The tendons: Interventional sonography

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Abstract While blind or fluoroscopically guided infiltration works well for intra-articular injections, injections into the tendon sheath are much more difficult. Ultrasound guidance with high-frequency transducers now allows visualization and infiltration of tendon sheaths. The interventional phase should be preceded by a diagnostic scan. Patients should be questioned to identify possible contraindications to the procedure and informed of the potential risks. Strict asepsis must be maintained for both patient and operator. This review includes separate discussions of the tendons in different areas of the body that are most commonly treated with ultrasound-guided injections, with descriptions of the lesions that are treated and the approach used for each. Interventional sonography is currently the only technique that allows visualization of the tendon being infiltrated. It requires training and experience as well as good knowledge of the indications and equipment used for the procedures, and the anatomy of the areas being treated.

Sommario Se l'infiltrazione alla cieca, o sotto fluoroscopia, funziona bene nelle iniezioni intra-articolari, l'iniezione nella guaina di un tendine è molto più difficile; grazie alle sonde ad alta frequenza è ora possibile visualizzare, e quindi infiltrare, la guaina tendinea con guida ecografica.

Un'ecografia diagnostica deve sempre precedere la procedura interventistica, vanno ricercate le controindicazioni e informato il paziente sui possibili rischi. Devono essere applicate rigide misure di asepsi, per paziente e operatore.

Nel presente lavoro vengono considerati separatamente i vari tendini che, più comunemente, presentano indicazioni al trattamento iniettivo ecoguidato, a seconda del distretto corporeo. Dopo la descrizione delle varie lesioni e del loro approccio, si conferma che l'ecografia interventistica è, al momento attuale, l'unica tecnica che permette di visualizzare la guaina del tendine da infiltrare; richiede, tuttavia, un apprendimento e una buona conoscenza delle indicazioni, delle attrezzature, così come dell'anatomia.

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Introduction

Blind or fluoroscopically guided infiltration works well for intra-articular injections, but correct needle placement is much more difficult when the injection is being made within a tendon sheath.

With ultrasonography, the operator can monitor the advancement of the needle "echoscopically." This approach is economical, widely available, and associated with no radiation exposure; in addition, the use of high-frequency transducers can improve the performance of sonography in both diagnostic and therapeutic settings [1]. With the new high-frequency linear transducers, it is now possible to visualize and infiltrate tendon sheaths [2]. Thanks to its low invasiveness, ultrasound-guided infiltration allows high-precision treatment with a very low rate of complications [3].

Materials and methods

The injection should always be preceded by a diagnostic ultrasound study to confirm the diagnosis and the feasibility of the infiltration. The patient should be informed as to how the procedure will be carried out and its possible complications (infections, hematoma, etc). Potential contraindications -allergies to local anesthetics or cortisone derivatives- must be excluded.

Access routes

The initial phase of the infiltration procedure involves an assessment of ballistics. Using a linear transducer (7.5 MHz or more) or a small L-shaped "golf-club" transducer for small parts imaging, the operator locates the landmarks of the target structure and the structures that must be avoided (arteries, nerves, tendons, etc.).

Strict asepsis must be maintained for the patient and operator, with the same measures used during fluoroscopically guided procedures. The transducer should be disinfected before the procedure; the gel is then applied and the transducer covered with a sterile plastic bag. A fenestrated sterile field drape is positioned over the area, and sterile gel is used.

Injection

In many cases, the cortisone derivative used for these procedures is cortivazol (Altim®). During the injection, the sheath becomes distended. The Altim® is visualized during the procedure as a flutter of hyperechogenicity emerging from the tip of the needle.

Common ultrasound-guided infiltration procedures

Shoulder

- Infiltration of the subacromial-subdeltoid bursa: bursopathy secondary to subacromial impingement and lesions involving the superficial zone of the supraspinatus

tendon. The infiltration is performed while the patient is supine to avoid discomfort and malaise; when possible the arm should be internally rotated, with the hand behind the back, to liberate the subacromial bursa and prevent movement. The access point is anterior, and the transducer is placed parallel to the axis of the needle to visualize the latter's advancement. The bursa is distended with 0.5% Xylocaine® (which allows the operator to perform Neer's impingement test), and the Altim® is then injected (Fig. 1).

- Aspiration-needling of calcifications involving the rotator cuff tendons: this technique has been discussed in previous articles.

Wrist and hand

All of the tendon sheaths of the wrist can benefit from ultrasound-guided infiltration. In routine clinical practice, the disorders most commonly treated are forms of stenosing tenosynovitis (Fig. 2). During infiltration of a tendon sheath, every attempt should be made to keep the transducer parallel to the surface of the tendon. This minimizes anisotropy artifacts, optimizes visualization of the tendon, and reduces the risk of harmful intratendinous infiltration [2]. If the tenosynovitis is the "florid" type, the infiltration can be delivered directly into the sheath, injecting a small amount of the corticosteroid derivative. In cases of stenosing tenosynovitis, the infiltration can be done with the needle in contact with the retinaculum of the first compartment (De Quervain's tendinopathy) or with the A1 pulley (trigger finger). The retinaculum and A1 pulley are usually thickened and often appear hyperemic on power Doppler imaging. For trigger finger, ultrasound-guided infiltration seems to be more effective than nonguided infiltrations, with a success rate of close to 90% [4].

Hip

- Infiltration of the psoas in conflict with the tendon and the acetabulum in patients with hip prostheses. For monitoring the advancement of the needle, ultrasound offers advantages over computed tomography related to the absence of metal artifacts [5]. Use of the antero-lateral approach makes it easier to keep the needle at a safe distance from vascular structures. A test injection of anesthetic (Xylocaine® 1%) is made when the needle is in contact with the anterior border of the prosthetic acetabulum, the presumed source of conflict. Altim® can be injected at the same time (after septic processes and mechanical mobilization have been excluded) or later of the anesthetic test is positive.
- Gluteal tendinopathy-bursopathy is the most common indication for periarticular infiltration of the hip. A lateral access is used, and the injection is made for trochanteric bursitis and for tendon thickening.

Ankle

- One of the most commonly prescribed infiltration procedures is for posterior tibial tenosynovitis [2]. Injection of corticosteroids into the sheath can cause

Figure 1 Infiltration of the subacromial-subdeltoid bursa.

secondary rupture of the tendon, which is often fissured, and the patient must be made aware of this risk. Infiltration should be reserved for those cases that have not responded to appropriate medical treatment. A golf club transducer should be placed behind and below the medial malleolus to obtain a longitudinal view of the tendon. The infiltration is done with a long needle for subcutaneous injections (Fig. 3).

- The sheath of the peroneal tendons can also be infiltrated; in this case the needle insertion tract should be

perpendicular to the long axis of the tendons. As with the tendons of the wrist, this approach sometimes allows infiltration of two adjacent tendons with a single insertion.

Foot and back foot

- The superficial plantar fascia may be thickened, with or without fissures. With sonographic guidance, a cortisone

Figure 2 Infiltration of the first extensor compartment.

Figure 3 Infiltration of the posterior tibial tendon sheath.

derivative (Altim[®]) can be injected onto the surface of the aponeurosis [2]. A medial approach is used (Fig. 4), and the transducer is positioned to obtain a frontal cross-section of the fascia. A needle for intramuscular injections is used to induce local anesthesia extending to the

aponeurosis and to infiltrate the latter's surface with the cortisone derivative.

- Achilles (or calcaneal) tendinopathy can be associated with retrocalcaneal bursitis. A lateral access is chosen, right in front of the Achilles tendon. Sonographic

Figure 4 Infiltration of the plantar aponeurosis.

Figure 5 Infiltration of the retrocalcaneal bursa.

guidance is carried out in the axial plane with the transducer placed behind the tendon. The needle is inserted parallel to the transducer and well visualized (Fig. 5).

Conclusions

Interventional ultrasonography is the only technique that allows visualization of the tendon sheath being infiltrated. Thanks to its low cost, wide availability, and zero radiation risk, it is becoming a fundamental technique, but it requires training and experience, as well as a good knowledge of the indications for the procedure, the equipment used, and the anatomy of the areas being treated.

Conflict of interest

The authors have no conflicts of interest to declare.

Appendix. Supplementary

Supplementary data related to this article can be found online at [doi:10.1016/j.jus.2011.12.002](https://doi.org/10.1016/j.jus.2011.12.002).

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