

Lateral Epicondylitis: Current Concept

In-Ho Jeon, Aashay Laxmikant Kekatpure, Ji-Ho Sun, Kyeong-Bo Shim, Sung-Hoon Choi, Sung-Joon Lim, Jae-Myeung Chun

Department of Orthopedic Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Lateral epicondylitis is one of the most common causes of elbow pain and has been known to be caused by degeneration of the extensor carpi radialis brevis (ECRB). Nonoperative treatment should be tried first in all patients, because it has been deemed highly successful; however only few prospective studies suggest that symptoms frequently was completely resolved. Operative treatment is indicated for recalcitrant pain after failed conservative treatment, which involves excision of the pathologic portion of the ECRB and results in a high degree of subjective relief and functional restoration. We will review the pathology of the lateral epicondylitis and operative and nonoperative treatment of lateral epicondylitis.

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Introduction

Lateral epicondylitis typically occurs in the fourth and fifth decades, is a common orthopedic condition. It has been reported to affect 1–3% of adult population each year.^{1,2)} Despite its relatively high prevalence, the development of a single effective and consistent management of lateral epicondylitis remains an unrealized goal. Conservative treatment includes physical therapy and eccentric exercises, shock-wave treatment, laser therapy, acupuncture, topical nitrates, epicondylar elbow straps, and injections of corticosteroid, botulinum toxin, autologous blood or platelet-rich plasma (PRP). Numerous surgical techniques have been described for refractory cases, including both open and arthroscopic methods.

Pathophysiology

The extensor carpi radialis brevis (ECRB) origin is the most commonly cited anatomic location of lateral epicondylitis pathology. Histologic sections of this area demonstrate noninflammatory angiofibroblastic tendinosis with neovascularization,

a disordered collagen scaffold, and mucoid degeneration.³⁾ Kraushaar and Nirschl⁴⁾ described four stages of tendinosis that may assist the therapist in determining what type of intervention to provide the patient. Stage 1 is described as a peritendinous inflammation. This stage is actually what most clinicians refer to as tendinitis. Crepitus is usually palpable over the common extensor tendon. Stages 2, 3, and 4 refer to the presence of angiofibroblastic degeneration, with stage 4 being the most severe. Due to fibrosis, stage 3 may lead to tendon rupture and stage 4 to calcification.⁴⁾

Another theory proposes that tendons have a limited blood supply when compared with muscle,⁵⁾ and are susceptible to injury when muscles remain contracted for long periods, effectively rendering the tendon avascular. This leads to the generation of destructive free radicals on reperfusion. Tendons undergoing repetitive use may experience a rise in temperature of up to 10%, which can lead to hyperthermic injuries. One study suggests that injury to the tendon activates protein kinases, which lead to apoptosis.⁶⁾ Many hypotheses are still being investigated, which include altered gene expression and an imbalance of matrix metalloproteinases and growth factors.⁷⁾

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Correspondence to: In-Ho Jeon

Department of Orthopedic Surgery, Asan Medical Center, University of Ulsan College of Medicine, 88 Olympic-ro 43-gil, Songpa-gu, Seoul 138-736, Korea

Tel: +82-2-3010-3896, **Fax:** +82-2-488-7877, **E-mail:** jeonchoi@gmail.com

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Clinical Features

Pain over the lateral aspect of the elbow is the most consistent symptom of lateral epicondylitis. This pain is usually sharp and is exacerbated by activities involving active wrist extension or passive wrist flexion with the elbow extended.

Tenderness is typically found on palpation at the site of insertion of the ECRB tendon, which is just anterior to the anterior border of the lateral epicondyle. However, not uncommonly the tenderness is more diffuse, centered around the lateral epicondyle, with a point of tenderness at the bony prominence itself.

Differential Diagnosis

Other conditions that should be considered include:

1. Cervical radiculopathy with pain in the elbow and forearm.
2. Elbow overuse as a compensatory mechanism for ipsilateral frozen shoulder. The elbow is likely to continue to be painful despite local treatment until the shoulder pathology is addressed.
3. Entrapment of the posterior interosseous nerve (PIN). Although PIN lacks a sensory component, entrapment in the lateral aspect of the forearm can result in neuropathic pain that masquerades as lateral epicondylitis.
4. Degenerative changes at the radiocapitellar joint and osteochondritis dissecans may also produce pain around that region.
5. Inflammation and edema of the anconeus.
6. Infection and inflammatory or degenerative arthritis may also give rise to clinical signs mimicking lateral epicondylitis.

Imaging

In most cases a diagnosis of lateral epicondylitis can be made clinically. However, where the diagnosis is less clear, further investigations may be required. Plain elbow radiographs can be helpful to exclude bony pathologies, including loose bodies, osteoarthritis and osteochondritis dissecans. In some cases patchy calcification in the overlying soft tissue may be seen on plain radiographs at the attachment of the common extensor tendon.

In lateral epicondylitis, the tendon origin appears thickened and hypoechoic on ultrasound. There may be hypoechoic linear clefts within the tendon, representing intrasubstance tears – a common occurrence in tendinopathy. Ultrasound provides moderate sensitivity (64–88%) when evaluating the extensor origin architecture but is of variable specificity (36–100%), depending on the study.^{8,9)} Given the significant level of operator dependence, ultrasound is most useful when performed and interpreted by experienced individuals.

Magnetic resonance imaging (MRI) is a more reproducible form of imaging than ultrasound and can demonstrate other

intra-articular pathology as well as reducing intra-operator variability.⁸⁾ An MR scan can confirm the presence of degenerative tissue and tears within the tendon and underlying capsule (Fig. 1). But MRI has not been shown to provide useful information in determining response to treatment because increased T2 signal may persist weeks after symptom resolution.¹⁰⁾ MRI findings must be correlated with clinical examination since 14–54% of asymptomatic elbows will have edema in the common extensor origin.^{10,11)}

Treatment

Nonsurgical Treatment

1) Bracing

Epicondylar counterforce braces work by reducing the level of tension in the forearm extensors. Several studies have shown that elbow straps, clasps or sleeve orthoses have superior results in terms of relief of pain and grip strength compared with a placebo orthosis or wrist splints.¹²⁾ However, a meta-analysis did not find one type of brace to be better than the others.¹³⁾

2) Nonsteroidal anti-inflammatory drugs (NSAIDs)

NSAIDs may improve short-term function. A study showed diclofenac to be superior to placebo in relieving pain,¹⁴⁾ but naproxen had similar outcomes to the placebo.

3) Physical therapy

Smidt et al.¹⁵⁾ reported a clinical result of corticosteroid injections, physical therapy and wait-and-see policy for lateral epi-



Fig. 1. Coronal T2 weighted image shows the presence of degenerative tissue and tears within the tendon and underlying capsule.

condylitis as a randomized controlled trial. At long term follow-up, their findings suggested that physical therapy becomes the best option, followed by a wait-and-see policy (Fig. 2).

Stretching exercise

Static stretching should be performed for the ECRB tendon, the site most commonly affected by lateral epicondylitis. The best stretching position result for the ECRB tendon is achieved with the elbow in extension, Lateral elbow tendinopathy forearm in pronation, and wrist in flexion and with ulnar deviation, according to the patient's tolerance (Fig. 3).¹⁶⁾ Recommendations for the optimal time for holding this stretching position vary, ranging from as little as 3 seconds to as much as 60 seconds.¹⁷⁾ Therapists believe that a stretch for 30 to 45 seconds is most effective for increasing tendon flexibility.^{17,18)}

Strengthening exercise

Most therapists agree that eccentric contractions appear to have the most beneficial effects for the treatment of lateral epicondylitis.^{16,19)} Moreover, eccentric exercises only for the injured tendon and not for all tendons in the relevant anatomical region. Eccentric exercises should be performed on a bed with the elbow supported on the bed in full extension, forearm in pronation, wrist in extended position (as high as possible), and the hand hanging over the edge of the bed. In this position, patients should flex their wrist slowly until full flexion is achieved, and then return to the starting position. Patients are instructed to continue with the exercise even if they experience mild pain.²⁰⁾

4) Injection

Injection therapies represent a crucial minimally invasive modality on the spectrum between conservative therapies and surgery. Injection is a reasonable option for patients who fail conservative measures or for those who desire more than conservative treatment and are should be informed injection. The choice of which injection or injections to offer patients, however,

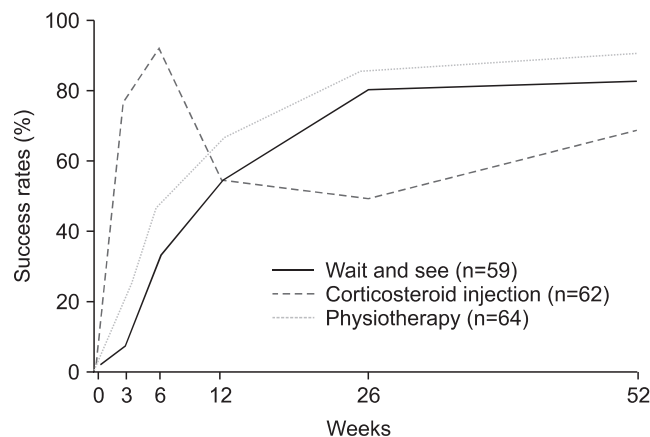


Fig. 2. Success rates of three treatment regimens. Data from the article of Smidt et al. (Lancet 2002;359(9307):657-62) with original copyright holder's permission.¹⁵⁾

is not clearly defined.²¹⁾

Krogh et al.²²⁾ performed a systematic review and meta-analysis of 17 trials with 1,381 patients comparing injection therapies in lateral epicondylitis. Unfortunately, only 3 of these studies had a low risk of bias. They found that glucocorticoid injections were not different from placebo beyond 8 weeks. Botulinum toxin showed a small benefit. Autologous blood and PRP were shown to be superior to placebo, as were prolotherapy and hyaluronic acid. Polidocanol and glycosaminoglycan were comparable to placebo. The largest effect size was seen with hyaluronic acid, followed by prolotherapy, autologous blood, PRP, and botulinum toxin. For the acute condition, which is within 6 weeks of onset, of either lateral and medial epicondylitis the best option appears to be rest and pain relief. For the recalcitrant painful elbow, however, biological treatment that is slowing down the repair mechanism (use of NSAIDs and corticosteroids), or accelerating the repair process (use of PRP) should be considered before performing surgery.

Krogh et al.²³⁾ performed a randomized, double-blind, placebo-controlled trial of local injection treatment of PRP and glucocorticoid. The effect of PRP or glucocorticoid injection on pain and disability at a primary end point of 3 months was not statistically different from saline injection. Injection with glucocorticoid demonstrated a short-term effect on both pain and disability but no long-term effect. Glucocorticoid reduces significantly both color Doppler activity and tendon thickness compared with PRP and saline.

On the other hand, Peerbooms et al.²⁴⁾ performed a prospective randomized, doubleblind, and multicentred study comparing one injection of corticosteroids with one injection of buffered PRP in patient with complaints of lateral epicondylitis for more than 6 months (total of 110 patients, power 0.9). Successful treatment was defined as more than a 25% reduction in visual analogue scale or disabilities of the arm, shoulder, and hand (DASH) score without a reintervention after 1 year. The results after 1 year showed that 21 of the 55 patients (40%) in the corticosteroid group and 38 of the 51 patients (75%) in the PRP group were defined as successful with the visual analogue scale

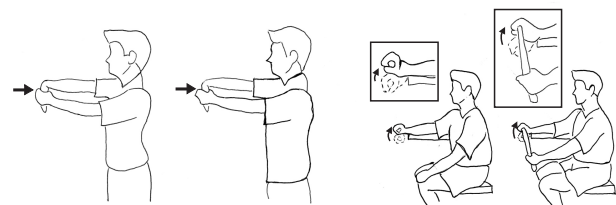


Fig. 3. Isotonic eccentric hand exercises with use of graduated weights of usually no more than 5 pounds may also be helpful. Repetitions are increased on a daily basis as the patient is able to perform them. If pain recurs, return to a lower level of exercise is advised in combination with nonsteroidal anti-inflammatory drugs or rest.

score; this was significantly different ($p < 0.001$). Twenty-three of the 55 patients (42%) in the corticosteroid group and 36 of the 51 patients (71%) patients in the PRP group were defined as successful with the DASH, which was also significantly different ($p < 0.003$).

5) Extracorporeal shock wave therapy (ESWT)

There is insufficient evidence in the literature to make a final determination on the role of ESWT in the management of lateral epicondylitis. Although Rompe et al.²⁵⁾ reported that three treatments of 1,000 impulses at 0.08 mJ/mm² without anesthesia using anatomic localization is effective in providing notable pain relief, two other studies^{26,27)} indicated that similar treatment protocols of 1,500 to 2,000 low-energy impulses with or without local anesthesia are no more effective than placebo. This suggests that anatomic localization may not be an adequate method for determining the optimal site of application. Failure of corticosteroid injection may be an important and positive predictive factor in determining a favorable response to ESWT.

Surgical Treatment

Failure of nonoperative therapy represents the most common indication for surgical treatment; however, before surgery is considered, other causes of lateral elbow pain should be excluded. As much as 8% of patients may qualify as surgical candidates, which in most cases signifies persistent symptoms after 6 to 12 months of nonsurgical therapy.²⁸⁾

1) Open debridement

A standard longitudinal incision is made over the lateral epicondyle and dissection is then deepened to expose the common extensor origin. Division of the common extensor origin and varying releases or excision of the orbicular ligament or the tendinotic tissue from the ECRB have been described: some authors have left the tendon divided, whereas others have described various types of lengthening or repair.²⁹⁾ Other authors have included decortication or drilling of the epicondyle to stimulate healing (Fig. 4).³⁾

There is no consensus regarding the optimal open surgical technique. The benefits of open release are that it allows careful inspection of the under-surface of the ECRB, which can reveal tears, and allows careful separation of the extensor carpi radialis longus (ECRL) from the anterior surface of the extensor aponeurosis, allowing for anatomical repair. The disadvantage is that excessive debridement may compromise lateral stability.³⁰⁾

2) Arthroscopic debridement

An arthroscopic technique was first described by Grifka et al.³¹⁾ in 1995. The method involves a 'soft spot' posterior lateral portal, an anteromedial (AM) viewing portal and an anterolateral (AL) working portal.

Debridement of the ECRB is performed in the anterior compartment, viewing from the proximal AM portal and working from the proximal AL portal. After the radiocapitellar joint is

identified, the forearm is pronated and supinated to assess for chondral wear on the radial head. The capsule overlying the ECRB may be classified as type 1 (intact), type 2 (linear tears), or type 3 (complete rupture with retraction); however, classification does not appear to predict outcome. The proximal AL portal is then established and debridement of the capsule is performed through this portal from proximal to distal with a combination of a 3.5-mm shaver and radiofrequency ablation. After resection of the capsule, the underlying fibers of the ECRB are debrided until the healthy overlying fibers of the extensor digitorum communis and ECRL are visualized. Decortication of the lateral epicondyle may then be performed with a shaver or motorized bur to stimulate local bleeding at the discretion of the surgeon (Fig. 5). Care is taken to work anterior to the equator of the radial head throughout the procedure so as not to injure the lateral ulnar collateral ligament and cause iatrogenic posterolateral instability.³²⁾

Baker and Baker³³⁾ reported prospectively on 30 elbows in 30 patients who underwent arthroscopic debridement, with a satisfaction rate of 87% at a mean follow-up of 130 months. The potential advantages of an arthroscopic approach are that it can diagnose and treat concomitant intra-articular pathology; it also potentially minimizes damage to healthy tissue, and allows visualization of the under-surface of the ECRB tendon. However, an arthroscopic procedure is more likely to take longer than an open operation, and associated with the potential risk of damage to the radial nerve.^{34,35)}

3) Postoperative management

Patients are usually discharged on the same day as their open and arthroscopic surgery, and are prescribed a rehabilitation program involving eccentric strengthening exercises. They are advised to avoid the offending activity for a minimum of three months, and to return to work within four to 12 weeks (if a

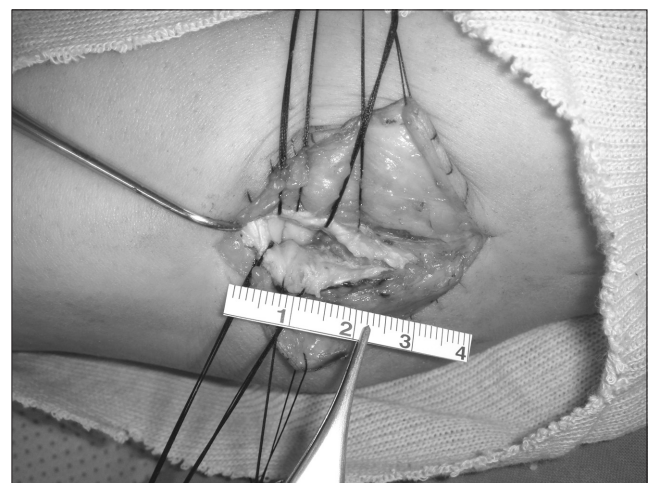


Fig. 4. Open technique for lateral epicondylitis: opening the common extensor origin and the joint, to perform a decortication of the lateral epicondyle.

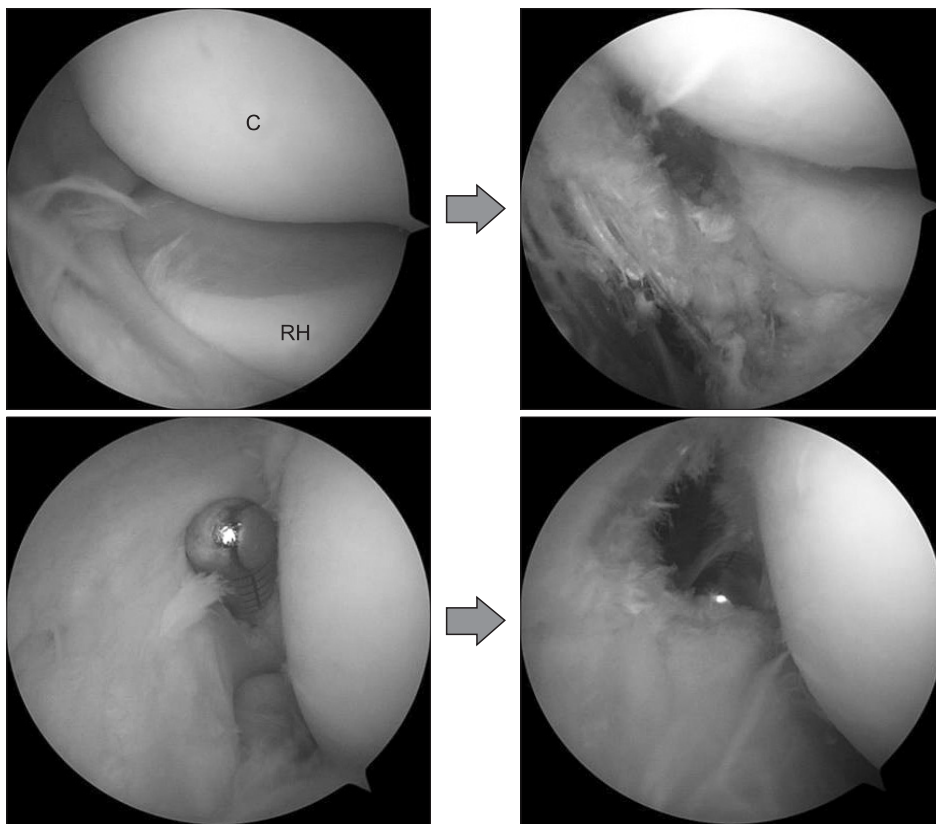


Fig. 5. Arthroscopic debridement for lateral epicondylitis. Arthroscopy from proximal anteromedial portal and instrument from anterolateral portal. After shaving the capsule and extensor carpi radialis brevis tendon, extensor carpi radialis longus muscle is exposed. C: capitellum, RH: radial head.

manual worker). Desk workers can return to work immediately but will still require modified duties to enable them to recover properly.³⁶⁾

Discussion

In recent years, there has been an interest in arthroscopic treatment of lateral epicondylitis. A cadaveric study demonstrated that arthroscopic release of the ECRB was a safe, reliable, and reproducible procedure for refractory lateral epicondylitis.³⁷⁾ However, the results of arthroscopic treatment of this condition have been variable. Timothy and Champ³⁸⁾ reported satisfactory results in 9 of 11 patients. However, he also had a 33% complication rate. Stapleton and Baker³⁹⁾ compared five patients treated arthroscopically with 10 patients treated by open debridement. They reported similar results and complication rates between the two groups. Later, Baker et al.⁴⁰⁾ reported on 39 elbows treated arthroscopically, with 37 reporting being 'better' or 'much better' at follow-up. Peart et al.⁴¹⁾ reported on 33 arthroscopic procedures for lateral epicondylitis, with 28% of patients failing to achieve good or excellent outcomes. Solheim et al.⁴²⁾ compared 225 patients treated arthroscopically with 80 patients treated by open release. Both methods provided an effective treatment of recalcitrant lateral epicondylitis without major complications. The arthroscopic method offered a small, but not insignificant, improvement in the outcome as evaluated

by the Quick-DASH score.

The variable results reported using various arthroscopic techniques may be related to increased difficulty in identifying the ECRB origin through the arthroscope.⁴³⁾ The tendon is extra-articular, and capsular release is required to visualize its origin. The tendon footprint is diamond shaped and located between midline of the radiocapitellar joint and the top of the humeral capitellum averaging 13 by 7 mm. The PIN should be well medial and distal to the area of dissection. The lateral collateral ligament is not compromised, as long as the release is kept anterior to the midline of the radiocapitellar joint. Care is taken not to release the extensor aponeurosis, which lies superficial to the ECRB tendon.

The Mayo Clinic reviewed a consecutive series of 36 patients with recalcitrant lateral epicondylitis treated with arthroscopic release using the aforementioned technique.⁴⁴⁾ There were 24 men and 12 women, with an average age of 42 years at the time of surgery. The cohort had symptoms for an average of 19 months before surgical intervention. Intraoperative findings revealed significant lateral intra-articular synovitis in approximately 30% of patients. Approximately 75% of cases had an intact elbow capsule or a minor linear capsular tear, whereas 25% had a significant proximal capsular disruption. All patients were evaluated by independent examiners for the purposes of this study at a minimum 2-year follow-up. On average, patients required 4 weeks to return to regular activities and 7 weeks to return to

full work duties. No major complications were reported. One patient had a neurapraxia of the superficial radial nerve that resolved by 2 weeks postoperatively. The average functional component of the Mayo Elbow Performance Score at follow-up averaged 11.1 out of 12 (range, 5–12). Grip strength averaged 91% of the opposite, uninvolved side. Subjective pain ratings as measured on a visual analog scale improved from 8.5 + 2.4 to 1.9 + 1.3 ($p < 0.01$). However, 10 patients reported continued pain with strenuous activities and repetitive use of the affected arm. Two patients continued to have significant pain and were considered failures.⁴⁴⁾

In summary, there is no agreement among the treating surgeons about the standard treatment protocol of lateral epicondylitis. In the nonoperative treatment shock wave nitric oxide patches with autologous injections have some researches support. But success is not guaranteed. The use of open release for Lateral epicondylitis has no consensus. The benefit is careful inspection but has a wide margin of excision compromising the lateral stability. On the other hand arthroscopic release of the ECRB appears to be an effective option for the surgical treatment of chronic lateral epicondylitis unresponsive to conservative modalities. Knowledge of the anatomy, including the extensor tendon origins as visualized from an intra-articular perspective, is essential for effective surgical release.

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