

Ultrasound-Guided, Minimally Invasive, Percutaneous Needle Puncture Treatment for Tennis Elbow

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ABSTRACT

Introduction: This report evaluates the efficacy of percutaneous needle puncture under sonographic guidance in treating lateral epicondylitis (tennis elbow).

Methods: Ultrasound-guided percutaneous needle puncture was performed on 76 patients who presented with persistent elbow pain. Under a local anesthetic and sonographic guidance, a needle was advanced into the calcification foci and the calcifications were mechanically fragmented. This was followed by a local injection of 25 mg prednisone acetate and 1% lidocaine. If no calcification was found then multiple punctures were performed followed by local injection of 25 mg prednisone acetate and 1% lidocaine. A visual analog scale (VAS) was used to evaluate the degree of pain pre- and posttreatment at 1 week to 24 weeks. Elbow function improvement and degree of self-satisfaction were also evaluated.

Results: Of the 76 patients, 55% were rated with excellent treatment outcome, 32% good, 11% average, and 3% poor. From 3 weeks posttreatment, VAS scores were significantly reduced compared with the pretreatment score ($P < 0.05$) and continued to gradually decline up to 24 weeks posttreatment. Sonography demonstrated that the calcified lesions disappeared completely in 13% of the patients, were reduced in 61% of the patients, and did not

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change in 26% of the patients. Color Doppler flow signal used to assess hemodynamic changes showed a significant improvement after treatment in most patients.

Conclusion: Ultrasound-guided percutaneous needle puncture is an effective and minimally invasive treatment for tennis elbow. Sonography can be used to accurately identify the puncture location and monitor changes.

Keywords: lateral epicondylitis; tendinitis; tennis elbow; ultrasound treatment

INTRODUCTION

Chronic tendinitis is a very painful, debilitating injury that can arise from excessive muscle use and can affect many tendons such as Achilles, patella and extensor tendons, and rotator cuff.¹ The overuse of the extensor tendons of the forearm can cause the common chronic sports injury lateral epicondylitis (tennis elbow).² The condition has a high incidence rate and is characterized by injury at the origin of the common extensor tendon attached to the lateral epicondyle of the humerus.³ Although many tennis players can become afflicted with this condition, it is not restricted to participants of this sport; other athletes or professionals can be affected if they partake in activities involving the elbow and wrist extension and/or supination related to overuse of the muscles that originate at the lateral epicondyle. The etiology of lateral epicondylitis remains unclear; pathology shows vascular hyperplasia, disorganized collagen, and dense populations of fibroblasts.⁴

Various treatments for lateral epicondylitis exist, including medicinal therapy, physical therapy, block therapy, shock

wave therapy, and surgery.⁵⁻⁸ However, the therapeutic outcomes are not consistent and none has emerged as the preferred treatment in terms of effectiveness. This study investigated the results of treating tennis elbow by ultrasound-guided percutaneous needle puncture.

MATERIALS AND METHODS

Patients

A total of 76 patients diagnosed with tennis elbow were treated by ultrasound-guided percutaneous needle puncture. All patients had unilateral lesions and had no history of elbow operation. The majority of the patients (47/76) had received physical and/or block therapy previously. However, the last therapy had been more than 2 weeks beforehand. Informed consent was obtained from all patients and our institutional ethics committee approved the trial.

Ultrasonography

Patients underwent sonographic evaluation before and after the puncture us-

ing a GE Logiq 700 Doppler ultrasound (General Electric Company, WI, USA) with a 6-10 MHz linear transducer. Patients sat with their forearm in internal rotation. We placed the ultrasonic probe on the lateral epicondyle so that the common extensor tendon attached to it was clearly visible on a coronal section in the long-axis direction.

Hemodynamic changes were assessed using a power Doppler ultrasound with fixed settings of color gain 90-100 db and wall filter 20-40 db. The color Doppler flow signal was divided into three grades: Grade 0, no blood flow; Grade 1, spotty color (little color dots); Grade 2, bar or strip shape. Grade 1 and Grade 2 demonstrate inflammation and hyperemic reaction in the tendons, which is benefit to the healing of tendon. For patients post-treatment, Grade 1 and Grade 2 indicate that treatment is effective.

Percutaneous Needle Puncture Procedure

Under local anesthetic (subcutaneous injection of 1% lidocaine) and sonographic guidance, a 16-gauge needle was advanced into the common extensor tendon. Calcifications were mechanically fragmented and washed with sterile water. Then a 1-mL mixture of 25 mg prednisone acetate and 1% lidocaine was injected to the fenestrated tendon. For the patients without calcification, multiple punctures were performed at the adjacent common extensor tendon and a 1-mL mixture of 25 mg prednisone acetate and 1% lidocaine was injected. If symptoms were not alle-

viated, the treatment was repeated two to three times. Each treatment had an interval of 1-2 weeks. Nonsteroidal anti-inflammatory agents were administered to help alleviate pain after injection.

Follow-Up and Effective Evaluation

All the follow-up examinations were completed by a specifically assigned doctor. Clinical evaluation and ultrasound were followed from 24 to 48 weeks. The degree of pain, pre- and posttreatment, was evaluated with a visual analog scale (VAS). The improvement of elbow function and degree of self-satisfaction were also evaluated. A VAS value of 1-3 represented no or mild pain and was scored as 1 point; 4-7 values represented moderate pain with a 2-point score; 8-10 values denoted severe pain and scored 3 points. Elbow function had three categories: no difficulty, difficult, extreme difficulty, scoring 1, 2, and 3 points, respectively. The degree of satisfaction was divided into satisfactory (1 point), partial satisfaction (2 points), and unsatisfactory (3 points). The points were added and, according to the sum of scores, the results were divided into: excellent (3 points), good (4-5 points), average (6-7 points), and poor (8-11 points).

Statistics

SPSS 12.0 statistical software was used for statistical analysis. *T* test and nonparametric statistics were used to determine the significant differences among the groups. Statistical significance was set at $P < 0.05$.

RESULTS

A total of 76 patients (31 men, 45 women; mean age, 42 ± 10 years; range, 21-61 years) were treated. All patients had elbow pain (mean time, 14 weeks; range, 9-26 weeks) refractory to conservative medical treatments: oral drugs (61 patients), local steroid injections (31 patients) and physical rehabilitation (34 patients), with each method being used alone or in combination with others.

Of the 76 patients, 55% ($n=42$) were rated with excellent treatment outcome, 32% ($n=24$) good, 11% ($n=8$) average, and 3% ($n=2$) poor outcome. Among the 76 patients, 58 were treated once, 12 treated twice, and four were treated three times.

Compared with pretreatment, VAS scores decreased significantly by 3 weeks posttreatment ($P < 0.05$) and continued to decline for the next 21 weeks; scores at the 6-, 12-, and 24-week examinations were all significantly lower than pretreatment ($P < 0.05$) (Table 1).

The calcific deposits were in the com-

mon extensor tendon in 31 cases, and the size of calcific deposits were 2-6 mm. The sonograms of the other 45 cases showed a local low-level echo within the common extensor tendon showing a lack of calcification. There was no sonographic evidence of rotator cuff tear in any of the patients. Calcified lesions disappeared completely in 13% (4/31) of the patients, were reduced in 61% (19/31), and did not obviously change in 26% (8/31). The time it took for the calcified lesions to disappear was 6.7 ± 0.5 weeks.

The ultrasound findings of the other 45 patients were not significantly altered. However, hemodynamic changes were detected in the majority of patients (65/76): lack of blood flow (Doppler flow signal Grade 0) was seen in 61 patients before treatment and significantly decreased to 11 patients posttreatment ($P < 0.05$). Prior to treatment, 15 patients had Grade 1 blood signal and none had Grade 2. After the percutaneous needle puncture procedure, the numbers of patients with Grade 1 and 2 blood flow significantly increased to 48 and 17, respectively (both $P < 0.05$). In this study, no adverse events were reported and no patient had obvious side effects or localized infection.

Table 1. Visual analog scores before and after percutaneous needle puncture treatment.

Time point	Visual analog scale
Pretreatment	7.8 ± 1.9
Weeks posttreatment	
1	7.7 ± 2.5
2	7.6 ± 1.4
3	$5.1 \pm 1.8^*$
6	$4.2 \pm 1.8^*$
12	$4.0 \pm 2.4^*$
24	$3.1 \pm 2.1^*$

* $P < 0.05$ vs. pretreatment.

DISCUSSION

This study showed that ultrasound-guided percutaneous puncture is an effective treatment for tennis elbow. Of the 76 patients, 87% had excellent or good treatment outcome scores, similar to that obtained in other treatment modalities.⁵⁻⁹ We had a high calcification removal and reduc-

tion rate in this study, probably because patients had short symptom duration (<4 weeks) and the calcification lesions were soft. In our study, we found that the two patients with hard calcification lesions did not respond well to our treatment procedure. Whether the hardness of the calcification influenced the therapeutic efficacy requires further study; in the meantime, surgery for these patients is more suitable.

Generally, puncture treatment has specific and obvious effects when performed at an accurate location. High-frequency ultrasound allows the morphologic abnormalities and the calcified lesions of the main tendon of the elbow to be clearly identified. Calcification after repetitive injury can be seen at the place of attachment of the common extensor tendon. This attachment place and calcification is punctured using ultrasound-guided percutaneous puncture procedure. This procedure offers the advantage of accurate localization, which is necessary to aid the proliferation of local blood vessels and reduce or remove calcifications, which in turn could possibly alleviate tendon pressure and the patient's symptoms.

Various other treatments for tennis elbow are available, including analgesics, localized block therapy, and surgery. However, the outcomes of these treatments are not consistent. Considering the radiation and economic factors, patients in this study did not receive x-ray examination. The accuracy of calcification lesion diagnosis by ultrasonography has been commonly recognized,^{10,11} so a lack of x-ray examination would not influence our diagnosis.

A main limitation of this study is that

there was no control group; all patients received needle puncture treatment. The second limitation of the study is that color power Doppler sensitivity is dependent on ultrasound scanner performance. Further studies are needed to clarify these limitations.

According to our preliminary study, treatment of tennis elbow by ultrasound-guided percutaneous puncture was satisfactory. Symptoms of most patients were significantly alleviated, especially in those with calcification lesions, in which the ultrasound provided accurate localization. Moreover, the procedure offered the advantage of ease of performance and was minimally invasive, and so could be conducted in an outpatient department. Therefore, we highly recommend ultrasound-guided percutaneous puncture for the treatment of tennis elbow.

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