6 Ultrasound-Guided Elbow Injection Techniques

Tolga Ergönenç

Ultrasound-Guided Elbow Injection Techniques

This chapter describes the injection techniques that are most commonly used around the elbow joint. The objective is to precisely define the position and alignment of the transducer and needle to ensure accurate tissue placement. This section also includes short clinical descriptions of each condition with anatomical details. The drugs, doses, and volumes mentioned are those used in clinical practice by the author. This section includes the following injection techniques commonly used in the elbow:

1. Elbow joint injection
2. Common extensor tendon injection (tennis elbow)
3. Common flexor tendon injection (golfer's elbow)
4. Olecranon bursa injection
5. Ulnar collateral ligament (UCL)
6. Ulnar nerve at the elbow
7. Deep branch of radial nerve at the elbow (posterior interosseous nerve syndrome)

Each procedure includes the following subheadings:

(a) Brief anatomy
(b) Common cause
(c) Injection indications
(d) Equipment needed
(e) Injection technique
  (i) Patient position
  (ii) Transducer position
  (iii) Needle direction and approach
  (iv) Target

Elbow Joint Injection

(a) Brief Anatomy

The distal humerus, proximal radius, and proximal ulna comprise the elbow joint, which is a complicated and compound joint produced by the articulations of three bones. The humeral/ulnar joint functions similarly to a hinge joint, allowing elbow flexion and extension. Forearm rotation is possible, thanks to the proximal radioulnar joint and the radiohumeral joint. The joint capsule encases the entire elbow joint.

The posterolateral approach is the safest and most straightforward method which accessing the elbow joint.

T. Ergönenç (✉)
Akyazı Hospital Pain and Palliative Care,
Sakarya, Turkey
e-mail: ergonenc@ultrasoundmsk.org

Y. El Miedany (ed.), *Musculoskeletal Ultrasound-Guided Regenerative Medicine*,
https://doi.org/10.1007/978-3-030-98256-0_6

(b) Common Cause

Elbow intra-articular injections can be used to treat a variety of pathologic conditions.

Symptoms of a painful elbow joint may be caused by either an intrinsic process, such as infection or osteoarthritis, or an extrinsic process, such as a fracture or dislocation. Repetitive stress and overuse can also cause injury and pain in the joint.

(c) Injection Indications

The etiology of a painful and swollen joint can be determined by ultrasound-guided diagnostic aspiration of joint fluid to evaluate if the accumulation is due to inflammatory or noninflammatory arthritis, infection, or crystal-induced arthropathy.

Steroids, hyaluronic acid, local anesthetic, Platelet Rich Plasma (PRP), and ozone can be injected into the joint in various situations.

(d) Equipment Needed
- 25-gauge needle.
- One syringe (5 ml).
- High-frequency linear array transducer/small hockey stick.
- Injectate: 1.0 mL of local anesthetic and 1 mL of injectable corticosteroids (2–3 mL ozone 15–25 mcg/ml).

(e) Injection Technique

(i) Patient Position
- Prone, propped up on a cushion with elbows overhead (lateral elbow joint) or elbow over the edge of the examination table with arm drooping over the edge of the table (posterior elbow joint injection) (Figs. 6.1 and 6.2).
- Sitting, the arm resting on a table with the elbow in slight flexion, the forearm pronated.

(ii) Transducer Position
- The radial head and capitellum are easily identified when the transducer is placed in the long axis of the radius above the posterior portion of the radiohumeral joint (Fig. 6.3).

Fig. 6.1 The patient's position of the posterior elbow joint injection. The elbow joint flexes to 90 degrees, and the arm droops over the table's edge

Fig. 6.2 The patient and transducer position of the posterior elbow joint injection with an in-plane approach

(iii) Needle Direction and Approach
- Out-of-plane approach, posterior to anterior direction (Fig. 6.4a, b).
- In-plane approach, distal to proximal direction (Fig. 6.5).

(iv) Target
- Radiocapitellar joint (Figs. 6.6, 6.7, and 6.8).

Common Extensor Tendon Injection (Tennis Elbow)

(a) Brief Anatomy

The extensor carpi radialis brevis tendon, the extensor digitorum communis tendon, the extensor digiti minimi tendon, and the extensor carpi ulnaris tendon are the four major components of the common extensor tendon (CET) anatomically which are origin on the anterior facet of the lateral epicondyle of the humerus. Wrist extension and radial/ulnar deviation are the functions of the CET.

Fig. 6.3 The transducer position of the elbow joint injection. The elbow in slight flexion, the forearm pronated. Move the transducer over the posterior aspect of the radiohumeral joint to identify the gap between the radial head and capitellum of the humerus

Fig. 6.5 In-plane approach, the needle is inserted at 45 degrees to the transducer in a distal to proximal direction

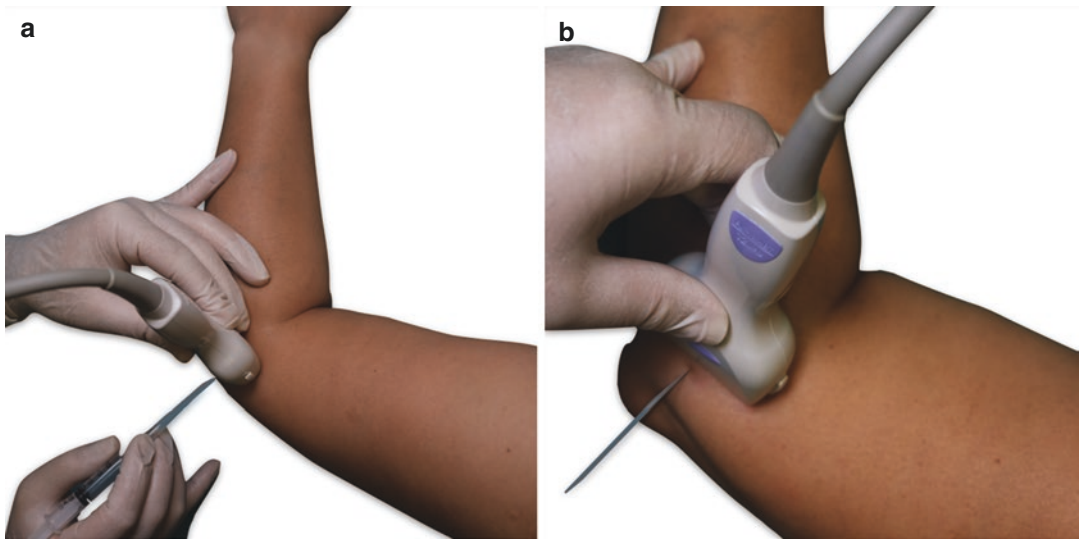

Fig. 6.4 (**a**) For best visualization of the radiohumeral joint, tilt the transducer. (**b**) Out-of-plane approach, the needle is inserted at 45 degrees to the transducer in a lateral to medial direction

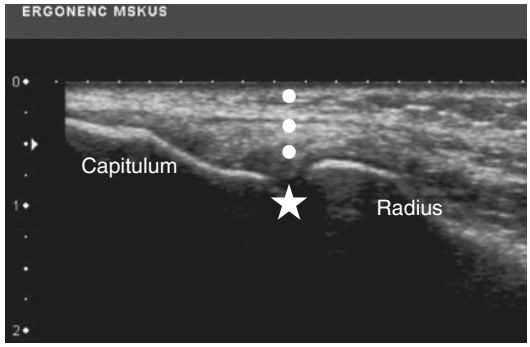

Fig. 6.6 Long-axis sonogram of the radiocapitellar joint (*). Out-of-plane walk-down approach. White circle needle tip

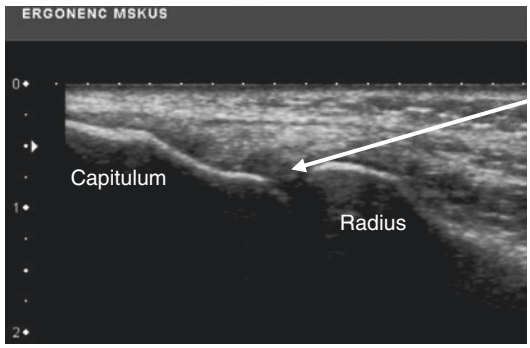

Fig. 6.7 Long-axis sonogram of the radiocapitellar joint. In-plane approach

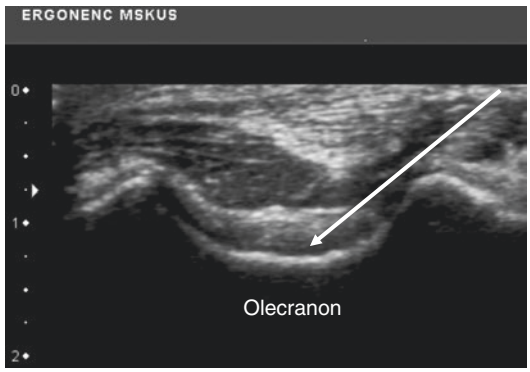

Fig. 6.8 Sonogram of the posterior elbow joint injection with an in-plane approach

(b) Common Cause

Extensor tendinopathy (tennis elbow) is a condition caused by repetitive stress/overuse injuries and microtrauma. Occupational disorders and physically demanding activities such as sport are implicated in the etiology.

(c) Injection Indications

CET injection can be performed on patients with persistent pain despite that conservative treatment. Steroids, local anesthetic, PRP, and ozone can be injected for extensor tendinopathy.

(d) Equipment Needed
- 25-gauge needle.
- One syringe (5 ml).
- High-frequency linear array transducer.
- Injectate: 1.0 mL of local anesthetic and 1 mL of injectable corticosteroids (1–2 mL ozone 15–25 mcg/ml).

(e) Injection Technique

(i) Patient Position
- Supine or sitting, the arm resting on a table with the elbow at approximately 90 degrees of flexion.

(ii) Transducer Position
- The common extensor tendon is easily identified when the transducer is placed in the long axis to the CET at its origin on the lateral epicondyle (Fig. 6.9).

(iii) Needle Direction and Approach
- The needle is inserted distal to proximal into the transducer at a 45-degree angle, passing through the extensor tendon to reach the epicondyle's anterolateral facet.
- In-plane (Fig. 6.9).

(iv) Target
- CET/lateral epicondyle anterolateral facet (Fig. 6.10).

Common Flexor Tendon Injection (Golfer's Elbow)

(a) Brief Anatomy

The anterior aspect of the medial epicondyle is the origin of the common flexor tendon (CFT) at the elbow. The CFT comprises four superficial group muscles of the forearm's flexor (pronator

Fig. 6.9 The patient and transducer position of the common extensor tendon injection with an in-plane approach. The transducer is placed long axis over the lateral elbow joint. The needle is inserted distal to proximal into the transducer at a 45-degree angle, passing through the extensor tendon to reach the epicondyle's anterolateral facet

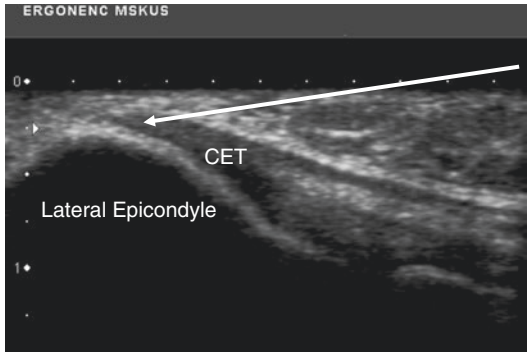

Fig. 6.10 Long-axis sonogram of the common extensor tendon and radiocapitellar joint. Injection for the tennis elbow with an in-plane approach

teres, palmaris longus, flexor carpi radialis, flexor carpi ulnaris). Forearm pronation, wrist flexion, and wrist flexion-adduction are all functions of the CFT muscles.

(b) Common Cause

Flexor tendinopathy (golfer's elbow) is a condition caused by repetitive stress/overuse injuries and microtrauma. Another consideration is that there are many occupations where repetition and excessive grasping are necessary that can cause inflammation and degeneration of the medial epicondyle.

(c) Injection Indications

CFT injection can be performed on patients with persistent pain despite that conservative treatment. Steroids, local anesthetic, PRP, and ozone can be injected for flexor tendinopathy.

(d) Equipment Needed
- 25-gauge needle.
- One syringe (5 ml).
- High-frequency linear array transducer.
- Injectate: 1.0 mL of local anesthetic and 1 mL of injectable corticosteroids (1–2 mL ozone 15–25 mcg/ml).

(e) Injection Technique

(i) Patient Position
- Supine or sitting, the arm resting on a table with the wrist in supine and medial compartment facing the interventionist (Fig. 6.11).

Fig. 6.11 The patient and transducer position of the common flexor tendon injection with an in-plane approach. The transducer is placed long axis over the medial elbow. The needle is inserted distal to proximal into the transducer at a 45-degree angle, passing through the flexor tendon to reach the medial epicondyle's interface

(ii) Transducer Position
- The common flexor tendon is easily identified when the transducer is placed in the long axis to the CFT at its origin on the medial epicondyle (Fig. 6.11).

(iii) Needle Direction and Approach
- The needle is inserted distal to proximal into the transducer at a 45-degree angle, passing through the flexor tendon to reach the medial epicondyle's interface.
- In-plane.

(iv) Target
- CFT/anterior facet of the medial epicondyle. Injection should not be performed to the medial collateral ligament (Fig. 6.12).

Olecranon Bursa Injection

(a) Brief Anatomy

The olecranon bursa is located between the skin of the extensor surface of the elbow and the olecranon process of the ulna, and it aids in the reduction of friction between two adjacent surfaces. It contains very little fluid in its normal state and is not visible with ultrasound. It has no communication with the joint.

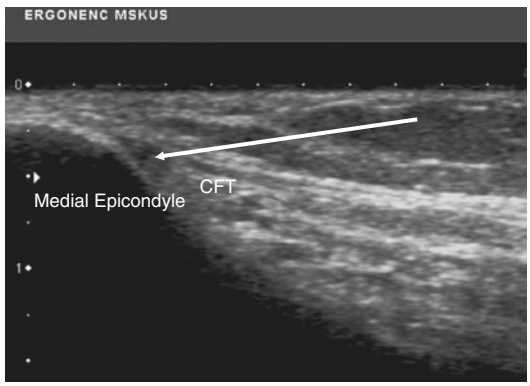

Fig. 6.12 Long-axis sonogram of the common flexor tendon and medial epicondyle. Injection for the golfer's elbow with an in-plane approach

(b) Common Cause

Olecranon bursitis can be caused by various factors, including direct trauma such as a fall or blow to the olecranon, infection such as septic bursitis, and inflammatory conditions such as rheumatoid arthritis and gout.

(c) Injection Indications

Chronic or recurring bursitis that has not responded to conservative treatment can be treated with aspiration of the olecranon bursa. In the case of septic bursitis, corticosteroids should not be injected.

(d) Equipment Needed
- 18-gauge needle.
- One syringe for aspiration (10–20 ml).
- One syringe for injectate (5 ml).
- High-frequency linear array transducer.
- Injectate: 1.0 mL of local anesthetic and 1 mL of injectable corticosteroids.

(e) Injection Technique

(i) Patient Position

Supine, prone, or sitting.
- Supine: the shoulder is internally rotated and with about 30 degrees flexion.
- Sitting: with the arm resting on a table in front and the elbow flexed at the edge of the examination table, with the shoulder partially abducted, and the elbow flexed, the distal arm hangs off the side, to approximately 90 degrees.
- Prone: the shoulder partially abducted and the elbow flexed at the edge of the examination table, allowing for the distal arm to hang off of the side.

(ii) Transducer Position
- Supine, prone, or sitting: the transducer is positioned long axis or short axis over the bursa of the olecranon.

(iii) Needle Direction and Approach
- The needle punctures the skin at a 45-degree angle with an in-plane

approach, that directly visualizes the bursa is allowed (Figs. 6.13 and 6.14).

Fig. 6.13 The patient and transducer position of the olecranon bursa injection with an in-plane approach. The transducer is placed long axis over the olecranon bursa. The needle is inserted parallel into the transducer, lateral to medial. The olecranon bursa is not visible in its usual state

Fig. 6.14 The patient and transducer position of the olecranon bursa injection with an in-plane approach. The transducer is placed long axis over the olecranon bursa. The needle is inserted parallel into the transducer, proximal to distal. The olecranon bursa is not visible in its usual state

(iv) Target
- Center of the olecranon bursa.

Ulnar Collateral Ligament (UCL)

(a) Brief Anatomy

The medial stabilizer of the elbow is the ulnar collateral ligament (UCL) that consists of three portions as an anterior, posterior, and transverse segment.

(b) Common Cause

The anterior segment of the UCL is responsible for the primary stabilization of the medial elbow, and this segment is critical during joint valgus stress.

During the overhead throwing, a tremendous amount of valgus stress is applied to the elbow in many cases. Repetitive microtrauma or single-throw injury can occur in sports activities.

(c) Injection Indications

Injection of regenerative solutions or only needle tenotomy can be performed on patients with persistent pain despite that conservative treatment.

(d) Equipment Needed
- 25-gauge needle.
- One syringe (5 ml).
- High-frequency linear array transducer.
- Injectate: 1.0 mL of local anesthetic and 1 mL of injectable corticosteroids.

(e) Injection Technique

(i) Patient Position
- Supine or sitting, elbow flexion with 30 degrees and the shoulder externally rotated, and the arm abducted at least 45 degrees.

(ii) Transducer Position
- On the medial elbow, a slight oblique plane exists. To the CFT, the UCL appears to be quite deep (Fig. 6.15).

Fig. 6.15 The patient and transducer position of the ulnar collateral ligament injection with an in-plane approach. Elbow flexion with 30 degrees and the shoulder externally rotated, and the arm abducted at least 45 degrees

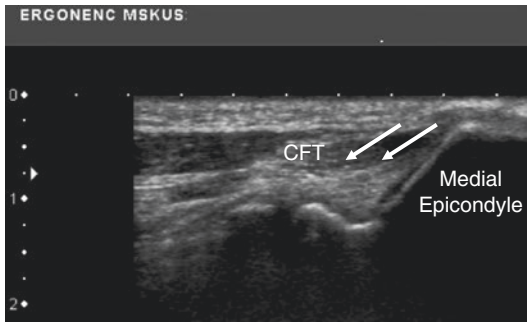

Fig. 6.16 Long-axis sonogram of the common flexor tendon and medial epicondyle and ulnar collateral ligament (white arrows). The needle should be inserted distal to proximal with an in-plane approach to the transducer

(iii) Needle Direction and Approach
- The needle should be inserted distal to proximal with an in-plane approach to the transducer.

(iv) Target
- Hypoechoic area of the pathologic ligament (Fig. 6.16).
- Take care to locate the ulnar nerve and avoid injecting too posteriorly, where the ulnar nerve may be located.

Ulnar Nerve at the Elbow

(a) Brief Anatomy

The ulnar nerve arises from the C8 and T1 nerve roots. It travels through the cubital tunnel before entering the flexor compartment of the forearm, where it is found between the two heads of the flexor carpi ulnaris muscle. About 5 cm proximal to the wrist, the ulnar nerve splits into dorsal and palmar branches.

(b) Common Cause

Numerous mechanisms can result in the entrapment or injury of the ulnar nerve at the elbow (cubital tunnel) or wrist (Guyon's canal). Dynamically evaluating the ulnar nerve at the elbow is beneficial in detecting ulnar subluxation, one of the most common causes of neuropathy.

(c) Injection Indications

Patients who have prolonged pain owing to ulnar nerve entrapment despite conservative treatment may benefit from the ulnar perineural injection. It could also be utilized for diagnostic purposes.

(d) Equipment Needed
- 25-gauge needle.
- One syringe (5 ml).
- High-frequency linear array transducer.
- Injectate: 1.0 mL of local anesthetic and 1–2 mL of injectable corticosteroids.
- For hydrodissection of the nerve up to 10–15 mL total volume (0.9% NaCl, local anesthetic, ± dextrose solution).

(e) Injection Technique

(i) Patient Position
- Supine, the shoulder abducted 90 degrees and the elbow flexed approximately 90 degrees.
- Sitting, the elbow flexed 90 degrees with the hand on the table.

(ii) Transducer Position
- At the elbow, place the transducer transverse position to the ulnar nerve.

(iii) Needle Direction and Approach

- The needle should be inserted medial to lateral with an in-plane approach (Fig. 6.17).
- The needle should be inserted distal to proximal with an out-of-plane approach (Fig. 6.18).

(iv) Target

- Spread medication around the circumference of the ulnar nerve. Create a "target sign" of injectate around the nerve (Fig. 6.19).

Deep Branch of Radial Nerve at the Elbow (Posterior Interosseous Nerve Syndrome)

(a) Brief Anatomy

The posterior interosseous nerve (PIN) is the terminal motor branch of the radial nerve.

Fig. 6.17 The patient and transducer position of the ulnar perineural injection with an in-plane approach. The elbow flexed 90 degrees with the hand on the table

Fig. 6.18 The patient and transducer position of the ulnar perineural injection with an out-of-plane approach. The elbow flexed 90 degrees with the hand on the table

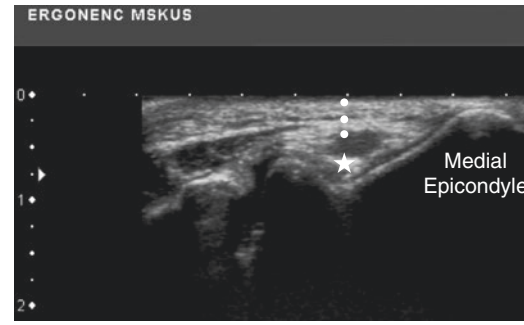

Fig. 6.19 Axial view of the ulnar nerve (*) at the cubital tunnel level. Out-of-plane walk-down approach. White circle needle tip

(b) Common Cause

Numerous mechanisms can result in the entrapment or injury of the median nerve PIN near or below the supinator muscle. Hypertrophy of the supinator muscle, fibrous bands, soft-tissue masses, radial head, and neck fractures may cause and compress the PIN.

(c) Injection Indications

Patients who have prolonged clinical signs due to PIN syndrome despite conservative treatment may benefit from this injection.

(d) Equipment Needed
- 25-gauge needle.
- One syringe (5 ml).
- High-frequency linear array transducer.
- Injectate: 1.0 mL of local anesthetic and 1–2 mL of injectable corticosteroids.
- For hydrodissection of the nerve up to 15–20 mL total volume (0.9% NaCl, local anesthetic, ± dextrose solution).

(e) Injection Technique

(i) Patient Position
- Sitting, the elbow flexed 90 degrees with the hand on the table and the forearm neutral or pronated (Fig. 6.20).

(ii) Transducer Position
- Place the transducer in a transverse position at the level of the distal humerus, find the radial nerve, and follow it distally until it splits into the superficial sensory branch and PIN.

(iii) Needle Direction and Approach
- The needle should be inserted lateral to medial with an in-plane approach (Fig. 6.20).

(iv) Target
- Spread medication around the circumference of the PIN. Create a "target sign" of injectate around the nerve (Fig. 6.21).

Fig. 6.20 The patient and transducer position of the PIN injection with a short-axis in-plane approach

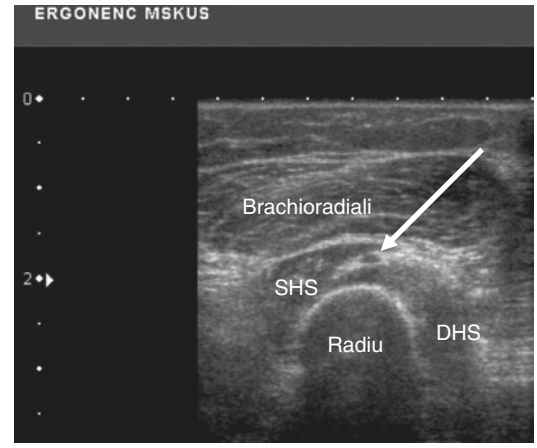

Fig. 6.21 Sonogram of the deep branch of the radial nerve (white arrow), PIN injection with a short-axis in-plane approach. Deep head of supinator (DHS). Superficial head of supinator (SHS)