One-year survey of two different ultrasound (US)-guided percutaneous treatments of lateral epicondylitis: results of a randomised controlled trial

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Purpose

Lateral epicondylitis (tennis elbow) was first described by F. Runge in 1873. Since then, much controversy over the pathophysiology and treatment of this disorder has been reported. This condition is an overuse injury involving the extensor muscles that origin on the lateral epicondylar region of the distal humerus. It is more properly termed as tendinosis and more frequently involves the origin of the extensor carpi radialis brevis muscle. Any activity involving wrist extension and/or supination can be associated with overuse of the muscles originating at the lateral epicondyle. Tennis has been the activity most commonly associated with this disorder. The risk of overuse injury increases 2-3 times in tennis players with more than 2 hours of play per week and 2-4 times in players older than 40 years. Several risk factors have been identified, including improper technique, size of racquet handle, and racquet weight.

Nevertheless only 10% of patients affected by this condition are tennis players. In fact, lateral epicondylitis is extremely common in today's active population.

For work-related lateral epicondylitis, a systematic review identified 3 risk factors: handling tools heavier than 1 kg, handling loads heavier than 20 kg at least 10 times per day, and repetitive movements for more than 2 hours per day. Besides that low job control and low social support are psychosocial factors associated with lateral epicondylitis.

Many authors proposed different aetiologies for lateral epicondylitis, such as inflammatory processes of the radial humeral bursa, synovium, periosteum, and the annular ligament. However, Nirschl and Pettrone attributed the cause of this disorder to microscopic tearing with formation of reparative tissue (i.e., angiofibroblastic hyperplasia) in the origin of the extensor carpi radialis brevis (ECRB) muscle. This microtearing and repair response can lead to macroscopic tearing and structural failure of the origin of the ECRB muscle.

Concomitant intra-articular lesions (e.g., loose bodies, synovitis, ulnohumeral osteophytes, chondral lesions) have been visualized during elbow arthroscopy in patients with lateral epicondylitis. However, while concomitant intra-articular pathology has been noted, this process is currently considered an extra-articular process.

Clinically, lateral epicondylitis is characterized by an initial mild pain localized in the lateral elbow region (lateral epicondyle) which gradually worsens and becomes stabbing or burning often associated with weak grip strength and moderate swelling.

These symptoms usually last all day long and aggravate during daily activities or sports.

The diagnosis of this condition is practically clinical, however imaging can help in some ways.
Radiographs can be helpful in ruling out other disorders or concomitant intra-articular pathology (eg, osteochondral loose body, posterior osteophytes). Calcification in the degenerative tissue of the extensor carpi radialis brevis muscle origin can be seen in chronic cases.

Magnetic resonance imaging can demonstrate the increased thickening and signal intensity changes of the common extensor tendon origin at the lateral epicondyl, the presence of macroscopic tear of the extensor carpi radialis brevis, with or without tears of the extensor digitorum communis and variable disruption of fibers. Tendinopathies and partial tears of the common extensor tendon are characterized by a high signal intensity in T2-weighted imaging. This technique can detect other concomitant pathologic findings such as edema and/or fracture lines after trauma and loose bodies.

US may be useful to confirm the clinical diagnosis in doubtful or refractory cases, to reveal the extent and severity of the disease and to monitor the response to therapy.

The main US features of lateral epicondylitis are preinsertional hypoechoic swelling of the tendon with focal or diffuse areas of decreased reflectivity in the tendon substance and loss of the fibrillary pattern related to tendinosis, fluid adjacent to the common tendon and ill-defined tendon margins. In high-grade tendinosis, the angiofibroblastic infiltration based on migration of fibroblasts and vascular granulation tissue within the tendon substance causes a striking hypervascular pattern of the intratendinous hypoechoic areas at color and power Doppler imaging.

Spurring at the common extensor tendon insertion and cortical irregularities at the anterolateral surface of the lateral epicondyle may also be recognized, although bony changes do not correlate with disease activity. Intratendinous calcifications may also be seen.
Fig.: The US-image shows a case of lateral epicondylitis. We can note the
disomogeneous ecostructure of the common estensor tendon. The color Doppler
makes clearly visible the associate fogistic tissutal hyperaemia

References: G. Ferrero; Radiology, Genoa University, Genoa, ITALY

Recently also sonoelastography has demonstrated to be effective in the diagnosis of
lateral epicondilitis, because this technique can visualize alterations of the elastic tissutal
properties.

Fig.: Sonoelastography. The arrow shows a focal soft area in the common extensor
tendon enthesis.

References: G. Ferrero; Radiology, Genoa University, Genoa, ITALY

The treatment of this disorder is extremely various and consist of: icing the painful area,
immobility, oral sommistration of NSAIDs, shockwaves, steroid injection and surgery.

Surgery is recommended only after a patient fails conservative treatment. Multiple
surgical techniques have been described for this problem. These include releasing the
common extensor origin (open or percutaneously, with or without repair), debriding
the pathologic tissue in the ECRB tendon, releasing the posterior interosseous nerve,
arthroscopic release, anconeus rotation, and denervation of the lateral epicondyle.
The purpose of this scientific paper is to describe our technical approach to US-guided percutaneous treatment of lateral epicondylitis, a common cause of elbow pain in general population, comparing two different types of treatment: dry needling and steroid injection.

Dry needling is a procedure that consists in repeated puncturing (scarification) of the common extensor tendon enthesis and of the lateral epicondyle periostium, which causes local hyperaemia and a little bleeding in the injured area.

**Images for this section:**

![Image of ultrasound showing lateral epicondylitis](image)

**Fig. 1:** The US-image shows a case of lateral epicondylitis. We can note the disomogeneous ecostructure of the common extensor tendon. The color Doppler makes clearly visible the associate flogistic tissutal hyperaemia.
Fig. 2: Sonoelastography. The arrow shows a focal soft area in the common extensor tendon enthesis.
Methods and Materials

We studied 46 patients (26 males, 20 females, age 45±8.6 [mean±standard deviation]) with clinical diagnosis of lateral epicondilitis, who underwent a US-guided percutaneous treatment. They were randomly subdivided into two groups. In the first group (23 patients), we performed an US-guided local anaesthesia, injecting a small amount of anaesthetic in the peritendineous soft tissues, then always under US guidance, the needle was advanced into the enthesis of the common extensor tendon. After that, a dry needling was performed on the insertional portion of the common extensor tendon and on the periostium. In the second group (23 patients), after local anaesthesia, we performed an US-guided injection of a small amount of steroid (1ml of triamcinolone acetonide 40 mg/ml), avoiding the tendon. During the procedure, a coronal scan of the enthesis has allowed a correct and continuous monitoring of the needle. A visual analogue scale was used to evaluate the degree of pain pre-and post-treatment at 2, 12, 24 and 48 weeks.

Fig.: The scheme presents a well performed coronal scan of the enthesis. It allows a correct and continuous monitoring of the needle up to the enthesis

References: G. Ferrero; Radiology, Genoa University, Genoa, ITALY
**Fig.:** The video shows the injection of a small amount of local anaesthetic in the peritendineous soft tissues.

**References:** G. Ferrero; Radiology, Genoa University, Genoa, ITALY
Fig.: The video shows how a dry needling is performed on the insertional portion of the common extensor tendon and on the periostium

References: G. Ferrero; Radiology, Genoa University, Genoa, ITALY
Fig.: The video shows the steroid injection procedure. The needle is retracted to reach the peritendineous soft tissues and a small amount of steroid (1ml of triamcinolone acetonide 40 mg/ml) is injected, avoiding the tendon.

References: G. Ferrero; Radiology, Genoa University, Genoa, ITALY

Images for this section:
**Fig. 1:** The scheme presents a well performed coronal scan of the enthesis. It allows a correct and continuous monitoring of the needle up to the enthesis.

**Fig. 2:** The video shows the injection of a small amount of local anaesthetic in the peritendineous soft tissues.
Fig. 3: The video shows how a dry needling is performed on the insertional portion of the common extensor tendon and on the periostium
Fig. 4: The video shows the steroid injection procedure. The needle is retracted to reach the peritendineous soft tissues and a small amount of steroid (1ml of triamcinolone acetonide 40 mg/ml) is injected, avoiding the tendon.
Results

In the first group, no significant improvement compared with baseline was found at 2 weeks but it was present at 12, 24 and 48 weeks (p < 0.001 for all). In the second group, a significant improvement compared with baseline was found at 2 weeks (p < 0.001) but not at 12, 24 and 48 weeks. Comparison between the two groups showed a significantly different outcome in favour of the second group at two weeks (p < 0.001) and in favour of the first one at 12, 24 and 48 weeks (p < 0.001).

![Graph showing results of the study](image)

**Fig.**: The graphic reports the results of our study

**References**: G. Ferrero; Radiology, Genoa University, Genoa, ITALY

**Images for this section:**
Fig. 1: The graphic reports the results of our study
Conclusion

US is extremely reliable in the identification and localization of common extensor tendon lesions, as it offers a precise guidance for the infiltrative treatment of lateral epicondylitis. Besides that, this procedure is also easy to perform, quick and above all non-invasive.

US-guided percutaneous dry needling alone is more effective than steroid injection, because it has a delayed but more long lasting effects.

Dry needling of periostium and enthesis causes local hyperaemia and little bleeding.

The blood contains platelets and white blood cells, that release some growth factors (i.e PDGF-AA, BB, AB and TGF-b1, b2) and cytokines around the injured area.

![GF and cytokines contained in platelets and WBC](image)

**Fig.**: Growth factors and cytokines contained in platelets and white blood cells

**References:** G. Ferrero; Radiology, Genoa University, Genoa, ITALY

These humoral factors promote the process of healing of the tissues, producing relevant post-procedural recovery phenomena.

Currently, at our Institution a combined approach of this two procedures is the treatment of choice since they can be considered as effective and minimally invasive treatments
for lateral epicondylitis. In addition, during and after the procedure, no complications occurred.

**Images for this section:**

![GF and cytokines contained in platelets and WBC](image_url)

**Fig. 1:** Growth factors and cytokines contained in platelets and white blood cells
References


Personal Information

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