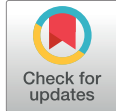




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Musculoskeletal Radiology / Radiologies musculo-squelettique

# Ultrasound of the Distal Insertions of the Ankle and Foot Tendons With Anatomical Correlation: A Review

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## Abstract

The distal insertions of the tendons crossing the ankle as well as the tendons originating in the foot are less well known by radiologists. We review the anatomy and ultrasound appearance of these insertions using our own cadaveric sectioning and dissection. The ultrasound images were correlated with anatomical slices. Occasionally magnetic resonance images were also used for better understanding. Understanding the normal appearance of these tendon insertions is important for diagnosing pathology in this region.

## Résumé

Les radiologistes ont une connaissance moins approfondie des points d'insertion distale des tendons traversant la cheville ainsi que des tendons dont l'origine se trouve dans le pied. Nous passons en revue les éléments anatomiques et l'apparence échographique de ces points d'insertion, au moyen de nos propres coupes et dissections de sujets décédés. Une corrélation a été établie entre les images échographiques et les vues anatomiques. Des images obtenues par résonance magnétique ont parfois été utilisées pour faciliter la compréhension. Il est important de connaître l'apparence normale des points d'insertion de ces tendons pour diagnostiquer les pathologies dans cette région.

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*Key Words:* Ankle tendons; Foot; Foot anatomy; Foot tendons; Foot ultrasound

During routine ultrasound imaging emphasis is typically placed on the parts of the tendons at the level of the ankle. The distal insertions of the tendons crossing the ankle joint are often not assessed. Insertional tendon pathology occurs and can remain undiagnosed. Such pathologies may include tendinosis, enthesitis, tenosynovitis, and tears. Understanding the anatomy of the tendon insertions is important to help radiologists arrive at the correct diagnosis.

We divided the tendons into 4 groups: anterior tendons, lateral tendons, medial tendons, and those tendons originating in the foot. The anterior group consists of the anterior tibial, extensor hallucis longus, extensor digitorum longus, and peroneus tertius tendons. The lateral group consists of

the peroneus brevis, peroneus longus, and peroneus quartus tendons. The medial group consists of the tibialis posterior, flexor digitorum longus, and flexor hallucis longus tendons. Tendons and muscles with an origin in the foot but connecting to ankle tendons include the extensor digitorum brevis, extensor hallucis brevis, flexor digitorum brevis, flexor hallucis brevis, and quadratus plantae [1,2]. We studied the tendons in cadavers and volunteers with ultrasound. Our aim was to show an imaging-anatomic correlation of the tendon insertions.

## Anterior Tendon Group

### *Anterior Tibial Tendon*

The anterior tibial tendon arises from the lateral tibial condyle, the upper lateral surface of the tibia, and the interosseous membrane. It descends along the medial aspect of the foot

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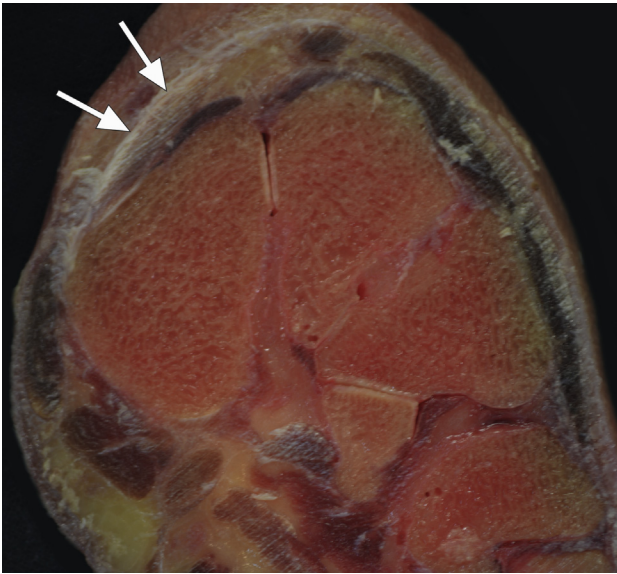


Figure 1. Coronal anatomical section of the anterior tibial tendon. Note insertion (arrows) of tibialis anterior on cuneiform, quite medially rather than anteriorly despite its name. This figure is available in colour online at <http://carjonline.org/>.

and may divide in 2 parts before its insertion. The tendon inserts at the inferomedial aspect of the first metatarsal base and the medial aspect of the medial cuneiform (Figures 1 and 2). This division into 2 parts may be misinterpreted as evidence of a split tear (Figure 3). A subtendinous bursa may rarely be found in this location. Described variations of tibialis anterior insertion include an insertion on the proximal phalanx of the big toe, and on the talus and calcaneus.

The tibialis anterior is the largest and strongest of the extensor tendons [3]. The tendon is responsible for 80% of dorsiflexion and inversion of the foot. It prevents the forefoot slapping and scraping the ground and helps support the longitudinal arch. Interestingly, the medial cuneiform band is the most common site of distal pathology including tendinopathy and partial tears of the tendon.

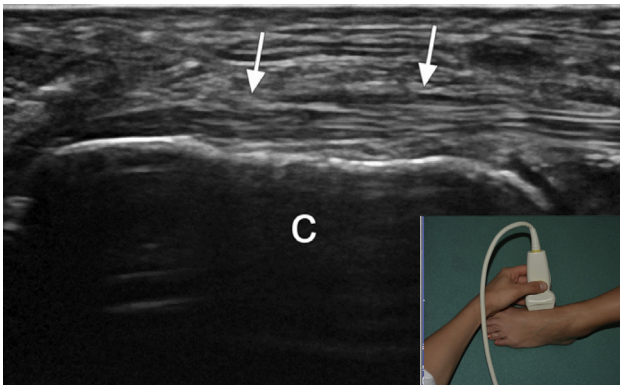


Figure 2. Ultrasound image in a sagittal oblique plane along long axis of tibialis anterior tendon. Note insertion of the tendon (arrows) on the cuneiform (C). Insert shows probe positioning. Ultrasound has the advantage compared with magnetic resonance imaging of allowing a direct comparison of thickness with the contralateral asymptomatic side. This figure is available in colour online at <http://carjonline.org/>.

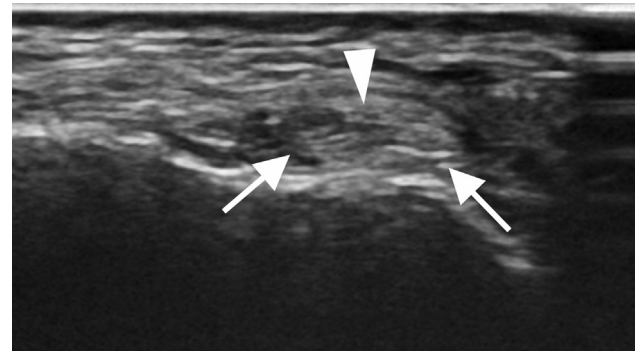


Figure 3. Ultrasound image in the coronal plane showing a bifid insertion of the tibialis anterior. Note the two tendon parts (arrows). Separation between tendon parts (arrowhead) should not be mistaken for a longitudinal split.

### *Extensor Hallucis Longus*

The extensor hallucis longus is a thin muscle arising from the anterior surface of the fibula and the interosseous membrane. The extensor hallucis longus inserts onto the dorsal surface of the base of the distal phalanx of the hallux and is a powerful dorsiflexor of the great toe (Figures 4 and 5) [3,4]. In case of a tear, loss of dorsiflexion is observed. The extensor hallucis brevis, in contradistinction, inserts more proximally at the base of the proximal phalanx (Figure 6). At the level of the metatarsophalangeal joint, both tendons are anchored by the extensor sling (Figures 7 and 8).

With ultrasound, the probe is placed along the long axis of the tendon for optimal visualization of the insertion.

### *Extensor Digitorum Longus*

The extensor digitorum longus arises from the lateral condyle of the tibia, the anterior surface of the fibula, and the interosseous membrane. At the level of the ankle, the muscle passes under the prominent extensor retinacula and divides in 4 tendons coursing over the dorsal aspect of the foot [1,4]. At

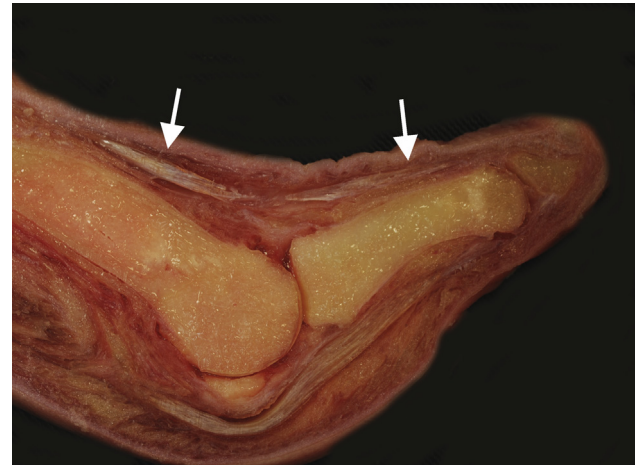


Figure 4. Sagittal anatomical slice of extensor hallucis longus. Note the extensor hallucis longus tendon inserting on the distal phalanx (arrows). This figure is available in colour online at <http://carjonline.org/>.

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