

## RESEARCH ARTICLE

# Surgical Treatment of Tennis Elbow; Minimal Incision Technique

Morteza Nakhaei Amroodi, MD ; Ali Mahmuudi, MD; Mostafa Salariyeh, MD; Arash Amiri, MD

Research performed at Bone and Joint Reconstruction Research Center, Shafa Orthopedic Hospital, Iran University of Medical Sciences, Tehran, Iran

Received: 15 May 2016

Accepted: 29 August 2016

## Abstract

**Background:** When non-operative treatment of tennis elbow fails; a surgical procedure can be performed to improve the associated symptoms. Different surgical techniques for treatment of lateral epicondylitis are prescribed. The purpose of this study was to evaluate the clinical outcomes of surgical treatment for tennis elbow based on small incision techniques.

**Methods:** This technique was performed on 24 consecutive patients between June 2011 and July 2013. Outcomes were assessed using the Patient-Rated Tennis Elbow Evaluation (PRTEE), Nirschl's staging system and visual analog scale (VAS) for pain and satisfaction criteria.

**Results:** There were 15 female and 9 male patients in the study. The mean duration of symptoms before surgery was 3.7 years. The average duration of follow-up was 34.8 months. The post-operative outcome was good to excellent in most patients. The mean VAS score improved from 7.2 to 3.5 points. The total PRTEE improved from 68.7 to 15.8 points.

**Conclusion:** This procedure provides a low complication rate which is associated with a high rate of patient satisfaction. Therefore, we suggest this option after failed conservative management of tennis elbow.

**Keywords:** Lateral epicondylitis, Surgical technique, Tennis elbow

## Introduction

Tennis elbow or lateral epicondylitis is the most common cause of chronic pain on the lateral side of the elbow and wrist extensor dysfunction (1). The chief complaints in lateral epicondylitis are decreased grip strength, decreased functional activities and increased pain, which may impart significant disability in daily activities (2). It affects 1–3% of the population in the age group of 40–60 years (3). Controversy exists regarding the pathophysiology of lateral epicondylitis, a common orthopaedic condition. Periostitis, fibrositis, radial nerve entrapment, bursitis, extensor tears, infection, intraarticular abnormality, and orbicular ligament inflammation have all been suggested as causes (4). In 75% of cases, the dominant side is affected, suggesting that work-related forceful and repetitive wrist extension may have a role in the pathogenesis (5). The choice of treatment for each case remains controversial and is determined based on the personal experience of the

treating physician. Many conservative treatments have been suggested including nonsteroidal anti-inflammatory drugs, ultrasound, low-dose laser therapy, steroid injection, functional brace and manipulative treatment, but none has shown consistent results (6). Most patients respond to nonoperative treatment (7); however, surgical treatment is necessary in 4%–11% of patients when symptoms persist (8,9).

For these patients, surgery can be offered and various operative techniques have been described including open common extensor origin release, partial excision of extensor origin with repair, Z lengthening of the extensor carpi radialis brevis, excision of the proximal part of the annular ligament, excision of the synovial fringe of the radiohumeral joint, bursectomy, percutaneous release of the common extensor origin, a combination of the aforementioned procedures, and an arthroscopic release (8–15). However, surgical procedures have yielded varying results and outcomes. This study was designed to verify

**Corresponding Author:** Mostafa Salariyeh, Bone and Joint Reconstruction Research Center, Shafa Orthopedic Hospital, Iran University of Medical Sciences, Tehran, Iran  
Email: mostafa.salariyeh@gmail.com



THE ONLINE VERSION OF THIS ARTICLE  
ABJS.MUMS.AC.IR

the effectiveness of “our minimal incision” technique as a day case procedure at our hospital for treatment of resistant tennis elbow.

### Materials and Methods

This is a retrospective case series consists of 24 consecutive patients that underwent surgical treatment for resistant tennis elbow, between June 2011 and July 2013 at our hospital (Bone and Joint Reconstruction Research Center, Shafa Orthopedic Hospital, Iran University of Medical Sciences, Tehran, IR Iran ). Inclusion criteria were as follows; all patients were chosen for the operation following an unfavorable response to nonsurgical treatment with a duration of at least one year with the following modalities including nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroid injections, physical therapy, platelet rich plasma (PRP) injection, exercise program and elbow brace. The mean local steroid injection given to the patients was 2.4 (range, 1 to 5 injections).

Exclusion criteria were as follows; patients were excluded if they were younger than 18 years, had a local infection, malignancy, elbow arthritis, generalized polyarthritis, ipsilateral shoulder dysfunction, accompanied pathology at cervical spine, neurological abnormalities, radial nerve entrapment, confirmed CTS, cardiac arrhythmia or a pacemaker, had received a corticosteroid injection within the previous six weeks or were pregnant. Our institute ethical committee approval and patient informed consent were obtained.

### Surgical technique

All operations performed by the first author. Under general anaesthesia and using pneumatic tourniquet, drape was done in a supine position on an arm board. An approximately 3-cm long skin incision was made, starting from the lateral epicondyle. The deep fascia was identified, incised and retracted. We reached ECRB tendon from ECRL and EDC interval then the origin of the extensor carpi radialis brevis (ECRB) was identified and the abnormal-appearing tendon was debrided. A rongeur was used to decorticate the epicondyle at the origin of extensor musculature. We were cautious not to enter the joint and to avoid damage to the annular ligament, capsule and articular cartilage. Finally, we reattached the ECRL, EDC and edge of the ECRB to the periosteum using number zero Vicryl suture. Hemostasis was achieved by pressure on the wound after tourniquet deflation. Finally, the fascia of the extensors, subcutaneous tissue and skin were sutured and a compression bandage applied [Figure 1]. The mean intraoperative bleeding was 20-30 cc and mean surgical time was 20-25 minutes.

### Rehabilitation

The arm was immobilized in a sling for two weeks. Rehabilitation consisted of early active range of motion and eventual return to full activity as tolerated. Heavy or repetitive manual work was discouraged for 6 weeks.

### Assessments and statistical analysis

Patients information were recorded in the questionnaires including demographic characteristics, age, sex, dominant

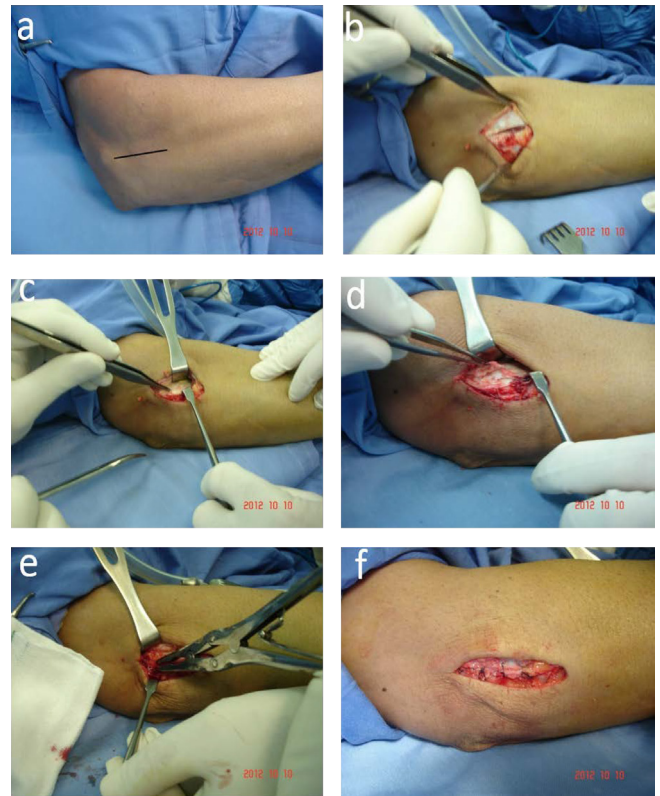


Figure 1.

Line of skin incision on lateral epicondyle (a)  
performing a complete release of the common extensor origin (b, c, d)  
decorticating the epicondyle with a rongeur (e)  
suturing the fascia of the extensors and closing the subcutaneous layer and skin (f)

hand, involved hand, onset of the condition, and patient's occupational status in three categories of unemployed, employed (having a job to make living for a minimum of one year) with an occupation requiring repetitive hand work, and occupation requiring minimal hand work. Post-operatively, the patients were recalled for assessment at 6 weeks, 3 and 6 months and then annually for an unlimited period of time. At each follow up after one year post-operatively, the patient-related tennis elbow evaluation (PRTEE ) and visual analogue scale (VAS) scores were completed and the last ones were used for analysis. Finally, data were analyzed using SPSS software V. 19.

### Results

Twenty-four patients (9 male and 15 female) were included in the present study. The mean age at the time of surgery was 38.5 years (ranged from 25 to 64). The dominant limb was involved in almost 62.5% of the cases. The average duration of preoperative symptoms was 3.7 years (ranged from 2 to 7 years). All patients had previous conservative treatment with no success to relieve their symptoms. The mean duration of post-operative follow up was 34.8 months (25 to 50) [Table 1].

**Table 1. patient's demographic factors (age, gender, dominant hand, involved hand and occupation)**

Age	Mean (38.5)	Min (25)	Max (64)
Sex	Male(9)	Female(15)	
Occupation	Forceful hand work 8	Low hand work 11	Unemployed 5
Dominant hand	Right(23)	Left (1)	
Involved hand	Right(14)	Left(10)	

**Table 2. Comparison of pre & post-operative VAS and PRTEE scores**

		Mean	Min	Max	P value
VAS	Pre-op	7.2	6	9	0.05>
	Post-op	3.5	0	8	
PRTEE	Pre-OP	68.7	50	85	0.05>
	Post-OP	15.8	4	43	

**Table 3. Postoperative Nirschl and pettrone grades**

Grade	Mean (38.5)	Patients
Excellent	Full return to all activity with no pain	16
Good	Full return to all activity with occasional mild pain	7
Fair	Normal activity with no pain, significant pain with heavy activity, and 75% or better subjective overall improvement in pain	1
Failure	No relief of postoperative symptoms	0

The VAS pain score improved from a pre-operative mean of 7.2 to a post-operative mean of 3.5. Baseline for pre-operative mean value of PRTEE score was 68.7, which decreased to 15.8 at final visit [Table 2]. Ten patients (41.7%) had anxiety and/or depression according to psychiatric consultations. Patients with this condition had significantly higher post-operation VAS pain score with mean pain score of 4.5, while patients without this issue, had a mean score of 2.8 ( $P<0.05$ ). Overall, 95.8% patients reported improvement of symptom post-operatively. we have obtained PTREE and VAS scores during the final visit that these scores are independent from the following parameters: involved arm, age, gender and occupation. No major complications occurred after surgery. All patients returned to work within an average time period of 4.8 weeks (ranged from 2-9 weeks). According to the Nirschl and Pettrone's grading system, 16 (66.7%) cases were excellent, 7 (29.1%) were good and 1 (4.1%) was fair (9) [Table 3]. At the final visit, no patient required further surgery or injection after surgery.

### Discussion

Lateral and medial epicondylitis are often treated with conservative measures, such as rest, medication, immobilization, physical therapy, and local steroid injection. Unfortunately, the rate of surgery for failed conservative treatment varying from 0 to 22% (7,9,16-18,28). It is believed that patient selection and surgical techniques are two important elements to obtain satisfactory outcomes.

Lateral epicondylitis has many possible causes and a number surgical options for treatment. Open ECRB release, percutaneous extensor tenotomy and arthroscopic ECRB release are currently the most preferred procedures with a success rate of 80-97% (19,20). The best surgical treatment is not known. The limitations of open ECRB release include late return to work and sporting activities due to prolonged postoperative recovery time, a risk of posterolateral instability of the elbow due to lateral ligament complex injuries, and the formation of neuroma after surgery (21). Percutaneous extensor tenotomy can be to address the shortcomings of open ECRB. However, it also increases the risk of recurrence due to the incomplete removal of a lesion and disrupts the concomitant treatment of an intraarticular lesion because of the limited visualization of the inside of a joint. With regard to arthroscopic ECRB release, it is difficult to suture the ruptured ECRB to avoid the risk of damage to the lateral collateral ligament during debridement, and to become mastered with the surgical technique in a short period (22).

Our study describes a typical group of patients, in the third or fourth decades of life, with long-standing symptoms not responding to nonoperative modalities of treatment. The results of this study are encouraging. 95.8% patients achieved an elbow that was completely free of pain at final follow-up. A total of 24 patients (9 men and 15 women) were included. The total PRTEE improved from 68.7 to 15.8 points. The pain VAS

improved from a mean value of 7.2 before the operation to 3.5 after the operation. Pannier and Masquelet also reported a study of proximal release of the ECRB. In their surgical technique, they associated deep aponeurotomy of the superficial head of the supinator; certain patients also underwent aponeurotomy of the common extensor of the fingers. They reported 78% excellent and good results (23). Leppilahti et al. compared the percutaneous technique with the reference open technique in 2004. They compared a group of 22 patients who underwent the open technique and 23 patients who were treated with percutaneous technique. They found more satisfactory results for the percutaneous group, with a better Disabilities of the Arm, Shoulder and Hand (DASH) score. Patients returned to work after 2 weeks in the percutaneous group versus 15 weeks in the open surgery group. Patient satisfaction was better in the group of percutaneously treated patients (24). Byung-ki cho et al., reported the result of mini-open muscle resection procedure under local anesthesia for lateral and medial epicondylitis. The average preoperative VAS scores of pain were 5.36 during rest, 6.44 during daily activities, and 8.2 during sports or occupational activities. After surgery, the VAS scores were improved significantly ( $P<0.01$ ); 0.3 during rest, 1.46 during daily activities, and 2.21 during sports or occupational activities. The preoperative Roles & Maudsley score was acceptable in 6 cases, and poor in 36 cases, which was changed to excellent in 23 cases, good in 16 cases, and acceptable in 3 cases after surgery. According to the grading system by Nirschl & Pettrone, 23 cases were excellent, 18 cases were good, and the remaining 1 case was fair. Overall, 41 cases (97.6%) achieved satisfactory results (25).

Bernardo Barcellos Tterra et al. described an arthroscopic treatment for chronic lateral epicondylitis, a technique consisted of an excision of the lateral joint capsule, debridement of the pathological ECRB tendon tissue, and decortication of the lateral epicondyle. The mean Mayo elbow functional score after the operation was 95 (ranged from 90 to 100). The mean value of pain

VAS improved from 9.2 before the operation to 0.64 after the operation. On Nirschl's scale, the patients presented an improvement from a mean value of 6.5 before the operation to approximately one. There were significant differences between before to after the surgery for the three used functional scores ( $P<0.01$ ). No correlations were observed using the Spearman test between the results and age, gender, length of time with symptoms before the operation or injury mechanism ( $P>0.05$ ) (26). Peart et al. compared the arthroscopic release technique and the open technique. In their study, 54 patients underwent open release of the ECRB tendon and 33 patients were operated arthroscopically. Of the 75 patients reviewed, there was no significant difference in the functional results between the two groups. However, the patients in the arthroscopic group were able to return to work earlier and had fewer associated postoperative treatments (27).

The limitation of this study was that an analysis was not made based on a comparison with other methods of anesthesia and surgical techniques. Such comparisons should be performed in further studies.

24 elbows with lateral epicondylitis, which were unresponsive to long-term conservative treatments, were managed successfully with minimal incision technique under general anesthesia. Overall, it is believed that this procedure provides an effective treatment option that reduces the time and expense required for conservative treatments, and promotes a rapid return to work. In addition, it is a relatively simple procedure, giving good results for patients with chronic tennis elbow, with low morbidity and early recovery.

Morteza Nakhaei Amroodi MD

Ali Mahmuudi MD

Mostafa Salariyeh MD

Arash Amiri MD

Shafa Orthopedic Hospital, Iran University of Medical Sciences, Tehran, Iran

## References

- Allander E. Prevalence, incidence, and remission rates of some common rheumatic diseases or syndromes. *Scand J Rheumatol.* 1974; 3(3):145-53.
- Dorf ER, Chhabra AB, Golish SR, McGinty JL, Pannunzio ME. Effect of elbow position on grip strength in the evaluation of lateral epicondylitis. *J Hand Surg Am.* 2007; 32(6):882-6.
- Gruchow HW, Pelletier D. An epidemiologic study of tennis elbow Incidence, recurrence, and effectiveness of prevention strategies. *Am J Sports Med.* 1979; 7(4):234-8.
- Kraushaar BS, Nirschl RP. Tendinosis of the elbow (tennis elbow). Clinical features and findings of histological, immunohistochemical, and electron microscopy studies. *J Bone Joint Surg Am.* 1999; 81(2):259-78.
- Major HP. Lawn-tennis elbow. *Br Med J.* 1883; 2(2):557.
- Labelle H, Guibert R, Joncas J, Newman N, Fallaha M, Rivard CH. Lack of scientific evidence for the treatment of lateral epicondylitis of the elbow. An attempted meta-analysis. *J Bone Joint Surg Br.* 1992; 74(5):646-51.
- Coonrad RW, Hooper WR. Tennis elbow: its course, natural history, conservative and surgical management. *J Bone Joint Surg Am.* 1973; 55(6):1177-82.
- Boyd HB, Mcleod AC. Tennis elbow. *J Bone Joint Surg Am.* 1973; 55(6):1183-7.

9. Nirschl RP, Pettrone FA. Tennis elbow. The surgical treatment of lateral epicondylitis. *J Bone Joint Surg Am.* 1979; 61(6):832-9.
10. Verhaar J, Walenkamp G, Kester A, van Mameren H, van der Linden T. Lateral extensor release for tennis elbow. A prospective long-term follow-up study. *J Bone Joint Surg Am.* 1993; 75(7):1034-43.
11. Bosworth DM. Surgical treatment of tennis elbow; a follow-up study. *J Bone Joint Surg Am.* 1965; 47(8):1533-6.
12. Moore Jr M. Radiohumeral synovitis, a cause of persistent elbow pain. *Surg Clin North Am.* 1953; 33(5):1363-71.
13. Hughes ES. Acute deposition of calcium near the elbow. *Bone Joint J.* 1950; 32(1):30-4.
14. Grundberg AB, Dobson JF. Percutaneous release of the common extensor origin for tennis elbow. *Clin Orthop Relat Res.* 2000; 376:137-40.
15. Baker CL Jr, Murphy KP, Gottlob CA, Curd DT. Arthroscopic classification and treatment of lateral epicondylitis: two-year clinical results. *J Shoulder Elbow Surg.* 2000; 9(6):475-82.
16. Nirschl RP. Elbow tendinosis/tennis elbow. *Clin Sports Med.* 1992; 11(4):851-70.
17. Gellman H. Tennis elbow (lateral epicondylitis). *Orthop Clin North Am.* 1992; 23(1):75-82.
18. Kamien M. A rational management of tennis elbow. *Sports Med.* 1990; 9(3):173-91.
19. Lo MY, Safran MR. Surgical treatment of lateral epicondylitis: a systematic review. *Clin Orthop Relat Res.* 2007; 463:98-106.
20. Szabo SJ, Savoie FH 3rd, Field LD, Ramsey JR, Hosemann CD. Tendinosis of the extensor carpi radialis brevis: an evaluation of three methods of operative treatment. *J Shoulder Elbow Surg.* 2006; 15(6):721-7.
21. Inhyeo R, Chaei C, Gu SB, Wo KB, Kyo PH. Arthroscopic treatment of the refractory lateral epicondylitis and associated synovitis. *J Shoulder Elbow Soc.* 2005; 5(2):86-7.
22. Kim SJ, Park BM, Oh KS. Arthroscopic treatment of lateral epicondylitis. *J Korean Orthop Sports Med.* 2007; 6(2):105-9.
23. Pannier S, Masquelet AC. Treatment of epicondylitis by deep fasciotomy of the extensor carpi radialis brevis and supinator: a review of 18 cases. *Rev Chir Orthop Reparatrice Appar Mot.* 2002; 88(6):565-72
24. Leppilahti J, Raatikainen T, Pienimäki T, Hänninen A, Jalovaara P. Surgical treatment of resistant tennis elbow. A prospective, randomized study comparing decompression of the posterior interosseous nerve and lengthening of the tendon of the extensor carpi radialis brevis muscle. *Arch Orthop Trauma Surg.* 2001; 121(6):329-32.
25. Cho BK, Kim YM, Kim DS, Choi ES, Shon HC, Park KJ, et al. Mini-open muscle resection procedure under local anesthesia for lateral and medial epicondylitis. *Clin Orthop Surg.* 2009; 1(3):123-7.
26. Terra BB, Rodrigues LM, Filho AN, de Almeida GD, Cavatte JM, De Nadai A. Arthroscopic treatment for chronic lateral epicondylitis. *Rev Bras Ortop.* 2015; 50(4):395-402.
27. Peart RE, Strickler SS, Schweitzer Jr KM. Lateral epicondylitis: a comparative study of open and arthroscopic lateral release. *Am J Orthop (Belle Mead NJ).* 2004; 33(11):565-7.
28. Kachooei AR, Talaei-Khoei M, Faghfour A, Ring D. Factors associated with operative treatment of enthesopathy of the extensor carpi radialis brevis origin. *J Shoulder Elbow Surg.* 2016; 25(4):666-70.