Randomized Prospective Evaluation of Injection Techniques for the Treatment of Lateral Epicondylitis

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abstract

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Lateral epicondylitis is a commonly made diagnosis for general practitioners and orthopedic surgeons. Corticosteroid injection is a mainstay of early treatment. However, conflicting evidence exists to support the use of steroid injection, and no evidence in the literature supports an injection technique.

Nineteen patients diagnosed with acute lateral epicondylitis were evaluated to compare the peppered- and single-injection techniques using the Disabilities of the Arm, Shoulder and Hand (DASH) score, visual analog score (VAS), and grip strength. For elbows with a single injection, mean grip strength increased from 22.9 to 27.8 \( (P = .053) \), mean VAS pain score decreased from 4.8 to 3.6 \( (P = .604) \), and mean DASH score decreased from 2.6 to 1.8 points \( (P = .026) \). For elbows with peppered injections, mean grip strength increased from 28.7 to 32.8 \( (P = .336) \), mean VAS pain scores decreased from 3.7 to 2.3 \( (P = .386) \), and mean DASH score decreased from 2.6 to 1.3 \( (P = .008) \).

No studies have directly compared the peppered-injection technique to the single-injection technique. Our results suggest that patient outcome is improved with the single injection. The biomechanical or chemical reason for the distinction is yet unknown, but we postulate that the peppered technique may actually further damage the already compromised tendon. The theory that the peppered injection stimulates blood flow may be overestimated or false. Histochemical studies of the pathologic tissue must be performed to further delineate the reason for improved outcomes with the single-injection technique.

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Lateral epicondylitis is a commonly made diagnosis for general practitioners and orthopedic surgeons. In spite of its incidence, evidence-based literature has failed to support a single treatment modality. Over 40 different treatment options have been described, including wait and see, activity modification and physical therapy, orthoses, oral and topical anti-inflammatory drugs, steroid injections, platelet-rich plasma, botulinum toxin, extracorporeal shock wave therapy, laser irradiation, and arthroscopic and open surgical intervention.\(^1,2\)

However, corticosteroid injection is a mainstay of early treatment due to its ease of administration, its cost effectiveness, and patient expectations. Although widely used, conflicting evidence exists to support the use of steroid injection to treat lateral epicondylitis. In addition, no evidence in the literature supports the single- vs peppered-injection technique.

**MATERIALS AND METHODS**

Thirty-one patients who presented with acute symptomatic lateral epicondylitis were selected for participation. Nineteen of those patients presented for at least 1 follow-up at a mean of 2.5 months postinjection. Patient history, physical examination, and radiographs were initially evaluated. Evaluation with magnetic resonance imaging (MRI) was not included in this study. All patients were treated with activity modification, ice, and oral anti-inflammatory drugs.

Patients were then prospectively randomized to receive a corticosteroid injection using either a single-injection or a peppered-injection technique. Inclusion criteria were patients with physical examination findings consistent with lateral epicondylitis, specifically pain with palpation at the extensor carpi radialis brevis and common extensor origin, pain with resisted wrist extension, and pain with resisted digit extension. Exclusion criteria were patients younger than 18 years, patients who had received previous injections to that elbow, and chronic cases defined as symptoms for >6 months, history of trauma to the elbow, evidence of neurologic source of pain (radial nerve entrapment or cervical radiculopathy), or intra-articular pathology (osteoarthrosis dissecans, osteo- or inflammatory arthritis, posterolateral rotatory instability, or plica).

Outcomes were measured via subjective and objective findings using the visual analog pain scale (VAS), Disability of the Arm, Shoulder and Hand (DASH) score, and grip strength evaluation prior to the injection and at 10 weeks postinjection. Patients who received no relief from the first injection were offered a second injection. Surgical intervention was an option for patients for whom both injections failed when symptoms persisted for >6 months despite conservative treatment.

**SURGICAL TECHNIQUE**

The patient was placed in a seated position with the affected arm resting comfortably on the examination table. The elbow was flexed to approximately 90° with the palm pronated so that it was flat on the table. The point of maximal tenderness was identified by palpation and marked. The skin was prepared using betadine and alcohol.

The injection of 1 mL of 10 mg/mL triamcinolone was mixed with 1 mL of 2% lidocaine. A 25-gauge needle was used for the injection. The area was cleaned with alcohol postinjection and a sterile bandage was applied. Patients were instructed to use oral anti-inflammatory drugs and ice to control local discomfort from the injection. A standard formal physical therapy program was initiated.

The single-injection technique was performed by penetrating the skin at the identified area of maximal tenderness. The needle was advanced to the bone and slowly pulled back a few millimeters. The entire quantity of the syringe was deposited at this location, and the needle was then withdrawn (Figure 1).

The peppered-injection technique also began with penetration of the skin at the area of maximal tenderness. The needle was advanced to the bone and then withdrawn a few millimeters. A small amount of the steroid/anesthetic was delivered. The needle was withdrawn without removing it from the skin and then redirected with deposition of fluid (Figure 1). A crepitation or cracking sensation may be felt, and redirection should be continued until this sensation ceases.\(^3,4\)

**RESULTS**

The study evaluated 33 elbows in 31 patients (15 single injections, 18 peppered injections) with a mean follow-up of 2.5 months. For elbows injected with a single injection, mean grip strength increased from 22.9 to 27.8 (\(P=.053\)) (Figure 2); mean pain score decreased slightly from 4.8 to 3.6 (\(P=.604\)) (Figure 3); and mean DASH score decreased from 2.6 to 1.8 points (\(P=.026\)) (Figure 4). For elbows injected with peppered injections, mean grip strength increased from 28.7 to 32.8 (\(P=.336\)) (Figure 5); mean pain score decreased from 3.7 to 2.3 (\(P=.386\)) (Figure 6); and mean DASH score decreased from 2.6 to 1.3 (\(P=.008\)) (Figure 7).

**DISCUSSION**

Lateral epicondylitis is debilitating for patients and vexing for the orthopedic surgeon. The literature offers multiple modalities for treatment, conservative and operative, all with varying reports of success. Fortunately, most patients report symptomatic improvement within 1 year with only 4% to 11% requiring surgical intervention.\(^5\) Several factors are associated with failure of conservative interven-
tion: manual laborer, involvement of the dominant arm, long duration of symptoms, high baseline pain levels at presentation, poor coping mechanisms, lower socioeconomic status, and concomitant pain in the neck or shoulder. Injection into the extensor carpi radialis brevis tendon and common extensor origin has long been the mainstay of treatment. Corticosteroids, platelet-rich plasma, whole blood, polidocanol, and prolotherapy have all been administered via local injection to the lateral elbow. Each has been shown to demonstrate some degree of efficacy with reduction in symptoms and be safe with low side effect profiles. Unfortunately, no single injection modality or technique has proven superior.

The use of corticosteroid injections for lateral epicondylitis is common secondary to accessibility, cost effectiveness, and patient expectations. Outcomes seem to vary with length of follow-up. Tonks et al designed a study with 4 treatment arms: observation only, single injection, physiotherapy, and single injection plus physiotherapy. Only patients allocated to the injection group had significantly improved outcomes in all parameters at 7 weeks. In that study, the physiotherapy/injection groups did not demonstrate the same improvement.

Triamcinolone, hydrocortisone, and lignocaine were prospectively compared by Price et al, who found early improvement in both steroid groups. This significant difference did not persist, and at 6 months no difference existed among all groups. Newcomer et al reported on a prospective randomized double blind trial comparing anesthetic only to anesthetic plus betamethasone. At baseline, 4 weeks, 8 weeks, and 6 months, no significant difference existed in the patient functional testing or grip strength. There were, however, improved VAS scores from 8 weeks to 6 months in the betamethasone group. The authors nullify this finding in the discussion, attributing the finding to either a type I statistical error or a clinically insignificant finding. They ultimately do not recommend steroid injection for treatment of lateral epicondylitis. This sentiment is echoed by Smidt et al and Bisset et al, who both showed early success with corticosteroid treatment in reduction of pain and improved grip; these findings did not persist, as there was a high recurrence noted in the injection group and ultimately improved outcomes at 1 year with physical therapy and wait and see treatments.

Theories to explain the lack of persistent improvement include tendon weakening from the cortisone or further injury.
to the tendon during the pain-free period invoked by the injection. Systematic reviews of the literature also conclude that injection of cortisone for lateral epicondylitis may result in short-term improvements, but those improvements lack longevity. Ultimately, all treatment groups, regardless of intervention, demonstrate resolution of symptoms with time. Injection technique has previously been addressed. The peppering technique was first described in 1964 by Pruce et al. Altay et al conducted a study using the peppering technique while comparing a combined steroid/anesthetic injection to only anesthetic. No significant difference was observed between the groups at 2, 6, and 12 months after injection in regard to provocative testing and Verhaar’s Scoring System for the Treatment of Lateral Epicondylitis. They attribute this improved excellent outcome in 93% of patients with steroid and 95% with no steroid to healing of the degenerative myxoid tissue that may be stimulated by multiple bleeding channels created with peppering.

To our knowledge, ours is the only study directly comparing the 2 known injection techniques for the treatment of lateral epicondylitis: single or peppered injection. Our results indicate that patients who underwent the single-injection technique experienced significant improvements in the DASH score, grip strength, and VAS pain scale compared to the peppered-injection technique. The biomechanical or chemical reason for the distinction is yet unknown, but we postulate that the peppered technique may further damage the already compromised area by physically creating a larger defect in the extensor carpi radialis brevis tendon near its insertion on the humerus. The theory that the peppered injection stimulates blood flow to improve healing may be overestimated or false. Similarly, there may be a chemical source of tendon disruption with diffuse effects of the cortisone and/or anesthetic. Histochemical studies of the pathologic tissue must be performed to further delineate the reason for improved outcomes with the single-injection technique.

The overwhelming strengths of our study are that it is a prospective randomized study directly comparing 2 treatment techniques and is the first of its kind. In addition, subjective and objective parameters were entertained to elicit a difference between the 2 groups. The study design followed patients for an average of 18 weeks after treatment (range, 3-324 days). The literature suggests that, within this time frame, cortisone treatments should
be beneficial but not persist at 12 months. Interestingly, we have identified a difference between the treatment groups in this short time frame, with the single-injection group experiencing significant improvements in VAS, grip strength, and DASH scores. It would be beneficial to evaluate these patients at 6 months and 1 year, with the hope of revealing continued improvement in the single-injection group.

As is true with many lateral epicondylitis studies, our population of patients was relatively small, and this is an area for further research. In addition, we look forward to following our patients’ outcomes at further intervals. Another outlet that is also not well delineated in the literature is the true pathologic status of the tissue at the lateral epicondyle. Certainly, there exists a spectrum from inflammation to necrotic tissue. With this in mind, success of treatment likely correlates with the extent of disease in addition to treatment modality. In future investigations, MRI completed before intervention may distinguish inflammation, tearing, and necrosis to provide valuable information in ultimately directing the treatment of lateral epicondylitis. The final weakness of the study involves postinjection therapy. Patients were not seen exclusively by 1 physical therapist; therefore, therapy may be a factor influencing patient outcome independent of injection technique. Fortunately, most protocols for this common diagnosis follow similar guidelines, and we do not feel that this negatively impacts the study conclusions. It is well established that steroid injections for lateral epicondylitis result in, at the very least, short-term benefits. This study supports the use of a single-injection technique over a peppered technique.

REFERENCES