Wrist and Hand

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The wrist and hand is an excellent region for the use of musculoskeletal ultrasound due to the superficial structures and the ability to perform dynamic scans. Common pathologies in this area include tenosynovitis of the dorsal wrist compartments, tendon ruptures, cysts, compression neuropathies, and arthritides.

Carpal Tunnel Syndrome

The carpal tunnel is located on the volar aspect of the wrist and is the most common compression neuropathy site in the upper limb [1]. Carpal tunnel syndrome (CTS) is a constellation of symptoms consisting of pain, paresthesias, and eventually thenar atrophy, arising from increased pressure within the tunnel, edematous states, or direct nerve trauma. Patients often complain of nocturnal paresthesias in the volar aspect of the thumb, index finger, middle finger, and radial half of the ring finger. Provocative tests such as compression over the carpal tunnel or Tinel's and Phalen's signs can help to reproduce the symptoms. The diagnosis is based on history, physical exam, electrodiagnostic studies, or cross-sectional area on ultrasound [2]. Corticosteroid injection into the carpal tunnel has been shown to provide improvement in pain, paresthesias, and function [3–5].

Scanning Technique and Anatomy to Identify

The patient should sit with the elbow flexed to 90°, forearm supinated with the hand resting comfortably. A towel may be placed under the wrist to place it in slight extension. The carpal tunnel lies just distal to the distal wrist crease. The transducer is placed transversely (short axis) to the median nerve, at the distal wrist crease. The bony borders of the tunnel include the scaphoid and trapezium laterally and the hamate and pisiform medially. The transverse carpal ligament or flexor retinaculum forms the superficial roof of the tunnel. The carpal tunnel contains the tendons of the flexor digitorum profundus, flexor digitorum superficialis, and flexor pollicis longus, and the median nerve. Identify the honeycomb-appearing median nerve in cross section. It generally appears relatively hypoechoic to the adjacent hyperechoic tendons in cross section. You can tilt the probe to adjust anisotropy; the nerve will remain present, but the flexor tendons may disappear at off angles. Have the patient move their flexor tendons to assess for adhesions which may be amenable to hydrodissection. Be sure to scan on the ulnar side of the canal to view the ulnar artery and nerve and radially to identify the radial artery (Fig. 4.1) [6, 7].

Injection Techniques: In-Plane Axial Ulnar-Sided Approach [8]

Patient positioning: Sit the patient with the affected arm resting comfortably on the table. A towel can be placed underneath the wrist to create mild extension.

Probe position: The transducer is placed short axis (transverse) to the median nerve at the wrist. Scan proximally and distally until the nerve is clearly identified under the transverse carpal ligament, at approximately the level of the pisiform (Fig. 4.2a).

Markings: Because of the shallow needle plane angle, make sure to identify and mark off the ulnar nerve and artery and insert the needle just radial or deep to these structures.

Needle position: The needle should be inserted on the ulnar side of the wrist crease parallel to the transducer for optimal needle visualization. Some practitioners attempt to get as close to the nerve as possible, while others argue that because the carpal tunnel is a confined space, placing the injectate anywhere in the tunnel may be effective. There are no studies comparing these approaches. Some practitioners

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hydrodissect the nerve off of the flexor retinaculum or flexor tendons if adhesions are present.

Injection Techniques: Out-of-Plane Axial Approach [9]

Patient positioning: Sit the patient with the affected arm resting comfortably on the table. A towel can be placed underneath the wrist to create mild extension.

Probe positioning: The transducer is placed axially to the median nerve at the wrist. Center the probe over the median nerve (Fig. 4.3a).

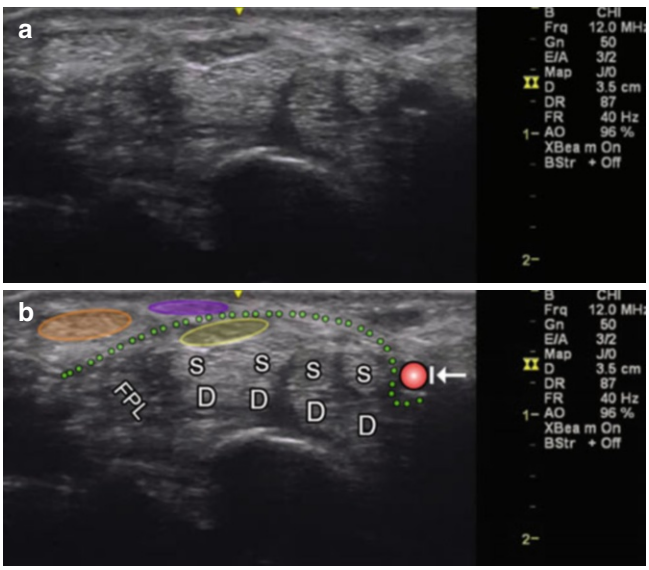

Fig. 4.1 (**a**) Axial view of the carpal tunnel. (**b**) *Orange oval*, flexor carpi radialis; *purple oval*, palmaris longus; *yellow oval*, median nerve; *FPL* flexor pollicis longus; *D* and *S* indicate the combined eight tendons of the flexor superficialis and digitorum muscles; *arrow with stop* indicates ulnar artery; and *dotted green line*, flexor retinaculum

Markings: Mark any obvious vessel or tendon prior to injection.

Needle position: The needle should be inserted at a steep angle at the center of the ultrasound probe, directed just adjacent to the median nerve. The needle tip is seen as a bright hyperechoic dot. The injectate is delivered next to the nerve. Hydrodissection is not performed with this technique since the whole needle path cannot be visualized.

Safety considerations: The palmar cutaneous branch of the median nerve arises just proximal to the flexor retinaculum and is a potential site for injury using a radial-sided approach; therefore, the ulnar approach is recommended. The palmar cutaneous branch of the ulnar nerve travels superficial to the flexor retinaculum and is a potential site for injury with the in-plane ulnar-sided approach [10]. The median nerve is very superficial therefore the in-plane approach is preferred to maximize visualization and avoid nerve injury. Patients may have hand numbness for the duration of the local anesthetic and should not plan on driving after the procedure.

Pearls:

- The median nerve is subject to anisotropy but not as much as the surrounding tendons. Nerve visualization can be improved by flexing and extending the fingers or wrist or by toggling the probe in the axial plane.
- Tracking the nerve proximally into the forearm may help differentiate it from the palmaris longus tendon.
- An oblique standoff technique may be helpful for small wrists.
- Doppler mode can help identify vascular structures such as a persistent median artery [11].

Equipment needed:

- High-frequency linear array transducer (10 MHz+)
- 25G 1.5″ needle
- 0.5 mL of steroid preparation
- 1–3 mL local anesthetic

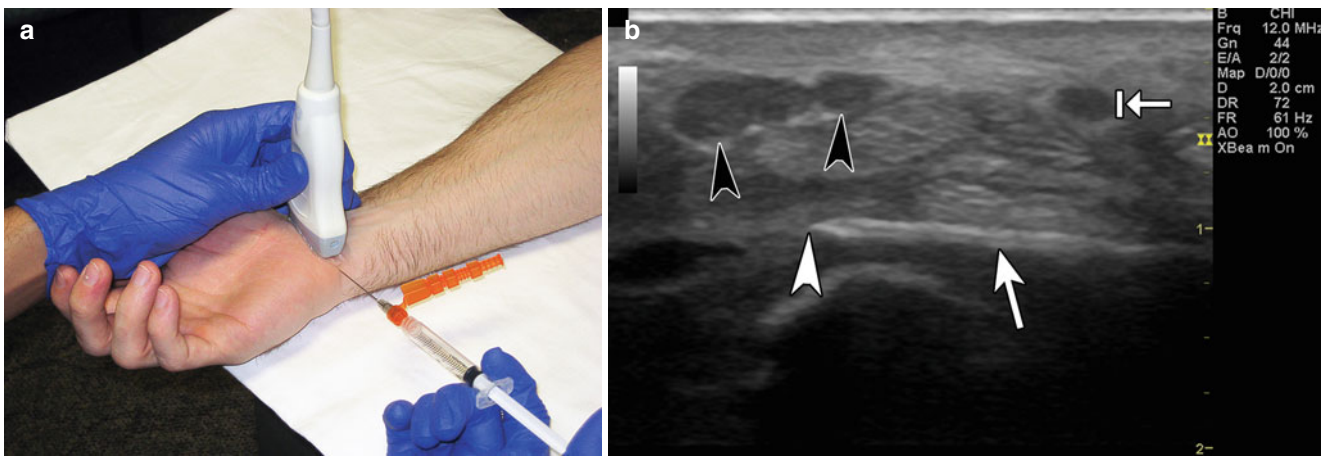

Fig. 4.2 (**a**) Example of probe position over carpal tunnel with ulnar-sided injection technique. (**b**) Example of in-plane approach. *Black arrowheads* point to bifid median nerve. *White arrowhead* points to needle tip. *White arrow* points to needle. *Arrow with stop* indicates ulnar artery

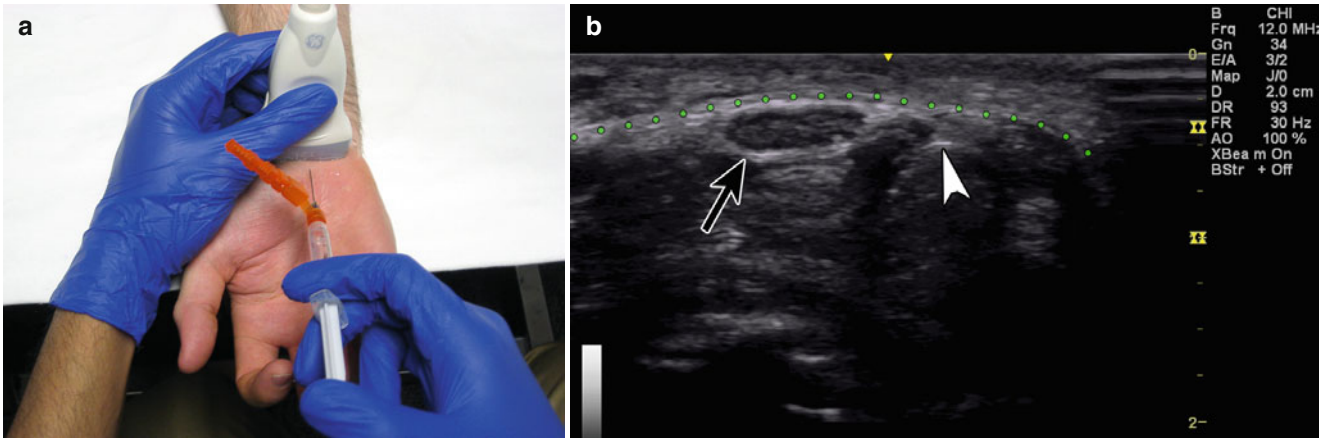

Fig. 4.3 (**a**) Example of probe position over carpal tunnel. (**b**) Example of out-of-plane approach. *White arrowhead* points to needle tip. *Black arrow* points to median nerve. *Green dotted line* represents flexor retinaculum

Table 4.1 Accuracy of ultrasound guided DRUJ injections

Study – DRUJ	Author	Accuracy (%)
Ultrasound guided	Smith et al. [35]	100

Distal Radioulnar Joint (DRUJ)

Although uncommon, the distal radioulnar joint (DRUJ) can be a source of ulnar-sided wrist pain [12]. The DRUJ allows for forearm supination and pronation and stabilizes the wrist. DRUJ pain typically comes from arthritis [13]. Presenting symptoms may include pain and weakness. Injections to confirm DRUJ pain were typically performed with fluoroscopy. Ultrasound guidance enables the effective placement of a needle into this small joint space with uneven anatomy (Table 4.1).

Scanning Technique and Anatomy to Identify

The patient should sit with the elbow in slight flexion and the forearm pronated so that the hand rests comfortably. The DRUJ lies deep to the fourth and fifth extensor compartments of the dorsal wrist. The transducer is placed transversely, short axis to the fourth and fifth extensor compartments over Lister's tubercle and the distal ulna. Identify the extensor digiti minimi (EDM) muscle which lies over the DRUJ (Fig. 4.4) [14, 15].

Injection Techniques: In-Plane Axial Approach [9]

Patient positioning: Sit the patient with the affected arm resting comfortably on a table with the wrist and hand in pronation, palm down.

Probe positioning: Place the transducer axially over the fourth and fifth extensor compartments at the wrist at the level of the ulnar styloid process and Lister's tubercle (Fig. 4.5a).

Markings: It may helpful to identify the ulnar styloid process and Lister's tubercle for bony anatomy and transducer placement and then the fifth extensor compartment to avoid needle placement into the EDM.

Needle position: The needle should be inserted on the ulnar side of the EDM parallel to the transducer for optimal needle visualization. The needle should be inserted deep to the EDM and aimed at the DRUJ recess between the ulna and radius.

Safety considerations: Prior to passing the needle below the extensor digiti minimi tendon, Doppler may help to identify the dorsal branch of the anterior interosseous artery which runs in a neurovascular bundle with transverse branches of the dorsal ulnar cutaneous nerve [12, 16].

Pearls:

- An oblique standoff technique may be used if the ulnar styloid process makes an appropriate needle angle difficult to attain.
- Doppler mode may help identify vascular structures.
- Extending the fingers may help improve identification of local anatomy.

Equipment needed:

- High-frequency linear array transducer (10 MHz+)
- 25G 1.5″ needle
- 0.5 mL of steroid preparation
- 1–3 mL local anesthetic

First Extensor Compartment

DeQuervain's disease is a painful tenosynovitis of the abductor pollicis longus (APL) and extensor pollicis brevis (EPB) tendons in the first dorsal extensor compartment of the wrist. DeQuervain's disease is thought to occur from overuse or trauma directly to the tendon sheath [17]. Symptoms include

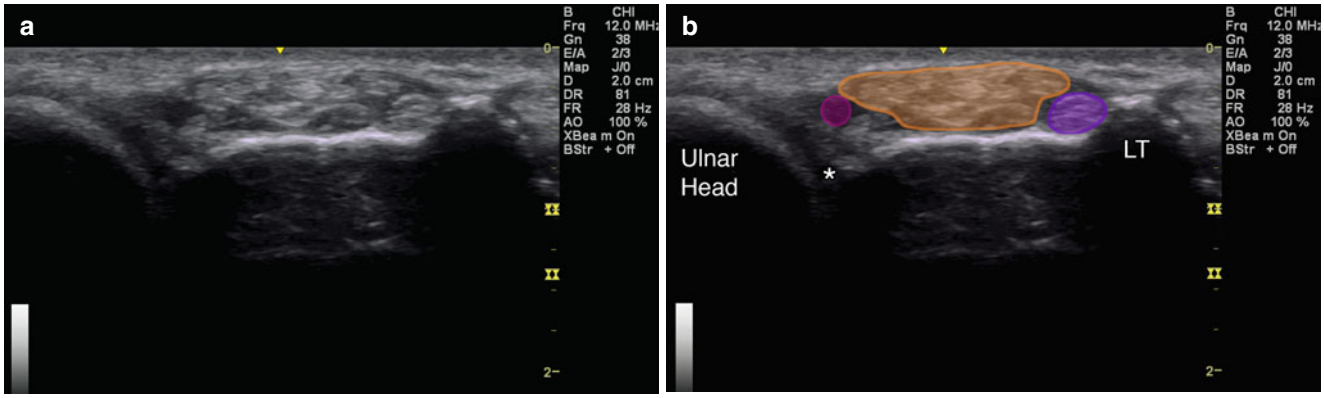

Fig. 4.4 (**a**) Axial view over dorsal distal radioulnar joint. (**b**) *Asterisk* indicates DRUJ; *purple circle*, third extensor compartment (extensor pollicis longus); *orange*, fourth extensor compartment (extensor digitorum and extensor indicis); *magenta circle*, fifth extensor compartment (extensor digiti minimi); *LT* Lister's tubercle; and ulnar head labeled

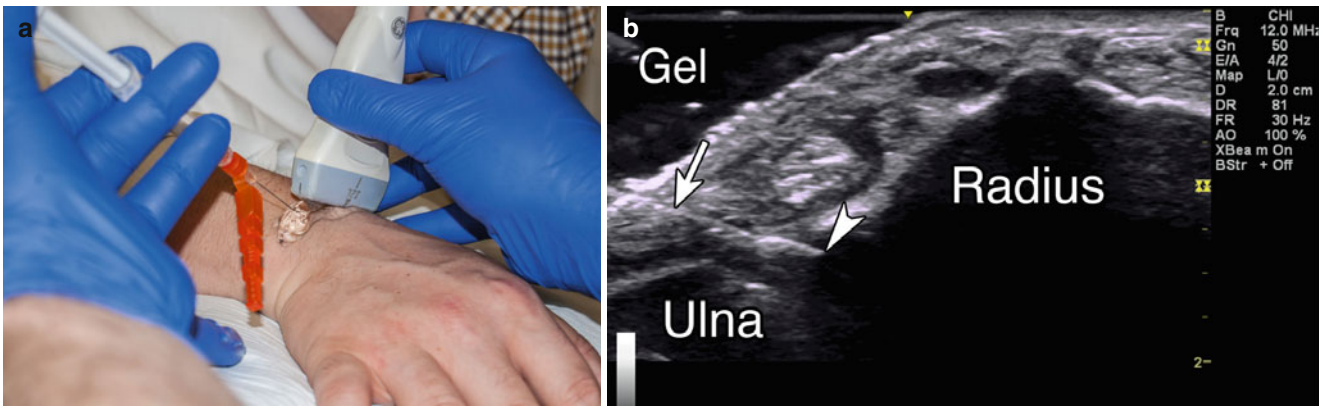

Fig. 4.5 (**a**) Example of probe position over DRUJ with gel standoff technique. (**b**) Example of in-plane approach. *White arrowhead* points to needle tip. *White arrow* points to needle. Gel-gel standoff, radius, and ulna labeled

Table 4.2 Relief following ultrasound guided 1st dorsal compartment injection

Study – 1st dorsal compartment	Author	Symptomatic relief at follow-up (%)
Ultrasound guided	Jeyapalan et al. [36]	94

hand, wrist, and thumb pain with activities that involve abduction and extension of the thumb. Provocative tests such as Finkelstein's maneuver may reproduce symptoms. The diagnosis is based on history and physical exam. Corticosteroid injection has been shown to provide improvement in pain and function (Table 4.2) [15, 18, 19].

Scanning Technique and Anatomy to Identify

The patient should sit with the elbow flexed and the wrist and hand in neutral position so that the radial styloid is facing up. The first extensor compartment is located directly over the radial styloid process. The transducer is placed transversely, short axis over the radial styloid. The APL and EPB tendons travel through this compartment and can be separated by a septum. The APL lies more volar than the EPB. Scanning further distally will show the two tendons diverging towards their insertions. Scanning proximally will show them side by side. The compartment is covered by an extensor retinaculum. Tendon sheath thickening may be apparent with transverse or longitudinal scanning; a "donut sign" may indicate synovitis (Fig. 4.6) [20, 21].

Injection Techniques: In-Plane Longitudinal Approach

Patient positioning: Sit the patient with the affected arm resting comfortably on a table. Place the hand in a neutral position with the radial styloid facing up.

Probe positioning: Place the probe longitudinal over the radial styloid and APL tendon (Fig. 4.7a).

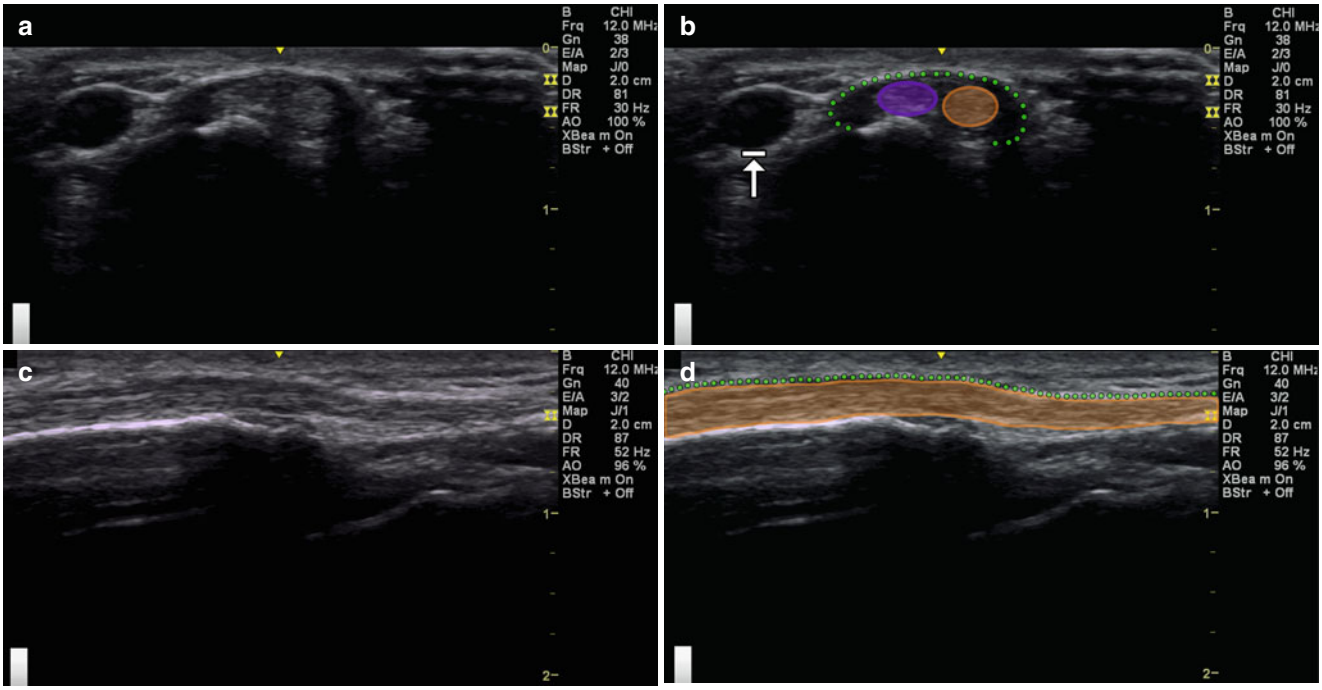

Fig. 4.6 (**a**) Axial view over first extensor compartment. (**b**) *Purple circle*, abductor pollicis longus; *orange circle*, extensor pollicis brevis; *dotted green line*, extensor retinaculum; *arrow with stop* indicates radial artery. (**c**) Longitudinal view over first extensor compartment. (**d**) *Orange* indicates abductor pollicis longus and extensor pollicis brevis; *dotted green line*, extensor retinaculum

Markings: Identify and mark any veins and the radial artery that lie volar to the 1st dorsal compartment.

Needle position: The needle should be inserted parallel to the transducer for optimal needle visualization. The needle tip target is the tendon sheath overlying the APL and EPB tendons.

Injection Techniques: Out-of-Plane Axial Approach

Patient positioning: The patient is seated with the affected arm resting comfortably on a table. Place the hand in a neutral position with the radial styloid facing up.

Probe positioning: Start by placing the transducer short axis (transverse) over the radial styloid and scan proximally and distally until the APL and EPB are clearly identified traveling in the same compartment (Fig. 4.8a).

Markings: Identify and mark any veins and the radial artery that lie volar to the 1st dorsal compartment.

Needle position: The needle should be inserted perpendicular to the transducer. Keep the needle tip superficial as the target site is the tendon sheath encasing the APL and EPB tendons.

Safety considerations: There is a risk of the following: prolonged bleeding, infection, tendon rupture, allergic reaction, increased pain, and decreased functional scores. If using corticosteroid, there is a risk of soft tissue (fat) atrophy and local depigmentation with corticosteroid injection.

Pearls:

- The superficial branch of the radial nerve can lie over the first dorsal compartment and may be temporarily blocked by the local anesthetic.
- The footprint of a standard probe is too large to fully cover a short axis view of the 1st dorsal compartment, and an oblique standoff technique may allow for better needle visualization.
- Doppler mode may help identify vascular structures.

Equipment needed:

- High-frequency linear array transducer (10 MHz+)
- 25G 1.5″ needle
- 0.5 mL of steroid preparation
- 1–3 mL local anesthetic

Scaphotrapeziotrapezoid (STT) Joint

The STT joint is located on the radial side of the wrist. STT joint pain is a common source of wrist pain; however, making an accurate diagnosis in this complex area of the wrist can be difficult [22]. The STT joint can produce pain on the dorsal or volar aspect of the wrist and mimic pain arising from the 1st carpometacarpal joint [23]. Patients often complain of deep achy arthritic-type pain. There are no specific provocative tests for STT joint pain; however, direct palpation of the volar STT joint should reproduce the pain [24, 25]. The diagnosis remains challenging with history and physical

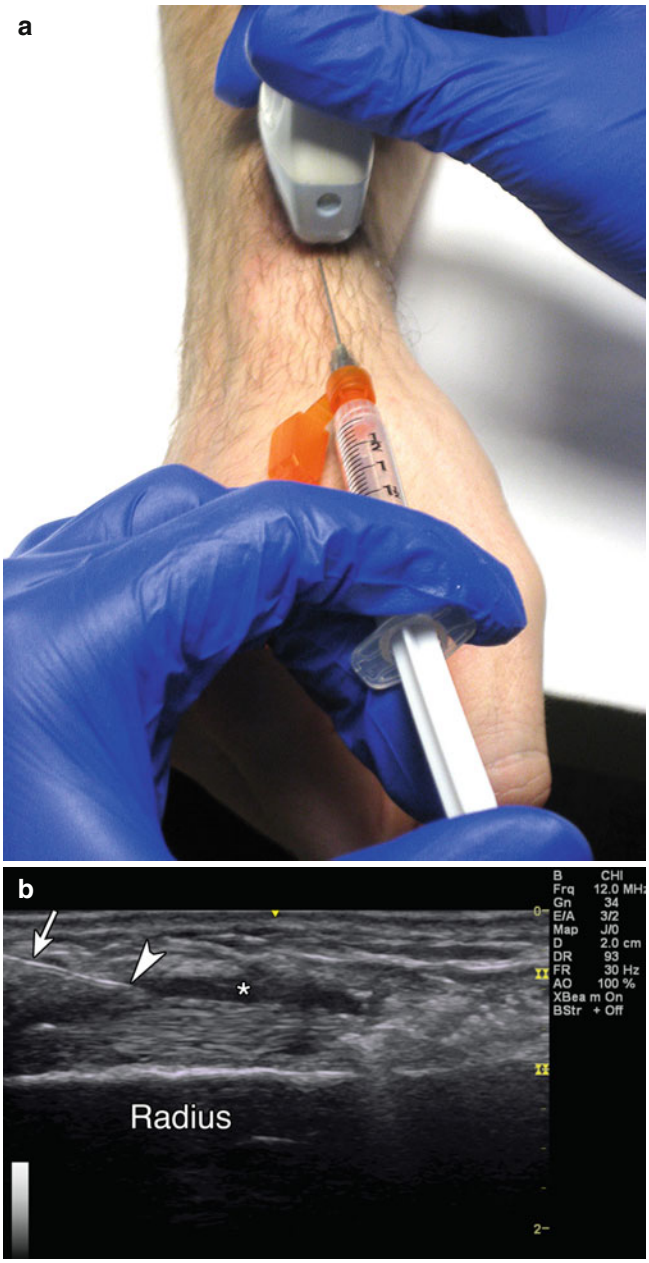

Fig. 4.7 (**a**) Example of longitudinal probe position over first extensor compartment. (**b**) Example of in-plane approach. *White arrowhead* points to needle tip. *White arrow* points to needle. *Asterisk* indicates injectate filling tendon sheath. Radius labeled

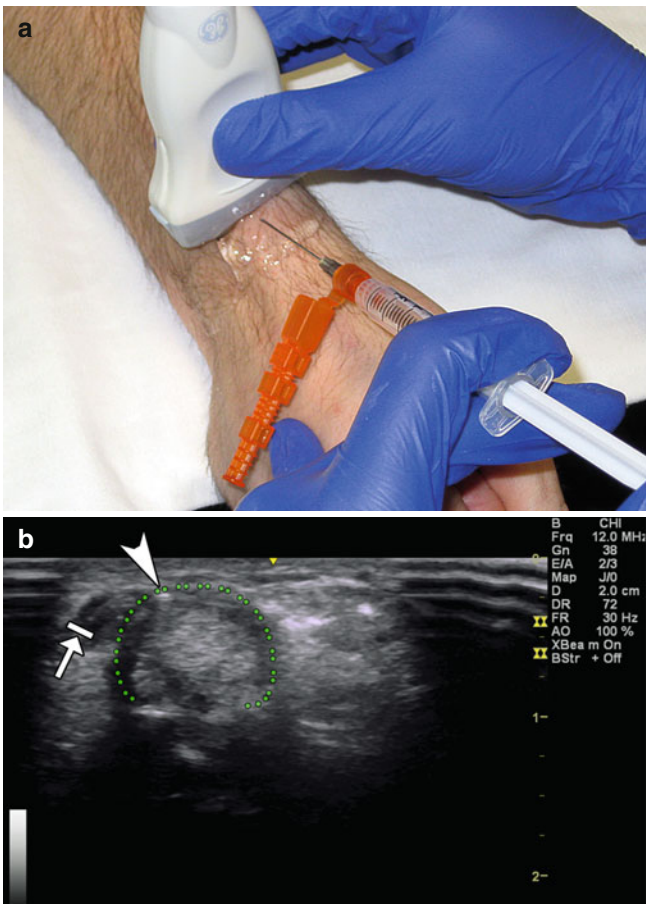

Fig. 4.8 (**a**) Example of transverse probe position over first extensor compartment. (**b**) Example of out-of-plane approach. *White arrowhead* points to needle tip. *Dotted green line* – tendon sheath. *Arrow with stop* indicates radial artery

Table 4.3 Accuracy of ultrasound guided versus palpation guided STT joint injections

Study – STT	Author	Accuracy (%)
Palpation guided	Smith et al. [37]	80
Ultrasound guided	Smith et al. [37]	100

exam alone. Injection into the STT joint can provide symptomatic relief and serve as a diagnostic tool (Table 4.3).

Scanning Technique and Anatomy to Identify

The patient should sit with the elbow flexed and the hand lying comfortably in the supinated position. A high-frequency linear transducer is placed longitudinal to the distal radius. The hyperechoic bony radius is followed distally until the radioscaphoid articulation is identified. Continue scanning distally until the trapezium and carpometacarpal joint are identified. Moving the thumb can help to identify the CMC joint. The flexor carpi radialis tendon can be visualized superficial to the STT joint. Doppler can be used to help identify the superficial palmer branch of the radial artery (Fig. 4.9).

Injection Technique: Out-of-Plane Longitudinal Approach

Patient positioning: Sit the patient with the affected arm resting comfortably on a table. Place the hand in a supinated position.

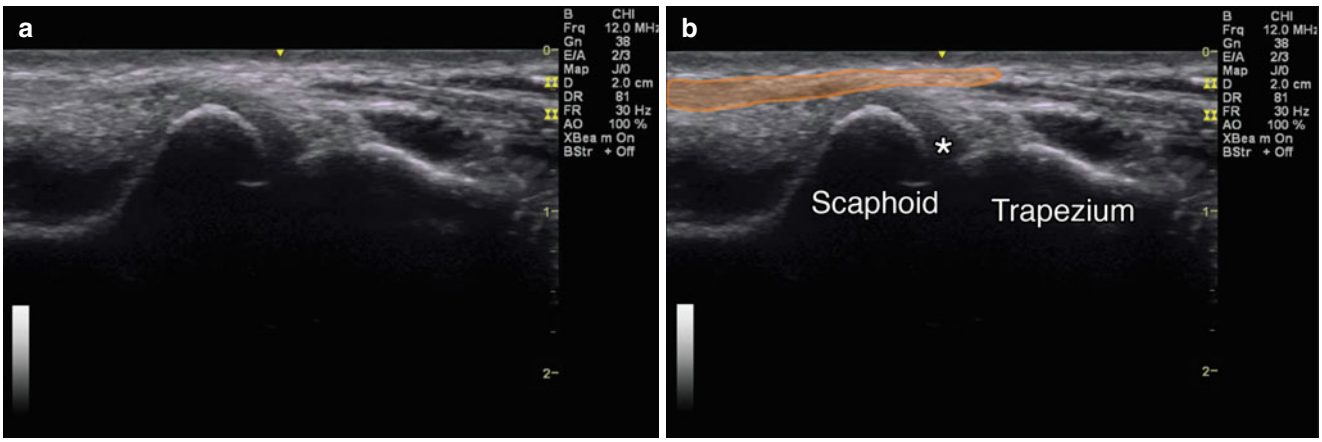

Fig. 4.9 (**a**) Sagittal view over volar aspect of STT Joint. (**b**) *Orange* – flexor carpi radialis traversing superficial to the scaphoid towards the second metacarpal bone, *asterisk* indicates STT joint, scaphoid and trapezium labeled

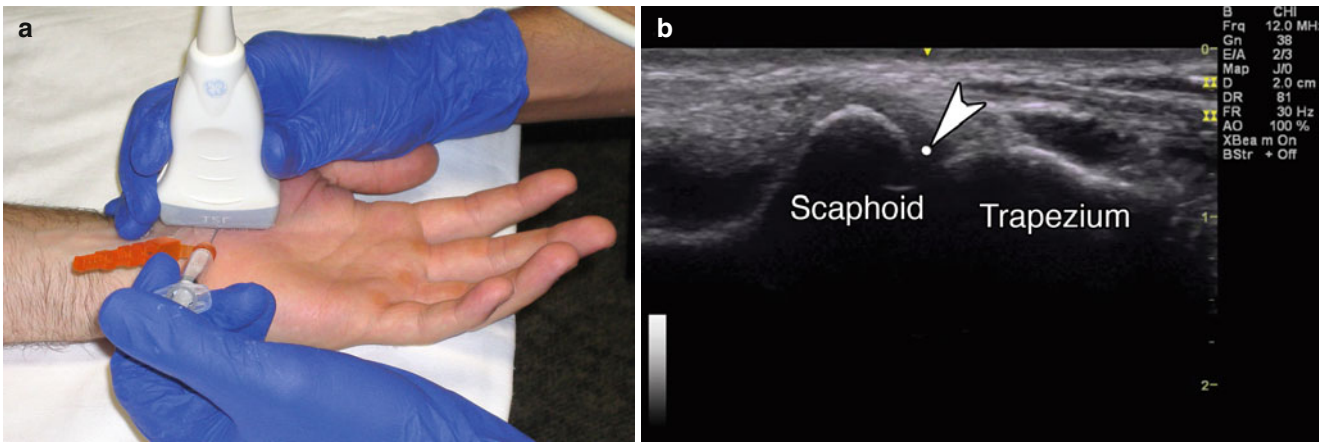

Fig. 4.10 (**a**) Example of longitudinal probe position over STT joint. (**b**) Example of out-of-plane approach. *White arrowhead* points to needle tip. Scaphoid and trapezium labeled

Probe positioning: Start by placing the transducer long axis (longitudinal) to the radius and scan distal until the scaphoid, trapezium, carpometacarpal joint, and the flexor carpi radialis tendon are clearly identified (Fig. 4.10a).

Markings: If the superficial palmar branch of the radial artery is identified, mark it so the probe and needle position can be adjusted to avoid puncture.

Needle position: The needle should be inserted on the radial side of the transducer, centered and perpendicular. The needle is advanced at a 45° angle until the needle tip is identified within the joint as a bright hyperechoic dot.

Safety considerations: Prior to advancing the needle, Doppler can be used to help identify the superficial palmer branch of the radial artery.

Pearls:

- Slightly extending the wrist and applying some radial or ulnar deviation may help to open up the joint space.

Equipment needed:

- High-frequency linear array transducer (10 MHz+)
- 25G 1.5″ needle
- 0.5 mL of steroid preparation
- 1–3 mL local anesthetic

Wrist Dorsal, Volar, and Flexor Tendon Sheath Ganglion Cyst

Ganglion cysts are soft tissue masses arising from the dorsal or volar aspects of the wrist. They are composed of mucoid material contained in randomly arranged sheets of collagen without a synovial lining and communicate with the joint via a pedicle [28]. Patients with ganglia can present with a painless mass, aching at the wrist, decreased ROM, decreased grip strength, or paresthesias if there is nerve compression. On exam, wrist ganglia are usually 1–2 cm cystic structures with limited mobility and rubbery feel. Often clinical presentation and exam can be enough to make the diagnosis [26]. Treatment consists of observation if asymptomatic or aspiration and

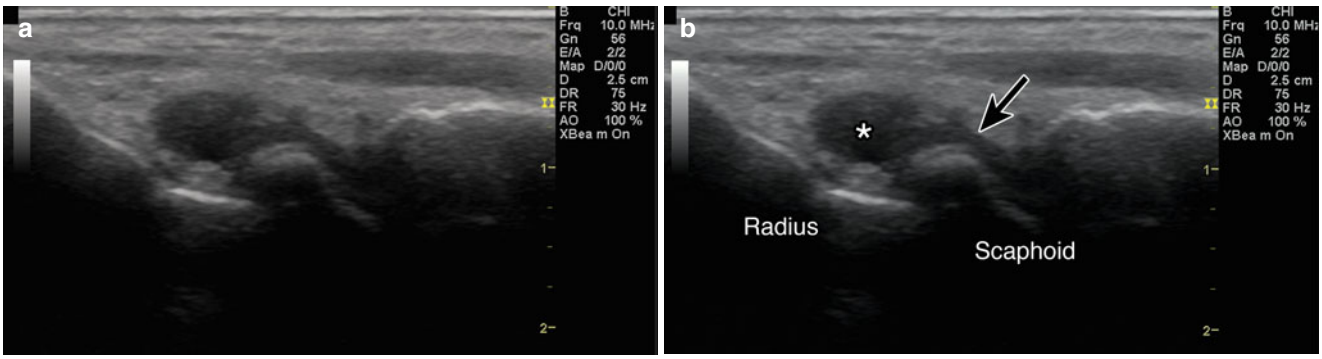

Fig. 4.11 (**a**) Longitudinal dorsal view over distal radius and scaphoid. (**b**) *Asterisk* indicates ganglion cyst. *Black arrow* shows (stalk) communication with the carpal joint. Radius and scaphoid labeled

surgical excision if symptomatic. Ultrasound-guided aspiration has been recommended especially for volar ganglia due to the risk of trauma to adjacent structures such as the radial artery and the recurrent branch of the median nerve [27].

Scanning Technique and Anatomy to Identify: Dorsal

The patient should sit with the elbow flexed to 90° and the forearm pronated so that the hand is resting comfortably. The most common site for ganglion cysts is the dorsal wrist as they arise from the scapholunate ligament 60–70 % of the time [28]. Begin with the probe longitudinally over the distal radius and scan distally until you identify the scaphoid bone. Once you identify the scaphoid, rotate the transducer to obtain an axial view of the scaphoid with the lunate located on the ulnar side. The majority of ganglia appear complex, look for well-defined margins, thick walls, posterior acoustic enhancement, and septations or locules [29].

Scanning Technique and Anatomy to Identify: Volar/Flexor Tendon Sheath

To evaluate the volar side of the wrist, have the patient supinate the forearm. A towel may be placed under the wrist to induce slight extension. Roughly 20 % of ganglia arise on the volar aspect of the wrist from the radiocarpal or scaphotrapezial joint [30]. In addition, 10 % can arise from the flexor tendon sheathes [26]. The transducer is placed longitudinally over the distal radius until the radiocarpal joint is identified. Note the proximity of the radial artery (Fig. 4.11).

Injection Techniques: In-Plane Sagittal Approach

Patient positioning: Sit the patient with the affected wrist resting comfortably on a table. The forearm is pronated for a dorsal cyst and supinated for a volar or flexor tendon sheath cyst.

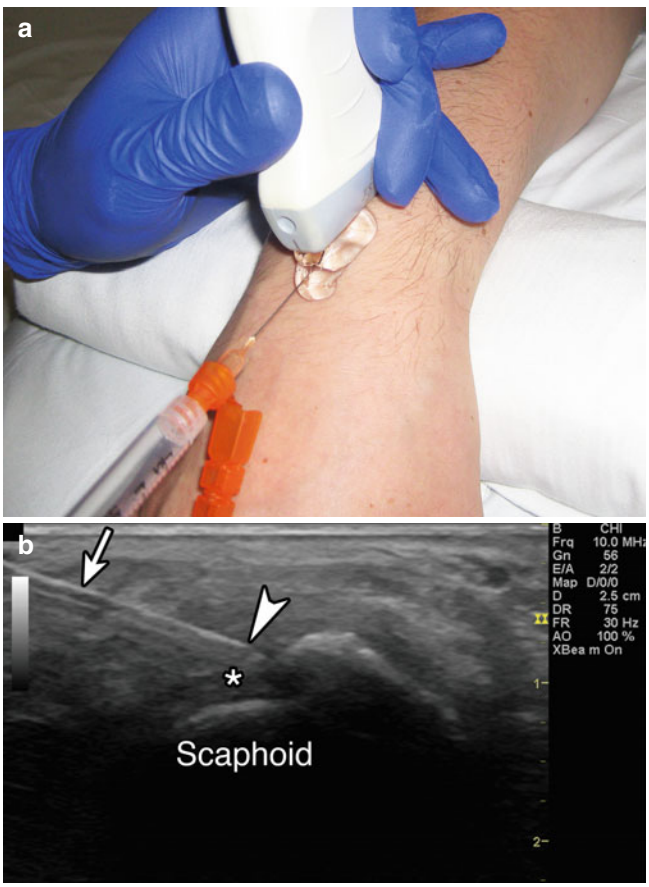

Fig. 4.12 (**a**) Example of longitudinal probe position over dorsal wrist with in-plane gel standoff technique. (**b**) Example of in-plane approach. *White arrowhead* points to needle tip. *White arrow* points to needle. *Asterisk* indicates ganglion cyst. Scaphoid labeled

Probe positioning: Place the transducer long axis over the ganglia until the ganglia is centered on the screen. Obtain short axis views to determine optimal needle placement (Fig. 4.12a).

Markings: Identify any neurovascular structures.

Needle position: The needle should be inserted in plane to the transducer for optimal needle visualization. Specific landmarks and direction of approach will vary based on the location of the cyst.

Safety considerations: Prior to injection, Doppler will help to identify adjacent vascular structures.

Pearls:

- An oblique standoff technique may be used if the ganglia are very superficial.
- Doppler mode may help identify vascular structures.
- Slightly flexing and extending the wrist may help improve visualization of the carpal bones.
- Flexing the fingers may help to identify structures surrounded ganglia opposed to flexor tendons.

Equipment needed:

- High-frequency linear array transducer (10 MHz+)
- 25G needle and 1–3 mL anesthetic for local anesthesia
- 16–18G 1.5″ needle for aspiration
- 0.5 mL of steroid preparation and 1 mL local anesthetic post-aspiration

Trigger Finger

Trigger finger is a stenosing tenosynovitis of the flexor digitorum and flexor pollicis longus tendons. Triggering or locking occurs at the first annular (A1) pulley which becomes thickened due to chronic repetitive friction. Diabetics have four times higher prevalence of triggering than the general population [31]. The diagnosis is based on history and physical exam. There may be pain at the A1 pulley, a palpable mass, or a tautness of the flexor tendons. The finger will get stuck when moving from active flexion to extension through the thickened A1 pulley (Tables 4.4 and 4.5).

Scanning Technique and Anatomy to Identify

The patient should sit with the hand resting comfortably and the fingers extended. The A1 pulley lies superficial and proximal to the metacarpophalangeal joint. The ultrasound probe is placed on the volar aspect of the hand just proximal to the MCP joint. Longitudinal scan shows the hyperechoic metacarpal head and the proximal phalanx deep with the tendons of the flexor digitorum profundus tendon and the flexor digitorum superficialis (FDS) tendon running over. The A1 pulley is seen here in cross section superficial to the tendon sheath. The probe is then rotated to give an axial image at the level of the A1 pulley. From superficial to deep, you should appreciate the FDS, flexor digitorum profundus (FDP), the volar plate (VP), and the metacarpal bone. The lumbricals can be seen laterally. Doppler can be utilized to identify the digital artery. Ultrasound diagnosis for trigger finger was described by Ebrahim et al., including hypoechoic thickening of the A1 pulley, visualization of a nodule in the FDS tendon, and dynamic visualization of triggering (Fig. 4.13) [32].

Table 4.4 Accuracy of blind versus ultrasound guided trigger point injections

Study – trigger finger		Accuracy tendon sheath (%)	Tendon proper injection (%)
Dae-Hee Lee et al. [38]	Blind	15	30
	Ultrasound guided	70	0

Table 4.5 Outcomes of blind versus ultrasound guided trigger finger injections

Study – trigger finger	Author	Success rate at 1 year (%)
Blind	Fleisch et al. [39]	57
Blind	Peters-Veluthamaningal et al. [40]	56
Ultrasound guided	Bodor et al. [41]	90

Injection Techniques: In-Plane Sagittal Approach

Patient positioning: Sit the patient with the affected hand resting palm up comfortably on a table.

Probe positioning: Obtain a long axis view of the affected flexor tendon at the level of the metacarpophalangeal joint. Identify the A1 pulley as a hyperechoic thickening of the volar aspect of the tendon sheath. A flexor tendon nodule or thickening may be noted. The A1 pulley synovial sheath may also demonstrate hypoechoic thickening or an effusion. The FDS, FDP, and VP should be centered on the screen. The A1 pulley wraps over these structures (Fig. 4.14a).

Markings: It may helpful to identify the digital arteries and nerves to avoid inadvertent needle puncture.

Needle position: The needle is inserted at a shallow angle from distal to proximal so that the tip of the needle is placed just distal to the A1 pulley and into the tendon sheath.

Injection Techniques: Out-of-Plane Axial Approach

Obtain a short axis view of the affected flexor tendon at the level of the metacarpophalangeal joint. Identify the A1 pulley overlying the FDS and FDP. The target is centered to the triangle formed by the FDS/FDP/VP, metacarpal bone, and the A1 pulley.

Patient positioning: Sit the patient with the affected hand resting palm up comfortably on table.

Probe positioning: Start by placing the transducer short axis (axial) over the A1 pulley at the level of the metacarpal

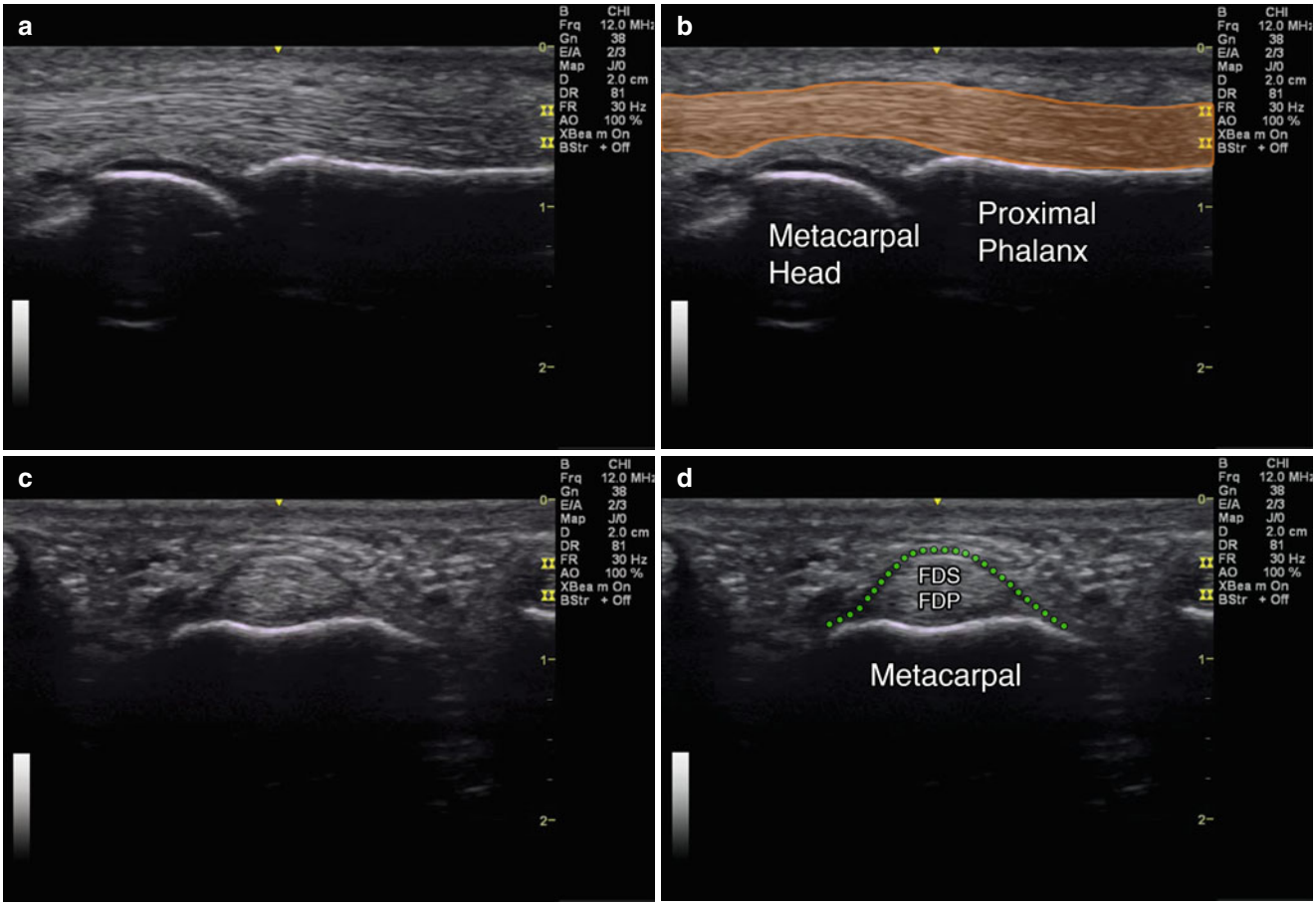

Fig. 4.13 (**a**) Sagittal view over FDS and FDP. (**b**) *Orange* – flexor digitorum superficialis and profundus tendons, metacarpal head and proximal phalanx labeled. (**c**) Axial view over A1 pulley at metacarpal head. (**d**) *Dotted green line* – tendon sheath, *FDS*, *FDP*, and metacarpal labeled

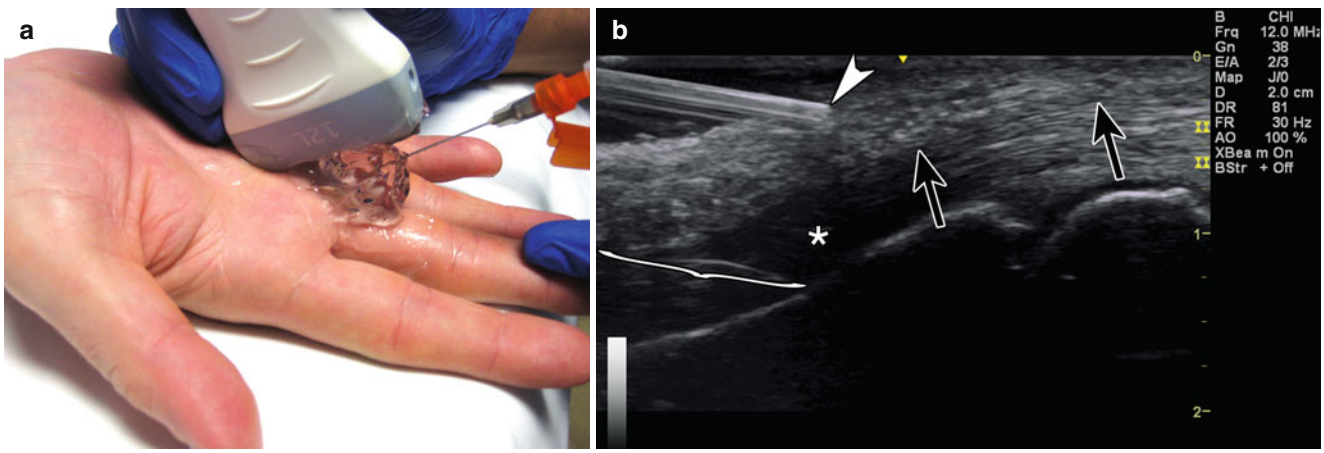

Fig. 4.14 (**a**) Example of sagittal probe position over trigger finger with gel standoff. (**b**) Example of in-plane approach. *Black arrows* point to tendon sheath. *White arrowhead* points to needle tip approaching target. *Asterisk* indicates anisotropy of FDS/FDP tendons. *Bracket* indicates needle reverberation

head. Make sure the pulley is located directly under the midpoint of the transducer (Fig. 4.15A).

Markings: It may helpful to identify the digital arteries and nerves to avoid inadvertent needle puncture.

Needle position: The needle is inserted at a steep angle, from either the proximal or distal end of the midpoint transducer so that the tip of the needle is seen within the target triangle. The needle tip is seen as a bright hyperechoic dot.

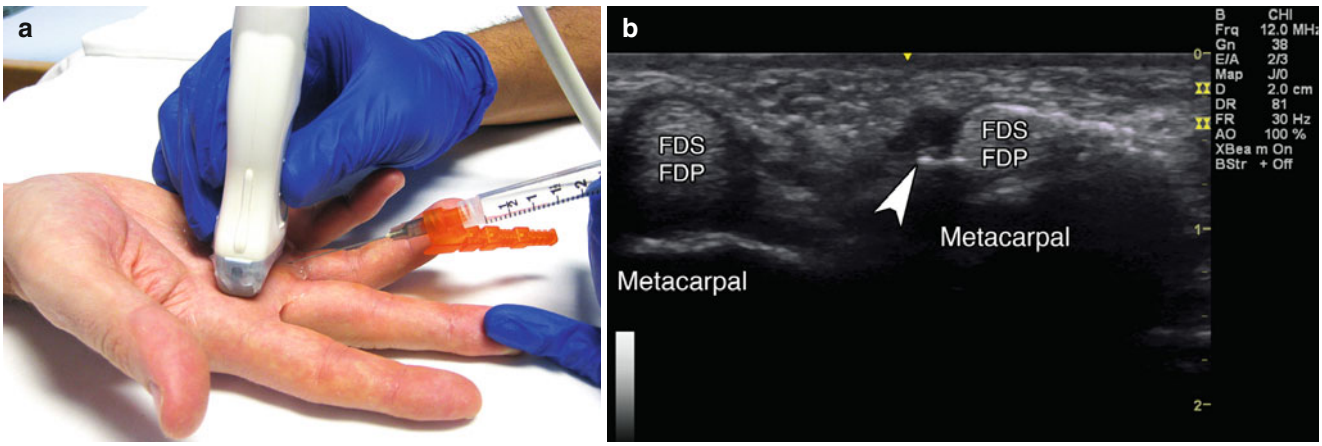

Fig. 4.15 (**a**) Example of axial probe position over trigger finger. (**b**) Example of out-of-plane approach. *White arrowhead* points to needle tip. *FDS*, *FDP*, and metacarpal labeled

Safety considerations: Do not inject the flexor tendons themselves. It may be helpful to retract the needle until loss of resistance is noted.

Avoid the digital arteries and nerves.

Pearls:

- A gel standoff technique may be used in the long axis injection.
- Doppler mode may help identify vascular structures.
- Slightly flexing and extending the fingers will help to identify a nodule if present within the tendon.

Equipment needed:

- High-frequency linear array transducer (10 MHz+)
- 25G 1.5″ needle for in-plane approach
- 25G 0.5″ needle for out-of-plane approach
- 0.5 mL of steroid preparation
- 1–3 mL local anesthetic

Hand: 1st Carpometacarpal (CMC) Joint

The thumb has three joints that can develop painful arthritis: the interphalangeal joint (IP), the metacarpophalangeal joint (MCP), and the carpometacarpal joint (CMC). CMC arthritis appears to be more frequent in women and is related to repetitive activity of the joint. Symptoms are typically thumb and wrist pain when pinching, grasping, and twisting the hand. Common physical exam findings include pain over the affected joint and a positive grind test [33, 34].

Scanning Technique and Anatomy to Identify

The patient should sit with the elbow flexed and the hand resting comfortably on a table. The hand position will move from pronated to neutral so that much of the joint can be circumferentially scanned. The transducer is placed in plane with the axis of the thumb so that the joint between the first metacarpal bone and base of the trapezium is identified. The APL and EPB tendons can be visualized passing over the CMC joint. Scan from one side of the joint to the other to evaluate for any bony joint changes (Fig. 4.16).

Injection Techniques: Out-of-Plane Longitudinal Approach

Patient positioning: Sit the patient with the affected arm resting comfortably on a table. Place the hand in neutral position with the thumb facing up.

Probe positioning: Place the transducer in the longitudinal plane centered over CMC joint (Fig. 4.17a).

Markings: Identify and mark the APL and EPB tendon to avoid inadvertent needle puncture.

Needle position: The needle should be inserted at a steep angle at the center of the transducer aimed directly at the joint space. The needle tip should be visible within the joint. Proper placement can be confirmed by seeing capsular distention upon injection.

Injection Techniques: In-Plane Longitudinal Approach

Patient positioning: The patient should sit with the affected arm resting comfortably on a table with the wrist and hand in pronation.

Probe positioning: Start by placing the transducer longitudinal over the CMC joint (Fig. 4.18a).

Markings: Identify and mark the APL and EPB tendon to avoid inadvertent needle puncture.

Needle position: The needle should be inserted parallel to the transducer for optimal needle visualization.

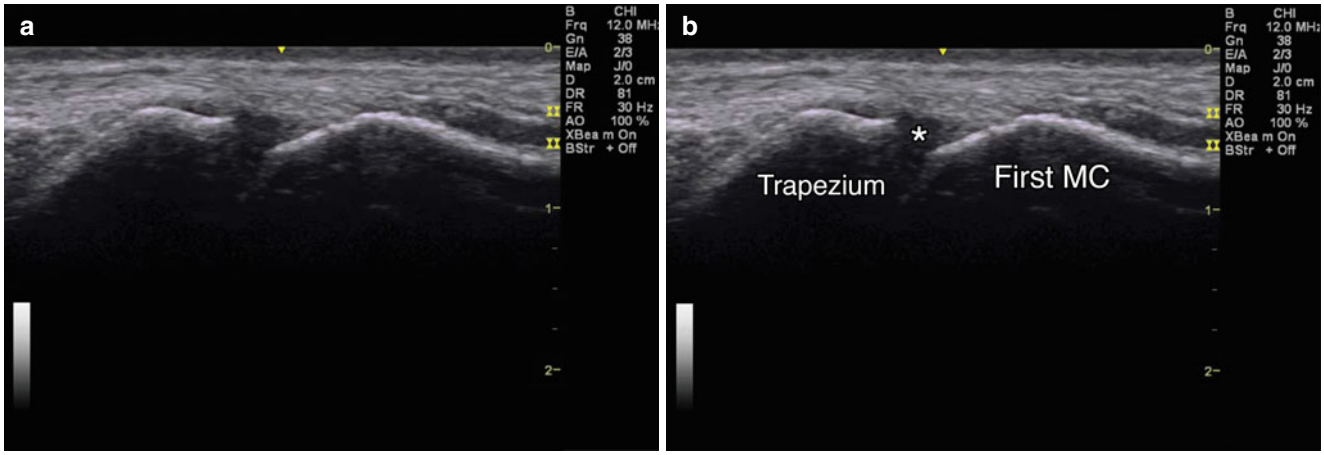

Fig. 4.16 (**a**) Sagittal view over CMC joint. (**b**) *Asterisk* indicates joint space. Trapezium and first metacarpal bone labeled

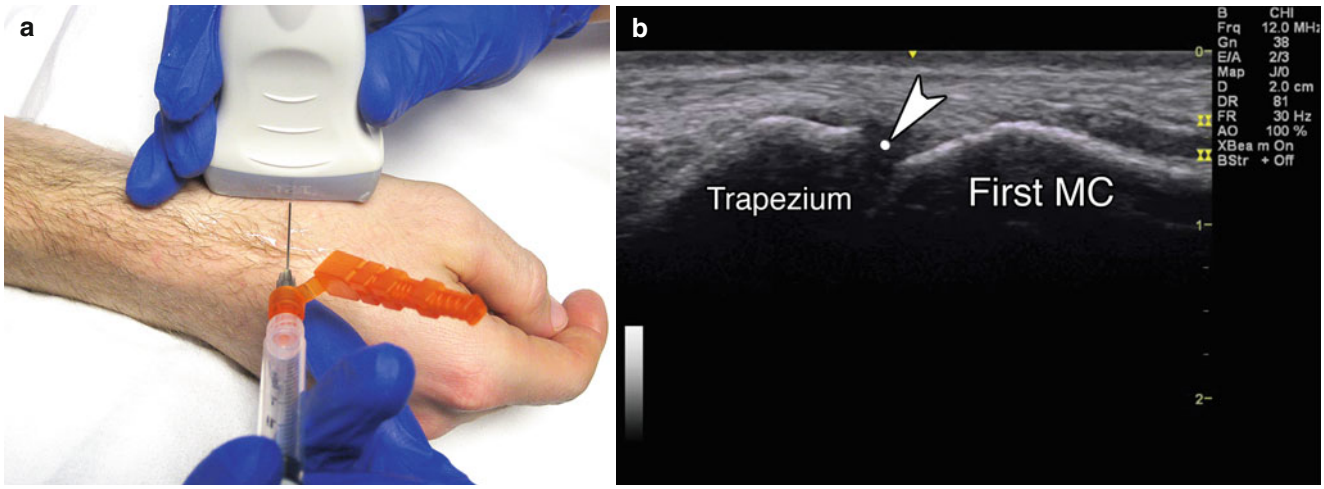

Fig. 4.17 (**a**) Example of longitudinal probe position over CMC joint. (**b**) Example of out-of-plane approach. *White arrowhead* points to needle tip. Trapezium and first metacarpal bone labeled

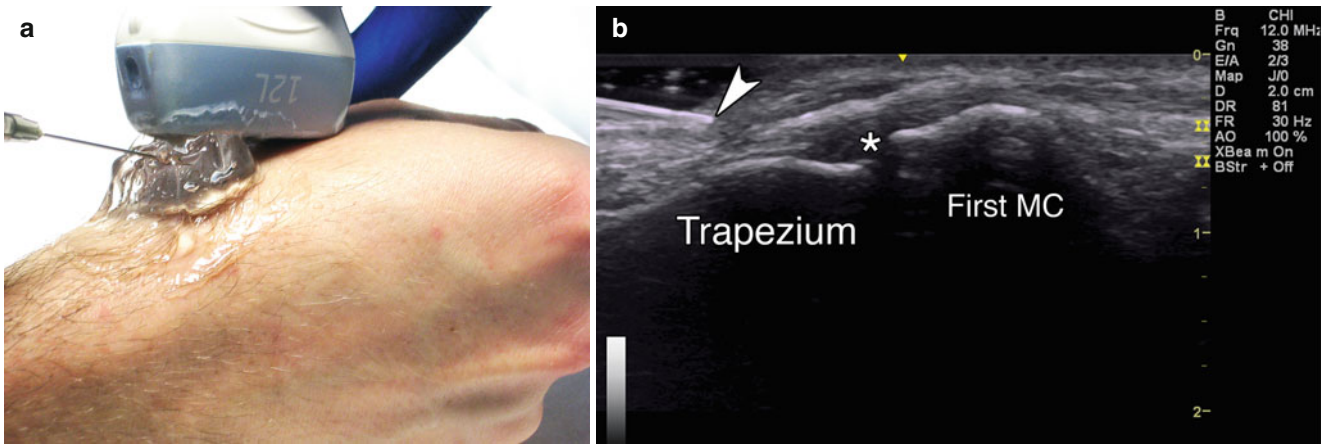

Fig. 4.18 (**a**) Example of probe position over CMC joint with gel standoff technique. (**b**) Example of in-plane approach. *White arrowhead* points to needle tip approaching joint. *Asterisk* indicates CMC joint space. Trapezium and first metacarpal bone labeled

Safety considerations: Do not inject the extensor tendons.
Pearls:

- An oblique standoff technique may be used.
- Flexing the thumb may help to open the CMC joint.

Equipment needed:

- High-frequency linear array transducer (10 MHz+)
- 25G 1.5″ needle
- 0.5 mL of steroid preparation
- 1–3 mL local anesthetic

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