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Original Research Article

Evaluation of Lateral Epicondylitis using MRI: A Clinical Study

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Abstract:

Introduction: Lateral epicondylitis results from repetitive strain on the extensor and supinator muscles of the wrist and forearm. Magnetic resonance imaging (MRI), known for its superior soft tissue contrast resolution, has shown satisfactory sensitivity, specificity, and accuracy in diagnosing lateral epicondylitis. The purpose of this research was to assess the effectiveness of MRI in patients diagnosed with lateral epicondylitis.

Materials and Methods: A randomized investigation was performed on a cohort of 123 consecutive patients, including 82 males and 41 females, all clinically diagnosed with chronic lateral epicondylitis. Each patient underwent a 3.0 T MRI scan, and the extent of tendinopathy was evaluated using a dedicated MRI scoring system. Clinical symptoms were measured using the Patient Rated Tennis Elbow Evaluation (PRTEE). The statistical analysis was carried out using SPSS version 21 software.

Results: MRI identified tendinopathy in all 123 elbows: 52 (42.3%) were grade 1, 38 (30.9%) grade 2, and 33 (26.8%) grade 3. Intra-observer agreement averaged 80.2%, with weighted kappa values of 0.79, 0.74, and 0.89 ($P < 0.001$) for individual radiologists, reflecting good reliability. Inter-observer reliability had a weighted kappa of 0.72. The median PRTEE score was 77 (range 8-96), with scores of 19, 23, and 60 for grades 1, 2, and 3, respectively. PRTEE scores increased with tendinopathy severity, showing a significant positive correlation (Spearman's $r = 0.94$, $P < 0.01$).

Conclusion: MRI serves as a reliable imaging modality for evaluating the radiological severity of chronic lateral epicondylitis, with the severity of MRI-detected signal changes correlating positively with the patient's clinical symptoms.

Keywords: Magnetic Resonance Imaging, Epicondylitis, Tendonitis, Tennis Elbow.

Introduction

Lateral epicondylitis is attributed to the repetitive strain of the wrist and forearm extensor and supinator muscles, primarily affecting the common extensor tendon (CET). The most frequent site of involvement is the origin of the extensor carpi radialis brevis tendon. Histopathological findings in the affected tendon include microtears, ongoing mucoid degeneration, incomplete repair processes, and angiofibroblastic tendinosis [1-3]. The term "epicondylitis" is somewhat misleading, as the condition does not predominantly involve acute or chronic inflammatory cells, making "lateral elbow tendinopathy" a more accurate term. Histological analyses have identified mucinous degeneration and angiofibroblastic hyperplasia within the tendon, leading to partial or complete tendon tears [4].

The diagnosis of lateral epicondylitis is primarily clinical, based on patient history and physical examination. Imaging techniques such as radiography and ultrasound can assist in diagnosis, but MRI is generally not required initially. However, if symptoms persist despite medical treatment, an MRI may be warranted to identify additional underlying abnormalities. Clinically, patients typically report pain in the lateral elbow, which is aggravated by resisted wrist extension and finger extension. Physical examination often reveals localized tenderness over the CET [5]. While MRI offers high soft tissue contrast resolution, it has shown adequate sensitivity, specificity, and accuracy in diagnosing lateral epicondylitis [6-9]. The aim of this study was to assess the effectiveness of MRI in patients diagnosed with lateral epicondylitis.

Material and Methods

A randomized study was conducted involving 123 consecutive patients diagnosed with chronic lateral epicondylitis. The cohort comprised 82 men and 37 women. None of the participants had received corticosteroid injections within 4 months prior to the MRI examination, nor had they undergone surgical treatment before the MRI assessment. Elbow radiographs were performed to rule out bony pathologies, such as osteoarthritis or intra-articular loose bodies. All participants underwent MRI of the affected elbows using a 3-Tesla MR system equipped with a dedicated surface coil. The examination was conducted with the patient in a supine position, the affected elbow extended, and the palms facing upward. To ensure optimal image quality, the affected arms were positioned as close as possible to the center of the MRI scanner.

The MR images were independently reviewed by three musculoskeletal radiologists who were blinded to the clinical details and the severity of the disease. Each radiologist assessed the images on three separate occasions, with at least a three-week interval between assessments. A scoring system, modified from Walz et al. [10], was used to evaluate the severity of tendinopathy at the lateral epicondyle. All participants underwent a standardized clinical assessment using the Patient-Rated Tennis Elbow Evaluation (PRTEE), [11] that comprises two sections: Part 1 assesses pain through 5 questions scored from 0 to 10, and Part 2 evaluates functional disability through 10 questions also scored from 0 to 10. Part 2 is divided into specific activities (e.g., turning a doorknob) and usual activities (e.g., dressing, washing). Functional scores are calculated by halving the sum of the scores and adding them to the pain scores. The total score ranges from 0 (no pain or disability) to 100 (severe pain and disability).

Overall agreement for MRI scoring was assessed. Inter- and intra-observer reliability were analyzed using the linear-weighted Fleiss' kappa statistic to determine the consistency among the three radiologists. Kappa values were categorized as follows: 0.41 to 0.60 for fair agreement, 0.61 to 0.80 for good agreement, and 0.81 to 1.00 for excellent agreement. Subsequently, the average MR scores from the three experts were correlated with the standardized clinical assessment using Spearman's rank correlation test, with significance set at $P < 0.05$.

Results

The study cohort consisted of 123 patients, with a male predominance (66.67%) compared to females (33.33%). Age distribution varied, with the majority of patients falling into the 31-40 year age group (43.9%). The 21-30 year age group comprised 27.64% of the participants, while 21.14% were in the 41-50 year range. Patients older than 50 years represented 5.69%, and those younger than 20 years were the least represented, at 1.63%.

Table 1: Demographic parameters of Patients

Parameter	n	%
Gender		
Male	82	66.67
Female	41	33.33
Age group (years)		
<20	2	1.63
21-30	34	27.64
31-40	54	43.9
41-50	26	21.14
>50	7	5.69

The MRI assessments revealed varying grades of tendinopathy among the patients. Grade 1 tendinopathy was the most common, observed in 42.28% of the patients. Grade 2 was noted in 30.89% of the cases, while Grade 3 was identified in 26.83% of the patients. These results suggest a moderate distribution of tendinopathy severity within the sample.

Table 2: MRI assessment of tendinopathy

Parameter	n	%
Grade 1	52	42.28
Grade 2	38	30.89
Grade 3	33	26.83
Total	123	100

The MRI findings for tendinopathy severity were classified as follows: Normal/Mild, Moderate, and Severe. The Normal/Mild category was characterized by uniformly low intensity or slight focal increase in tendon signal on fat-suppressed T2 images, which was not similar to fluid. Moderate severity was indicated by a noticeable focal increase in tendon signal, also not resembling fluid. Severe tendinopathy was defined by a significant or widespread focal increase in tendon signal, which might include distinct fluid signal intensity.

Table 3: CET Tendinopathy Score on MRI Findings

Severity	MRI Findings
Normal/Mild	Uniformly low intensity or slight focal increase in tendon signal on fat-suppressed T2 images, not similar to fluid.
Moderate	Noticeable focal increase in tendon signal, not similar to fluid.
Severe	Significant or widespread focal increase in tendon signal, with or without distinct fluid signal intensity.

The weighted kappa values for intra-observer consistency were 0.79, 0.74, and 0.89 ($P < 0.001$) for the radiologists, respectively, indicating good reliability. The overall weighted kappa value for inter-observer reliability was 0.72. The median PRTEE score across all patients was 77 (ranging from 8 to 96). Specifically, the median PRTEE scores for tendinopathy grades 1, 2, and 3 were 19, 23, and 60, respectively. A progressive increase in PRTEE scores was observed with increasing tendinopathy grades. Spearman's test demonstrated a significant positive correlation between the tendinopathy grades and PRTEE scores (correlation coefficient $r = 0.94$, $P < 0.01$).

Discussion

Lateral epicondylitis, commonly known as tennis elbow, is a pathological condition affecting the common extensor tendon (CET) [12]. The primary cause is often repetitive stress from forearm extensor muscle contractions, leading to structural disruption and degeneration of the tendon and its matrix, which can eventually result in macroscopic tears and tendon failure [13,14].

Diagnosis of lateral epicondylitis is primarily clinical, with patients presenting a range of symptoms from mild and persistent discomfort to severe, disabling pain affecting daily activities. Various outcome measures have been used to classify symptoms, such as the Visual Analog Scale (VAS) [15], the Disabilities of Arm, Shoulder, and Hand (DASH) Questionnaire [16], and the Upper Extremity Function Scale (UEFS) [17]. However, these tools may not always provide a precise assessment of joint-specific symptoms or functions, as they can be lengthy and include irrelevant questions.

The Patient-Rated Tennis Elbow Evaluation (PRTEE) questionnaire, developed by MacDermid and colleagues, specifically targets patients with lateral epicondylitis [18]. Rompe's study [11] demonstrated that the PRTEE is a reliable, reproducible, and sensitive instrument for evaluating lateral epicondylitis, showing higher standardized response means (SRM) compared to other outcome measures. Consequently, PRTEE was selected for clinical assessment in our study. MRI findings in lateral epicondylitis typically include increased signal intensity within or around the CET, tendon thickening, and localized fluid collection near the lateral collateral ligament [19,20]. Potter et al. and Steinborn et al. reported that MRI findings correlate well with surgical and histological results [21]. Previous studies have indicated that patients with lateral epicondylitis are statistically more likely to show MRI signal changes compared to controls [22,23]. A meta-analysis confirmed that 90% of patients with lateral epicondylitis exhibit abnormal signal in the CET, as opposed to 14% in controls [24]. Our study corroborates these findings, affirming that most patients with chronic lateral epicondylitis have MRI signal changes [20,22-24]. Walton et al. and Martin et al. demonstrated good inter- and intra-observer reliability in MRI assessments of tendinopathy, and our study also confirms that MRI signal changes can be consistently interpreted by different radiologists and across multiple views [20,25].

The relationship between MRI findings and clinical symptoms of lateral epicondylitis remains unclear. Savnik et al [22]. Found no significant difference in pain levels between patients with and without MRI signal changes. However, our study identified a positive correlation between MRI signal changes and PRTEE scores. This discrepancy may stem from differing clinical assessment methods; Savnik's study did not include functional deficit evaluations. Clarke et al. also found that ultrasound changes in the CET positively correlated with clinical symptoms [26].

For patients with mild lateral epicondylitis, PRTEE evaluation often reveals mild focal signal intensity increases on MR T2WI images, indicating mild

injury. Conservative treatment, including rest and activity modification, is recommended. If symptoms persist, MRI should be considered. For moderate lateral epicondylitis, PRTEE typically shows moderate focal signal intensity changes, reflecting moderate injury. Severe cases, evaluated by PRTEE, often exhibit generalized focal increased signal intensity on MR T2WI images, suggesting severe injury. Previous research [27-29] indicates that severe cases may also involve additional abnormalities, such as lateral ligament injury, bone injury, and edema in the wrist extensor muscles. Thus, comprehensive assessment, including MRI, is essential for effective clinical treatment, encompassing physiotherapy, strengthening exercises, corticosteroid injections, and possibly surgery. Limitations of this study include the small number of patients with surgically confirmed chronic lateral epicondylitis and the potential influence of previous therapies, such as wrist or forearm straps, physiotherapy, and corticosteroid injections, on MRI or clinical assessment outcomes.

Conclusion

MRI is a robust and dependable modality for evaluating the radiological severity of chronic lateral epicondylitis. It effectively correlates the observed MR signal changes with the clinical symptoms experienced by patients. This correlation underscores MRI's ability to provide detailed insights into the pathological changes within the affected tendons and surrounding soft tissues, offering clinicians valuable information for accurate diagnosis and treatment planning

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