

Research Article

Early Clinical and Radiological Outcomes of Minimal Incision ECRB Release for Chronic Lateral Epicondylitis: A Prospective Pilot Study

Neelagowda V Patil¹, Deepak MK², Shreyas S Vastrad³, Suhas S Swamy⁴, Devadutt J Menon⁵

¹Professor, Department of Orthopaedics. Mysore Medical College and Research Institute.

²Assistant Professor, Department of Orthopaedics. Mysore Medical College and Research Institute.

³Post graduate, Department of Orthopaedics. Mysore Medical College and Research Institute.

⁴Post graduate, Department of Orthopaedics. Mysore Medical College and Research Institute.

⁵Post Graduate, Department of Orthopaedics. Mysore Medical College and Research Institute.

*Corresponding Author
Shreyas S Vastrad

Article History

Received: 13.05.2026

Revised: 29.05.2026

Accepted: 18.06.2026

Published: 27.06.2026

Citations:

Patil, N. V., Deepak, M. K., Vastrad, S. S., Swamy, S. S., & Menon, D. J. (Year). Early clinical and radiological outcomes of minimal incision ECRB release for chronic lateral epicondylitis: A prospective pilot study. *J Surg Radiol*, V5(6) 398-404

Abstract: **Introduction:** Lateral epicondylitis is a common degenerative condition affecting the extensor carpi radialis brevis tendon, leading to pain and functional limitation. While most patients respond to conservative management, a subset develops persistent symptoms requiring surgical intervention. Minimal incision surgery has emerged as a less invasive alternative with potential for faster recovery. The study was conducted to evaluate clinical and radiological outcomes following minimal incision surgery in patients with lateral epicondylitis, focusing on pain relief, functional improvement, and tendon healing. **Methods:** The prospective observational study was conducted at tertiary care teaching hospital for a period of two years, which included 15 patients fulfilling the inclusion criteria. All patients underwent minimal incision surgery. Clinical outcomes were assessed using the Mayo Elbow Performance Score (MEPS) and Visual Analog Scale (VAS) at pre-operative, 2-week, and 3-month intervals. Radiological assessment was performed using ultrasonography. **Results:** The mean age was 41.67 ± 8.66 years. Pre-operatively, all patients had poor MEPS (44.00 ± 9.67) and severe pain (VAS 7.87 ± 0.64). At 2 weeks, MEPS improved to 65.00 ± 9.82 , and at 3 months to 88.00 ± 10.49 ($p < 0.001$). VAS decreased significantly to 4.47 ± 0.74 at 2 weeks and 2.07 ± 0.80 at 3 months ($p < 0.001$). Ultrasonography showed healing in 80% of patients. Complications were minimal (6.7%). **Conclusion:** Minimal incision surgery is a safe and effective treatment for refractory lateral epicondylitis, providing significant pain relief, functional recovery, and radiological healing with low complication rates.

Keywords: Lateral epicondylitis, Tennis elbow, Visual Analog Scale, Functional outcome, Radiological healing.

INTRODUCTION

Lateral epicondylitis, commonly known as tennis elbow, is a common musculoskeletal disorder characterized by pain and tenderness over the lateral aspect of the elbow, resulting in functional impairment of the upper limb. It predominantly affects individuals in the working-age population and is associated with repetitive wrist extension, forearm supination, and forceful gripping activities [1]. Although initially considered an inflammatory condition, current evidence supports a degenerative tendinopathy involving the extensor carpi radialis brevis tendon, characterized by angiofibroblastic degeneration rather than acute inflammation [2].

The prevalence of lateral epicondylitis ranges between 1–3% in the general population, with peak incidence in the fourth to sixth decades of life [3]. It commonly involves the dominant upper limb and significantly affects daily activities, occupational productivity, and quality of life [4]. The condition results from repetitive microtrauma leading to tendon degeneration and disorganized collagen structure, shifting treatment emphasis from anti-inflammatory approaches to tendon healing modalities [5].

Conservative management remains the first-line treatment and includes activity modification, NSAIDs, physiotherapy, bracing, corticosteroid injections, and shockwave therapy [6]. Corticosteroid injections provide short-term pain relief but are associated with high recurrence rates and poorer long-term outcomes [7].

Physiotherapy shows moderate success, though outcomes vary due to adherence and protocol differences [8]. Surgical intervention is considered in patients with persistent symptoms beyond six to twelve months [9].

Various surgical techniques include open release, arthroscopic debridement, percutaneous release, radiofrequency micro tenotomy, and mini-open procedures [10]. Open surgery is associated with larger incisions and longer recovery, while arthroscopic techniques allow better visualization but require expertise [11,12]. Minimally invasive techniques aim to reduce tissue trauma while maintaining effectiveness [13].

Minimal incision surgery enables targeted debridement through a small incision, potentially reducing operative time, pain, and recovery duration [14]. Imaging modalities such as ultrasonography and MRI are useful

for diagnosis and postoperative evaluation [15]. However, most studies focus on clinical outcomes, with limited data correlating functional improvement and radiological healing.

Despite the availability of multiple surgical techniques, no gold standard procedure exists. Limited prospective data correlate functional recovery with radiological healing, as most studies focus mainly on clinical outcomes. Therefore, a prospective evaluation correlating functional scores with radiological changes is necessary to determine whether structural healing translates into clinical improvement. This study aims to bridge this gap by assessing both functional and radiological outcomes following minimal incision surgery.

MATERIALS AND METHODS

The prospective observational study was conducted in the Department of Orthopedics, Mysore Medical College and Research Institute, Mysore, over a period of two years (December 2023 to December 2025). 15 adult patients fulfilling the inclusion criteria were selected for the study by using a simple random sampling technique. Ethical clearance was obtained from the Institutional Ethics Committee before starting the study.

Inclusion Criteria

Patients aged 20–60 years diagnosed with lateral epicondylitis with symptoms persisting for more than 3 months, failure of conservative management including NSAIDs and physiotherapy, willing to undergo surgical intervention and comply with regular follow-up visits and ready to provide written informed consent.

Exclusion Criteria

Local infection, elbow arthritis, malignancy, prior treatment with steroids or PRP, Carpal tunnel syndrome, radial nerve entrapment, accompanied pathology a cervical spine, people with comorbidities (Diabetes, HIV, TB, Malignancy, neurological comorbidities), patients with associated ipsilateral upper limb injuries hindering the post-operative weight bearing.

A detailed preoperative clinical evaluation was carried out for every patient, including assessment of pain severity and functional limitation. Baseline functional status was documented using the Mayo Elbow

Performance Score (MEPS), and pain intensity was assessed using the Visual Analogue Scale (VAS). Pre-operative imaging using ultrasonography was done to confirm the diagnosis. Relevant laboratory investigations were performed as part of routine preoperative evaluation. All patients were planned for surgical management using the minimal incision technique for lateral epicondylitis. The surgical procedures were performed under regional anesthesia in the form of brachial plexus block, as per institutional protocol. A minimal longitudinal skin incision measuring approximately 1.5 to 2 cm was made over the lateral epicondyle of the elbow and careful dissection was carried out to expose the degenerated and pathological ECRB tendon fibers which were excised under direct visualization. Following excision of the diseased tendon tissue, multiple drill holes were made over the lateral epicondyle to promote neovascularization and enhance tendon healing. Postoperatively, all patients were monitored for immediate complications and managed according to standard postoperative care protocols. A structured postoperative rehabilitation protocol was followed for all patients. During the first postoperative week, passive range of motion exercises of the elbow and wrist were initiated. Between the second and fourth postoperative weeks, active range of motion exercises were encouraged. From the fourth to sixth week, progressive strengthening exercises were introduced. Between six and twelve weeks postoperatively, resistance exercises were commenced, with gradual return to full functional activity by the end of eight to ten weeks. Patients were followed up at regular intervals of 2 weeks, 1 month, and 3 months postoperatively. At each follow-up visit, clinical examination was performed, pain was assessed using the Visual Analogue Scale, and functional outcome was evaluated using the Mayo Elbow Performance Score. Radiological ultrasonographic assessments were also performed during follow-up to evaluate tendon healing and resolution of pathological changes. All findings were documented systematically as per the predefined study parameters.

The data obtained during the study were collected, compiled, and analyzed in a systematic manner. All recorded data were entered into a structured proforma and statistical analysis was conducted using the SPSS version 28.0.

RESULTS

Table 1: MEPS Component and Total Scores at Different Time Points (Pre-op, 2 Weeks, 3 Months) (N = 15)

MEPS Parameter	Pre-operative (Mean ± SD)	2 Weeks Post-op (Mean ± SD)	3 Months Post-op (Mean ± SD)
Pain	11.00 ± 6.87	26.00 ± 6.87	40.00 ± 9.26
Motion	11.67 ± 4.88	14.67 ± 2.97	17.67 ± 2.58
Stability	10.00 ± 0.00	10.00 ± 0.00	10.00 ± 0.00

Function	11.33 ± 2.97	15.00 ± 1.89	20.33 ± 2.97
Total Score	44.00 ± 9.67	65.00 ± 9.82	88.00 ± 10.49

There was a progressive improvement across all MEPS components from pre-operative to 3 months. Pain and function domains show the most marked improvement, indicating effective symptom relief and recovery. Stability remains unchanged, confirming preserved joint integrity. The total MEPS score improves from poor (44.00) to good–excellent range (88.00), demonstrating strong functional recovery.

Table 2: Visual Analog Scale (VAS) Scores at Different Time Points (N = 15)

Time Point	N	Mean ± SD
VAS Score Pre-op	15	7.87 ± 0.64
VAS Score 2 Weeks Post-op	15	4.47 ± 0.74
VAS Score 3 Months Post-op	15	2.07 ± 0.80

Pain assessment using the Visual Analog Scale demonstrated a progressive and clinically meaningful reduction in pain intensity over time. The mean pre-operative VAS score of 7.87 ± 0.64 indicates severe baseline pain. This value decreased to 4.47 ± 0.74 at two weeks post-operatively, reflecting early postoperative pain relief. By three months, the score further reduced to 2.07 ± 0.80, indicating minimal residual pain.

This stepwise reduction in pain severity demonstrates the short-term and sustained analgesic benefit of minimal incision surgery, supporting its effectiveness in symptom control and improving patient comfort during rehabilitation.

Table 3: Comparison of Pre-operative and Post-operative Ultrasonographic Findings (N = 15)

Parameter	Pre-operative n (%)	Post-operative n (%)
Vascularity / Inflammation	6 (40.0%)	3 (20.0%)
Effusion	6 (40.0%)	1 (6.7%)
Calcification	2 (13.3%)	—
Edema	4 (26.7%)	—
Tendinopathy	—	0 (0.0%)

Post-operative ultrasonography shows a clear reduction in pathology, with vascularity decreasing from 40.0% to 20.0% and effusion from 40.0% to 6.7%. Notably, tendinopathy resolved completely (0.0%), indicating effective tendon healing. Overall, these findings confirm significant radiological improvement following minimal incision surgery.

Table 4: USG Grade Distribution Pre- and Post-operatively (N = 15)

USG Grade Category	Pre-operative n (%)	Post-operative n (%)
Inflammatory	4 (26.7%)	—
Degenerative	5 (33.3%)	—
Advanced (Effusion / Calcification)	6 (40.0%)	—
Normal / Healed	—	12 (80.0%)
Mild Residual Inflammation	—	2 (13.3%)
Post-surgical Effusion/Complication	—	1 (6.7%)
Total	15 (100.0%)	15 (100.0%)

Pre-operatively, most patients had advanced (40.0%) and degenerative (33.3%) changes, indicating chronic disease. Post-operatively, 80.0% showed normal/healed tendons, with only 13.3% mild inflammation and 6.7% residual effusion. This demonstrates a clear shift from disease to healing, confirming significant radiological recovery after surgery.

Table 5: Comparison of MEPS Total Scores Between Pre-operative and Post-operative Periods (N = 15)

Comparison	Mean Difference ± SD	t-value	df	p-value
Pre-op vs 2 Weeks Post-op	-21.00 ± 6.04	-13.48	14	<0.001
Pre-op vs 3 Months Post-op	-44.00 ± 5.41	-31.49	14	<0.001

There was a highly significant improvement in MEPS scores at both time points (p < 0.001). Functional scores improved by 21 points at 2 weeks and 44 points at 3 months, indicating progressive and substantial recovery. This confirms that minimal incision surgery results in early and sustained functional improvement.

Table 6: Comparison of VAS Scores Between Pre-operative and Post-operative Periods (N = 15)

Comparison	Mean Difference ± SD	t-value	df	p-value
Pre-op vs 2 Weeks Post-op	3.40 ± 0.51	25.97	14	<0.001
Pre-op vs 3 Months Post-op	5.80 ± 0.68	33.22	14	<0.001

There was a highly significant reduction in VAS scores at both time points ($p < 0.001$). Pain decreased by 3.40 points at 2 weeks and 5.80 points at 3 months, indicating rapid and sustained pain relief. This confirms that minimal incision surgery provides significant and lasting pain reduction.

Table 7: Correlation between MEPS Total Score and VAS Score at Three-Month Post-operative Period (N = 15)

Variables Compared	Pearson Correlation (r)	p-value
MEPS Total 3 Months Post-op vs VAS Score 3 Months Post-op	-0.878	<0.001

A very strong and statistically significant negative correlation was observed between MEPS total scores and VAS pain scores at three months post-operatively ($r = -0.878$, $p < 0.001$). This indicates that patients with lower pain levels demonstrated significantly better functional outcomes during the later recovery phase. Clinically, this highlights the critical role of sustained pain control in achieving optimal long-term functional recovery following minimal incision surgery.

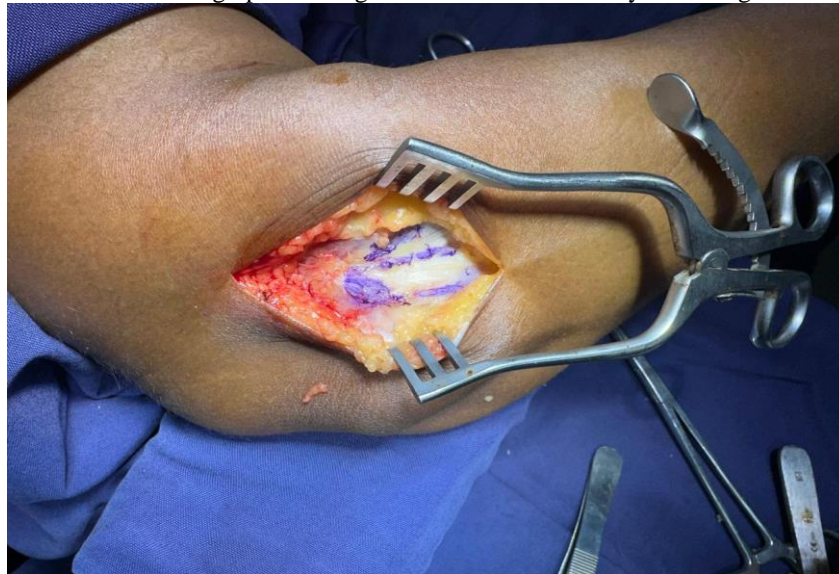


Fig. 1- Intra operative picture showing ECRB degenerative tissue in the interval between ECRL and EDC.

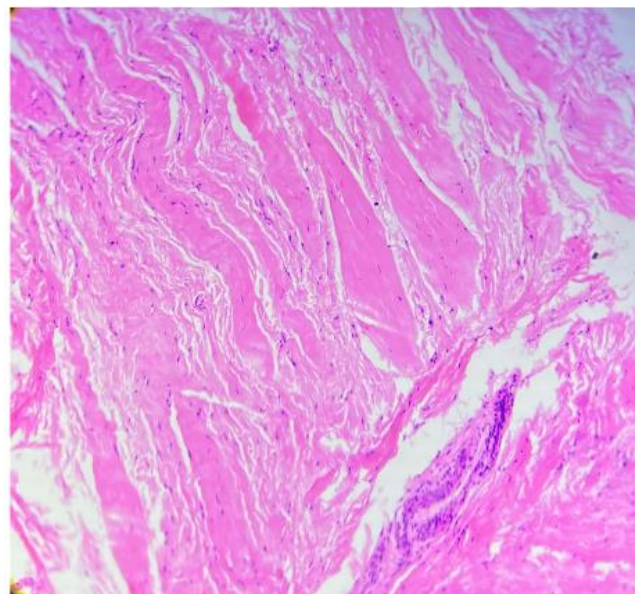


Fig. 2- Histopathological image of the excised tissue showing fragmentation and degradation of collagen with areas of neovascularisation

DISCUSSION

The aim of the present study was to evaluate the clinical and radiological outcomes following minimal incision surgery in patients with chronic lateral epicondylitis who

failed to respond to adequate conservative management. Specifically, the study sought to assess postoperative improvement in pain using the Visual Analog Scale (VAS), functional recovery using the Mayo Elbow Performance Score (MEPS), and structural tendon

changes using ultrasonographic evaluation at defined follow-up intervals.

The study population predominantly comprised middle-aged individuals, with a mean age of 41.67 ± 8.66 years, and 80.0% of patients between 31–50 years, indicating that lateral epicondylitis requiring surgery mainly affects the economically productive age group. There was a near-equal sex distribution (male 53.3%, female 46.7%), suggesting comparable disease burden across genders. The dominant limb was involved in 73.3% of cases, consistent with repetitive overuse as a major etiological factor. These findings align with surgical series reported by Coleman et al. [16], Amroodi et al. [17], while Buchbinder et al. [18] emphasized that operative treatment should be reserved for refractory cases after failed conservative therapy.

The present study demonstrated a significant and progressive improvement in MEPS scores following minimal incision surgery. The mean total score improved from 44.00 ± 9.67 pre-operatively to 65.00 ± 9.82 at 2 weeks and 88.00 ± 10.49 at 3 months ($p < 0.001$). Component-wise, pain, motion, and function showed continuous improvement, while stability remained preserved throughout. This indicates both early and sustained functional recovery. Similar improvements have been reported by Coleman et al. [16] and Lee et al. [19], who demonstrated durable postoperative functional gains.

Outcome categorization demonstrated a clear shift from 100% poor pre-operatively to 73.3% excellent, 20.0% good, and 6.7% fair outcomes at 3 months. At 2 weeks, most patients had good outcomes (80.0%), which progressed to excellent outcomes by 3 months. This reflects a progressive transition from severe disability to near-normal function, consistent with findings of Coleman et al. [16] and Lee et al. [19], who reported high rates of satisfactory outcomes following surgical intervention in chronic lateral epicondylitis.

Pain assessment showed a steady decline in VAS scores from 7.87 ± 0.64 pre-operatively to 4.47 ± 0.74 at 2 weeks and 2.07 ± 0.80 at 3 months ($p < 0.001$). This demonstrates both early and sustained pain relief. Similar reductions have been reported by Lattermann et al. [20], Nazar et al. [21], and Amroodi et al. [17], where minimally invasive and arthroscopic procedures consistently reduced pain scores to below 2 in most patients.

VAS severity showed a marked transition from severe pain in 93.3% pre-operatively to 0% at 3 months, with a corresponding increase in mild pain to 93.3%. At 2 weeks, most patients had moderate pain (86.7%). This stepwise improvement reflects effective pain control and is consistent with findings of Nazar et al. [21] and Lin et al. [22], who reported rapid postoperative pain reduction following minimally invasive techniques.

Ultrasonographic evaluation demonstrated significant radiological healing, with vascularity reducing from 40.0% to 20.0%, effusion from 40.0% to 6.7%, and complete resolution of tendinopathy (0.0%) post-operatively. These findings indicate objective tendon recovery, supporting clinical improvement. In contrast, Buchbinder et al. [18] highlighted variability in outcome reporting across studies, while Muir et al. [23] emphasized the need for objective imaging-based outcome assessment, which this study provides.

Pre-operative grading showed predominantly advanced (40.0%) and degenerative (33.3%) changes, while post-operatively, 80.0% of patients demonstrated normal or healed tendons, with only minimal residual inflammation (13.3%) and complication-related changes (6.7%). This demonstrates a clear shift from pathological degeneration to radiological healing, supporting the structural effectiveness of minimal incision surgery.

Statistical analysis revealed a highly significant improvement in MEPS scores at both 2 weeks and 3 months ($p < 0.001$), with mean differences of -21.00 ± 6.04 and -44.00 ± 5.41 , respectively. These results confirm early and sustained functional recovery, consistent with outcomes reported by Coleman et al. [16] while Burn et al. [24] highlighted similar success rates across surgical modalities with minimally invasive techniques offering faster recovery.

VAS scores showed a statistically significant reduction at both time points ($p < 0.001$), with decreases of 3.40 ± 0.51 at 2 weeks and 5.80 ± 0.68 at 3 months. This confirms strong analgesic efficacy of minimal incision surgery. Comparable reductions have been reported by Lattermann et al. [20], Nazar et al. [21], supporting consistent pain relief across minimally invasive techniques.

A strong negative correlation between MEPS and VAS was observed at 3 months ($r = -0.878$, $p < 0.001$), indicating that improved pain control is closely associated with better functional outcomes in the late postoperative phase. This is consistent with findings by Coleman et al. [16], and Stiefel and Field [25], who demonstrated parallel improvements in pain and function following surgical intervention. This reinforces that in chronic lateral epicondylitis, pain reduction is a key determinant of functional recovery in the long term.

The present study has notable strengths, including its prospective design and structured evaluation of clinical (MEPS, VAS) and radiological (USG) outcomes following minimal incision surgery for lateral epicondylitis. The use of validated scoring systems, uniform surgical technique in a single centre, and standardized follow-up ensured consistency and reliability of results. Inclusion of pre- and post-operative ultrasonography provided objective evidence of tendon healing, while statistically significant improvements in

pain and function support internal validity and procedural safety. However, limitations include a small sample size, lack of a control group, and short follow-up period of three months, which limits assessment of long-term outcomes and recurrence. The single-centre design may reduce generalizability, and reliance on ultrasonography and limited assessment of psychosocial and rehabilitation factors may affect comprehensive outcome interpretation.

CONCLUSION

Overall, the study supports the role of minimal incision surgery as a reliable intermediate option between prolonged conservative therapy and more extensive surgical approaches for lateral epicondylitis. The consistent improvements in pain, function, and radiological parameters suggest that the technique effectively addresses both clinical symptoms and structural pathology. While larger comparative studies with longer follow-up are required to establish long-term durability and relative superiority, the present findings indicate that minimal incision surgery offers a balanced combination of effectiveness, safety, and efficiency. In appropriately selected patients with refractory lateral epicondylitis, this approach can lead to meaningful functional recovery, durable pain relief, and improved quality of life.

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