



Arthroscopic debridement of the extensor carpi radialis brevis for recalcitrant lateral epicondylitis

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Hypothesis: Lateral epicondylitis usually responds well to nonoperative management. A limited number of refractory cases may require surgical intervention. The objective of this study was to assess the outcome of arthroscopic release of the extensor carpi radialis brevis (ECRB) tendon in a consecutive series of patients.

Materials and methods: A retrospective review of 36 patients with lateral epicondylitis treated surgically between January 2001 and January 2004 was performed. There were 24 men and 12 women averaging 42 years at the time of surgery. In all patients, nonoperative management failed, and they underwent surgery at a mean of 19 months after the onset of symptoms. An arthroscopic release of the ECRB was performed. Data collection was performed by an independent examiner.

Results: Operative findings included 28% of patients with significant intra-articular synovitis and 36% with a Baker type 1 lesion, 39% with a type 2 lesion, and 25% with a type 3 lesion. At a mean follow-up of 3.5 years, the mean Mayo Clinic elbow score was 11.1 (range, 5 to 12). By use of visual analog scales, pain improved from 1.5 ± 1.3 preoperatively to 8.1 ± 2.4 at follow-up ($P < .01$). Of the patients, 10 (31%) reported mild pain with strenuous activities and 2 (6%) received no benefit from the procedure. Patients required a mean of 3.8 weeks to return to regular activities and 7 weeks to return to full work duties. No serious complications were identified.

Conclusions: Arthroscopic release of the ECRB is a viable option for recalcitrant lateral epicondylitis. This procedure appears to be safe and effective and allows for management of associated intra-articular pathology.

Level of evidence: Level IV, Case Series, Treatment Study.

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Keywords: Elbow; lateral epicondylitis; ECRB; arthroscopy

Lateral epicondylitis, or “tennis elbow,” is the most common affliction of the elbow.⁹ The condition is self-limiting, with the majority of patients responding favorably to conservative measures. However, conservative treatment

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fails in approximately 4% to 12% of patients, who ultimately undergo surgical intervention.^{3,5,8,12} Numerous surgical procedures for this condition have been described.^{3,10,11,15,16} The majority of these procedures involve debridement or release of the origin of the extensor carpi radialis brevis (ECRB) tendon.

Recently, arthroscopic treatment of lateral epicondylitis has been described. The reported advantages include the ability to debride the tendon undersurface without dividing the common extensor aponeurosis, the ability to evaluate the joint for intra-articular pathology, and possibly, a shortened rehabilitation period.^{11,16} In an effort to more reliably identify the ECRB arthroscopically, we developed an arthroscopic technique to treat lateral epicondylitis.⁷ The purpose of this study is to report subjective and objective outcomes in a cohort of 36 consecutively treated patients who underwent arthroscopic ECRB release with this method.

Materials and methods

Institutional Review Board clearance was obtained from Rush University Medical Center, Chicago, Illinois (study No. 04101806).

Patients enrolled in this study were operated on during a 3-year period from January 2001 to January 2004. The inclusion criteria included lateral epicondylitis for which conservative treatment measures failed, consisting of anti-inflammatory medication, physical therapy, and corticosteroid injections for a minimum of 6 months.

All patients underwent an examination and evaluation by an independent examiner solely for the purpose of this study (C.L.). This included range of motion, grip strength with a handheld dynamometer, and a standardized questionnaire including a visual analog scale (VAS) for pain, the Mayo functional elbow score, and satisfaction criteria.

Operative technique

The operative technique described in this article is based on anatomic studies and extensive cadaveric work published by the senior authors (A.A.R. and M.S.C.).⁷

Positioning

The patient is placed in the lateral decubitus positioned with the operative side up. All potential pressure points are carefully padded. A rolled blanket or elbow stirrup attachment for the operative table is positioned underneath the arm, allowing the elbow to move from 90° of flexion to full extension. The arm is sterilely prepared and draped. A sterile tourniquet is placed on the arm at the midhumeral level. The surgical landmarks are drawn on the elbow, including the olecranon, lateral epicondyle, and medial epicondyle. The ulnar nerve is drawn in its position to bring constant attention to its location (Figure 1). The extremity is exsanguinated with a compressive elastic bandage, and the tourniquet is inflated.

Arthroscopic portals are drawn, including a standard medial (viewing) portal.¹⁴ The elbow joint is inflated with 30 mL of



Figure 1 Anatomic landmarks drawn before arthroscopy.

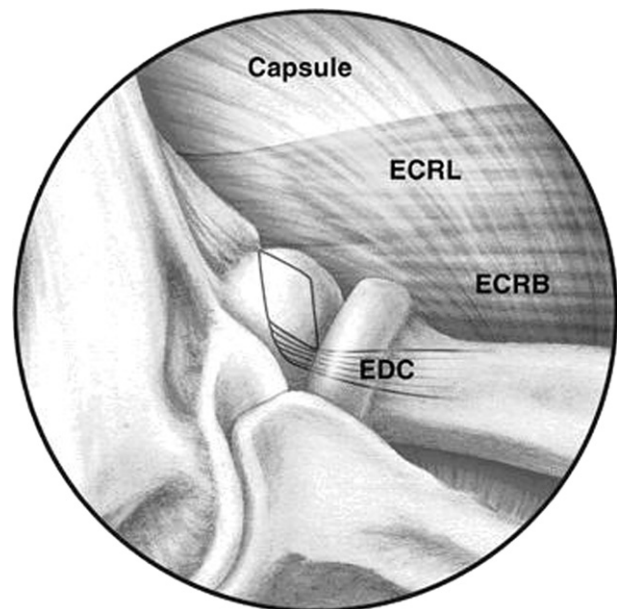


Figure 2 Anatomic illustration depicting common extensor tendon origins as viewed from within elbow joint. Note that the ECRB courses to the top of the capitellum. *ECRL*, Extensor carpi radialis longus. *ECRB*, Extensor carpi radialis brevis; *EDC*, extensor digitorum communis.

normal sterile saline solution through the soft spot outlined by the lateral epicondyle, radial head, and olecranon to facilitate entry into the intra-articular space with the arthroscope.

Portals are injected with a local anesthetic before the tourniquet is inflated. An incision through only skin is made for the medial portal. A hemostat is passed through the fascia and spread at the joint capsule. The arthroscopic cannula is introduced with a blunt trocar. The tip of the trocar is directed inferior toward the center of the anterior compartment of the elbow and is gently pushed through the elbow capsule. The trocar is removed, and a standard-sized 30° arthroscope is introduced. A thorough examination of the anterior compartment of the elbow joint is performed, including the articular surfaces and the capsule, as well as an evaluation for instability.

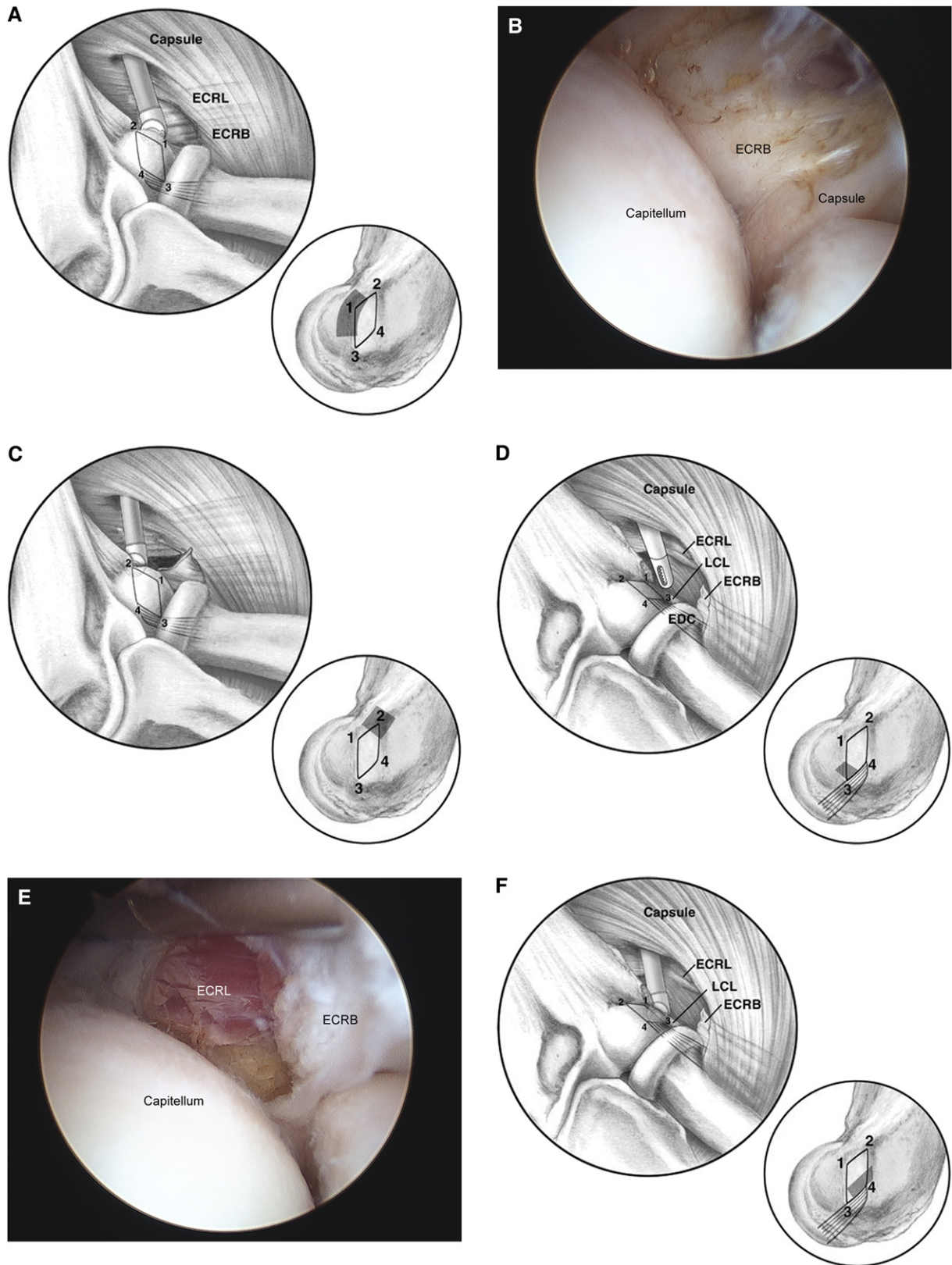


Figure 3 (A) Step 1 of arthroscopic procedure for ECRB release. (B) Arthroscopic photograph depicting ECRB tendon origin after release of capsule. (C) Step 2. (D) Step 3. The number 3 in the *inset* represents the collateral ligament. (E) Arthroscopic photograph after release of ECRB tendon origin. Note the muscular extensor carpi radialis longus (*ECRL*) in the background. (F) Step 4. *LCL*, Lateral collateral ligament.

A modified lateral portal (working portal) is then established through an “outside-in” technique. This lateral portal is located 1 cm proximal and 1 cm anterior to the lateral epicondyle. The ECRB proximal attachment begins at the level of the articular surface of the capitellum, and therefore, it is important to establish this portal proximal to the standard direct lateral portal to improve the ability to resect the entire ECRB origin (Figure 2). An 18-gauge spinal needle is introduced into the joint to localize the correct position and to ensure that the arthroscopic tools can be effectively used. A small incision is made through the skin only, and a 5.25-mm threaded cannula is then introduced. Alternatively, after the skin incision, the lateral anterior capsule can be penetrated with a hemostat or trocar and the arthroscopic instruments used through the portal without a cannula. At all times during the procedure, it is important to understand the location of the posterior interosseous nerve and keep cutting or ablation instruments directed away from it.⁷

The size of the area that will be debrided is approximately 13×7 mm. This trapezoidal-shaped area of insertion has been clearly defined and can be consistently resected.⁷ The amount of resection can be gauged by use of the known dimensions of the arthroscopic shaver.

Step 1

The capsule must be opened and partially resected to allow visualization of the brevis tendon origin, which is extra-articular. With an electrothermal device or, alternatively, a shaver, the capsule is released anterior to the midline of the radiocapitellar joint. The ECRB's tendinous attachment may be avulsed from the lateral humerus (Baker type 2 and type 3). Debridement of the insertion site continues (Figure 3, A and B).

Step 2

The surgeon resects at the proximal articular margin of the capitellum until the extensor carpi radialis longus fibers come into view. The superior aspect of the capitellum marks the proximal anterior margin of tendon resection (Figure 3, C).

Step 3

The surgeon resects anterior to the lateral collateral ligament. The lateral collateral ligament origin on the humerus marks the posterior margin. Damage to the collateral ligament is possible if the resection of the ECRB is “blind” because of collapse of the anterior soft tissue into the viewing space or there is an inability to directly see the ligament from the anterior-medial portal because of less-than-optimal placement. The anterior soft tissue can be retracted with a small elevator placed through a small 3-mm accessory anterior-lateral portal. Visualization can be improved “around the corner” with a 70° arthroscopic lens as needed (Figure 3, D and E).

Step 4

The surgeon resects to the extensor digitorum communis (EDC) ridge and fibrous origin posterior-inferiorly. It is important to stop at the fibrous origin of the EDC, which is superficial to the ECRB. Resection through the EDC origin can result in substantial reduction in the soft tissue between the skin and the lateral elbow joint because of retraction of the ECRB and a portion of the EDC away from the humerus (Figure 3, F).

After the release is completed, the epicondyle origin is decorticated mechanically with a shaver or bur or, most easily,

Table I Demographics

	Data
Age	42 ± 7 y
Gender	24 male/12 female
Injections	2.5 (mean)
Therapy	3.5 ± 4 mo
Heavy manual laborer	66%
Worker's compensation	36%
Repetitive use	75%

with a handheld small curette. The tendinous origin of the ECRB is not repaired after release.

Patients' extremities were splinted postoperatively for 3 to 5 days. After this, elbow range of motion was initiated, allowing patients to return to their normal activities of daily living as tolerated. Isometric strengthening with formal therapy was begun once full motion was achieved, typically by 2 to 4 weeks. Resistance exercises were started 4 to 6 weeks postoperatively. Unrestricted use of the extremity was allowed at approximately 12 weeks.

Statistical analysis was performed comparing preoperative and postoperative measures on noncategorical data by use of the Student *t* test. Pearson χ^2 analysis was used for categorical data. A 2-tailed test was used in all cases, and differences were accepted at $P < .05$.

Results

In total, 36 patients met the study criteria, 24 men and 12 women. The mean age at the time of surgery was 42 ± 7 years. The dominant arm was involved in 58% of cases. Overall, 75% of all patients described their job as requiring “repetitive motion.” Two-thirds (66%) performed work activities that were classified as “heavy manual labor” as defined by the US Department of Labor guidelines (maximum lifting ≥ 75 lb). Thirty-six percent of patients attributed their condition to an injury or activities required at work and were treated under their worker's compensation insurance. The cause of the condition was reported as “repetitive overuse” in 26 patients (72%), tennis in 6 (17%), and a single traumatic event in 4 (11%) (Table I).

Patients underwent surgery at a mean of 19 months from the onset of symptoms. Nonoperative treatment before surgery included a mean of 3.5 months of physical therapy. All patients were treated with at least 1 corticosteroid injection (mean, 2.5).

Patients were evaluated for the purposes of this study at a mean of 3.5 ± 1.2 years postoperatively. The mean postoperative Mayo functional elbow score was 11.1 (range, 5 to 12). The VAS pain ratings (with 10 being the worst pain the patient had ever felt and 0 being no pain ever) improved from a mean of 8.5 to 1.9 ($P < .01$) (Table I). No significant associations were observed between age, gender, worker's compensation status, preoperative length of nonoperative treatment, mechanism of injury, and functional outcome ($P > .05$).

Table II Results

	Morrey/Mayo score	VAS for pain	Lack of extension (°)	Grip strength (% of opposite side)	Return to work (wk)
Preoperatively	NA	8.5 ± 1.3	NA	NA	NA
3.5-y follow-up	11.1 (5 to 12)	1.9 ± 2.4 ($P \leq .012$)	3.4° (−5° to 15°)	91% (41% to 100%)	3.8 ± 3.1; WC, 4.1 ± 2.8 ($P \leq .62$)

NA, Not applicable; WC, worker's compensation.

Physical examination showed mean extension of 3° (range, −5° to 15°) and flexion of 125° (range, 90° to 147°). No patient had a greater than 10° difference in range of motion for flexion or extension compared with the opposite side. The overall grip strength measured as a percentage of the opposite side was 91% (range, 41% to 100%).

All patients returned to work at a mean of 4.8 ± 3.1 weeks postoperatively. Worker's compensation patients returned to work at a mean of 4.1 ± 2.8 weeks after surgery ($P > .05$). Return to full duty was documented in all patients after 7 weeks. Of 32 patients, 20 (63%) were completely satisfied at the time of follow-up and would undergo the surgery again, and none of these patients reported pain. Mild pain with strenuous activities and repetitive use of the affected arm was reported by 10 patients (31%). Eight of these patients rated their surgery a success, whereas two did not. Finally, 2 patients (6%) continued to have significant pain with activities of daily living and considered the surgery a failure (Table II).

Arthroscopic findings

During arthroscopy, 10 patients (28%) had intra-articular synovitis in the region of the radiocapitellar joint, which was debrided. One patient had a loose body that required removal. According to the Baker classification, there were 13 patients (36%) with a type 1 lesion (intact capsule), 14 (39%) with a type 2 lesion (linear capsular tear), and 9 (25%) with a type 3 lesion (complete capsular tear) of the ECRB origin. No patients had evidence of lateral joint instability or significant chondromalacia. There were no statistical correlations between the arthroscopic findings and clinical outcome parameters ($P > .05$).

Complications

One patient had transient subjective forearm paresthesias for 2 weeks after surgery. This resolved spontaneously. No additional complications were noted.

Discussion

Lateral epicondylitis is a common elbow diagnosis that usually responds to conservative treatment. Operative intervention may be indicated in a small percentage of

recalcitrant cases. This study evaluated a surgical technique that we developed to identify and specifically release the origin of the ECRB arthroscopically.⁷ The goal was to provide clinical outcome data to support our previous anatomic investigations. The results show that adequate clinical outcome and pain relief can be achieved with this technique. We noted significant improvement in the Mayo functional elbow and VAS pain scores at a mean follow-up of 3.5 years. Of the patients, 88% were satisfied with the procedure. We could not show a significant correlation with any demographic factor and outcome. Notably, there were no statistical differences between worker's compensation patients and non-worker's compensation patients.

It must be noted, however, that nearly one-third of patients still reported discomfort during strenuous activities and 6% of cases were considered failures. Thus, as noted in other studies regardless of the technique used, the results of epicondylitis surgery are not uniform. In the only prospective series of open release, Verhaar et al¹⁸ reported a 66% rate of satisfaction with the results at 1-year follow-up. Only one-third had returned to work. For these patients, 6 to 12 weeks was required for adequate, though not necessarily complete, recovery. Nirschl and Pettrone¹² reported that 85% of patients treated with an open technique had complete relief of symptoms and had no activity restrictions. Baumgard and Schwartz⁴ treated 35 patients with a percutaneous release and reported excellent results in 91%.

Arthroscopic release is an option for surgically treating lateral epicondylitis. Owens et al¹³ reported on 16 patients who all improved after arthroscopic release. There were no complications in this series, with a mean return to unrestricted work of 6 days. Baker et al³ reported on 42 arthroscopic lateral epicondylitis releases. Of the patients, 95% reported that they were "better" or "much better" postoperatively. However, only 62% were "relatively pain free" and 10% had pain with everyday activities, similar to the results with open release.^{4-6,8,9,15-17}

Subsequently, Baker¹ compared open and arthroscopic release. Good or excellent results were reported in 10 of 15 patients in each group. However, one-third of patients in each group had results judged as fair to poor at minimum 2-year follow-up. No differences were identified between open and arthroscopic surgical treatment of lateral epicondylitis with regard to long-term function, diminution of symptoms, and return of strength. Baker and Baker² have published the long-term results of this cohort. The findings indicate that the overall results do not deteriorate over time. Patients who did

well after 2 years maintained their level of function, and the elbow did not become painful in some cases even 10 years after the procedure. Szabo et al¹⁷ also compared arthroscopic release with open and percutaneous procedures for lateral epicondylitis. Like Baker, they found no significant differences between treatment groups.

One reported advantage of an all-arthroscopic procedure is the ability to evaluate and treat associated pathology within the elbow joint without added morbidity or surgical dissection. The importance of this was illustrated by Baker¹ when he found a high incidence of intra-articular pathology (60%). In our study, 31% of our patients had intra-articular pathology that was easily managed with standard arthroscopic techniques.

Conclusions

We found the clinical outcomes of an arthroscopic technique that we developed to accurately release the ECRB tendon origin to be safe and effective for cases of lateral epicondylitis resistant to conservative measures. A small subset of patients do have persistent symptoms, including some who obtain minimal benefit from the procedure. This underscores the importance of preoperative education and careful patient selection.

Disclosure

Anthony A. Romeo receives royalties and research funding and is a consultant for Arthrex. However, none of these funds were applied to or conflicted with this project. Brian J. Cole receives royalties from Arthrex and Stryker. He also consults for Genzyme, Zimmer, DePuy, Arthrex, Carticept, and Regentis. Research support is provided by Arthrex, Zimmer, and DePuy. However, none of these funds were applied to or conflicted with this project.

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