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Original Research Article

Ultrasound-Based Correlation of Ipsilateral Rotator Cuff Pathologies in Patients with Lateral Epicondylitis: A Cross-Sectional Observational Study

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Abstract:

Background: Lateral epicondylitis (LE) is a prevalent overuse syndrome affecting the common extensor origin of the elbow. Emerging biomechanical evidence suggests a kinetic chain dysfunction linking the shoulder and elbow; however, the routine screening for ipsilateral rotator cuff disorders in LE patients remains underutilized.

Aims and Objectives: To determine the prevalence of coexisting, potentially asymptomatic, rotator cuff pathologies in patients diagnosed with LE using high-resolution ultrasonography (USG).

Methods: This descriptive cross-sectional study was conducted from October 2015 to August 2017. A total of 112 participants (calculated based on a 30% assumed prevalence with 5% absolute precision) diagnosed with unilateral LE underwent comprehensive clinical examination and USG evaluation of both the affected elbow and the ipsilateral shoulder. Functional outcomes were assessed using the Oxford Elbow and Shoulder Scores. Statistical significance was set at $p < 0.05$.

Results: Of the 112 patients (mean age 43.5±8.5 years; 57.1% female), 92 (82.1%) had right-sided involvement. Clinical provocative tests for the shoulder revealed supraspinatus tendinopathy in 27 (24.1%) patients and subacromial impingement in 12 (10.7%). USG confirmed ipsilateral shoulder pathologies in 41 patients (36.6%, 95% CI: 27.8% – 45.4%), while 71 (63.4%) had normal shoulders. The most common findings were supraspinatus tendinosis and subacromial bursitis. Notably, 3 out of 41 patients (7.3%) with sonographic shoulder abnormalities were entirely asymptomatic. The association between LE and shoulder disorders was statistically significant ($p=0.016$).

Conclusion: More than one-third (36.6%) of patients with lateral epicondylitis harbor underlying rotator cuff derangements. Routine clinical and sonographic screening of the ipsilateral shoulder is strongly recommended in this cohort to facilitate holistic rehabilitation and prevent recalcitrant symptoms.

Keywords: Lateral Epicondylitis, Rotator Cuff Injuries, Ultrasonography, Cross-Sectional Studies, Tendinopathy.

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Introduction

Lateral epicondylitis (LE), commonly referred to as "tennis elbow," is a chronic, disabling musculoskeletal condition characterized by pain and tenderness at the lateral aspect of the elbow, specifically over the common extensor origin (CEO).[1] It predominantly affects individuals aged 40 to 65 years and is strongly associated with occupations or activities requiring repetitive wrist extension and forceful gripping, such as using handheld tools, lifting, and playing racket sports.[2,3] The Extensor Carpi Radialis Brevis (ECRB) is the muscle most frequently implicated in the degenerative process at its origin.[4]

The rotator cuff, comprising the supraspinatus, infraspinatus, teres minor, and subscapularis muscles, provides dynamic stability to the glenohumeral joint. Rotator cuff pathologies, ranging from tendinopathy to full-thickness tears, are common degenerative conditions, particularly in individuals over 50 years of age, and are frequently asymptomatic.[5,6] A growing body of evidence supports the concept of a "kinetic chain" where dysfunction in proximal segments (shoulder) affects distal segments (elbow). Specifically, weakness in the rotator cuff, especially the supraspinatus, or subacromial impingement can lead to compensatory overuse of the wrist extensors to maintain upper limb function during abduction and external rotation

activities.[7,8] This compensatory mechanism is hypothesized to accelerate degenerative changes at the CEO, culminating in LE.

Ultrasonography (USG) has emerged as a highly sensitive and specific diagnostic tool for musculoskeletal pathologies. It boasts a sensitivity and specificity exceeding 90% for detecting rotator cuff tears and is equally adept at confirming LE by visualizing hypoechoic regions, calcifications, and neovascularity at the CEO.[9,10]

Despite the theoretical biomechanical link, routine clinical assessment of the shoulder in patients presenting with LE is not standardized. Consequently, underlying rotator cuff disorders may remain undiagnosed and untreated, potentially leading to suboptimal outcomes and recurrence of elbow symptoms.[11]

Gap Analysis and Objectives: There is a paucity of large-scale cross-sectional studies evaluating the exact prevalence of ipsilateral shoulder pathologies in a purely LE cohort using validated imaging. This study aims to bridge this gap. The primary objective was to diagnose LE using USG and screen the ipsilateral shoulder of the same patients to identify the frequency and spectrum of underlying rotator cuff disorders.

Materials and Methods

Study Design and Setting: This was a descriptive, cross-sectional, hospital-based observational study conducted at the Department of Orthopaedics, Sri Chamundeshwari Medical College Hospital & Research Institute, over a period of 23 months, from October 2015 to August 2017. The study protocol adhered to the principles of the Declaration of Helsinki and was approved by the Institutional Ethical Committee (Approval No. SMCHRI/IEC/2015/125).

Sample Size Calculation: Based on a previous pilot study and the reported prevalence of asymptomatic rotator cuff tears in the general population (approx. 30%), the minimum sample size was calculated for a 95% confidence interval with a 5% absolute precision. Using the formula: $n = Z^2 * P(1-P) / d^2$, where Z=1.96, P=0.30, and d=0.05, the required sample size was 112. We enrolled 112 consecutive patients who met the inclusion criteria to ensure adequate statistical power.

Participant Selection

Inclusion Criteria

- Patients presenting with signs and symptoms of unilateral lateral epicondylitis confirmed by USG.
- Age between 18 and 70 years.
- Willing to provide written informed consent.

Exclusion Criteria

- Acute elbow trauma or fracture.
- History of invasive treatment (steroid injections/surgery) for elbow pain within the preceding 6 months.
- Inflammatory arthritis, diabetes mellitus, or crystal deposition diseases (e.g., gout).
- Bilateral elbow pain.

Clinical Evaluation: All patients underwent a detailed history-taking and a standardized clinical examination.

A. Elbow Assessment

The diagnosis of LE was established using provocative tests:

- **Mill's Test**
- **Cozen's Test**
- **Maudsley's Test**
- **Chair Lift Test**

B. Ipsilateral Shoulder Assessment

To screen for rotator cuff involvement, the following specific tests were performed:

- **Jobe's Empty Can Test** (for supraspinatus).
- **Neer's Impingement Sign** (for subacromial impingement).
- **Drop Arm Test** (to rule out large/full-thickness rotator cuff tears).
- **Gerber's Lift-off Test** (for subscapularis).

C. Functional Scoring

The functional disability of the affected elbow and shoulder was quantified using the validated Oxford Elbow Score (OES) and Oxford Shoulder Score (OSS), respectively. Lower scores indicated greater dysfunction.

Radiological/Ultrasound Examination: A single, experienced consultant radiologist, blinded to the detailed clinical history except for the affected side, performed all USG examinations using a high-frequency (7-12 MHz) linear array transducer (Siemens Acuson S2000).

A. Elbow USG Protocol

The common extensor origin was evaluated in longitudinal and transverse planes. Sonographic findings were graded based on:

- **Hypoechoic region**: Grade 1 (<30% area), Grade 2 (30-50%), Grade 3 (>50%).
- **Hypervascularity / Neovascularity** (Doppler): Grade 1 (<20%), Grade 2 (20-80%), Grade 3 (>80%).
- **Tendon thickening** and **cortical irregularity** at the lateral epicondyle were also documented.

B. Shoulder USG Protocol

The supraspinatus, infraspinatus, subscapularis tendons, biceps tendon, subacromial-subdeltoid (SASD) bursa, and the acromioclavicular (AC) joint were systematically evaluated for tendinosis, partial/full-thickness tears, bursitis, and degenerative changes.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (means, standard deviations, frequencies, and percentages) were calculated. Continuous variables were compared using the independent t-test, and categorical variables using the Chi-square test. A p-value of < 0.05 was considered statistically significant. All confidence intervals (CI) were calculated at the 95% level.

Results

Baseline Demographic Characteristics: A total of 112 patients were included. The cohort comprised 48 males (42.9%) and 64 females (57.1%), with a mean age of 43.5 ± 8.5 years (range: 25–63). The right side was affected in 92 patients (82.1%), and the left in 20 patients (17.9%). Ninety-two patients (82.1%) had involvement of their dominant limb. The mean duration of symptoms was 6.1 ± 5.4 months (range: 1–36 months).

Clinical Provocative Test Results: The diagnostic sensitivity of elbow tests is detailed in Table 1. The Chair Lift Test exhibited 100% positivity. For the shoulder, Jobe's Empty Can test was positive in 27 patients (24.1%), Neer's Impingement sign in 12 (10.7%), and Gerber's Lift-off test in 3 (2.7%). The Drop Arm test was negative in all 112 patients, excluding complete massive rotator cuff tears.

Table 1: Sensitivity of Clinical Provocative Tests

Clinical Test	Positive Cases (n)	Sensitivity (%)
Chair Lift Test	112	100.0
Mill's Test	103	92.0
Cozen's Test	103	92.0
Maudsley's Test	97	86.6
Jobe's Empty Can (Shoulder)	27	24.1*
Neer's Impingement (Shoulder)	12	10.7*
(Prevalence in this cohort, not sensitivity)		

Functional Scoring Analysis: The mean Oxford Elbow Score was 31.3 ± 4.4 out of 48. There was a statistically significant sex-based difference: males had significantly higher scores (mean 32.7 ± 3.8) than females (mean 30.2 ± 4.6), indicating that females presented with greater functional impairment and pain perception ($p=0.019$).

Ultrasound Findings

A. **Elbow USG (Confirmation of LE):** Hypoechoic changes at the CEO were universally present (100%). Grading distribution is illustrated in Table 2

Table 2: Elbow Ultrasonographic Grading of Pathologies.

Sonographic Feature	Present (n, %)	Grade 1	Grade 2	Grade 3
Hypoechoic Region	112 (100%)	65 (58.0%)	47 (42.0%)	0 (0%)
Neovascularity	27 (24.1%)	21 (18.8%)	6 (5.4%)	0 (0%)
Paratenon Neovascularity	21 (18.8%)	15 (13.4%)	6 (5.4%)	0 (0%)
Tendon Thickening	112 (100%)	-	-	-

B. **Shoulder USG (Ipsilateral):** Out of 112 patients, shoulder USG revealed abnormalities in 41 patients (36.6%, 95% CI: 27.8% – 45.4%). The remaining 71 patients (63.4%) had normal shoulder ultrasound scans.

The spectrum of shoulder pathologies is summarized in Table 3. Supraspinatus tendinosis was the most frequent finding. Interestingly, of the 41 patients with abnormal shoulder USG, 38 (92.7%) had clinical symptoms, while 3 (7.3%) were completely asymptomatic with respect to the shoulder.

Table 3: Spectrum of Ipsilateral Shoulder Pathologies Detected on USG

Shoulder Pathology	Frequency (n)	Percentage (%)
Supraspinatus Tendinosis/Tendinitis	27	24.1
Subacromial-Subdeltoid Bursitis	12	10.7
AC Joint Arthrosis / Hypertrophy	8	7.1
Infraspinatus Tendinosis	4	3.6
Long Head of Biceps Tendinopathy	3	2.7
Subscapularis Tendinosis	3	2.7
Total Unique Pathologies (Overlap possible)	**41**	**36.6**

Association Analysis: The association between the presence of lateral epicondylitis and concurrent ipsilateral shoulder disorders was statistically significant (Chi-square test, p = 0.0160).

Discussion

The present cross-sectional study investigated the prevalence of ipsilateral rotator cuff disorders in a well-defined cohort of 112 patients with lateral epicondylitis. Our findings demonstrate that over one-third (36.6%) of patients presenting with tennis elbow harbor coexisting shoulder pathologies, a rate significantly higher than the background prevalence of asymptomatic rotator cuff tears in the general population.[5] This suggests a strong clinical and biomechanical association that warrants recognition in routine orthopedic practice.

Epidemiological and Diagnostic Correlates: Our demographic data align with the established literature, confirming that LE predominantly affects the dominant limb (82.1%) and the middle-aged population (mean 43.5 years).[2,12] The Chair Lift test demonstrated 100% sensitivity in our cohort, surpassing even Cozen's and Mill's tests, which had 92% sensitivity. This supports the assertion by Tosti et al.[4] that the Chair Lift test is a vital, highly specific maneuver for diagnosing LE, potentially due to the maximal isometric loading it places on the ECRB origin.

The Kinetic Chain Connection: The core finding of this study-a 36.6% incidence of shoulder pathology-strongly supports the "kinetic chain" theory in upper extremity biomechanics.[7,8] When the rotator cuff (specifically the supraspinatus) is weakened or impinged, the glenohumeral joint loses its dynamic stabilizers. The body compensates by utilizing the long extensors of the wrist to maintain grip and perform lifting tasks involving shoulder abduction and external rotation.[7] This compensatory overuse directly translates to chronic microtrauma at the common extensor origin, culminating in LE. Our clinical findings corroborate this, as Jobe's test (supraspinatus) was the most frequently positive shoulder test (24.1%), followed by Neer's sign (10.7%).

Clinical Relevance of Asymptomatic Pathology: A critical, clinically actionable finding is the presence of completely asymptomatic shoulder pathologies in 3 out of 41 patients (7.3%). While all patients had clinical elbow symptoms, these silent shoulder lesions would have been missed if we had not performed USG. Ahmad et al.[13] and Yamamoto et al.[14] have previously noted that rotator cuff tears are frequently asymptomatic. Our study implies that these silent lesions may act as subclinical drivers of distal pathology. Unless the proximal shoulder pathology is addressed, treatment focused solely on the elbow (e.g., local corticosteroid injections or physiotherapy) may yield only temporary relief or fail altogether due to persistent compensatory mechanisms.[11]

Sex Disparities in Pain Perception: Our results indicated that females had significantly lower Oxford Elbow Scores compared to males, implying greater pain perception or functional impairment. This aligns with studies by Haahr et al.[15] and Shiri et al.[16] which suggest that hormonal factors, central pain processing, and ergonomic differences may contribute to higher reported disability in women with upper limb tendinopathies.

Limitations

Despite its strengths, the authors acknowledge several limitations inherent to this study.

1. **Cross-Sectional Design**: The observational nature of the study precludes establishing a direct causal relationship between shoulder pathology and LE. We can only report a statistically significant association.
2. **Single Sonologist**: While the radiologist was experienced, all USG examinations were performed by a single observer. We did not perform inter-observer or intra-observer reliability assessments, which could introduce measurement bias.
3. **Lack of a Control Group**: We did not include a group of age- and sex-matched healthy controls without elbow pain to compare the baseline prevalence of shoulder USG findings.
4. **Single-Center Setting**: The sample was drawn from a single tertiary care hospital in South India, which may limit the generalizability of the findings to other populations with different occupational exposures.
5. **Follow-up Data**: We did not evaluate the long-term clinical outcomes of treating the detected shoulder pathologies. Whether addressing these shoulder lesions improves the resolution or recurrence rate of LE remains to be proven in future prospective interventional studies.

Recommendations for Clinical Practice: Based on our findings, we recommend the following integrated clinical algorithm:

1. **Routine Screening**: All patients diagnosed with lateral epicondylitis should undergo baseline shoulder provocative tests (Jobe's, Neer's, Gerber's) during the initial clinical examination.
2. **Imaging Protocol**: If clinical shoulder signs are positive, or if the patient fails to respond to standard elbow-directed conservative treatment

within 4-6 weeks, a single-sitting USG of the ipsilateral shoulder should be performed alongside the elbow.

3. **Holistic Rehabilitation**: Physiotherapy protocols should extend beyond the elbow to include rotator cuff strengthening and scapular stabilization exercises to break the compensatory kinetic chain.

Conclusion

This study confirms that approximately one-third (36.6%) of patients suffering from lateral epicondylitis have coexisting ipsilateral shoulder pathologies, most commonly supraspinatus tendinosis. The presence of asymptomatic rotator cuff derangements in this cohort is a significant clinical consideration. Given that isolated elbow treatment may overlook the proximal driver of the pathology, we advocate for a paradigm shift towards evaluating the entire upper limb kinetic chain. Orthopedic surgeons and primary care physicians must screen the shoulder in all LE patients to ensure accurate diagnosis, effective management, and improved long-term functional outcomes.

Declarations

Statement of Ethics: This study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Ethical Committee of Sri Chamundeshwari Medical College Hospital & Research Institute (Approval No. SMCHRI/IEC/2015/125). All procedures involving human participants were performed in accordance with the ethical standards of the institutional and/or national research committee.

Informed Consent: Written informed consent was obtained from all individual participants included in the study. Participants were assured of their anonymity and the confidentiality of their data.

Patient Anonymity: All personal identifiers (names, registration numbers, and specific dates) have been removed to ensure complete anonymity in accordance with the CARE/STROBE guidelines.

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Author Contributions (Credit)

1. **Dr. Nagaraju Honnegowda**: Conceptualization, Investigation, Supervision, Writing – Review & Editing.
2. **Dr. Madhusudan B.**: Data Curation, Methodology, Formal Analysis, Writing – Original Draft Preparation.
3. **Dr. ShreeKrishna Nanda Sagar:** Project Administration, Validation, Visualization, Writing – Review & Editing, Corresponding Author.

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