



**European Society of
MusculoSkeletal Radiology**

Musculoskeletal Ultrasound Technical Guidelines

VI. Ankle

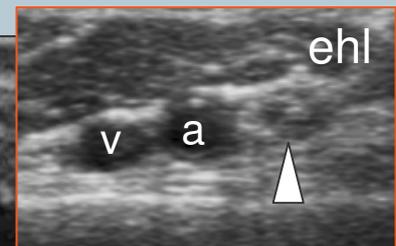
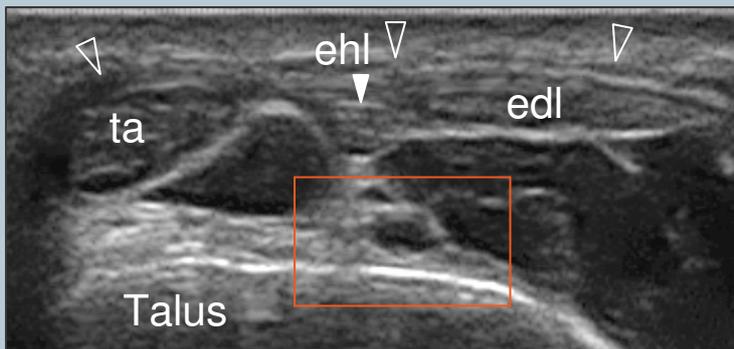
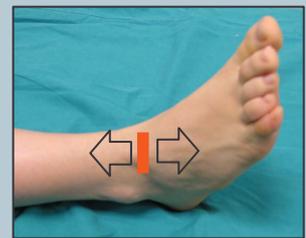
Ian Beggs, UK
Stefano Bianchi, Switzerland
Angel Bueno, Spain
Michel Cohen, France
Michel Court-Payen, Denmark
Andrew Grainger, UK
Franz Kainberger, Austria
Andrea Klauser, Austria
Carlo Martinoli, Italy
Eugene McNally, UK
Philip J. O'Connor, UK
Philippe Peetrans, Belgium
Monique Reijnierse, The Netherlands
Philipp Rempik, Germany
Enzo Silvestri, Italy

Note

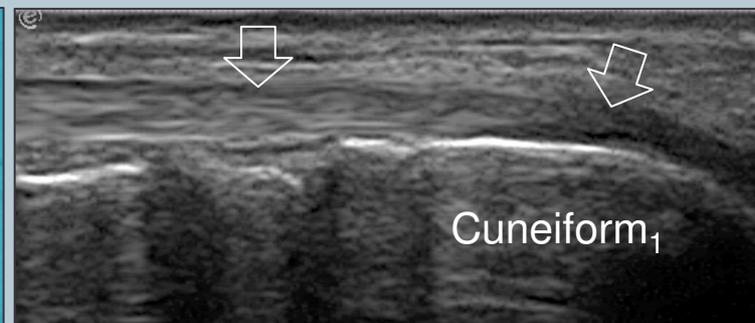
The systematic scanning technique described below is only theoretical, considering the fact that the examination of the ankle is, for the most, focused to one (or a few) aspect(s) only of the joint based on clinical findings.

1 ANTERIOR ANKLE: extensor tendons

Patient seated on the examination bed with the knee flexed 45° so that the plantar surface of the foot lies flat on the table. Alternatively, the patient may lie supine with the foot free to allow manipulation by the examiner during scanning. Place the transducer in the axial plane and sweep it up and down over the dorsum of the ankle to examine the tibialis anterior, extensor hallucis longus and extensor digitorum longus. These tendons must be examined in their full length starting from the myotendinous junction. Look at the tibialis anterior artery and the adjacent deep peroneal nerve.



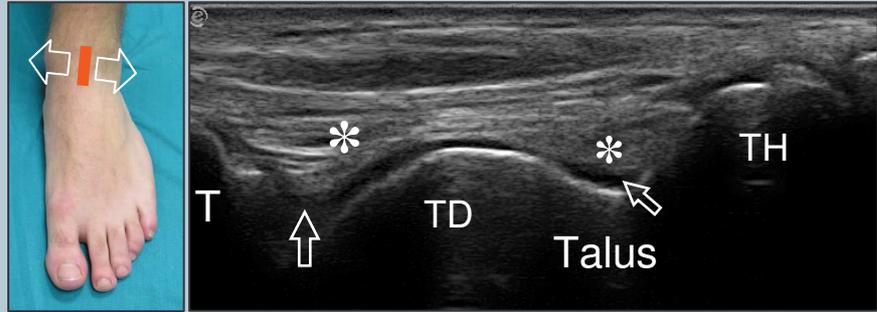
Be sure to examine the superior extensor retinaculum and the insertion of the tibialis anterior tendon, which lies distally and medially. Follow the tibialis anterior tendon up to reach its insertion onto the first cuneiform.



Legend: a, anterior tibial artery; edl, extensor digitorum longus tendon; ehl, extensor hallucis longus tendon; ta, tibialis anterior tendon; void arrows, distal tibialis anterior tendon; v, anterior tibial vein; void arrowheads, superior extensor retinaculum; white arrowhead, deep peroneal nerve

2 anterior recess of the ankle joint

Place the transducer in the mid longitudinal plane over the dorsum of the ankle to examine the anterior recess of the tibiotalar joint. Fluid may be shifted away from this recess using excessive plantar flexion. 60%-70% of the talar dome can be easily assessed by moving the probe medially and laterally.



Legend: asterisks, anterior fat pad; arrows, anterior recess of the tibiotalar joint; T, tibia; TD, talar dome; TH, talar head

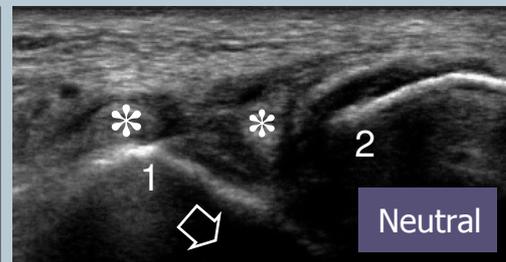
3 anterior talofibular ligament

From the position described at point-1, roll the forefoot slightly internally (inversion) to stretch the lateral ligaments. A small pillow under the medial malleolus may help to improve the contact between transducer and skin over the lateral ankle. Place the transducer parallel to the examination bed placing its posterior edge over the distal lateral malleolus to image the anterior talofibular ligament.



Legend: LM, lateral malleolus; void arrowheads, anterior talofibular ligament

When distinguishing a partial from a complete tear is difficult, perform a sonographic anterior drawer test by placing the patient prone with the foot hanging over the edge of the examination table while pulling the forefoot anteriorly when in plantar flexion and inversion. When the ligament is torn, the anterior shift of the talus against the tibia will open the gap in the substance of the ligament.



Neutral

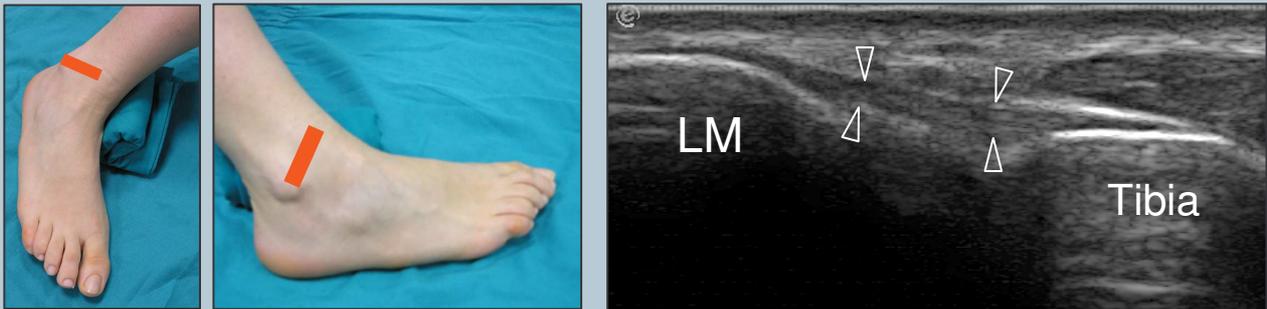


Drawer test

Legend: Asterisks, ligament stumps; arrow, talar shift; 1, talar landmark; 2, fibular landmark

4 anterior tibiofibular ligament

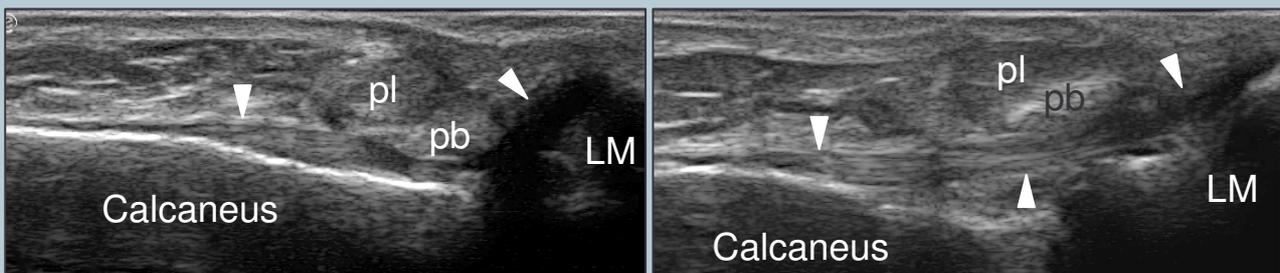
From the position described at point-3 (first sentence), keep the posterior edge of the transducer on the lateral malleolus and rotate its anterior edge upwards to image the anterior tibiofibular ligament. The transducer will pass over a part of the talar cartilage, which lies in between the anterior talofibular ligament and the anterior tibiofibular ligament.



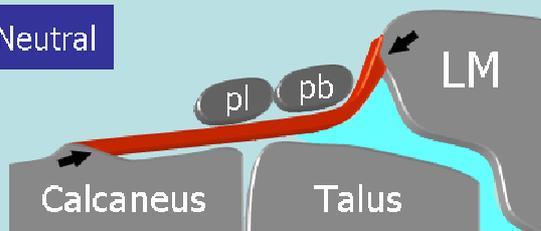
Legend: arrowheads, anterior tibiofibular ligament; LM, lateral malleolus

5 calcaneofibular ligament

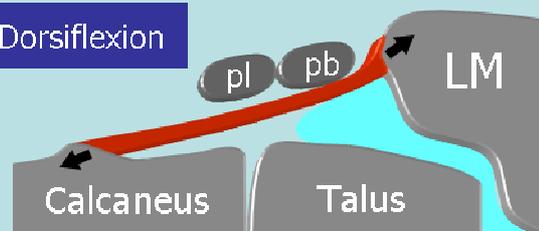
With the ankle lying on its medial aspect, place the transducer in an oblique coronal plane with its superior edge over the tip of the lateral malleolus and its inferior margin slightly posterior to it, towards the heel, while the foot is dorsiflexed to image the calcaneofibular ligament.



Neutral



Dorsiflexion

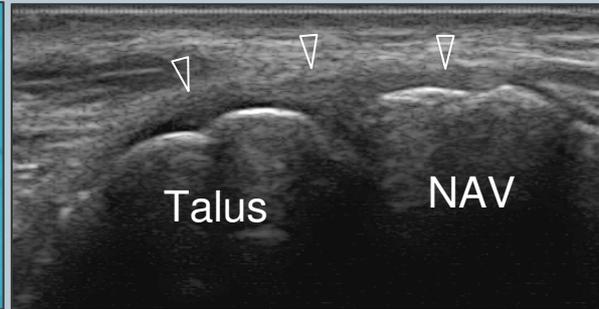


Legend: arrowheads, calcaneofibular ligament; LM, lateral malleolus; pb, peroneus brevis tendon; pl, peroneus longus tendon

6 dorsal midtarsal ligaments

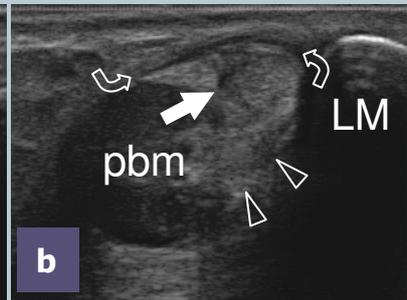
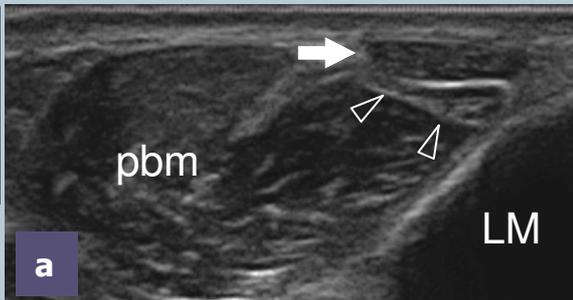
Look at the following midtarsal ligaments: dorsal talonavicular, dorsal calcaneocuboid and calcaneo-cuboido-navicular ligament (avulsion of the anterolateral tubercle of the calcaneus).

Legend: arrowheads, dorsal talonavicular ligament; NAV, navicular bone



7 LATERAL ANKLE: peroneal tendons

Behind the lateral malleolus, place the transducer over the peroneal tendons to examine them in their short-axis (long-axis planes are of limited utility). Because these tendons arc around the malleolus, tilt the transducer to maintain the US beam perpendicular to them and avoid anisotropy as scanning progresses. Continue to follow these tendons upwards for approximately 5 cm and downwards through the inframalleolar region.



Check them at the level of the peroneal tubercle of calcaneus, and the peroneus longus down to the area where the os peroneum can be found. Follow the peroneus brevis until the base of the 5th metatarsal. Look at the superior and inferior peroneal retinacula.



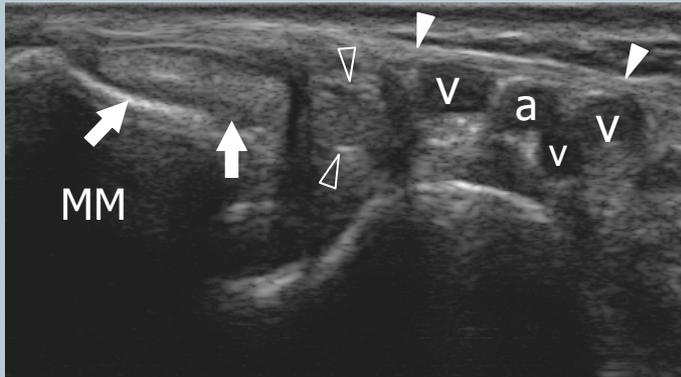
Legend: arrowheads, peroneus brevis tendon; curved arrows, superior extensor retinaculum; LM, lateral malleolus; pbm, peroneus brevis muscle; void arrow, peroneal tubercle; white arrow, peroneus longus tendon

When intermittent subluxation of the peroneals is suspected clinically, perform scanning at rest and during dorsiflexion and eversion of the foot against resistance, placing the transducer in a transverse plane over them, at the level of the lateral malleolus. Stress eversion can be done while pushing with the examiner's free hand on the forefoot of the patient, to see subtle subluxation or distension of the superior retinaculum.



8 MEDIAL ANKLE: tibialis posterior and flexor digitorum longus tendons

For examination of the medial ankle, the patient is seated with the plantar surface of the foot rolled internally or in a “frog-leg” position. Alternatively, the patient may lie supine with the foot rotated slightly laterally. A small pillow under the lateral malleolus may help to improve the contact between transducer and skin over the medial ankle. The examination of tendons is performed first.

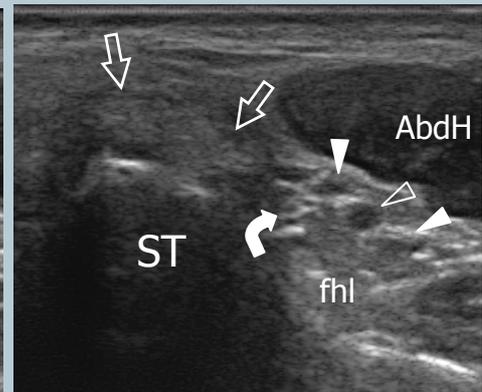
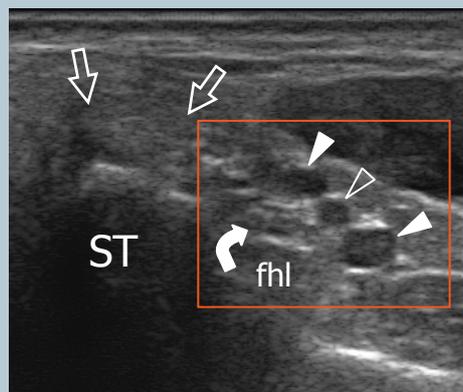


Behind the medial malleolus, place the transducer over the short-axis of the tibialis posterior and the flexor digitorum longus tendons. Follow the tibialis posterior from the myotendinous junction down to its insertion on short-axis planes. Check the presence of an accessory navicular bone on long-axis scans over the insertion of the tibialis posterior.

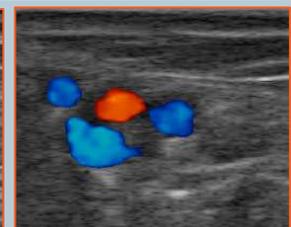
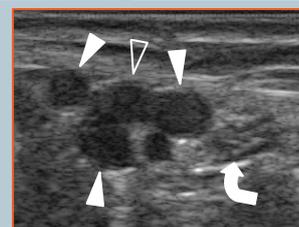
Legend: a, tibialis posterior artery; MM, medial malleolus; v, posterior tibial veins; void arrowheads, flexor digitorum longus tendon; white arrowheads, flexor retinaculum; white arrows, tibialis posterior tendon

9 tarsal tunnel and tibial nerve

Examine the flexor digitorum longus tendon down to reach the sustentaculum tali. Look at the flexor retinaculum, the posterior tibial vessels and the tibial nerve with its divisional branches (medial and lateral plantar nerves). Compression may help to assess whether the veins are patent.



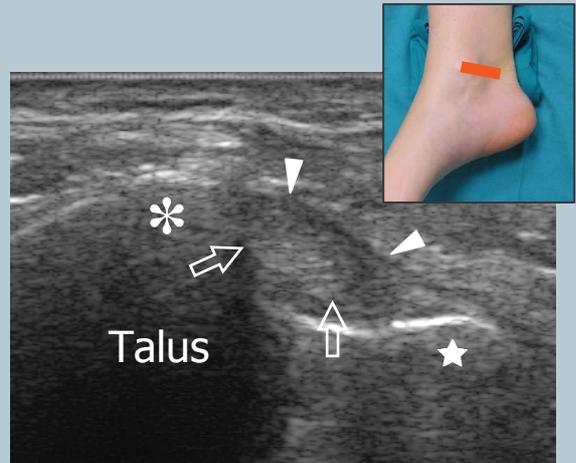
Legend: AbdH, abductor hallucis muscle; curved arrow, tibial nerve; fhl, flexor hallucis longus tendon; ST, sustentaculum tali; straight arrows, flexor digitorum longus tendon; void arrowhead, posterior tibial artery; white arrowheads, posterior tibial veins



10 flexor hallucis longus tendon (short-axis)

In the same position, look more posteriorly to demonstrate the flexor hallucis longus. Bony landmarks are the lateral and medial talar tubercles. The tendon lies in between them. Use passive flexion-extension of the great toe to assess this tendon while it curves over the posterior talus. Follow this tendon on short-axis plane as it passes under the sustentaculum tali and crosses the flexor digitorum longus.

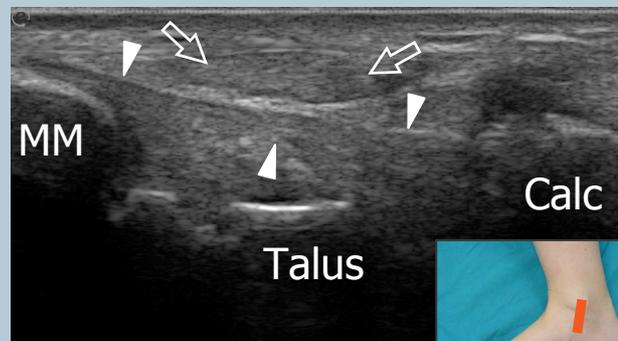
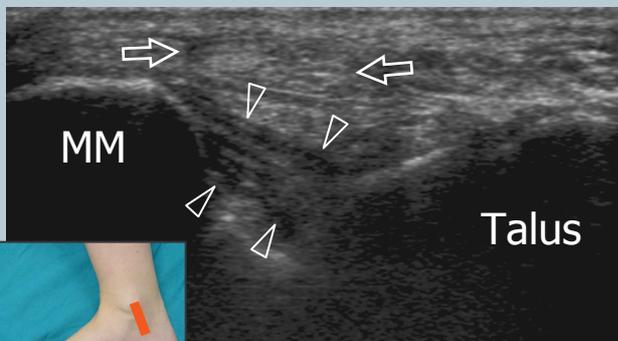
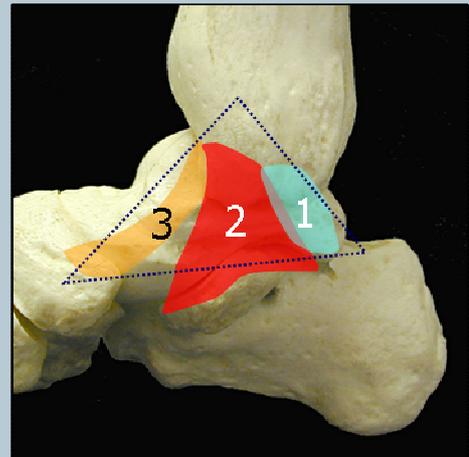
Legend: asterisk, medial tubercle; star, lateral tubercle; arrows, flexor hallucis longus tendon; arrowheads, retinaculum



11 deltoid ligament

The posterior part of the deltoid ligament is examined while dorsiflexing the foot by means of coronal scans. The superior edge of the transducer is kept over the tip of the medial malleolus whereas the inferior edge is rotated slightly posterior (tibiotalar), parallel or slightly anterior (tibiocalcaneal) to it. The anterior part (tibionavicular) of the ligament is best seen in a neutral position. Look at the spring ligament (lateral calcaneonavicular) ligament which lies straight between the sustentaculum tali and the navicular bone.

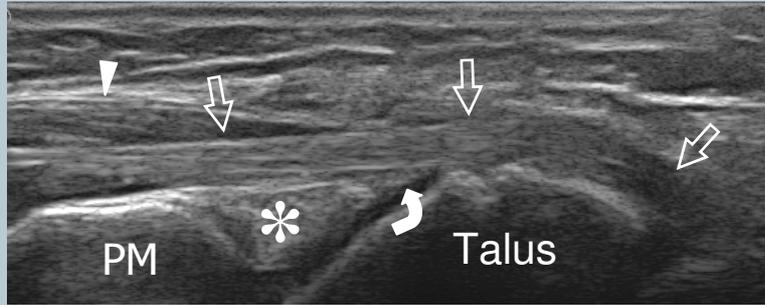
Legend: Deltoid ligament components. 1, tibiotalar ligament; 2, tibiocalcaneal ligament; 3, tibionavicular ligament



Legend: arrows, posterior tibial tendon; MM, medial malleolus; void arrowheads, tibiotalar ligament; white arrowheads, tibiocalcaneal ligament; Calc, calcaneus

12 flexor hallucis longus tendon (long-axis) and posterior joint recess

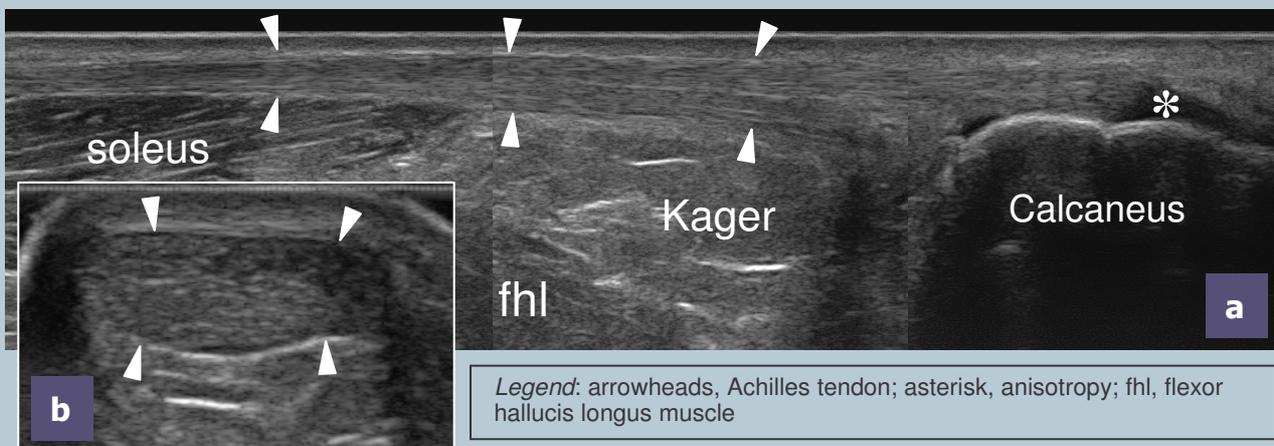
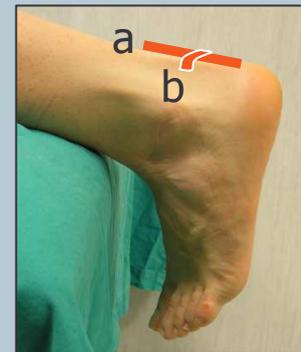
Place the patient prone with the foot resting on the toes over the table to maintain the foot perpendicular to the leg. The probe is positioned just medial to the Achilles tendon in an oblique sagittal plane to examine the proximal portion of the flexor hallucis longus in its long-axis and the posterior recesses of the tibiotalar and subtalar joints. Fluid in the posterior recess may travel anteriorly in this position.



Legend: asterisk, posterior fat pad; arrowhead, flexor hallucis longus muscle; curved arrow, posterior ankle recess; straight arrows, flexor hallucis longus tendon; PM, posterior tibial malleolus

13 Achilles tendon

On a prone position, let the foot hanging out of the examination table. Look clinically to the position of the foot, comparing both sides to see any differences that can lead to the diagnosis of Achilles tendon full-thickness tear. Then, examine the Achilles tendon from its myotendinous junction to its calcaneal insertion by means of transverse and longitudinal planes. While scanning the Achilles tendon on short-axis planes, tilt the probe on each side of the tendon to assess the peritendinous envelope. Measure the size of the Achilles tendon only on transverse planes. The Achilles tendon has to be followed down to its calcaneal insertion. Check the retroachilles and the retrocalcaneal bursae.

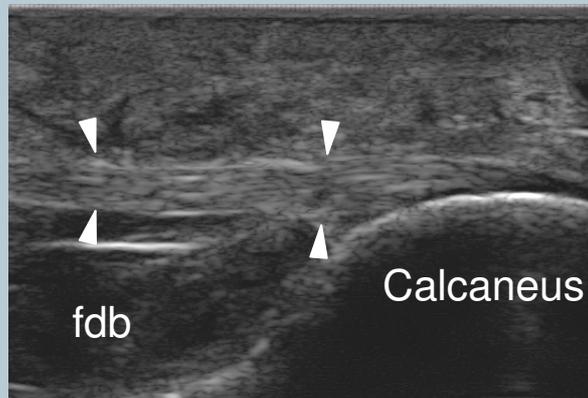


Legend: arrowheads, Achilles tendon; asterisk, anisotropy; fhl, flexor hallucis longus muscle

Check the plantaris tendon. In cases of complete Achilles tendon tear, the plantaris may mimic residual intact fibers of the Achilles. Dynamic scanning during passive dorsal and plantar flexion help to distinguish partial from complete Achilles tendon tears.

14 plantar fascia

In the same position described at point-13, place the transducer over the plantar aspect of the hindfoot to examine the calcaneal insertion of the plantar fascia. Long-axis scans obtained just medial to midline are used. Measure the fascia at the point where it leaves the calcaneal tuberosity. The gain may be increased to avoid beam absorption by the thick plantar sole.



Legend: arrowheads, plantar fascia; fdb, flexor digitorum brevis muscle