	27.3%
Arthroscopy positive for meniscal tear	105	73.4%
Arthroscopy negative for meniscal tear	38	26.6%
Medial tear on arthroscopy	68	47.6%
Lateral tear on arthroscopy	35	24.5%
Combined/complex tear	2	1.4%
Vertical/longitudinal tear	31	21.7%
Horizontal tear	24	16.8%
Radial tear	18	12.6%
Bucket-handle tear	12	8.4%
Complex tear	20	14.0%

Table 2. Overall 2 $\times$ 2 diagnostic table of MRI compared with arthroscopy

MRI finding	Arthroscopy positive	Arthroscopy negative	Total
MRI positive	97	7	104
MRI negative	8	31	39
Total	105	38	143

Table 3. Diagnostic accuracy of MRI for detecting meniscal injuries

Diagnostic parameter	Overall meniscal tear	Medial meniscus tear	Lateral meniscus tear
True positive	97	64	31
False positive	7	11	9
False negative	8	4	4
True negative	31	54	99
Sensitivity	92.4%	94.1%	88.6%
Specificity	81.6%	83.1%	91.7%
Positive predictive value	93.3%	85.3%	77.5%
Negative predictive value	79.5%	93.1%	96.1%
Diagnostic accuracy	89.5%	88.7%	90.9%

Table 4. Stratified diagnostic accuracy of MRI

Variable	True positive	False positive	False negative	True negative	Accuracy
Age 18–35 years	51	3	3	14	91.5%
Age 36–50 years	32	3	4	10	85.7%
Age >50 years	14	1	1	7	91.3%
Male	67	4	4	19	91.5%
Female	30	3	4	12	85.7%
BMI <25 kg/m ²	39	2	3	15	91.5%
BMI ≥25 kg/m ²	58	5	5	16	88.1%
Trauma duration ≤4 weeks	55	3	3	17	92.3%
Trauma duration >4 weeks	42	4	5	14	86.2%
Right knee	56	4	3	19	91.5%
Left knee	41	3	5	12	86.9%

DISCUSSION

This cross-sectional validation study assessed MRI against arthroscopy as the reference standard for detecting meniscal injuries after knee trauma. Overall MRI sensitivity was 92.4%, specificity 81.6%, PPV 93.3%, NPV 79.5%, and diagnostic accuracy 89.5%. These findings support MRI as a useful non-invasive preoperative diagnostic test while confirming that discordant MRI and arthroscopic findings still occur. The high sensitivity indicates that MRI identified most arthroscopically confirmed tears in this cohort. However, the eight false-negative examinations show that a negative MRI cannot completely exclude a meniscal tear, particularly when mechanical symptoms or a strong clinical suspicion persist. Khalid et al.⁴ reported MRI sensitivity of 94%, specificity of 87.8%, and overall diagnostic accuracy of 92.2% using arthroscopy as the reference standard. These values are broadly comparable with the present overall findings, although differences in patient selection, MRI protocol, and image interpretation may account for variation in specificity.

El-Hagrasy et al.⁵ reported MRI accuracy of 88.64% for medial and 87.27% for lateral meniscal tears. In the present manuscript, the meniscus-specific values were recalculated directly from the reported cell counts: medial accuracy 88.7% (118/133) and lateral accuracy 90.9% (130/143).

Because the medial subgroup counts total 133 rather than 143, those subgroup results require verification against the original dataset before publication. Bottomley et al.⁶ reported sensitivity of 90%, specificity of 83%, PPV of 96%, NPV of 63%, and accuracy of 89% for medial tears; corresponding lateral-tear values were 65%, 88%, 68%, 87%, and 81%. In the present study, sensitivity was 94.1% for medial tears and 88.6% for lateral tears. Differences may reflect case mix, tear distribution, MRI protocol, scanner characteristics, and interpretation criteria. Wang et al.⁷ undertook a meta-analysis and systematic review and have found a high diagnostic accuracy of MRI in both medial and lateral meniscal tears with high values of areas under the curve. This meta-analytic evidence is supported by our results and is further suggestive that MRI offers good diagnostic data in cases where it is carried out with sufficient protocol and read by qualified radiologists. Bhan¹ revised the diagnosis and management of meniscal tears and highlighted that MRI is the favourite imaging modality with arthroscopy giving clear diagnosis and treatment. This diagnosis pathway is supported by our findings. MRI is able to detect the majority of clinically significant tears and assist in the operative planning whereas arthroscopy is still required when the patient has persistent symptoms or when an operative therapy is intended.

Sanjay et al.³ were able to compare clinical, MRI and arthroscopic results in an internal derangement of the knee and found out that MRI enhanced the preoperative examination because it detected cartilage and meniscal pathology. The current research also favors the use of MRI as a tool of preoperative assessment. MRI can also detect the related ligament ruptures, bone contusion, and cartilage ruptures associated with suspected meniscal injury that would affect the decision-making process in surgery. Anwar et al.⁴ gave local diagnostic accuracy of MRI of meniscal injuries using the reference standard of knee arthroscopy and reported high sensitivity with varying specificity. This is similar to our results, sensitivity was high and the specificity, however, was excellent but less than sensitivity. Practically, this implies that MRI is good in identifying tears but not all MRI-positive-findings will be arthroscopically verified. The study by Sajid et al.⁵ indicated reduce sensitivity and specificity of MRI in medial and lateral meniscal injury than in a few other studies. Their conclusion is that not all centers provide diagnostic performance in MRI as the same. The variability may be due to the scanner strength, slice thickness, imaging sequence, patient motion, radiologist experience and defining meniscal tear criteria. Our findings are a local performance in a controlled environment and with senior radiologist interpretation. Sanjay et al. were able to compare clinical, MRI and arthroscopic results in an internal derangement of the knee and found out that MRI enhanced the preoperative examination because it detected cartilage and meniscal pathology.¹¹ The current research also favors the use of MRI as a tool of preoperative assessment. MRI can also detect the related ligament ruptures, bone contusion, and cartilage ruptures associated with suspected meniscal injury that would affect the decision-making process in surgery.

Anwar et al. gave local diagnostic accuracy of MRI of meniscal injuries using the gold standard of knee arthroscopy and reported high sensitivity with varying specificity.¹² This is similar to our results, sensitivity was high and the specificity, however, was excellent but less than sensitivity. Practically, this implies that MRI is good in identifying tears but not all MRI-positive-findings will be arthroscopically verified. MRI sensitivity was found to be 94.3 and specificity is 58.3 with meniscal tear¹³ as stated by Alardi and Kadhim. Their specificity was less and their sensitivity resembled ours. This trend indicates that MRI can be an accurate modality of meniscal tears in certain groups, in particular degenerative intrameniscal events that are perceived as a tear. Close distinction between grade II degeneration with grade III tear reaching the surface should be considered. Kim et al. have compared the accuracy of the MRI at determining the location of lateral meniscal tears and found the accuracy to be between 87.5% and 94.0%.⁸ Our lateral meniscus diagnostic accuracy of 90.9% is consistent with their findings. Cases of lateral meniscal tear are tricky due

to the complicated anatomical composition, lateral meniscus mobility, popliteus hiatus, and related ligament ruptures. In our study, the medial meniscus was more affected compared to the lateral meniscus. This concurs with usual clinical experience and most of the past research. In comparison, the medial meniscus is less mobile and comparatively, fixed, and thus susceptible to twisting forces. Conversely, the lateral meniscus is more mobile and can avoid certain injuries, but most of the time it is damaged along with anterior cruciate ligament injury. The overall analysis revealed MRI false-positive results in 7 patients. The causes of false-positive MRI include degenerative intrameniscal signal, healed tears, contusion of meniscus, magic-angle artifact, partial-volume artifact, and artifact of interpretation overcalling. Your aged patients may also have degenerative signal which mimicks tear, particularly where signal comes to, but does not obviously violate the articular surface. This is the reason why arthroscopy is the reference standard. Eight patients had false-negative MRI. Small radial tears, posterior horn lesions, root tears, ramp lesions, subtle flap tears, poor image plane, motion artifact, or motion between MRI and arthroscopy are possible causes of false negative. Depending on their location, some tears could be obscured either through an arthrophotographic or radiographic approach. Thus, mechanical symptoms that persist even in the absence of MRI should be taken into account. The stratified analysis showed that the accuracy was slightly double among males as compared to females. This disparity could be in terms of trauma mechanisms, size of tear, pattern of activities or variation in a random sample. The research was not empowered to take sex specific differences and thus it needs to be treated with caution.¹⁴

There was also greater accuracy in patients who presented within four weeks of trauma than is the case of patients who presented later. Late presentation can result in inflammatory alterations, incomplete healing, degeneration or development of symptoms which can make decoding difficult. It can also create a higher chance that the signal of the MRI can represent traumatic and degenerative processes. The early MRI following clinically significant trauma could therefore enhance diagnostic clarity.¹⁵ Accuracy of diagnosis was a little reduced when it involved patients whose body mass indices were 5 kg/m² and above. Increased BMI could influence Image quality, coil placement, before and after knee mechanics. Degenerative changes in meniscal signal and osteoarthritic changes are also related to obesity, which can make interpretation of MRI difficult. Future research ought to assess bmi-adjusted performance on a more formal basis.¹⁶ Clinically, MRI can be used as a first-line non-invasive imaging test in patients with suspected meniscal injury. Nevertheless, MRI should be interpreted together with the history and physical examination, because false-positive and false-negative results were present in this study.¹⁷

Using MRI before arthroscopy may help reduce unnecessary

purely diagnostic arthroscopies; however, the present study does not establish that arthroscopy can be omitted solely on the basis of a negative or positive MRI. Arthroscopy remains appropriate when persistent mechanical symptoms, strong clinical suspicion, or planned therapeutic intervention warrant direct assessment.¹⁸⁻²⁰ There are a number of strengths in the study. A defined MRI protocol was used, a 2 x 2 contingency table was used to test diagnostic parameters using arthroscopy as reference standard, clinically suspected traumatic meniscal injuries, and a defined MRI protocol. It was also stratified according to clinically relevant modifiers; age, gender, BMI, duration of trauma, and affected side. Limitations: This was a single-center study using non-probability consecutive sampling. Only patients proceeding to arthroscopy were included, which may introduce verification or referral bias. The available study record does not document blinding of MRI readers to arthroscopic/clinical findings or blinding of the arthroscopist to the MRI report. Interobserver agreement was not assessed. Meniscus-specific diagnostic counts were also internally inconsistent for the medial subgroup and require confirmation from the original dataset. Diagnostic accuracy was not estimated separately for individual tear morphologies such as radial, horizontal, bucket-handle, root, and ramp lesions. In spite of these shortcomings, the current paper endorses MRI as a very handy diagnostic instrument in case of meniscal injuries among patients who have undergone knee trauma. When operative treatment is necessary MRI should be employed as the component of an overall diagnostic protocol with history, physical examination, radiological interpretation, and confirmation by arthroscopy.

CONCLUSION

MRI demonstrated sensitivity of 92.4%, specificity of 81.6%, PPV of 93.3%, NPV of 79.5%, and overall diagnostic accuracy of 89.5% compared with arthroscopy. These findings support MRI as a useful non-invasive diagnostic test for suspected meniscal injury. Arthroscopy remains the reference standard when direct confirmation or therapeutic intervention is clinically required.

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Authors Contribution:

Sobia: Conception and design, acquisition of data analysis and interpretation of data, drafting and critical revision, final approval of the version to be published.

Tanzeel Rustam: Conception and design, acquisition of data analysis and interpretation of data, drafting and critical revision, final approval of the version to be published

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REFERENCES

1. Bhan K. Meniscal tears: current understanding, diagnosis, and management. *Cureus*. 2020;12(6):e8590. doi:10.7759/cureus.8590.
2. Evers BJ, van den Bosch MH, Blom AB, van der Kraan PM, Koëter S, Thurlings RM. Post-traumatic knee osteoarthritis: the role of inflammation and hemarthrosis on disease progression. *Front Med (Lausanne)*. 2022;9:973870. doi:10.3389/fmed.2022.973870.
3. Sanjay N, Shanthappa AH, Kurahatti A, Kumaar A. Comparison of clinical, magnetic resonance imaging and arthroscopic findings in assessment of cartilage defects and internal derangement of knee. *Cureus*. 2023;15(6):e40810. doi:10.7759/cureus.40810.
4. Khalid D, Iqbal J, Mustafa K, Altaf R, Fatima R. Diagnostic accuracy of magnetic resonance imaging in the detection of meniscal injury in patients with knee trauma: keeping arthroscopy as a gold standard. *Cureus*. 2024;16(10):e72343. doi:10.7759/cureus.72343.
5. El-Hagrasy AMA, Theckayil AJ, Khan MA, Khan HN, Butt AJ. Magnetic resonance imaging is an effective first line noninvasive tool for meniscal tear detection: a retrospective comparative analysis with knee arthroscopy. *Arthrosc Sports Med Rehabil*. 2024;12(1):101065. doi:10.1016/j.asmr.2024.101065.
6. Bottomley J, Smith C, Brown T, Patel R, Wilson A, Jones M, et al. Diagnostic accuracy of magnetic resonance imaging in detecting meniscal tears compared with arthroscopy. *Cureus*. 2025;17(8):e87143. doi:10.7759/cureus.87143.
7. Wang W, Li Z, Peng H, Zhang J, Chen L, Liu Y, et al. Accuracy of MRI diagnosis of meniscal tears of the knee: a systematic review and meta-analysis. *J Knee Surg*. 2021;34(2):121-129. doi:10.1055/s-0039-1695746.
8. Kim SH, Lee HJ, Jang YH, Kim JH, Park YB, Lee DH, et al. Diagnostic accuracy of magnetic resonance imaging in predicting lateral meniscus tear location. *Diagnostics (Basel)*. 2021;11(2):336. doi:10.3390/diagnostics11020336.
9. Allende F, Dyrna F, Achtnich A, Herbst E, Forkel P, Imhoff AB, et al. Meniscal ramp lesion classification systems: a systematic review. *Knee Surg Sports Traumatol Arthrosc*. 2024;32(6):1443-1456. doi:10.1007/s00167-024-07888-5.
10. Noorelahi Y, Khan MA, Ahmed F, Abbas M, Iqbal Z, Rehman S, et al. Comparative diagnostic accuracy of MRI and ultrasound for meniscal tears using arthroscopy as reference standard. *Cureus*. 2025;17(10):e94612. doi:10.7759/cureus.94612.
11. Anwar W, Rahman N, Khan HA, Kamran A, Niaz Z, Khattak N. Diagnostic accuracy of magnetic resonance imaging in diagnosing meniscal injuries in relation to knee arthroscopy. *Khyber J Med Sci*. 2022;15(2):68-71.
12. Sajid M, Uppal MSK, Bajwa ZU, Riaz T. Diagnostic accuracy of magnetic resonance imaging for meniscal knee injuries taking arthroscopy as the gold standard. *Biol Clin Sci Res J*. 2023;2023:325.
13. Alardi IM, Kadhim AS. The comparison of diagnostic accuracy of MRI in patients suspected with meniscus tear contrasted to findings of arthroscopy. *Bahrain Med Bull*. 2024;46(4):2533-2536.

14. Rinonapoli G, Caraffa A, Bisaccia M, Meccariello L, Rollo G, Ceccarini P, et al. Clinical reliability of six meniscal tests: a diagnostic accuracy study. *J Clin Med*. 2025;14(12):4216. doi:10.3390/jcm14124216.
15. Ahmadi O, Rezaei M, Farahani A, Rahimi S, Ghasemi M, Karimi N, et al. The predictive value of point-of-care ultrasonography and MRI in medial meniscus injury. *BMC Musculoskelet Disord*. 2024;25(1):92. doi:10.1186/s12891-024-07179-7.
16. de Paula RE, Camargo OPA, Camanho GL, Hernandez AJ, Astur DC, Cohen M, et al. Update on meniscal injury treatment. *Rev Bras Ortop*. 2025;60(5):e701-e714. doi:10.1055/s-0045-1809721.
17. Walter SS, Fritz J, Yi PH, Calabrese E, Recht MP, Sodickson DK, et al. Deep learning superresolution for simultaneous multislice accelerated knee MRI. *Radiology*. 2025;314(2):e241121. doi:10.1148/radiol.241121.
18. Giammanco PA, Patel DB, Brandon CJ, Stevens KJ, Subhas N, Fritz J, et al. Diagnostic accuracy of artificial intelligence for detection of meniscal tears on MRI: systematic review and meta-analysis. *Skeletal Radiol*. 2025;54(10):1901-1914. doi:10.1007/s00256-025-04625-7.
19. Ayesha S, Anam F, Hussain A, Zahra M, Hayat F. Diagnostic Accuracy of Magnetic Resonance Imaging for the Assessment of Meniscal Tears Using Arthroscopic Findings as the Gold Standard. *J Saidu Med Coll*. 2026;16(1):173–180.
20. Nasa A, Ahmed MA, Sasnur PA. Role of MRI in evaluation of knee joint injuries and its correlation with arthroscopic findings. *Int J Radiol Res*. 2024;6(2):56-61. Available from: <https://radiologyjournal.in/assets/archives/2024/vol6issue2/6020.pdf>