

SONOGRAPHY AND MENISCUS TEAR

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Abstract

This study aimed to evaluate the effectiveness of ultrasound (US) in diagnosing meniscal degeneration and tears in comparison with magnetic resonance imaging (MRI) and arthroscopy. A total of 35 patients participated in the study and were divided into two age groups (≤ 35 years and > 35 years). Following MRI and US examinations, 25 patients also underwent arthroscopic evaluation. Statistical comparisons were performed using the kappa agreement test, chi-square test, and McNemar test where appropriate. US was found to be less effective than MRI in detecting meniscal degeneration. For meniscal tears, US demonstrated a sensitivity of 90.9% and a specificity of 63.6%, whereas MRI showed a sensitivity of 93.3% and a specificity of 100%. The medial meniscus posterior horn was the region most effectively visualized by US, while the main bodies of the menisci were more challenging to assess. In patients aged ≤ 35 years, US achieved a sensitivity and specificity of 80% and 100%, respectively, compared to 66.7% and 75% in patients over 35 years.

Keywords: Meniscal lesions, ultrasound, magnetic resonance imaging, arthroscopy.

Introduction

The knee is one of the most frequently used joints in the human body and is highly susceptible to sports-related injuries. Meniscal tears and degenerative changes are among the most common meniscal disorders. Magnetic resonance imaging (MRI) has a diagnostic accuracy comparable to that of arthroscopy and is therefore considered the gold standard for evaluating internal meniscal derangements, including tears and degeneration (1,2). However, MRI is not always readily accessible, lacks the ability to perform dynamic assessments, and is both time-consuming and costly. In contrast, ultrasound (US) is a non-invasive, widely available, and cost-effective imaging method that allows for dynamic testing. Nevertheless, concerns remain regarding its diagnostic reliability (2,3).

The purpose of the study

The objective of this study was to evaluate the effectiveness of ultrasound (US) compared to MRI in detecting meniscal tears and degeneration. Patients referred to the radiology department with clinically suspected meniscal pathology underwent US and MRI, and the results were compared with findings from arthroscopic surgery to assess the accuracy of each imaging method. The study was designed to examine the medial and lateral menisci, as well as their anterior, posterior, and body regions, separately for each imaging modality. Additionally, patients were categorized by age to evaluate the influence of meniscal anatomy and patient age on the diagnostic performance and limitations of US.



Materials and methods

All patients in the study were referred to our department following a clinical examination by an orthopedist who suspected meniscal pathologies, such as tears or degeneration. Each participant was fully informed about the study and provided their written consent. Approval from the institutional review board was also obtained. The study included 35 patients experiencing knee pain and locking. All participants underwent both MRI and ultrasound (US) examinations, and 22 of them also underwent arthroscopic surgery. The MRI and US examinations were performed by radiologists who were blinded to the findings of the other modality. Typically, the MRI and US exams were conducted on the same day or within a few days of each other, with MRI being performed first. Decisions regarding arthroscopy were based on both radiological and clinical findings made by orthopedic surgeons. The medial and lateral menisci were analyzed for tears and degeneration, focusing on the anterior horn, posterior horn, and body of each meniscus. Subsequently, the patients were divided into two age groups—those aged ≤ 35 years and those older than 35 years—to compare the findings across the groups.

Results

MRI and ultrasound (US) examinations of the knee were conducted on 35 patients (25 males and 10 females), aged between 19 and 65 years. Of these, 22 patients underwent arthroscopic evaluation and surgery, allowing for a comparison of the arthroscopic findings with MRI and US results. Since the internal structure of the meniscus cannot be assessed via arthroscopy, degeneration was evaluated only based on MRI and US findings. Ultrasound identified meniscal degeneration in 15 of the 35 patients (43%), while MRI detected it in 23 of the 35 patients (65.7%). Table 2 outlines the degeneration patterns in different parts of the meniscus as observed by MRI and US. No degeneration was detected by US in the meniscal body; therefore, no comparative statistical analysis was performed for this region. The medial meniscus posterior horn showed the highest incidence of degeneration, with 11 patients (40.7%) affected. Using the κ test, the agreement between MRI and US for detecting degeneration was low, with a κ value below 0.5 ($P = 0.123$), indicating poor statistical concordance. Moderate agreement was found only in the lateral meniscus anterior horn ($\kappa = 0.5\text{--}0.75$, $P = 0.0017$), whereas other regions (medial meniscus anterior horn, medial meniscus posterior horn, and lateral meniscus posterior horn) showed poor agreement with κ values below 0.5. In the 35 patients, a total of 24 meniscal tears in 22 patients were detected by US, compared to 45 tears in 27 patients identified by MRI. Among the 22 patients who underwent arthroscopy, 21 tears in 14 patients were confirmed. The distribution of meniscal tears by region and detection method (US, MRI, and arthroscopy) is detailed in Table 3. Most tears were located in the medial meniscus posterior horn. Moderate agreement was observed between US and arthroscopy ($\kappa = 0.5\text{--}0.75$, $P = 0.008$) and between US and MRI ($\kappa = 0.5\text{--}0.75$, $P = 0.005$) for tear detection. MRI and arthroscopy showed higher agreement ($\kappa > 0.75$, $P < 0.001$). US demonstrated a sensitivity of 90.9% and a specificity of 63.6% for detecting meniscal tears. One tear detected by US was not confirmed by arthroscopy (9.1% false positive), and four tears confirmed by arthroscopy were missed by US (36.4% false negative). MRI had a sensitivity of 93.3% and a specificity of 100% for tear detection. Only one tear reported by MRI was not confirmed by arthroscopy (6.7% false positive), and no false negatives were observed.



Conclusion

Ultrasound (US) is not a reliable replacement for MRI in the routine diagnosis of meniscal lesions. MRI demonstrates greater sensitivity in detecting both tears and degeneration compared to US. However, in specific situations—such as in younger patients, traumatic injuries, or cases where MRI is contraindicated—US can serve as a quick preliminary screening tool to prioritize patients for further evaluation. Notably, in patients aged 35 years or younger, the sensitivity and specificity of US improve significantly. While US is relatively effective at visualizing the posterior horns of the menisci, it has limited capability to adequately assess the meniscal bodies.

LITERATURE

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