Learning objectives

- Describe the anatomic localizations of common accessory ossicles of the foot and ankle,
- Describe the MRI characteristics of accessory ossicles
- Discuss the clinical importance of accessory ossicles of the foot and ankle

Background

Accessory ossicles of the foot and ankle are normal variants which vary widely in their prevalence and appearance. These bones may sometimes cause painful syndromes and clinical trouble in trauma patients, therefore knowledge of their radiologic appearance is essential for proper diagnosis and management. Familiarity with these normal variants is also important to prevent wrong diagnoses.

This presentation describes an overview of accessory ossicles around the foot and ankle with MR imaging characteristics. Their anatomy, epidemiology and differential diagnosis are also discussed. Examples of accessory pain syndromes and diagnostic pitfalls in trauma cases are presented.

Findings and procedure details

Accessory ossicles are extra bones that usually originate from an unfused primary or secondary ossification center and their function is not well known. Sesamoids are small bones that are partially or totally embedded within a joint capsule or a tendon that passes over a joint. Their function is to decrease friction to protect the tendon from injury and improve the tendons biomechanical function [1,2]. Both of these entities have similar imaging features, being ovoid or nodular, well corticated, small bones and they can be bipartite or multipartite [1].

Os peroneum:
Os peroneum is located within the peroneus longus tendon near the cuboid with an oval or round shape (Fig. 1 on page 4). It has been stated in the literature that os peroneum can be cartilagenous, fibrocartilagenous or ossified. Os peroneum accepted as a normal part of the skeleton by some authors that can present in everyone in cartilaginous form [1,2]. The ossified form is present in 26 % of the population. It can be bipartite (%30) [3] or multipartite. Fracture of os peroneum can be seen following trauma and possible differential diagnoses are from os vesalianum, apophysis and avulsion fracture of the 5th
metatarsal [2]. Also os peroneum can cause peroneus longus tenosynovitis, tendon tear and os peroneum syndrome which is one of the reasons of lateral plantar foot pain (Fig. 2 on page 5) [3,4].

Os subfibulare:

Os subfibulare is an accessory ossicle located at the tip of the lateral malleolus (Fig. 3 on page 6). There are different theories regarding its formation. Some authors think it may be the result of an avulsion fracture of the lateral malleolus caused by the traction of the anterior talofibular ligament whereas others think of os subfibulare as a real sesamoid that originates from an accessory ossification center [2]. They are usually asymptomatic but they can cause painful syndromes that result from degenerative process or fracture of the bone itself. The main differential diagnosis is avulsion fracture of the lateral malleolus.

Accessory navicular:

Accessory navicular bone, also called os tibiale externum, is the second most common accessory bone of the foot, with a reported incidence of 4-21% [5]. It can be present adjacent to the navicular tuberosity. Three different types have been reported in the literature. Type I is a sesamoid bone within the posterior tibial tendon (Fig. 4 on page 7). Type II is the most common type that accounts for 50% of all accessory navicular bones (Fig. 5 on page 8) which results from a persistent secondary ossification center [1,2,5], connected to the tuberosity by a fibrocartilaginous synchondrosis and posterior tibial tendon inserts at this accessory bone [5]. Type III is a prominent navicular tuberosity also called cornuate navicular (Fig. 6 on page 9). Type II is the most symptomatic type and it can mimic avulsion fracture. Also, accessory navicular syndrome can cause pain that is localized to the medial aspect of the navicula and bone marrow edema can be observed on MRI in accessory ossicle and navicula (Fig. 7 on page 10) [6].

Os trigonum:

Os trigonum is an unfused secondary ossification center located posterior to the talus (Fig. 8 on page 11). Os trigonum articulates with posterolateral talus through a fibrocartilagenous synchondrosis. Os trigonum can be present in 1-25% of the population [7]. They are best seen on lateral radiographs and may be bipartite (Fig. 9 on page 12) or multipartite. Fracture of the lateral process of talus (also known as Shepherd's fracture) should be distinguished from os trigonum. Os trigonum can cause posterior ankle impingement syndrome in relation to its size and stability (Fig. 10 on page 13).

Os calcaneus secundarius:
Os calcaneus secundarius is an accessory ossicle located adjacent to the anterior calcaneal process (Fig. 11 on page 13). This rare ossicle’s incidence is stated to be between 0.6 and 7% [5]. It is difficult to distinguish os calcaneus secundarius from a fracture of the anterior process of calcaneus. In such situations MRI is to demonstrate the bone marrow edema of the fractured calcaneal process.

Os supranaviculare:

Os supranaviculare is located adjacent to dorsal navicula (Fig. 12 on page 14) [1]. This ossicle is also known as talonavicular dorsale, talonavicular ossicle or Pirie’s bone [5,7]. It is a very rare accessory ossicle, present in 1% of the population [8]. Os supranaviculare is easily detected on lateral ankle radiographs. It can be misdiagnosed as a cortical avulsion fracture of the tarsal navicular which mostly occurs in middle-aged women who wear high-heeled shoes [5].

Hallucal sesamoids:

Hallux sesamoid bones are always seen at foot radiographs [7]. They are normally oval-shaped, and completely included in the flexor hallucis brevis tendon (Fig. 13 on page 15). There is a medial and lateral hallux sesamoid with the medial one commonly being bipartite (Fig. 14 on page 16) [1,2]. Therefore, bipartite hallucal sesamoids can be misdiagnosed as fractures in trauma patients. Also, infection like sesamoiditis (Fig. 15 on page 17), arthritis and osteonecrosis can cause pain [1].

Images for this section:
Fig. 1: Os peroneum (Sagittal T1 weighted MRI).

© Akdeniz University - Antalya/TR
**Fig. 2:** Peroneus longus tendinopathy; os peroneum with increased intensity of peroneus longus tendon and adjacent soft tissue edema (Proton density and T1 weighted axial images respectively).

© Akdeniz University - Antalya/TR
Fig. 3: Sagittal T1 weighted ankle MRI shows os subfibulare.

© Akdeniz University - Antalya/TR
Fig. 4: Type I accessory os navicular bone (T1 wighted Sagittal and axial images).

© Akdeniz University - Antalya/TR
**Fig. 5:** Type II accessory os naviculare (T1 weighted axial image).

© Akdeniz University - Antalya/TR
Fig. 6: Type III accessory os naviculare (Axial and sagittal T1 weighted images).

© Akdeniz University - Antalya/TR
**Fig. 7:** Type II accessory os naviculare with painful accessory navicular syndrome. Bone marrow edema of navicula and the accessory navicular bone is present (PD fat saturated images).

© Akdeniz University - Antalya/TR
Fig. 8: Small os trigonum adjacent to the lateral process of the talus.

© Akdeniz University - Antalya/TR
**Fig. 9:** Bipartiate os trigonum.

© Akdeniz University - Antalya/TR

**Fig. 10:** Increased signal intensity of the os trigonum and surrounding soft tissue edema is seen in a patient with painful ankle and clinical examination is consistent with posterior ankle impingement syndrome.

© Akdeniz University - Antalya/TR
**Fig. 11:** Os calcaneus secundarius; located adjacent to the anterior calcaneal process (T1 weighted sagittal and transvers images).

© Akdeniz University - Antalya/TR
Fig. 12: Os supranaviculare is located adjacent to dorsal navicula.

© Akdeniz University - Antalya/TR
Fig. 13: Medial (yellow arrow) and lateral (red arrow) sesamoid bones.

© Akdeniz University - Antalya/TR
**Fig. 14:** Bipartiate sesamoid bone (T1 weighted sagittal image).

© Akdeniz University - Antalya/TR
Fig. 15: In a case without history of trauma, intensity changes of lateral sesamoid bone is considered as sesomoiditis.
Conclusion

When imaging is performed for traumatic or non-traumatic foot pain, the presence of accessory ossicles can cause misdiagnosis. Therefore; knowledge of MRI features of accessory ossicles is important, especially when a patient undergoes MRI because of foot pain. An understanding of the appearances of these bones in MRI will prevent the radiologist from making a false diagnosis.

Personal information

References