Learning objectives

- Describe the anatomic features of accessory muscles of the ankle
- Identify MRI findings of accessory muscles of the ankle
- Discuss the clinical importance of accessory muscles of the ankle
Background

Accessory muscles around the ankle are not uncommon and can be seen in routine MRI's. The prevalence is ranging from 1% to 26% [1,2]. They can be asymptomatic or can cause pain or present as a palpable mass. Noninvasive and accurate diagnosis is possible with MRI. However, knowledge of the anatomy of these muscles is essential for precise diagnosis and distinguishing from other entities such as soft tissue neoplasms in patients with a palpable mass or tendon tears in patients presenting with pain. The purpose of this exhibit is to review the accessory muscles around the ankle and demonstrate some examples of accessory muscles in the ankle.
Findings and procedure details

There are many accessory peroneal muscles reported, such as peroneus quartus, peroneus accessories, peroneocalcaneus externum, peroneus digiti minimi and peroneus tertius [1,2,3]. However, the name peroneus quartus is sometimes used to refer to any one of these muscles, therefore reported prevalence of these variations vary widely.

Peroneus quartus muscles (Fig. 1 on page 6) are more common in males and are frequently bilateral [1,4]. The most common origin is from peroneus brevis, with posterior surface of fibula and peroneus longus being other possibilities. It courses inferiorly medial and posterior to other peroneal tendons. It may insert into different points, according to which different types of the muscle are classified. The most common insertion point is the calcaneus (in which case it is called peroneocalcaneus externum), with peroneal tubercle, the retrocochlear eminence, cuboid bone, base of fifth metatarsal and tendons of peroneus longus or brevis being other possible insertion points [1,4]. Peroneus quartus is commonly asymptomatic; however, it causing lateral ankle pain, ankle instability, and, in case of hypertrophy of its attachments, peroneal tenosynovitis have been reported. It can also cause crowding in the retromalleolar groove, predisposing to peroneus brevis tendon dislocation and tear [5]. The muscle can potentially be identified with ultrasonography [6], however, MRI remains the best imaging modality, where it can be seen medial to peroneus brevis, separated from it by a fat plane [1,2]. The most important differential diagnosis is a longitudinal split tear of the peroneal tendons, from which the muscle can be differentiated by examining the more proximal images where an anomalous muscle belly will be seen [1,2].

Flexor digitorum accessories longus (FDAL, Fig. 2 on page 6) is the second most common variant in the ankle, seen in 6-8% of people, and is more common in males [7]. It can originate from either the medial margin of tibia and the fascia of deep posterior compartment or from the lateral margin of fibula. Its tendon descends posterior and superficial to the tibial nerve, passes through the tarsal tunnel and inserts into the quadratus plantae or flexor digitorum longus tendon. It is closely related to the posterior tibial artery and nerve, therefore its presence can be associated with tarsal tunnel syndrome [1,2]. It can also be a possible culprit in flexor hallucis longus (FHL) tenosynovitis, causing repeated friction of the FHL in the tarsal tunnel [7]. It can be imaged on MRI where the muscle is seen in the tarsal tunnel, superficial to the nerve and vessels. It can contain fleshy fibers in the tarsal tunnel, and this may be helpful for identification.

Peroneocalcaneus internus (Fig. 3 on page 7, Fig. 4 on page 8) originates at the medial aspect of lower fibula, inferior to the origin of FHL; descends posterior and lateral to it, passes through the tarsal tunnel and inserts onto the medial aspect of calcaneus
inferior to the sustentaculum. It is frequently bilateral. It is usually asymptomatic; however, it displaces FHL anteriorly and laterally which may potentially cause compression of the neurovascular bundle in the tarsal tunnel. It can cause tenosynovitis of FHL and a case associated with posterior impingement has been reported [8]. It can also be associated with neurovascular injury in endoscopic surgery, where it can be mistaken for FHL [8]. Once again, MRI is the imaging modality of choice. It can be difficult to differentiate from FDAL, in which case insertion into calcaneus and the presence of a fat plane between the muscle and quadratus plantae can be helpful for diagnosis. Another important point to consider is that sometimes FHL can have two tendinous slips, which may be mistaken for PCI.

Accessory soleus (Fig. 5 on page 9, Fig. 6 on page 10) is seen in 0.7-5.5% of people, is more common in males and usually unilateral [1]. It originates from the anterior surface of soleus or from the fibula and soleal line of tibia; descends anterior to the Achilles tendon and then inserts onto the upper surface or the medial aspect of calcaneus with a muscular or tendinous insertion or onto the Achilles tendon. It can present as a soft tissue mass in the posterolateral ankle and this appearance can further be mistaken as a mass in x-rays where an increased soft tissue density obliterates the Kager fat pad anterior to the Achilles tendon. It can also cause swelling and pain, more common in athletes and exertional in nature [1,9]. Although its course does not involve the tarsal tunnel, association with tarsal tunnel syndrome in cases of medial calcaneal insertion has been reported [2]. Again, MRI is the imaging modality of choice, where the muscle is anterior to Achilles tendon and superficial to the flexor retinaculum. Abnormal signal intensity can be seen on MRI related to trauma, ischemia or atrophy.

Tibiocalcaneus internus is a rare accessory muscle. It originates from medial crest of tibia, courses inferiorly deep to flexor retinaculum and posterior to the neurovascular bundle; and inserts onto the medial aspect of calcaneus anterior to the insertion of the Achilles tendon [1]. A case has been reported where it caused tarsal tunnel syndrome [10].
Fig. 1: Peroneus quartus muscle.

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Fig. 2: Axial T1 weighted image shows flexor digitorum accessories longus (red arrow). TP; tibialis posterior, FDL; flexor digitorum longus.

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Fig. 3: Sagittal T1 weighted images of peroneocalcaneus internus muscle.

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**Fig. 4:** Axial T1 weighted image of peroneocalcaneus internus muscle.

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Fig. 5: Sagittal T1 weighted images of the right ankle shows accessory soleus.

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Fig. 6: Axial T1 weighted MR image of the ankle with accessory soleus.

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Conclusion

In some cases accessory muscles may present in routine MRI images and a radiologist should be familiar with the appearances of the accessory muscles. While the majority of the muscles are asymptomatic, in some cases they can cause symptoms like pain or palpable mass. In such situations, it is important to diagnose the cause of the pain or exclude a neoplasm. MRI is the imaging of choice.
References


