

Diagnostic significance of magnetic resonance imaging in detecting meniscal injuries of the knee joint

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Relevance: Meniscal injuries are among the most common causes of knee pain, functional impairment, and disability in both athletes and the general population. Accurate diagnosis of meniscal lesions is essential for selecting appropriate treatment strategies and preventing the progression of degenerative joint changes. Arthroscopy is considered the gold standard for diagnosing meniscal injuries; however, it is an invasive procedure. Magnetic Resonance Imaging (MRI) is a non-invasive imaging modality that provides detailed visualization of soft tissue structures of the knee joint. Therefore, evaluating the diagnostic accuracy of MRI in detecting meniscal injuries remains a relevant issue in modern musculoskeletal radiology.

Objective: to assess the diagnostic significance of Magnetic Resonance Imaging (MRI) in detecting meniscal injuries of the knee joint by comparing MRI findings with arthroscopic results.

Materials and Methods: A study included 92 patients with clinical suspicion of meniscal injury who underwent MRI examination followed by diagnostic or therapeutic arthroscopy. The study population consisted of 56 males (60.9%) and 36 females (39.1%), with a mean age of 34.7 ± 9.8 years. MRI examinations were performed using a 1.5-T scanner with standard knee protocols including T1-weighted, T2-weighted, proton density (PD), and fat-suppressed sequences in sagittal, coronal, and axial planes.

Arthroscopic findings were used as the reference standard. The diagnostic performance of MRI was evaluated by calculating sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy. Statistical analysis was performed using SPSS 27.0 software. Quantitative data were expressed as mean $\pm$ standard deviation ($M \pm SD$). Categorical variables were analyzed using the Chi-square (χ^2) test. Agreement between MRI and arthroscopic findings was assessed using Cohen's kappa coefficient (κ). A p-value < 0.05 was considered statistically significant.

Results: Arthroscopy confirmed meniscal tears in 71 of 92 patients (77.2%). MRI correctly identified meniscal injuries in 68 of these patients and correctly excluded injury in 18 of 21 patients without tears.

The sensitivity of MRI for detecting meniscal tears was 95.8% (95% CI: 88.4–99.1%), while specificity was 85.7% (95% CI: 63.7–97.0%). The positive predictive value was 95.8%, and the negative predictive value was 85.7%. The overall diagnostic accuracy of MRI reached 93.5%.

A statistically significant agreement was observed between MRI and arthroscopic findings ($\kappa = 0.84$, $p < 0.001$), indicating excellent concordance. Medial meniscal tears were detected in 49 patients (53.3%), whereas lateral meniscal tears were identified in 22 patients (23.9%). MRI demonstrated slightly higher sensitivity for medial meniscal lesions (97.9%) compared to lateral meniscal lesions (90.9%), although the difference was not statistically significant ($p = 0.184$).

Grade III meniscal tears represented the most frequent injury pattern, accounting for 61.9% of all confirmed lesions. Associated anterior cruciate ligament (ACL) injuries were identified in 27 patients (29.3%), emphasizing the value of MRI in evaluating concomitant intra-articular pathology.

Conclusion: MRI is a highly accurate and reliable non-invasive imaging modality for diagnosing meniscal injuries of the knee joint. The technique demonstrates excellent sensitivity, specificity, and agreement with arthroscopic findings. MRI enables comprehensive assessment of meniscal tears and associated ligamentous injuries, making it the preferred imaging method for preoperative evaluation and treatment planning in patients with suspected meniscal pathology.

Keywords: knee joint, meniscal injury, meniscal tear, magnetic resonance imaging, MRI, arthroscopy, diagnostic accuracy, musculoskeletal radiology, statistical analysis.