ORIGINAL ARTICLE

DIAGNOSTIC ACCURACY OF MAGNETIC RESONANCE IMAGING IN ANTERIOR CRUCIATE LIGAMENT TEAR, TAKING ARTHROSCOPY AS GOLD STANDARD

Waqar Ali, Syed Dilbagh Ali Shah, Luqman Khan, Aftab Ali, Muhammad Maaz Raza, Zeeshan Khan, Safeer Ullah, Rao Erbaz Hassan

Department of Orthopaedics, Khyber Teaching Hospital, Peshawar, Pakistan

ABSTRACT

Objective: To determine the diagnostic accuracy of Magnetic Resonance Imaging (MRI) in detecting anterior cruciate ligament (ACL) tears, using arthroscopy as the gold standard.

Material And Methods: We conducted this cross-sectional validation study in the Orthopedics Department at Khyber Teaching Hospital, Peshawar. A total of 296 patients were enrolled. All participants underwent knee MRI and were compared with arthroscopic findings, which served as the reference standard. Diagnostic parameters and overall accuracy were calculated. Statistical analysis was performed using SPSS 25.

Results: Of the 296 patients, MRI detected ACL tears in 172 (58.1%) cases, while arthroscopy confirmed tears in 197 (66.6%) cases. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of MRI were 70.1%, 65.7%, 80.1%, and 52.4%, respectively, with an overall diagnostic accuracy of 68%. A statistically significant association was observed between MRI and arthroscopy findings ($p < 0.01$). The ROC curve demonstrated fair discriminative ability of MRI.

Conclusion: MRI exhibits moderate diagnostic accuracy in detecting ACL tears, with a reliable predictive value when results are positive. However, its limited sensitivity and specificity in this context highlight the need for cautious interpretation, especially in MRI-negative cases. Arthroscopy remains the definitive diagnostic tool, particularly for ambiguous or complex injuries.

Keywords: Anterior Cruciate Ligament Injuries, Magnetic Resonance Imaging, Arthroscopy

This article may be cited as: Ali W, Shah SDA, Khan L, Ali A, Raza MM, et al. Diagnostic Accuracy Of Magnetic Resonance Imaging In Anterior Cruciate Ligament Tear, Taking Arthroscopy As Gold Standard. J Med Sci 2026 January - March;34(1):4-9

The knee is a hinge joint, connecting the tibia and femur. Its stability mainly relies on the surrounding ligaments. Of the eleven ligaments that support the joint, the anterior cruciate ligament (ACL) is especially important for preventing the tibia from moving forward relative to the femur. [1] The knee undergoes significant mechanical stress during daily activities, with sports-related injuries being a leading cause. The ACL is the most commonly torn ligament in the body, accounting for about 28.9% of all ligament injuries. Because of its close location, ACL tears are often accompanied by injuries to the medial and lateral collateral ligaments. [2]

Correspondence
Dr. Syed Dilbagh Ali Shah
Associate Professor
Department of Orthopaedics, Khyber Teaching Hospital, Peshawar, Pakistan
Cell: +92-312-6914030
Email: Drdilbagh@gmail.com
Date Received: 19/12/2025
Date Revised: 26/03/2026
Date Accepted: 27/3/2026

Magnetic Resonance Imaging (MRI) and arthroscopy have significantly improved the diagnosis of knee conditions. MRI is often preferred for its non-invasive approach and high sensitivity in detecting meniscal injuries; however, its effectiveness in identifying ACL tears is still debated. [3] MRI provides superior soft tissue contrast and multi-planar capabilities, making it especially useful for examining the complex anatomy of the knee. Reported MRI sensitivities include 87.8% for ACL tears, 93.5% for medial meniscal tears, and 77.7% for lateral meniscal tears. [4]

MRI not only visualizes all intra-articular ligaments but also detects certain extra-articular structures that may be missed during arthroscopy. Arthroscopy, on the other hand, is a minimally invasive procedure usually done as a day case and remains the gold standard for diagnosing intra-articular ligament injuries. [5] However, emerging evidence shows that a reliable MRI can help reduce unnecessary diagnostic arthroscopies. [6] Shakir et al. reported that MRI had a sensitivity of 66.7%, specificity of 75.9%, positive predictive value (PPV) of 81.1%, negative predictive value (NPV) of 59.4%, and an overall diagnostic accuracy of 70.3% in detecting ACL tears. [7]

In our clinical setting, patients with suspected ligamentous knee injuries routinely undergo MRI, followed by arthroscopy when indicated. Despite the widespread use of MRI, no recent local study has evaluated its diagnostic accuracy specifically for ACL injuries. This study was therefore designed to determine the accuracy of MRI in detecting ACL tears, using arthroscopy as the gold standard. The findings aim to support orthopedic surgeons in counseling patients more effectively and may help reduce the need for invasive diagnostic procedures when MRI findings are sufficiently reliable.

MATERIALS AND METHODS

A cross-sectional validation study was conducted in the Department of Orthopaedics at Khyber Teaching Hospital, Peshawar, over a six-month period from November 2024 to May 2025, after obtaining ethical approval. The sample size was determined using Buderer's formula, considering an expected prevalence of ACL tear at 28.9%, MRI sensitivity of 66.7%, and specificity of 75.9%, with a 10% margin of error and a 95% confidence interval. This resulted in a required sample size of 296 participants. [7]

Patients aged between 18 and 60 years, of either gender, and clinically suspected of having a partial or complete ACL tear were enrolled through a non-probability consecutive sampling method. Exclusion criteria included previous surgical procedures on the affected knee, contraindications to MRI or arthroscopy, dislocated knees, or fractures involving the femoral condyle or tibial plateau.

After obtaining informed written consent, participants were recruited from the orthopedic outpatient clinic. Demographic and clinical variables, including age, gender, BMI, laterality, duration of symptoms, socioeconomic status, education level, occupation, and place of residence, were recorded on a structured form. Clinical assessment was performed by a senior orthopedic surgeon.

All participants underwent MRI using a 1.5 Tesla Magnetom Harmony scanner (SIEMENS, Munich, Germany) with a dedicated knee coil. Sequences included T1, T2, STIR, PD, and PD with fat suppression, captured in axial, sagittal, and coronal planes. For optimal ACL visualization, sagittal images were taken with the knee flexed at 15° in a supine position. MRI scans were interpreted by a senior radiologist with over five years of post-fellowship experience. An ACL tear on MRI was defined using standard criteria. A complete tear was diagnosed based on complete fiber discontinuity, non-visualization, or abnormal laxity of the ligament, often accompanied by secondary signs. A partial tear was defined as increased intraligamentous signal with partial fiber disruption but preserved continuity. A normal ACL appeared as a continuous, low-signal, well-oriented ligament. All patients underwent diagnostic arthroscopy, performed by a sports fellowship-trained orthopedic surgeon under general or spinal anesthesia. The radiologist was blinded to the clinical examination findings, and the orthopedic surgeon was blinded to the MRI report until after the arthroscopy was completed.

Data were collected and entered by the principal investigator. Statistical analysis was performed using IBM SPSS version 25. Descriptive statistics were presented as means and standard deviations for continuous variables and as frequencies and percentages for categorical variables. A 2×2 contingency table was used to calculate the sensitivity, specificity, PPV, NPV, and overall diagnostic accuracy of MRI compared to arthroscopy. 95% confidence intervals (CIs) were reported for all these indices. McNemar's test was used to compare correlated proportions, and receiver operating characteristic (ROC) curves were plotted to evaluate overall diagnostic performance. A p-value less than 0.05 was considered statistically significant. The Standards for Reporting of Diagnostic Accuracy Studies (STARD) 2015 Protocols were followed in reporting this study. [8]

RESULTS

A total of 296 patients were enrolled in the study. Most of them were male (80.7%), with a mean age of 31 ± 4.92 years. Baseline demographic and clinical characteristics of the study population are presented in Table 1. The study's patient flowchart is given in Figure 1.

ACL tears were identified on MRI in 172 patients (58.1%), while 124 (41.9%) showed no tear. Arthroscopy, used as the reference standard, confirmed ACL tears in 197 patients (66.6%) and ruled out tears in 99 (33.4%). A cross-tabulation of MRI findings against arthroscopy is presented in Table 2. The overall diagnostic metrics, along with their confidence intervals and statistical significance, are presented in Table 3.

The likelihood ratio analysis showed a positive likelihood ratio (LR+) of 2.04 and a negative likelihood ratio (LR−) of 0.45, indicating that a positive MRI moderately increases the probability of an ACL tear, while a negative MRI reduces the probability but does not reliably exclude the diagnosis.

The ROC curve revealed an area under the curve (AUC) of 67.9% (95% CI: 61.3%–74.4%) for the ACL tear on MRI (Figure 2).

S Subgroup analysis revealed better MRI performance in complete versus partial ACL tears. For complete tears, sensitivity, specificity, PPV, NPV, and diagnostic accuracy were 82.4%, 72.1%, 88.6%, 62.3%, and 78.9%, respectively, while for partial tears, these values were lower at 58.7%, 60.4%, 66.2%, 52.8%, and 59.5%. Similarly, MRI showed higher diagnostic performance in early presentations (<6 weeks), with sensitivity, specificity, PPV, NPV, and accuracy of 85.2%, 76.8%, 89.5%, 70.4%, and 82.1%,

compared to 62.7%, 60.3%, 73.4%, 47.6%, and 61.5% in late presentations (>6 weeks).

Table No 1: Baseline demographic and clinical characteristics of the study population (n=296).

Characteristics		N (%), mean ± SD
Enrolled cases		296 (100%)
Gender	Male	239 (80.7%)
	Female	57 (19.3%)
Age (years)		31 ± 4.92
Weight (kgs)		73 ± 6.89
Height (meters)		1.7 ± 1.01
BMI (kg/m²)		24.1 ± 3.34
Duration of symptoms (months)		12 ± 2.47
Age groups (years)	20–25	106 (35.8%)
	26-30	101 (34.1%)
	31-35	54 (18.2%)
	36-40	31 (10.5%)
	>40	4 (1.3%)
Injury Type	RTA	165 (55.7%)
	Fall form height	74(25%)
	Sports related	57 (19.3%)
Residence	Rural	188(63.5%)
	Urban	108 (36.5%)
Socioeconomic group	Lower-income group	100(33.8%)
	Middle-income group	104 (35.1%)
	Higher-income group	92 (31.1%)

Table No 2: Comparison of MRI and arthroscopic findings in detecting ACL tears

	ACL Tear on Arthroscopy		χ^2 (P-value)
ACL Tear on MRI	+	-	6.72 (<0.01)
+	138 (46.6%)	34 (11.4%)	
-	59 (19.9%)	65 (21.9%)	

Table No 3: Diagnostic performance of MRI in identifying ACL tears using arthroscopy as the reference standard

MRI	ACL Tear (95% CI)	χ^2
(p-value)	70.1% (63.4%, 76.2%)	460.8 (<0.01)
Specificity	65.7 % (56%, 74.5%)	189.3 (<0.01)
PPV	80.1% (73.9%, 85.7%)	698.1 (<0.01)
NPV	52.4% (43.6%, 61.1%)	136.6 (<0.01)
Diagnostic Accuracy	68%	

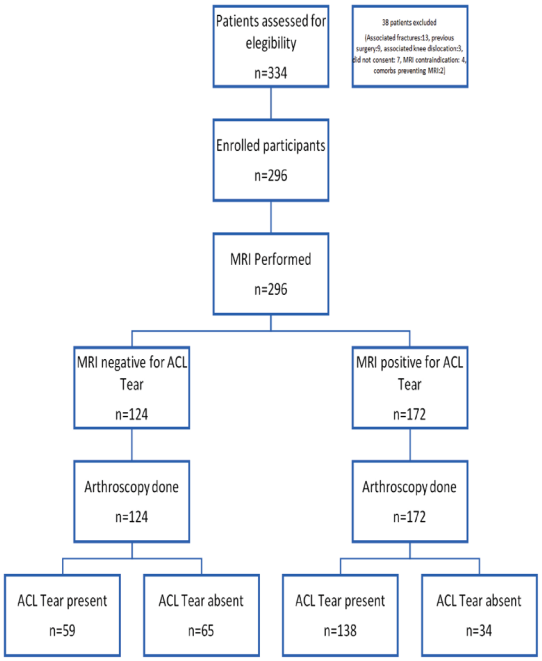

Fig 1:Patient flow diagram throughout the study

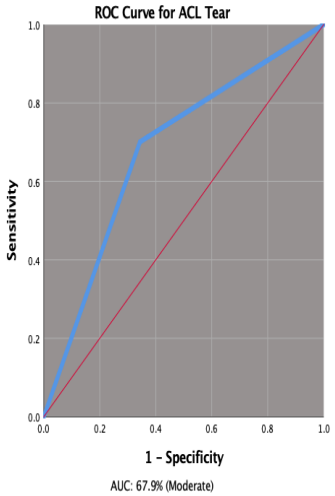

Fig 2: ROC curve for MRI in detecting ACL tears

DISCUSSION

In this study of 296 patients, MRI showed a sensitivity of 70.1% and a specificity of 65.7% for detecting ACL tears compared to arthroscopy, with an overall accuracy of 68%. This matches findings from a similar cross-sectional study of a local cohort, which reported comparable sensitivity (66.7%), specificity (75.9%), PPV (81.1%), and accuracy (70.3%) of MRI in diagnosing ACL injuries.[7]

However, our sensitivity is significantly lower than what has been reported in several international studies. For example, a prospective Chinese study of 78 patients found an MRI sensitivity of 95.45% and a specificity of

91.67% (accuracy of 94.87%) for diagnosing ACL injury.[9] A meta-analysis of 21 studies published between 2006 and 2016 pooled sensitivity and specificity at 87% and 90%, respectively (AUC = 0.93). [10] Similarly, high performance (> 90% sensitivity) was reported by a Pakistani cohort from Lahore (93.3% sensitivity, 85.7% specificity, accuracy 91.9%) and a military hospital study (93.2% sensitivity, 76.3% specificity, accuracy 90%). [11, 12]

Our lower sensitivity and specificity may be due to several factors. The use of a 1.5 T MRI scanner, which offers diagnostic accuracy comparable to 3 T for ACL injuries according to meta-analyses, [is one such factor.] Inclusion of partial tears, which are inherently more difficult to detect because they may resemble mucinous degeneration, exhibit normal or subtle signal changes, or present with ambiguous imaging features, likely reduced overall performance. This is supported by our subgroup analysis, in which complete tears showed higher diagnostic accuracy (78.9%) than partial tears (59.5%), aligning with the literature that indicates significant challenges in identifying nuanced or incomplete ligament disruptions. [13, 14]. Additionally, the timing of imaging affects accuracy: delayed MRIs may allow edema to resolve and scar tissue to form, obscuring ligament abnormalities, which has been shown to impact detection and agreement in related knee ligament pathology. [15] Finally, interpreter experience plays a role, as specialist musculoskeletal radiologists generally achieve higher diagnostic performance than general readers, and differences in expertise may have contributed to the moderate accuracy observed in our cohort, since radiologist experience influences accuracy. [16] Taken together, the combination of subtle partial tears, timing of imaging, and non-specialist interpretation likely explains our lower diagnostic performance compared to studies reporting higher accuracy under optimized conditions.

Conversely, several studies highlight that MRI's diagnostic accuracy may surpass that of manual examination in complex or partial injuries, although results vary depending on the reader's expertise. Navali et al. and Kostov et al. reported clinical tests (Lachman, anterior drawer) that, in some cases, matched or exceeded MRI accuracy when performed by experienced examiners. [17, 18] In other settings, MRI proved to be more sensitive, especially for complex injuries. [9, 19]

A related study evaluating the diagnostic performance of clinical tests for meniscal pathology concluded that clinical examination and MRI should be used together to enhance diagnostic accuracy. [20] These qualitative reports support the idea that MRI may both overcall and undercall tears in ambiguous cases, particularly if imaging is performed early when swelling is present, or if interpretation lacks specialized expertise.

Beyond diagnostic performance, AI integration is rapidly advancing ACL imaging. Deep learning models, especially convolutional neural networks, have demonstrated high accuracy in detecting ACL tears on MRI, often approaching or exceeding clinician performance, with pooled sensitivity and specificity reported around 87–91% in systematic analyses. [21]

Specific AI-assisted approaches have achieved near-perfect diagnostic accuracy in some studies, outperforming less-experienced readers. [22] Certain multicenter validations show strong generalizability across scanners and populations. [23] Machine learning models using multi-sequence radiomics have reported high AUCs with robust performance in both training and validation cohorts. [24] Together, these findings suggest that AI-enhanced imaging can improve diagnostic accuracy and streamline workflow efficiency.

Advanced quantitative MRI techniques, including 3D isotropic imaging, T2 mapping, diffusion tensor imaging, and super-resolution protocols, improve microstructural visualization of the ACL, enhancing the detection of subtle and partial tears. Although ACL-specific evidence remains limited, promising results from accelerated 3T deep learning–based imaging indicate strong future potential. [25] Diagnostic accuracy varies globally due to factors such as radiologist expertise, scanner variability, and injury chronicity; however, AI-assisted tools can help standardize interpretations and close this gap. These advances may also boost cost-effectiveness by reducing scan times and unnecessary arthroscopies, especially in resource-limited settings. [26, 27] Clinically, this supports an integrated diagnostic approach combining patient history, physical examination, and AI-enhanced MRI, with arthroscopy reserved for discordant cases pending further large-scale validation.

This study has several limitations. Including both complete and partial ACL tears, especially partial tears, likely reduced diagnostic accuracy, as shown in our subgroup analysis (complete tears 78.9% vs. partial tears 59.5%). Only one non-specialist radiologist interpreted the scans, which could have caused reader variability. Although all patients had arthroscopy, the single-center design might limit how well the results apply to other clinical settings. Also, differences in the timing of MRI after injury could have affected sensitivity, as delayed imaging may hide subtle ligament abnormalities.

Our PPV of 80.1% indicates that MRI-positive findings remain fairly predictive of ACL tears confirmed by arthroscopy in our setting. The lower NPV (52.4%) warns against ruling out ACL injury based solely on MRI-negative results. These findings reinforce that, while MRI provides useful non-invasive diagnostics, it should be interpreted alongside clinical examination and surgeon judgment, especially in cases of uncertain or partial tears. In such situations, arthroscopy is still essential for a definitive diagnosis.

CONCLUSION

MRI showed moderate diagnostic accuracy for ACL tears in our group, with an overall accuracy of 68%. While a positive MRI reliably confirms an ACL tear, the low negative predictive value (52.4%) indicates that a negative MRI cannot confidently rule out the injury. Therefore, clinical judgment should guide decisions, and arthroscopy remains the definitive standard, especially for partial or unclear injuries. MRI acts as a useful, non-invasive screening method, but negative results should not replace thorough clinical examination.

REFERENCES

1. Koster CH, Harmsen AM, Lichtenberg MC, Bloemers FW. ACL injury: How do the physical examination tests compare? J Fam Pract. 2018 Mar;67(3):130-134. PMID: 29509817.
2. Abdullah RH, Khattab RT, Ahmed AR. Role of magnetic resonance imaging in evaluation of anterior cruciate ligament injuries. Egypt J Hosp Med. 2017;69(7):2897–905. doi: 10.12816/0042584
3. Mohammed ER, Metwally NAES, Elaidy AAS. Role of magnetic resonance imaging in assessment of anterior cruciate ligament post-grafting cases in terms of graft integrity and complications. Egypt J Hosp Med. 2019;76(2):3446–53. doi: 10.21608/ejhm.2019.37930
4. 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. doi: 10.1016/j.ejrnm.2017.12.003
5. Krakowski P, Nogalski A, Jurkiewicz A, Karpi-ski R, Maciejewski R, Jonak J. Comparison of Diagnostic Accuracy of Physical Examination and MRI in the Most Common Knee Injuries. Applied Sciences. 2019; 9(19):4102. doi: 10.3390/app9194102
6. Takahashi S, Nagano Y, Ito W, Kido Y, Okuwaki T. A retrospective study of mechanisms of anterior cruciate ligament injuries in high school basketball, handball, judo, soccer, and volleyball. Medicine (Baltimore). 2019;98(26):e16030. doi: 10.1097/MD.0000000000016030
7. Ullah S, Shah DB, Khan Q, Khan MA, Janan H, Khan A. Diagnostic accuracy of magnetic resonance imaging (MRI) knee in detecting anterior cruciate ligament (ACL) tear, taking arthroscopy as gold standard. *J Pak Orthop Assoc*. 2021;33(2):53–6.
8. Cohen JF, Korevaar DA, Altman DG, Bruns DE, Gatsonis CA, Hooft L, et al. STARD 2015 guidelines for reporting diagnostic accuracy studies: explanation and elaboration. BMJ Open. 2016;6(11):e012799. doi: 10.1136/bmjopen-2016-012799
9. Zhao M, Zhou Y, Chang J, Hu J, Liu H, Wang S, Si D, Yuan Y, Li H. The accuracy of MRI in the diagnosis of anterior cruciate ligament injury. Ann Transl Med. 2020 Dec;8(24):1657. doi: 10.21037/atm-20-7391. PMID: 33490169; PMCID: PMC7812197.
10. Li K, Du J, Huang LX, Ni L, Liu T, Yang HL. The diagnostic accuracy of magnetic resonance imaging for anterior cruciate ligament injury in comparison to arthroscopy: a meta-analysis. Sci Rep. 2017 Aug 8;7(1):7583. doi: 10.1038/s41598-017-08133-4. PMID: 28790406; PMCID: PMC5548790.
11. Ahmad MW, Saeed A, Rashid N. Diagnostic accuracy of Magnetic resonance imaging (MRI) knee in detecting anterior cruciate ligament (ACL) tears assuming arthroscopy as gold standard. J Fatima Jinnah Med Univ. 2024;18(3):130–3. doi: 10.37018/bksk6936
12. Javaid A, Anam W, Ullah H, Afzal T, Mahmood R, Balooch S ud D. Diagnostic accuracy of Magnetic Resonance Imaging (MRI) in the detection of anterior cruciate ligament (ACL) tear, keeping arthroscopic findings as gold standard. Pak Armed Force Med J. 2023;73(5):1249–52. doi: 10.51253/pafmj.v73i5.7687
13. Cheng Q, Zhao FC. Comparison of 1.5- and 3.0-T magnetic resonance imaging for evaluating lesions of the knee: A systematic review and meta-analysis (PRISMA-compliant article). Medicine (Baltimore). 2018 Sep;97(38):e12401. doi: 10.1097/MD.0000000000012401.
14. Nouri N, Bouaziz MC, Riahi H, Mechri M, Kherfani A, Ouertatani M, Ladeb MF. Traumatic Meniscus and Cruciate Ligament Tears in Young Patients: A Comparison of 3T Versus 1.5T MRI. J Belg Soc Radiol. 2017 Mar 29;101(1):14. doi: 10.5334/jbr-btr.1158.
15. Han AX, Tan TJ, Nguyen T, Lee DY. Timing of magnetic resonance imaging affects the accuracy and interobserver agreement of anterolateral ligament tears detection in anterior cruciate ligament deficient knees. Knee Surgery & Related Research. 2020 Nov 27;32(1):64.
16. Gill SS, Haq T, Zhao Y, Ristic M, Amiras D, Gupte CM. AI demonstrates comparable diagnostic performance to radiologists in MRI detection of anterior cruciate ligament tears: a systematic review and meta-analysis. European Radiology. 2025 Sep 25:1-8.
17. Navali AM, Bazavar M, Mohseni MA, Safari B, Tabrizi A. Arthroscopic evaluation of the accuracy of clinical examination versus MRI in diagnosing meniscus tears and cruciate ligament ruptures. Arch Iran Med. 2013 Apr;16(4):229-32. PMID: 23496367.
18. Kostov H, Arsovski O, Kostova E, Nikolov V. Diagnostic assessment in anterior cruciate ligament (ACL) tears. Pril (Makedon Akad Nauk Umet Odd Med Nauki). 2014;35(1):209-18. PMID: 24798607.
19. Li X, Hou Q, Zhan X, Chang L, Ma X, Yuan H. The accuracy of MRI in diagnosing and classifying acute traumatic multiple ligament knee injuries. BMC Musculoskelet Disord. 2022 Jan 13;23(1):43. doi: 10.1186/s12891-021-04976-1.
20. Khan L, Shahrukh Q, Roghani AS, Ghaffar S, Hassan RE, Shah SS, Khan H, Tarangi IS, Noormal, Ali A. Diagnostic Accuracy of McMurray's Test for Meniscal Injury of the Knee Joint, Taking Arthroscopy as the Gold Standard. Cureus. 2025 May 12;17(5):e83970. doi: 10.7759/cureus.83970. PMID: 40519368; PMCID: PMC12162387.
21. Wolfgart JM, Hofmann UK, Praster M, Danalache M, Migliorini F, Feierabend M. Machine Learning to Recognise ACL Tears: A Systematic Review. Applied Sciences. 2025 Apr 22;15(9):4636.

22. Chen KH, Yang CY, Wang HY, Ma HL, Lee OK. Artificial Intelligence–Assisted Diagnosis of Anterior Cruciate Ligament Tears From Magnetic Resonance Images: Algorithm Development and Validation Study. Jmir Ai. 2022 Jul 26;1(1):e37508.

23. Tran A, Lassalle L, Zille P, Guillin R, Pluot E, Adam C, Charachon M, Brat H, Wallaert M, d'Assignies G, Rizk B. Deep learning to detect anterior cruciate ligament tear on knee MRI: multi-continental external validation. European Radiology. 2022 Dec;32(12):8394-403.

24. Cheng Q, Lin H, Zhao J, Lu X, Wang Q. Application of machine learning-based multi-sequence MRI radiomics in diagnosing anterior cruciate ligament tears. Journal of orthopaedic surgery and research. 2024 Jan 31;19(1):99.

25. Hall J. Could AI-Powered Abbreviated MRI Reinvent Detection for Structural Abnormalities of the Knee? Diagnostic Imaging. 2025 Apr 24; Available from: https://www.diagnosticimaging.com/view/ai-powered-abbreviated-mri-detection-structural-abnormalities-knee-?

26. Kunze KN, Rossi DM, White GM, Karhade AV, Deng J, Williams BT, Chahla J. Diagnostic performance of artificial intelligence for detection of anterior cruciate ligament and meniscus tears: a systematic review. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2021 Feb 1;37(2):771-81.

27. Minamoto Y, Akagi R, Maki S, Shiko Y, Tozawa R, Kimura S, Yamaguchi S, Kawasaki Y, Ohtori S, Sasho T. Automated detection of anterior cruciate ligament tears using a deep convolutional neural network. BMC musculoskeletal disorders. 2022 Jun 15;23(1):577.

CONFLICT OF INTEREST: Authors declare no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE: NIL

Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Ali W	✓	✓	×	×	✓	×
Shah SDA	✓	×	✓	✓	✓	×
Khan L	✓	✓	×	×	×	✓
Ali A	✓	×	✓	✓	✓	×
Raza MM	✓	✓	×	×	×	✓
Khan Z	✓	×	✓	✓	✓	×
Ullah S	✓	×	✓	✓	✓	×
Hassan RE	✓	✓	×	×	×	✓

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethical Approval:

This study was approved by the Institutional Ethical Review Board of Khyber Teaching Hospital, Peshawar, Pakistan Vide No. 460/DME/KMC, Dated 06/06/2024