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ORIGINAL ARTICLE

Outcomes of Continued Intensive Conservative Treatment Versus Arthroscopic Extensor Carpi Radialis Brevis Release for Recalcitrant Lateral Epicondylitis: A Non-randomized Controlled Trial

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Abstract

Introduction There is no consensus on treatment of recalcitrant lateral epicondylitis (RLE). This is a prospective, non-randomized, interventional study comparing pain scores and functional outcomes between arthroscopic extensor carpi radialis brevis release and continued intensive conservative treatment.

Materials and Methods The study compared two groups: Group 1, consisting of 25 patients undergoing continued conservative treatment for 24 months, and Group 2, consisting of 25 patients undergoing arthroscopic extensor carpi radialis brevis release with decortication (ARD). VAS (Visual Analogue Scale) score for lateral elbow pain at rest and after routine daily activities were compared at 6 weeks, 24 weeks, 12 months and 24 months. Functional outcomes were compared with grip strength, and patients reported functional outcome scores, pre-intervention and 24 months post-intervention.

Results There was a significant improvement in VAS scores for pain, functional outcome scores, and grip strength in both the groups post-intervention ($P < 0.05$). VAS scores for pain at rest in both the groups were significantly better after the interventions, at all follow-up durations ($P < 0.001$). VAS scores for pain after routine daily activities were significantly better in group 2 at 24 weeks ($P = 0.002$) and afterward ($P < 0.001$). Group 2 had significantly better functional outcome scores at 24 months ($P < 0.001$) though the difference in grip strength was not statistically significant ($P = 0.121$).

Conclusion The present study shows favourable functional outcomes and pain scores of ARD compared to continued intensive conservative treatment for RLE.

Level of Study II, Non-randomized comparative study.

Keywords Lateral epicondylitis · Recalcitrant · Elbow arthroscopy · ECRB release · Lateral epicondyle decortication · Conservative management

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Introduction

Lateral epicondylitis (LE) is the most commonly encountered "myotendinosis" of the extensor muscles of the forearm. It was first described by Runge in 1873 [1]. LE prevalence has been estimated at 1–3% in the general population and up to 7% among manual workers [2, 3].

The pathogenesis of LE has been discussed by several authors [4–8]. It is considered to be a result of chronic strain and overuse of the extensor tendons. Anatomically the extensor carpi radialis brevis (ECRB) is most commonly involved. Repeated over-activity and over-use may lead to micro-tears in the tendinous origin of ECRB, and due to lack of tendon healing, it is replaced by immature reparative tissues [8]. Histological examination of these lesions usually reveals a degenerative, non-inflammatory process called "angiofibroblastic dysplasia" [9].

Patients whose pain persists beyond 6 months despite conservative management or who fail to respond after local steroid infiltrations are recalcitrant lateral epicondylitis (RLE) [10–12]. These patients are candidates for surgical intervention. It is not clear in the literature what should be the best subsequent treatment in these patients. Literature has shown no difference between open surgical treatment and continued conservative treatment in these patients [13, 14]. The arthroscopic treatment has the advantage of being minimally invasive, and studies have shown similar results of both open and arthroscopic treatments [15–18]. However, there are no comparative studies between continued conservative and arthroscopic treatments.

The purpose of this study is to compare continued intensive nonoperative treatment with the arthroscopic release of ECRB and decortication (ARD) for RLE. The study hypothesis was that arthroscopic management for RLE may be clinically better than the continued intensive nonoperative management.

Materials and Methods

Study Design

A prospective, non-randomized, interventional study was conducted between November 2017 and March 2021, including patients enrolled for the study between November 2017 and March 2019. Institutional ethical committee clearance was obtained before enrolling patients in this study. Written and informed consent was obtained from each patient. The study's primary objective was to compare the intensity of pain and functional outcomes between arthroscopic release and continued intensive nonoperative treatment for RLE. The secondary objectives of the study were to compare any complications arising in the post-intervention period and to note any other associated intra-articular findings during diagnostic elbow arthroscopy.

Inclusion criteria were patients between 20 and 60 years of age, with pain and tenderness localized at the common extensor origin (CEO), a positive cozens test, duration of symptoms of at least 6 months, and with failed conservative treatment including local infiltrations of steroid injections up to 2–3 times. Any patients with systemic polyarthritis, fibromyalgia, cervical radiculopathy, and any previous history of injury or surgery in the elbow which may interfere with the outcome analysis were excluded from the present study. Failure of treatment has been defined as persistence or no improvement in elbow pain (VAS score > 50%) during rest or routine physical activities.

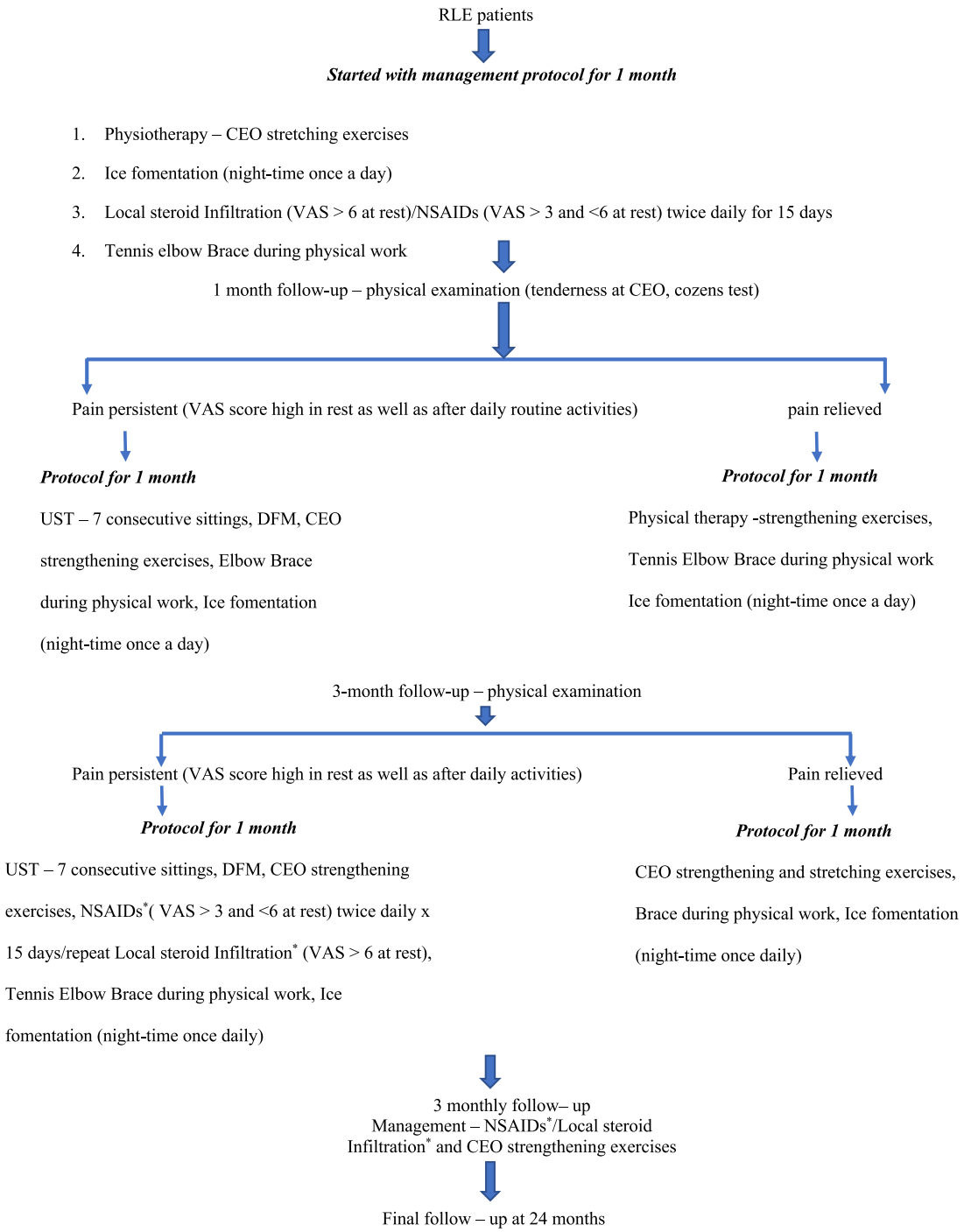
The study compared two groups: Group 1, consisting of 25 patients undergoing continued intensive nonoperative treatment, and Group 2, composed of 25 patients undergoing ARD. Protocols followed for management both the study groups are outlined in flowcharts shown in Fig. 1 (Group 1) and Fig. 2 (Group 2). All patients undergoing ARD underwent pre-operative magnetic resonance imaging of the affected elbow to rule out any intra-articular cause which may lead to pain at the lateral elbow. During the follow-up visits, no patients were allowed to take anti-inflammatory drugs freely if not indicated according to the outlined protocol. The minimum follow-up duration was 2 years post-intervention (24–39 months). No cross-over was allowed between the two study groups. All patients in both the study groups completed their minimum follow-up period of 2 years.

Operative Procedure

All surgeries were performed by a single specialist arthroscopy surgeon (T.G). Patients undergoing ARD were operated in lateral decubitus with the affected elbow supported over static elbow support under Interscalene block. Tourniquet was inflated in all cases, and the joint was insufflated using 20 ml of normal saline. Diagnostic arthroscopy through a standard anterolateral and posteromedial portal was performed first to rule out intra-articular pathology, followed by arthroscopic ECRB release and decortication of the lateral epicondyle (Figs. 3 and 4).

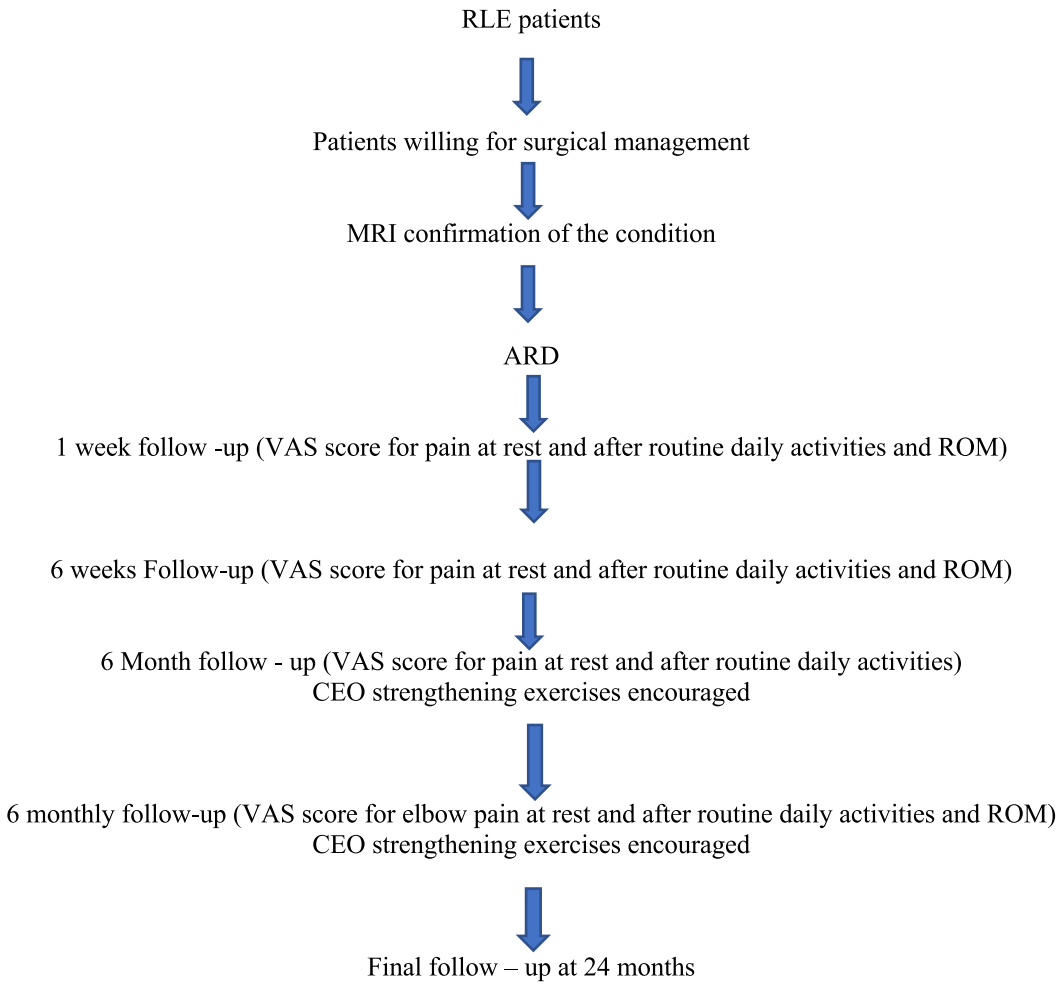
Postoperative Rehabilitation Protocol

All patients undergoing ARD were started on cryotherapy, elbow range of motion, and grip strengthening exercises after the surgery. Anti-inflammatory drugs were allowed in the post-operative period twice daily for 5 days. Elbow



Footnote – RLE – Recalcitrant lateral epicondylitis, UST – Ultrasonic therapy, DFM – Deep Friction massage, CEO – Common extensor origin, VAS – Visual analog scale, NSAIDs – Non-steroidal anti-inflammatory drugs, *According to VAS score for elbow pain

Fig. 1 Flowchart of Management protocol followed in Group 1. *RLE* recalcitrant lateral epicondylitis, *UST* ultrasonic therapy, *DFM* deep friction massage, *CEO* common extensor origin, *VAS* visual analog scale, *NSAIDs* non-steroidal anti-inflammatory drugs, *According to VAS score for elbow pain



Footnote – RLE – Recalcitrant lateral epicondylitis, MRI – Magnetic resonance imaging, ARD – Arthroscopic release and decortication, CEO – common extensor origin, VAS – Visual analog scale, ROM- Range of motion

Fig. 2 Flowchart of management protocol followed in Group 2. *RLE* recalcitrant lateral epicondylitis, *MRI* magnetic resonance imaging, *ARD* arthroscopic release and decortication, *CEO* common extensor origin, *VAS* visual analog scale, *ROM* range of motion

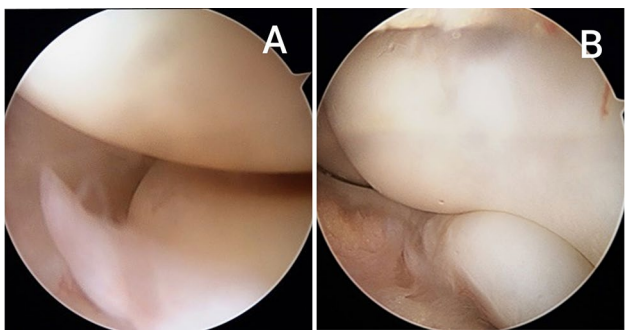


Fig. 3 Arthroscopic view of the elbow joint shows lateral (**A**) and medial (**B**) sides of the joint

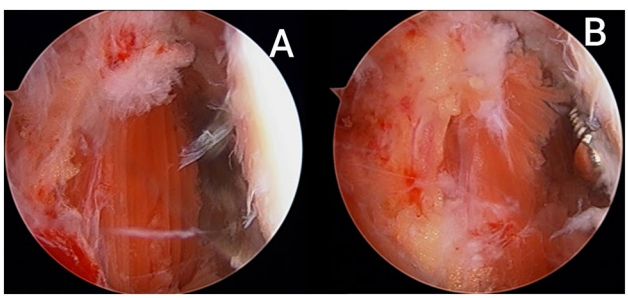


Fig. 4 Intra-operative arthroscopic images show the release of the capsule (**A**) and the common extensor origin (**B**)

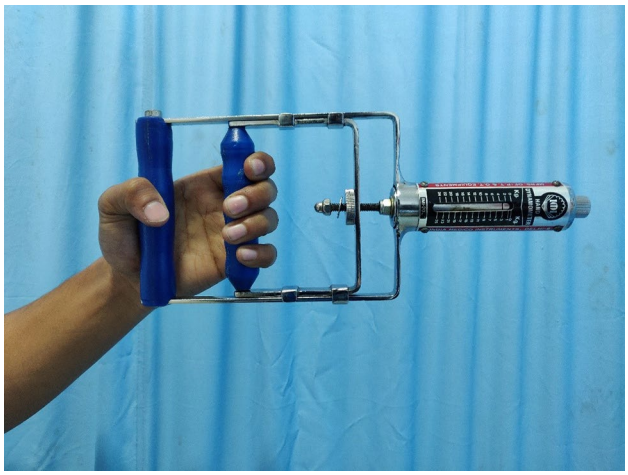


Fig. 5 Measurement of grip strength is using a hand-held dynamometer

strengthening exercises were started at 3 weeks, and return to sports, and normal daily activities, including lifting weights, were allowed only after 3 months.

Outcome Measures Assessment

VAS scores for lateral elbow pain at rest and during routine activities were noted pre-intervention and 6 weeks, 24 weeks, 12 months, and 24 months post-intervention. VAS score for pain was taken on a scale of 1–10 mm (Fig. 6, supplementary material). Objective grip strength measurement was assessed with a hand-held dynamometer at pre-intervention and 24 months post-intervention (Fig. 5). Functional outcomes were evaluated pre-intervention and finally at 24 months post-intervention, noting the range of motion by hand-held goniometer scales and by using patient-reported outcome measures like American Shoulder and Elbow Surgeons – elbow (ASES-e) score [19], patient-rated tennis elbow evaluation (PRTEE) score [20, 21], disabilities of the arm, shoulder, and hand (DASH) score [22] and short form-12 (SF-12) score [23]. A single physical therapist assessed all outcomes during their follow-up visits.

Statistical Tests

All continuous variables were expressed as means and standard deviations and categorical variables in absolute numbers and percentages. Categorical variables were compared using the chi-square test between the two groups. The Shapiro–Wilk test analyzed all parameters to check for normal distribution. Continuous parametric variables were compared using the paired *T* test before and after intervention in the same group. Continuous parametric variables between both groups were compared using the independent sample *T* test. All statistical tests were two-sided with a level of significance of five percent. Results were considered statistically significant when the p-value was less than 0.05. All data were statistically analyzed using SPSS software version 23.0 (SPSS Inc., Chicago, IL, USA).

The sample size calculation was done based on the mean difference in postoperative VAS (Visual Analogue Scale) scores for pain (on the scale of 0–10) between the two groups. Considering a minimal clinically significant difference (MCID) of 1 on the VAS scale, of 0–10 [24] a standard deviation of 1.2 for this scale [25], power of 0.80, and 95% confidence intervals, the sample size was calculated as 23 in each group. Most similar studies comparing different modalities of treatment of lateral epicondylitis repost a similar sample size [26].

Results

There was no difference in the baseline characteristics of the two groups, as shown in Table 1. Patients were predominantly females in both groups. VAS score (Table 2), functional outcome scores, range of motion, and grip strength before and after the intervention in group 1 and group 2 are summarized in Table 3. There was a significant improvement in VAS scores for pain and functional outcome scores at final follow-up in both the groups. VAS scores for pain at rest in both groups were significantly better after the arthroscopic surgery at all durations of follow-up (Table 2). VAS scores for pain after routine daily activities were significantly better in group 2 at 24 weeks and afterward. Thus, at 24 weeks and

Table 1 Baseline characteristics of the patients in both the groups

	Group 1 ($n=25$)	Group 2 ($n=25$)	*P* value
Age (mean ± SD) (years)	42.4 ± 10.4	38.4 ± 9.9	0.174
Duration of symptoms (Mean ± SD) (months)	14.8 ± 6.4	17.95 ± 6.7	0.096
Lesion on dominant Side/nondominant side (numbers, percentage)	Right (15/3, 60%/12%) left (4/3, 16%/12%)	Right (18/2, 72%/8%), left (3/2, 12%/8%)	0.074
Males: females	6:19	8:17	0.40

Table 2 Comparison of visual analogue scale for pain on a scale of 1–10 between the two groups

VAS score	Group 1 (mean ± SD)	Group 2 (mean ± SD)	*P* value
Pre-intervention			
At rest	6.85 ± 1.08	6.35 ± 1.03	0.145
After routine daily activities	9.4 ± 0.68	9.3 ± 0.73	0.657
Post intervention (6 weeks)			
At rest	3.95 ± 0.94	3.05 ± 0.82	**0.002**
After routine daily activities	5.3 ± 0.73	5.1 ± 0.71	0.388
Post intervention (24 weeks)			
At rest	3.65 ± 1.13	2.7 ± 0.65	**0.002**
After routine daily activities	5.3 ± 1.08	4.6 ± 0.82	**0.02**
Post intervention (12 months)			
At rest	4.1 ± 1.29	2.9 ± 1.11	**0.003**
After routine daily activities	5.3 ± 1.45	3.85 ± 1.26	**0.001**
Post intervention (24 months)			
At rest	3.8 ± 1.10	1.7 ± 0.65	**< 0.001**
After routine daily activities	4.8 ± 1.05	3 ± 0.97	**< 0.001**

Statistically significant *P* values mentioned in bold

SD standard deviation; *VAS* visual analogue scale

Table 3 Comparison of functional outcomes between both the groups at 2 years follow-up

Variables		Group 1	Group 2	*P* value (inter-group comparison)
Range of motion				
Flexion	Pre-intervention (mean ± SD)	137 ± 6.56	136 ± 7.53	0.538
	Post intervention (mean ± SD)	138.5 ± 4.89	137 ± 8.01	0.452
	P value	0.186	0.428	
Supination	Pre-intervention (mean ± SD)	90	90	–
	Post intervention (mean ± SD)	90	90	–
	P value	–	–	
Pronation	Pre-intervention (mean ± SD)	90	90	–
	Post intervention (mean ± SD)	90	90	–
	P value	–	–	
Grip strength (kgs)	Pre-intervention (mean ± SD)	8.3 ± 1.59	7.35 ± 1.81	0.086
	Post intervention (mean ± SD)	14.95 ± 2.37	16.1 ± 2.22	0.121
	P value	**< 0.001**	**< 0.001**	
ASES-e	Pre-intervention (mean ± SD)	77.4 ± 3.77	79.15 ± 3.71	0.147
	Post intervention (mean ± SD)	66.05 ± 4.13	62.05 ± 3.06	**0.001**
	P value	**< 0.001**	**< 0.001**	
PRTEE	Pre-intervention (mean ± SD)	80.1 ± 6.27	83.7 ± 5.40	0.06
	Post intervention (mean ± SD)	51.8 ± 9.53	37.65 ± 5.44	**< 0.001**
	P value	**< 0.001**	**< 0.001**	
DASH	Pre-intervention (mean ± SD)	46.4 ± 1.50	48.465 ± 2.12	0.075
	Post intervention (mean ± SD)	34.55 ± 8.76	27.2 ± 3.04	**< 0.001**
	P value	**< 0.001**	**< 0.001**	
Short form -12 score	Pre-intervention (mean ± SD)	43.04 ± 2.37	43.58 ± 1.15	0.68
	Post intervention (mean ± SD)	49.34 ± 4.88	54.05 ± 1.04	**0.0002**
	P value	**< 0.001**	**< 0.001**	

Statistically significant *P* values mentioned in bold

SD standard deviation; *PRTEE* patient-rated tennis elbow evaluation score; *DASH* disabilities of the arm, shoulder, and hand score; *ASES-e* American shoulder and elbow surgeons—elbow score

beyond, the surgically intervened group did better than the conservatively treated group in pain scores both at rest and after activities. Group 2 had significantly better functional outcome scores at 24 months (Table 3). Although the objective grip strength was better in Group 2 than Group 1, it was not statistically significant. There was no significant difference in range of motion between the two groups.

All patients in Group-1 received local steroid infiltration (Injection methylprednisolone acetate 40 mg in the affected elbow) once. Repeat infiltrations of the steroids were required in eight patients for recurrence of symptoms. Patients were allowed NSAIDs (tab Etoricoxib 90 mg once daily at bedtime) according to the protocol mentioned in Fig. 1. Three patients received repeat steroid infiltrations after 3–6 months from their first infiltration after being enrolled in group 1, two patients received between 6 and 12 months after the first dose of steroid infiltration, and the other three patients after 12 months. Two patients in Group-2 had initial relief of symptoms, but the symptoms recurred after 2.5 months after the surgery. They were initially managed with elbow strengthening exercises and night-time ice-fomentation only for 1 month. They were offered re-surgery if they did not improve for 6 months after the index surgery. Arthroscopic release of the common extensor origin was performed again at 6 months in both cases, which resulted in pain relief. They reported average pain relief of 65% on the VAS scale, 3 months after re-surgery, and 90% pain relief after 1 year post-re-surgery.

No patients in either group had any other complications like local infections, wound complications requiring further management, or any kind of post-intervention neurovascular deficit. The intra-articular loose body was seen in one patient arthroscopically and was removed. Lateral plica was also identified arthroscopically in one patient and was excised.

Discussion

This prospective comparative shows favorable patient-reported functional outcomes and pain relief on the VAS scale with ARD as compared to continued intensive non-operative treatment for RLE. Objective grip strength was also improved in the group undergoing ARD, but it was not statistically significant.

LE may affect up to 3% of the adult population, and about 6% of these cases may have symptoms for more than 6 months [27–29]. These figures suggest that RLE is not rare and may be commonly seen in general orthopedic practice. Yet, the answers to this problem are far from satisfactory. Though conservative treatment seems to work for most patients having a lesser duration of symptoms, the ideal treatment for patients whose symptoms have lasted for more than six months is not clear. The condition is disabling as it interferes with activities of routine work. Most patients would have tried different forms of conservative treatment, such as physiotherapy, exercises, oral and injectable anti-inflammatory medications, biological injections like platelet-rich plasma, and modification of activities. Therefore, patients with recalcitrant symptoms may be receptive to more invasive treatment.

Several surgical techniques have been compared for the treatment of RLE. These include open release, percutaneous release, or arthroscopic release. There is a lack of good-quality literature on this subject as most available studies are poor in methodological quality. Some studies have shown that there may be no difference in outcomes of surgical treatment versus conservative treatment of RLE [13, 14]. Bateman et al. [13] conducted a systematic review of the surgical treatment of RLE and concluded that surgery for RLE was less effective than conservative treatment. Kroslak et al. [14] performed a prospective, randomized, double-blinded control trial comparing open surgical procedures for RLE with a sham surgical procedure. No significant difference was observed between the two groups in pain scores, functional outcome, and grip strength. The present study, on the contrary, shows better functional outcome and pain scores with arthroscopic release over continued intensive conservative treatment.

Arthroscopy is minimally invasive and may have lesser complication rates than open release. Moradi et al. [15] in their systematic review comparing open versus arthroscopic surgery for LE suggested that two techniques did not differ in functional outcomes however, the arthroscopic method was associated with lesser complications. Wang et al. [16] studied six clinical trials in their meta-analysis and found no difference between the two techniques. Thus, open and arthroscopic approaches may have similar outcomes. Arthroscopic release may be the preferred form of treatment for a surgeon trained in elbow arthroscopy. Arthroscopy also has the advantage that a complete inspection for intra-articular pathologies can be done [17] which may be an important cause of recurrent symptoms. Routine open surgical procedures cannot address these pathologies. Another advantage of the arthroscopic technique is that the release is carried out from inside-out compared to the open technique where the exposure of common extensor origin is carried out from outside-in, thereby causing minor damage to the standard extensor mechanism. The tendon insertion is close to the articular capsule and is easier to identify with arthroscopy.

Similar to this current study, many studies have shown the effectiveness of arthroscopic surgery in RLE [18, 30–35]. The procedure has shown promising outcomes, with most patients having improved pain scores and function. However, these studies were either non-comparative or compared arthroscopic surgery with some other type

of surgical procedure. No study has compared outcomes of arthroscopic procedures with nonoperative conservative treatment. Two years of follow-up for arthroscopic surgery is sufficient to compare its results with nonoperative conservative management. The present study, however, has some limitations. Patients were allocated to the study groups non-randomly. Magnetic resonance imaging scans were used only to diagnose the lesion at common extensor origin, only among those patients undergoing operative procedures. Also, it could have been used for further characterization of the lesion during follow-up. The current comparative study has a relatively smaller sample size, although it is sufficiently powered to detect statistically significant differences in pain scores between the two groups.

Conclusions

The current study supports arthroscopic surgery for RLE compared to continued intensive nonoperative treatment. ARD results in better functional outcomes and pain scores compared to no surgical intervention. Studies with longer follow-up may be warranted to compare these two methods over time.

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Availability of Data and Materials The datasets used and/or analyzed during the current study may be available from the corresponding author on reasonable request. Data regarding this study is not available in any electronic databases.

Declarations

Conflict of interest All authors (s) declare that they do not have any competing interest concerning this research, authorship, and/or publication of this article.

Ethical Approval Ethics approval for the study had been taken from the institutional ethics committee before starting the study.

Consent to Participate Informed consent was taken from all individual participants included in the study.

Consent to Publish All authors have read the final prepared draft of the manuscript and approve this version in its current format if considered further for publication.

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