Original Article
DOI: https://doi.org/10.70749/ijbr.v3i4.1108

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://induspublishers.com/IJBR
ISSN: 2960-2793/ 2960-2807

Diagnostic Accuracy of Magnetic Resonance Imaging Knee in Diagnosis of Anterior Cruciate Ligament Tear Taking Arthroscopy as Gold Standard

Remsha Hameed Khan[1], Javed Iqbal[2], Adnan Ahmad[1], Seemab Kamal[2]

[1]Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro, Sindh, Pakistan.
[2]Lady Reading Hospital, Peshawar, KP, Pakistan.

ARTICLE INFO

Keywords

Anterior Cruciate Ligament, MRI, Arthroscopy, Diagnostic Accuracy.

Corresponding Author: Remsha Hameed Khan,
Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro, Sindh, Pakistan.
Email: remsha.hameed71@gmail.com

Declaration

Authors' Contribution: All authors equally contributed to the study and approved the final manuscript. *Detail is given at the end.
Conflict of Interest: No conflict of interest.
Funding: No funding received by the authors.

Article History

Received: 09-01-2025, Revised: 12-03-2025
Accepted: 04-04-2025, Published: 30-04-2025

ABSTRACT

Background: Anterior cruciate ligament (ACL) tears are knee injuries that commonly occur and may severely affect the quality of joint function. Diagnosis of an ACL tear is commonly done with MRI, but accuracy will be dependent on several factors. **Objective:** To determine the diagnostic accuracy of magnetic resonance imaging knee in diagnosis of anterior cruciate ligament tear taking arthroscopy as gold standard. **Study Design:** Cross-sectional validation study. **Duration and Place of Study:** The study was conducted from January 2024 to June 2024 at the Radiology Department of Lady Reading Hospital, Peshawar. **Methodology:** A total of 160 patients between 18–60 years of age with symptoms consistent with ACL tears were enrolled. The imaging sequences used for MRI included a variety of different sequences on a Toshiba 1.5T machine. All patients underwent arthroscopic evaluation and results were compared with MRI findings. **Results:** The mean age of participants was 30.0 ± 9.29 years. MRI identified 132 positive cases (82.5%) and 28 negative cases (17.5%), while arthroscopy confirmed 136 positive cases (85%) and 24 negative cases (15%). The diagnostic accuracy of MRI was 86%, with a sensitivity of 90%, specificity of 63%, positive predictive value (PPV) of 93%, and negative predictive value (NPV) of 54%. **Conclusion:** MRI is a safe and noninvasive modality for ACL tear detection with a diagnostic accuracy similar to arthroscopy.

INTRODUCTION

The anterior cruciate ligament (ACL) is also responsible for stabilizing the knee joint and helps limit excessive rotation and valgus/varus movement, and limit movement of the tibia in an anterior direction relative to the femur.[1] The most common causes of ACL injuries are those involving sudden changes in direction, jumping and deceleration, including soccer, basketball, and downhill skiing.[2] The ACL tear causes severe pain, edema of the knee, instability of the knee joint and inability to weight bear.[3] If untreated, this injury can become chronic knee joint instability and hurts other structures in the knee including the menisci and articular cartilage.[4] If the tear is incomplete, it can be treated non-operative, however more severe tears will require surgery to help get the best result in the long term.

An accurate diagnosis of an ACL tear is essential to ensuring proper treatment.[5] Diagnosis involves a proper clinical examination, through a proper patient history and examination. Clinicians can test the integrity of the ACL with routine clinical tests such as the Lachman test, anterior drawer test, and pivot shift test.[6] In the case of a partial tear or when physical examination produces findings that are unconvincing or inconclusive in making the diagnosis, physical examination alone becomes insufficient. Making a diagnosis is aided by imaging techniques, and the most common noninvasive technique for seeing ACL and other structures of the knee is Magnetic Resonance Imaging (MRI).[7]

Magnetic Resonance Imaging (MRI) became the standard in diagnosing ACL tears due to its ability to take clear non-invasive images of the knee's internal structures.[8] MRI uses strong magnetic fields and radio waves to create images of soft tissues including ligaments, cartilage, and muscle without exposing the patient to ionizing radiation. In the diagnosis of ACL tears, MRI is very accurate in diagnosing complete and partial tears with very high sensitivity and specificity in diagnosing ACL injuries as reported in scientific

Copyright © 2025. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.

literature.[9] MRI capacity to visualize concomitant injuries such as meniscal damage and damage to the cartilage qualifies it as an essential tool in the examination of the knee as a unit. MRI also allows pre-operative planning and evaluation by the surgeon to establish the extent of damage and the most suitable approach to surgery.[10]

Arthroscopy remains the gold standard in the diagnosis and treatment of ACL tears because of the direct visual examination of the knee's internal structures through a small camera inside the joint.[11] This minimally invasive procedure allows the surgeon to not only confirm the presence of an ACL tear but also ascertain the severity of damage and any accompanying damage to the supporting tissues such as the menisci and articular cartilage.[12] Although invasive in nature compared to MRI, arthroscopy provides an definitive diagnosis and accompanying therapy in the form of ligament reconstruction where indicated. Arthroscopic surgery benefits from shorter recovery times and fewer complications compared to open surgery.[13] Despite the specificity of arthroscopy in the diagnosis of ACL injuries, MRI remains an excellent and first-line imaging technique due to its non-invasive nature, speed of examination, and ability to image an spectrum of knee structures.[14]

A study found that 55.4% of patients exhibited tears of the anterior cruciate ligament (ACL).[15] Another investigation assessed the diagnostic performance of MRI for ACL tears, reporting a sensitivity of 66.67% and a specificity of 75.90%.[16]

The research is warranted by the necessity to accurately and timely diagnose anterior cruciate ligament (ACL) tears in order to guide effective treatment and improve patient outcomes. Magnetic Resonance Imaging (MRI) is one of the most commonly used modalities to evaluate ACL injury; however, its diagnostic accuracy in the form of sensitivity and specificity is a subject of ongoing research. Identification of the accuracy of MRI for diagnosing ACL tears is necessary to ensure optimal clinical decision-making and appropriate management of knee injury. The purpose of the research is to identify the diagnostic accuracy of MRI for detecting ACL tears to optimize its clinical utility and patient care.

METHODOLOGY

A cross sectional study was done during six months in Radiology Department of Lady Reading Hospital Peshawar. The sample included a total of 160 patients, and the sample size was calculated using World Health Organization Sample Size Calculator with a confidence level of 95% and a margin of error 10% keeping into account the estimated frequency of ACL tear and previously reported sensitivity and specificity values of MRI for this pathology.[15,16]

Inclusion criteria was individuals aged between 18 and 60 years, presenting with at least three of the following symptoms: popping sensation at the time of injury, knee pain, knee swelling, and restricted range of motion. Patients with a history of knee surgery, femoral condyle fractures, or tibial plateau fractures were excluded. After obtaining written informed consent, demographic details, including age, gender, and address, were recorded on a pre-designed proforma, and each patient underwent a medical and physical assessment.

Subsequently, patients underwent MRI at the hospital's radiology department. The MRI was conducted using a Toshiba 1.5 Model Vantage machine, with imaging sequences such as T2 Axial, T2 Coronal, PD Coronal, T1 Sagittal, T2 Sagittal, and GRI Sagittal. Slice thickness ranged from 4.5 to 5 mm. A radiology fellow supervised the MRI process, and findings were interpreted in accordance with predefined criteria for diagnosing ACL tears. Following the MRI, all patients underwent arthroscopic evaluation, performed under the supervision of an orthopedic fellow, with results noted and compared to MRI findings.

Data analysis was performed using SPSS software version 25. Descriptive statistics that included mean ± standard deviation were calculated for continuous variables such as age and duration of injury. Categorical variables such as MRI findings, arthroscopic findings, sensitivity, specificity, positive predictive value, and negative predictive value were presented as frequencies and percentages. Diagnostic accuracy of MRI was established by using a 2x2 table, with MRI findings compared with arthroscopic findings as the reference standard. Stratified analysis based on age, gender, and duration of injury was performed to identify effect modifiers. Chi-square tests at a 5% level of significance were employed to establish post-stratification differences.

Results

As shown in Table-I, the mean age of participants was 30.0 ± 9.29 years, with an average injury duration of 25.3 ± 12.15 days. The cohort consisted predominantly of males (95.6%) with only 4.4% females.

Table I

Patient Demographics

Demographics		Mean ± SD / n (%)
Age (years)		30.025±9.29
Duration of Injury (days)		25.319±12.15
Gender	Male	153 (95.6%)
	Female	7 (4.4%)

Table-II presents the results of MRI and arthroscopy in diagnosing ACL tears, where MRI showed 132 positive cases (82.5%) and 28 negative cases (17.5%), while arthroscopy revealed 136 positive cases (85%) and 24 negative cases (15%).

Copyright © 2025. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.

Table II

Overall results of MRI and Arthroscopy in diagnosis of anterior cruciate ligament tear

Anterior Cruciate Ligament Tear	MRI	Arthroscopy
Positive	132(82.5%)	136(85%)
Negative	28(17.5%)	24(15%)
Total	160 (100%)	160 (100%)

Table-III compares MRI and arthroscopy with respect to true positives (TP), false positives (FP), false negatives (FN), and true negatives (TN). The chi-square value was 39.60, and the p-value was highly significant (0.000), indicating a strong association between the two diagnostic methods.

Table III

Comparison of MRI versus Arthroscopy in diagnosis of anterior cruciate ligament tear

MRI	Arthroscopy		Total
	Positive	Negative	
Positive	123 (TP)	9 (FP)	132
Negative	13 (FN)	15 (TN)	28
Total	136	24	160

Chi square = 39.60
P value = 0.000

Key:

TP = True positive
FP = False positive
FN = False negative
TN = True negative

Table-IV presents the diagnostic parameters for MRI in ACL diagnosis, showing a sensitivity of 90%, specificity of 63%, diagnostic accuracy (DA) of 86%, positive predictive value (PPV) of 93%, and negative predictive value (NPV) of 54%.

Table IV

Sensitivity, Specificity, Diagnostic Accuracy, PPV and NPV of MRI in diagnosis of anterior cruciate ligament tear

Diagnostic Parameter	Result
Sensitivity	90%
Specificity	63%
Diagnostic Accuracy	86%
PPV	93%
NPV	54%

In the stratified analysis of diagnostic parameters based on age, gender, and injury duration (Table-V), the following findings were noted: For participants aged ≤40 years, MRI had high sensitivity (91%), specificity (79%), and diagnostic accuracy (89%), with a PPV of 96% and NPV of 86%. However, for those aged >40 years, sensitivity decreased to 88%, and specificity dropped to 0%, with lower diagnostic accuracy (68%), PPV of 75%, and NPV of 0%. Regarding gender, males showed good diagnostic parameters, including a sensitivity of 90%, specificity of 77%, and PPV of 97%, whereas females had a very poor performance with a sensitivity of 0%, specificity of 29%, and a PPV of 0%. For injury durations ≤30 days, sensitivity was 86%, specificity was 63%, with a diagnostic accuracy of 82%, while for injury durations >30 days, the sensitivity increased to 100%, with specificity at 60%, diagnostic accuracy at 96%, and a PPV of 96%.

Table V

Stratified analysis of Sensitivity, Specificity, Diagnostic Accuracy, PPV and NPV of MRI in diagnosis of anterior cruciate ligament tear with age, gender and duration of injury

Variables	Groups	Diagnostic Parameter	Result
Age (years)	≤40	Sen	91%
		Spec	79%
		DA	89%
		PPV	96%
		NPV	86%
	>40	Sen	88%
		Spec	0%
		DA	68%
		PPV	75%
		NPV	0%
Gender	Male	Sen	90%
		Spec	77%
		DA	89%
		PPV	97%
		NPV	50%
	Female	Sen	0%
		Spec	29%
		DA	29%
		PPV	0%
		NPV	100%
Duration of Injury (days)	≤30	Sen	86%
		Spec	63%
		DA	82%
		PPV	92%
		NPV	48%
	>30	Sen	100%
		Spec	60%
		DA	96%
		PPV	96%
		NPV	100%

DISCUSSION

The results in this study demonstrate that MRI is a very useful diagnostic technique for ACL tears with 90% sensitivity, 63% specificity, 86% diagnostic accuracy, 93% PPV, and 54% NPV. This renders MRI an optimal first diagnostic tool in clinical practice where arthroscopy cannot be done in a timely fashion or is not indicated. The high sensitivity (90%) proves that MRI is very efficient to find true positive cases, which is very important to detect early and intervene. While the 63% specificity is moderate, MRI can diagnose ACL tears correctly in 63% of patients, and even if the MRI is done correctly, false positives can occur, most often in patients with other knee pathology that can mimic ACL tears. The high PPV of 93% emphasizes the efficacy of MRI in confirming suspected tears (when positive for ACL tear, it is almost always true). However, there is some doubt regarding a negative MRI reading: although the lower NPV (54%) does suggest, a negative MRI

Copyright © 2025. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.

should be taken with a degree of caution, especially when clinical suspicion for ACL injury is high.

However, stratified analyses also indicate that MRI diagnostic performance is dependent on age, gender and duration of injury. In patients ≤ 40 years old, the MRI was most accurate, perhaps because less degenerative change could lead to interpretation complications. The poor performance in females, 0% sensitivity, however points to possible anatomical/hormonal differences which affect the accuracy of MRI in this population, which should be investigated. Similarly, the greater accuracy of the MRI in patients with injury durations >30 days in diagnosing ACL tears can be attributed to more severe and better-defined tissue changes over time that enhance the diagnostic capability of MRI.

These results are in accordance with other scientific work that has explored the diagnostic utility of MRI in detecting ACL tears. In one such study, Ashfaq Ahmed et al. [17] reported 93.33% sensitivity, 85.71% specificity, and 91.89% diagnostic accuracy. These results show the identical trend in the performance of MRI for the diagnosis of ACL tears. Both sensitivity and specificity in the two studies are very high, indicating the ability of MRI to correctly identify most of the true positive cases. There is, however, variation in specificity, with our study reporting lower specificity (63%) compared to Ahmed's study (85.71%). This could be due to differences in the study population, including the nature of the injury or other pathology around the knee joint that could affect the accuracy of MRI. The recruitment of patients with varying durations of injury in our study could also have affected the specificity.

Similarly, Muhammad Afaq et al. [18] also reported 92.31% sensitivity, 87.23% specificity, and 90.40% diagnostic accuracy. These findings are similar to our study, with sensitivity and diagnostic accuracy being identical. Specificity in their study was higher compared to our study, which again could be because of differences in patient populations or MRI protocols.

Conversely, Shakir Ullah et al. [16] reported 66.67% sensitivity, 75.90% specificity, and 70.28% diagnostic accuracy. Their results are lower, as far as sensitivity and diagnostic accuracy are concerned, compared to our study. This could be due to patient selection as their study had a lower number of patients and possibly a different injury distribution. The lower sensitivity in their study shows that MRI was less sensitive in detecting true positive cases, and this could be due to the fact that the study was focusing on a different patient group or employing a less standardized MRI protocol.

Considering the stratified analysis in our research, we noted that the performance of MRI was influenced by age, gender, and injury duration. In patients ≤40 years of age, MRI performed exceptionally well, with 91% sensitivity, 79% specificity, and 89% diagnostic accuracy, the same as the findings of Ayesha Javaid et al. [19] They noted 93.20% sensitivity, 76.31% specificity, and 90% diagnostic accuracy. Both studies reveal that the performance of MRI is better in younger patients, which is due to less complex injury patterns and clearer MRI images in this age group. Also, the difference in specificity in our research (79%) and that of them (76.31%) is due to the difference in the severity or nature of injury in the study populations.

On the contrary, for patients >40 years, we observed a striking drop in specificity (0%) and a significant drop in diagnostic accuracy (68%), a result not observed in the other studies. That would suggest that MRI is less reliable in older age groups, perhaps due to the fact that degenerative changes in the knee joint might affect the accuracy of MRI, in a way that it is difficult to distinguish between ACL tears and aging changes.

For gender variation, our study found that males had 90% sensitivity, 77% specificity, and 97% PPV, similar to Ayesha Javaid et al.'s [19] study, who also found high diagnostic accuracy in males. Our study's females, on the other hand, had extremely poor diagnostic indices, with 0% sensitivity, 29% specificity, and 0% PPV. This variation may be explained by anatomical differences or hormonal variations between genders that may influence the diagnostic capability of MRI. Other studies, like that of Ahmed et al. [17] have also found that MRI may be less accurate in females, particularly in diagnosing ACL tears.

For injury duration, we observed that MRI was better in patients with injury durations >30 days, with 100% sensitivity, 60% specificity, and 96% diagnostic accuracy. This agrees with a study by Muhammad Afaq et al. [18] where they observed high sensitivity and diagnostic accuracy. The longer duration of injury likely allows more pronounced changes to take place in the ACL that are readily detected by MRI as tears.

The observed variation in sensitivity, specificity, and diagnostic accuracy underscores the necessity of considering variables such as age, gender, and injury duration in MRI utilization in ACL diagnosis. The results confirm MRI as a valuable preoperative imaging in suspected ACL injury management, despite the fact that arthroscopy is the gold standard, especially in more complex cases or in the presence of inconclusive MRI results.

Nevertheless, our study has some limitations. However, this is a single center study and the results of this study may differ in other geographical areas or health care facilities. One limitation of the results may be a relatively small sample size. Secondly, it did not take the differences between MRI methods used into account as they might affect the comparability and quality of the results. In the future, the results will need to be confirmed on large scale and multi center studies

Copyright © 2025. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.

to investigate determinants of the diagnostic accuracy of MRI in ACL injury detection.

CONCLUSION

We conclude from our study that MRI is a reliable and noninvasive diagnostic tool for ACL tears and its diagnostic accuracy is high as compared with arthroscopy. Though MRI offers much in terms of info, the quality of the read depends on several variables, like age, gender and the duration of the injury. Although it has good tests, MRI should be used as a supplement to the exam, not as the gold standard for diagnosing ACL tears except in complex or ambiguous cases.

Acknowledgments

The commitment and thoroughness shown by the medical team in maintaining precise records and managing patient information in an organized manner is truly commendable and greatly valued.

Author's Contribution

The authors have each played a key role in the creation of this manuscript, as outlined below.
Dr. Remsha Hameed Khan was responsible for the study's conceptualization, drafting the article, and gathering hospital data.
Dr. Javed Iqbal assisted in the development of the article, the conceptualization of the study, as well as the analysis and interpretation of the data.

REFERENCES

1. Ye, B., Liu, G., He, Z., Xu, J., Pan, H., & Zhu, H. (2024). Biomechanical mechanisms of anterior cruciate ligament injury in the jerk dip phase of clean and jerk: A case study of an injury event captured on-site. *Heliyon*, *10*(11), e31390. https://doi.org/10.1016/j.heliyon.2024.e31390
2. Schick, S., Cantrell, C. K., Young, B., Mosher, Z., Ewing, M., Elphingstone, J. W., Brabston, E., Ponce, B. A., & Momaya, A. M. (2023). The mechanism of anterior cruciate ligament injuries in the National Football League: A systematic video review. *Cureus*. https://doi.org/10.7759/cureus.34291
3. Jenkins, S. M., Guzman, A., Gardner, B. B., Bryant, S. A., Del Sol, S. R., McGahan, P., & Chen, J. (2022). Rehabilitation after anterior cruciate ligament injury: Review of current literature and recommendations. *Current Reviews in Musculoskeletal Medicine*, *15*(3), 170-179. https://doi.org/10.1007/s12178-022-09752-9
4. Agarwal, V., Kale, A., & Khandge, A. (2023). Influence of Meniscal repair vs. meniscectomy on anterior cruciate ligament reconstruction in terms of knee stability and radiological imaging. *Cureus*. https://doi.org/10.7759/cureus.43396
5. Shom, P., Varma, A. R., & Prasad, R. (2023). The anterior cruciate ligament: Principles of treatment. *Cureus*. https://doi.org/10.7759/cureus.40269
6. Rodriguez, K., Soni, M., Joshi, P. K., Patel, S. C., Shreya, D., Zamora, D. I., Patel, G. S., Grossmann, I., & Sange, I. (2021). Anterior cruciate ligament injury: Conservative versus surgical treatment. *Cureus*. https://doi.org/10.7759/cureus.20206
7. Al Mohammad, B., & Gharaibeh, M. (2024). Magnetic resonance imaging of anterior cruciate ligament injury. *Orthopedic Research and Reviews*, *16*, 233-242. https://doi.org/10.2147/orr.s450336
8. Qiu, Z., Xie, Z., Lin, H., Li, Y., Ye, Q., Wang, M., Li, S., Zhao, Y., & Chen, H. (2024). Learning Co-plane attention across MRI sequences for diagnosing twelve types of knee abnormalities. *Nature Communications*, *15*(1). https://doi.org/10.1038/s41467-024-51888-4
9. Kulwin, R. L., Schmidt, G. J., Snyder, D. A., & Klitzman, R. G. (2023). Clinical examination in the diagnosis of anterior cruciate ligament injury: A blinded, cross-sectional evaluation. *JAAOS: Global Research and Reviews*, *7*(2). https://doi.org/10.5435/jaaosglobal-d-22-00123
10. Risvas, K., Stanev, D., Benos, L., Filip, K., Tsaopoulos, D., & Moustakas, K. (2022). Evaluation of anterior cruciate ligament surgical reconstruction through finite element analysis. *Scientific Reports*, *12*(1). https://doi.org/10.1038/s41598-022-11601-1
11. Klein, E., & Solomon, D. (2023). Editorial commentary: Arthroscopy is the gold standard for diagnosis of Meniscal ramp lesions: Magnetic resonance imaging also may be helpful. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, *39*(3), 600-601. https://doi.org/10.1016/j.arthro.2022.12.007
12. Ji, C., Chen, Y., Zhu, L., & Zhang, J. (2021). Arthroscopic anterior cruciate ligament injury in clinical treatment of joint complications and CT observation. *Journal of Healthcare*

Copyright © 2025. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.

Engineering, *2021*, 1-10. https://doi.org/10.1155/2021/6667046

13. Papaleontiou, A., Poupard, A. M., Mahajan, U. D., & Tsantanis, P. (2024). Conservative vs surgical treatment of anterior cruciate ligament rupture: A systematic review. *Cureus*. https://doi.org/10.7759/cureus.56532
14. Chen, C., Liu, X., Wu, P., Liang, Q., Peng, S., Hu, P., & Liao, Y. (2024). High-resolution oblique coronal MRI at optimal flexed-knee angle: A novel imaging method for enhanced anterior cruciate ligament tear diagnosis. *Journal of Orthopaedic Surgery and Research*, *19*(1). https://doi.org/10.1186/s13018-024-04956-w
15. Eldeen, D. S., Abdulmalek, B. Y., Sohail, Y. R., Shaker, A. A., Hussain, S. K., & Riyad Ali, A. A. (2020). Prevalence of anterior cruciate ligament injury and other ligament injuries among the Saudi community in Jeddah city, Saudi Arabia. *International Journal of Radiology and Imaging Techniques*, *6*(1). https://doi.org/10.23937/2572-3235.1510062
16. Shah, S. D. B. A., Khan, Q., Khan, M. A., & Janan, H. (2021). Diagnostic accuracy of Magnetic Resonance Imaging (MRI) Knee in detecting Anterior Cruciate Ligament (ACL) tear taking arthroscopy as gold standard. *Journal of Pakistan Orthopaedic Association*, *33*(02), 53-56.
17. Ahmed, A., Razzaque, M. A., Kaleem, M., Zaman, A. U., Akram, R., & Javed, S. (2017). Diagnostic accuracy of magnetic resonance imaging in detecting anterior cruciate ligament injuries. *Medical Journal of Indonesia*, *26*(3), 218-23. https://doi.org/10.13181/mji.v26i3.1873
18. Afaq, M., Talib, A., Nasim, R., Javed, K., Butt, H. A., Shahid, F., & Uddin, I. (2022). Diagnostic accuracy of magnetic resonance imaging in diagnosing ACL injuries taking arthroscopy as gold standard. *Pakistan Journal of Medical and Health Sciences*, *16*(11), 430-432. https://doi.org/10.53350/pjmhs20221611430
19. Javaid, A., Anam, W., Ullah, H., Afzal, T., Mahmood, R., & Salah ud din Balooch. (2023). Diagnostic accuracy of magnetic resonance imaging (MRI) in the detection of anterior cruciate ligament (ACL) tear, keeping Arthroscopic findings as gold standard. *Pakistan Armed Forces Medical Journal*, *73*(5), 1249-1252. https://doi.org/10.51253/pafmj.v73i5.7687

Copyright © 2025. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.