

The Accessory Ossicles of the Foot and Ankle; a Diagnostic Pitfall in Emergency Department in Context of Foot and Ankle Trauma

Ayak ve Ayak Bileği Çevresinde Görülen Aksesuar Kemikçikler; Acil Serviste Ayak ve Ayak Bileği Travma Hastalarında Tanısal Tuzak

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Abstract

Numerous normal anatomic variants including different accessory ossicles and sesamoid bones are found around the foot and ankle region. They are usually of no clinical importance and are often recognized as an incidental radiographic finding. However, in the context of trauma, these ossicles may cause misdiagnosis due to various radiological pitfalls and this may result in under or overtreatment. Therefore, a thorough knowledge of these accessory ossicles and sesamoid bones is important for the physician to recognize the pathologic process and normal anatomic variants. This pictorial review summarizes the most common accessory ossicles found around the foot and ankle in skeletally mature subjects and the fractures that may cause confusion with accessory ossicles and sesamoid bones. (*JAEM 2012; 11: 106-14*)

Key words: Accessory ossicle, foot, ankle, fracture, os trigonum, os vesalianum, os intermetatarsale, os supranaviculare, os supratolare, os peroneum, os subtibiale, os subfibulare, hallux sesamoid, os calcaneus secundarius

Özet

Ayak ve ayak bileği çevresinde, normal anatomik varyant sayılan çok sayıda aksesuar ve sesamoid kemik bulunmaktadır. Bunlar genellikle herhangi bir klinik önem taşımazlar ve tesadüfi bir radyolojik bulgu olarak saptanırlar. Ancak, travma varlığında, bu kemikçikler radyolojik olarak yanlış tanıya ve gereksiz tedavilere neden olabilirler. Bu sebeple, acil hekimlerinin normal anatomik varyantları tanıması, aksesuar ve sesamoid kemikler hakkında bilgi sahibi olması önemlidir. Bu derlemede aksesuar ve sesamoid kemikle ilgili karışıklığa neden olabilecek kırıklar ve ayak ve ayak bileği çevresinde bulunan en yaygın aksesuar kemikçikler özetlemiştir. (*JAEM 2012; 11: 106-14*)

Anahtar kelimeler: Aksesuar kemik, ayak, ayak bileği, kırık, os trigonum, os vesalianum, os intermetatarsale, os supranaviculare, os supratolare, os peroneum, os subtibiale, os subfibulare, halluks sesamoid, os kalkaneus secundarius

Introduction

Trauma of the foot and ankle is commonly seen in patients presenting to accident and emergency departments (1). Although, the use of Ottawa Ankle Rules has reduced unnecessary radiographs, radiography still remains the most appropriate initial imaging modality in patients with suspected fractures (2). The decision to engage in further imaging, indications for conservative treatment versus surgery and consultation with an orthopedic surgeon or radiologist, often rests on the emergency physician's interpretation of the radiographical findings. Therefore, it is important for the emergency physician to be aware of abnormal and normal variants of bony lesions of the foot and ankle and the various radiological pitfalls that may cause confusion. Many skeletal variations of the foot and ankle are found, including different accessory ossicles and sesamoid bones.

Sesamoid bone is a small rounded bone embedded within a tendon or joint capsule. Sesamoid bones are typically found in locations where a tendon passes over a joint. They prevent the friction between the tendon and the joint, protect the tendon and increase its biomechanical effect by changing the direction of pull of the tendon. On the other hand, accessory ossicles are usually derived from the failure of union of secondary ossification centers to the main bony mass. They usually remain asymptomatic and are recognized as an incidental radiographic finding (3). However, in the context of trauma, these ossicles can be misdiagnosed as avulsion fractures, or a reverse situation in which an avulsion fracture can be evaluated as an accessory ossicle is possible.

This pictorial review summarizes the most common accessory ossicles found around the foot and ankle and the fractures that may cause confusion with the accessory ossicles and sesamoid bones

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(Figure 1) (Table 1). Their clinical significance, differential diagnosis, anatomy, epidemiology, related symptomatic disorders and the clinical and radiological features that help differentiate these distinct entities from fractures are also discussed and demonstrated. We aimed to summarize the necessary knowledge for emergency physicians to facilitate a correct and timely diagnosis and to decrease the rate of misdiagnosis that may lead to under or over-treatment, and unnecessary referrals. This review will focus only on the adult population because skeletally immature patients have different radiological characteristics due to the presence of physis or apophysis, and some ossicles are radiologically evident at different periods of skeletal maturation.

Os trigonum

A secondary ossification center appears between the ages of 8 and 13 at the posterolateral aspect of the talus. Usually, this ossification center fuses with the talus within one year of its appearance (4). Fusion causes formation of a large posterolateral process which is referred to as a ‘fused os trigonum’, a ‘Stieda’s process’, or a ‘trigonal process’. When, it remains separate from the talus it is referred to as os trigonum (Figure 2) (5). The os trigonum articulates with the lateral tubercle through a fibrocartilagenous synchondrosis (Figure 3). The prevalence of the os trigonum ranges between 1-25% of the population in different studies from Turkey and Japan (6-8). On con-



Figure 1. Locations of common accessory ossicles and sesamoid bones seen around the foot and ankle. 1. Accessory navicular bone 2. Os vesalianum 3. Os peroneum 4. Os intermetatarsium 5. Medial hallux sesamoids 6. Lateral hallux sesamoid 7. Hallux interphalangeal sesamoid bone 8. Metatarsophalangeal sesamoid bone 9. Os subfibulare 10. Os subtibiale 11. Os trigonum 12. Os calcaneus secundarius 13. Os supratolare 14. Os supranaviculare

Table 1. Summary of accessory ossicles and sesamoid bones that may simulate fractures around the foot and ankle

Accessory/sesamoid bone	Location	Confused fractures and anatomical variants	Important clinical and radiographic findings in acute avulsion fractures
Os trigonum	Posterolateral to the talus	Fractures of posterior process of talus	Positive nutcracker sign, remarkably sharp edges and discontinuity of the cortical lining
Os vesalianum	Adjacent to the base of 5 th metatarsal	5th metatarsal base avulsion fracture, Jones fracture	Tenderness over 5 th metatarsal base, uncorticated sharp fracture line
Os subfibulare	Distal fibular tip	Lateral malleolar avulsion fracture	Tenderness over distal fibular bony tip, a missing part of the lateral malleolus, sharp uncorticated fracture line without sclerosis
Os peroneum	At the level of the calcaneocuboid joint within the substance of the peroneus longus tendon	Cuboid fractures, bipartite os peroneum	Disruption in marginal cortical continuity of cuboid, proximal migration and diastasis of bipartite os peroneum
Os calcaneus secundarius	Adjacent to the anterior superior facet of calcaneus	Anterior superior calcaneus fracture	Tenderness over the anterior superior facet of calcaneus, uncorticated often triangular fragment with sharp edges
Os intermetatarsium	Interspace between 1 st and 2 nd metatarsal	Lisfranc fracture-dislocation	Disruption in tarsometatarsal joint alignment, increased distance between cuneiforms
Os subtibiale	At the tip of medial malleolus	Isolated medial malleolar avulsion fracture	Tenderness over the bony medial malleolar tip, a missing part of the medial malleolus, sharp uncorticated fracture line without sclerosis
Os supratolare	On the dorsal aspect of talar neck	Cortical avulsion fracture of talar head	Transverse oriented thin flake of cortical bone
Os supranaviculare	On the dorsal margin of talonavicular joint space	Dorsal cortical avulsion fracture of navicula	Lack of cortication at the fracture margin of the avulsed fragment in lateral radiograph
Accessory navicular	Adjacent to the posteromedial tuberosity of the navicular bone.	Navicular tuberosity avulsion fracture	Tenderness over navicular tuberosity, proximal migration of the fragment
Hallux sesamoids	At the level of the 1 st metatarsal head within the medial and lateral slips of the flexor hallucis brevis	Fracture of hallux sesamoid bones, bipartite hallux sesamoid bone	Sharp, radiolucent, uncorticated fracture line with marked diastasis and often fit together well

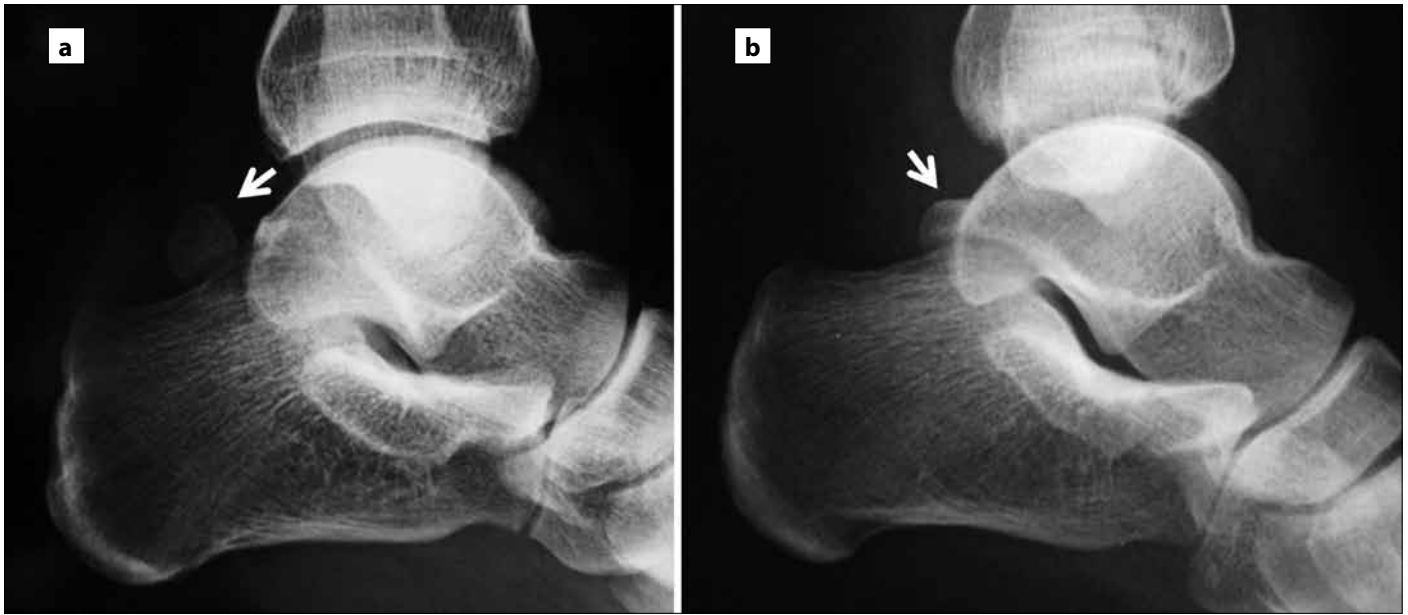


Figure 2. (a) Lateral ankle radiograph of a 44-year-old male patient. Arrow shows the os trigonum. (b) Lateral ankle radiograph of a 21-year old female patient. Arrow shows a fused os trigonum forming a posterolateral process of talus.

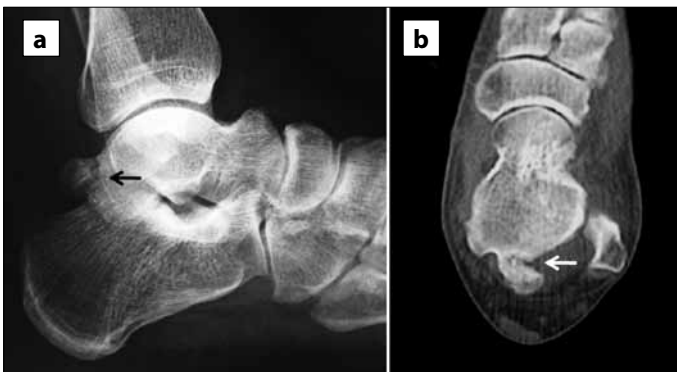


Figure 3. (a) Lateral ankle radiograph of a 39-year-old male patient presenting with ankle trauma. Black arrow shows a radiolucent irregular line mimicking a possible fracture. (b) Further CT imaging shows a partial synchondrosis between os trigonum and talus (white arrow)

ventional radiography, the os trigonum is usually triangular but may also appear round or oval. It is usually solitary and less than 1 cm in size but may be bipartite or even multipartite. The margins of the ossicle may be smooth or serrated (5).

The os trigonum may be radiographically misinterpreted as fractures of the lateral or medial tubercles of the posterior process of the talus (Figure 4) (3). These fractures are usually caused by forced plantarflexion of the ankle that results in acute compression between the posterior malleolus of the tibia and the tuber calcaneus. Clinical symptoms include pain and tenderness over the posterior aspect of the ankle, and increased pain during passive plantarflexion of the ankle, the so-called 'nutcracker sign' (9). These fractures may be misinterpreted as an os trigonum because of the difficulty in assessing the fracture on plain radiographs and the similarity of location with os trigonum. The fracture fragment often appears to resemble an os trigonum on lateral radiographs, and is thus called 'pseudo os trigonum sign' (10).



Figure 4. Lateral ankle radiograph of a 34-year-old female patient admitted after a traffic accident. Arrows show a fracture of posterior process of talus simulating an os trigonum (arrow)

It is important to distinguish between these two distinct entities because failure to recognize and treat this fracture may lead to instability, pain, stiffness and post-traumatic subtalar degenerative arthritis (10). Lateral radiographs best demonstrate the presence of the os trigonum. However, CT should be the preferred choice of imaging modality when a fracture of the posterior tubercle of the talus is suspected (11). CT provides adequate cortical detail to distinguish the rounded, sclerotic margins of an os trigonum from the remarkably sharp edges and discontinuity of the cortical lining of an acute tubercle fracture. Additionally, CT imaging provides an accurate assessment of fragment location, size, displacement, and comminution to enable a prompt surgical plan.

Os vesalianum

The os vesalianum is located adjacent to the base of the fifth metatarsal, and is embedded in the peroneus brevis tendon. It articulates both with the base of the fifth metatarsal and the cuboid bone (12). It is a rare accessory bone, with an estimated prevalence of between 0.1-5.9% in different studies (6-8). Os vesalianum should be differentiated from an acute avulsion fracture of the fifth metatarsal, Jones fracture, stress fractures and non-union of the fifth metatarsal base (Figure 5) (13). Lateral oblique radiographs best demonstrate the ossicle and its articulations. Although it is asymptomatic in

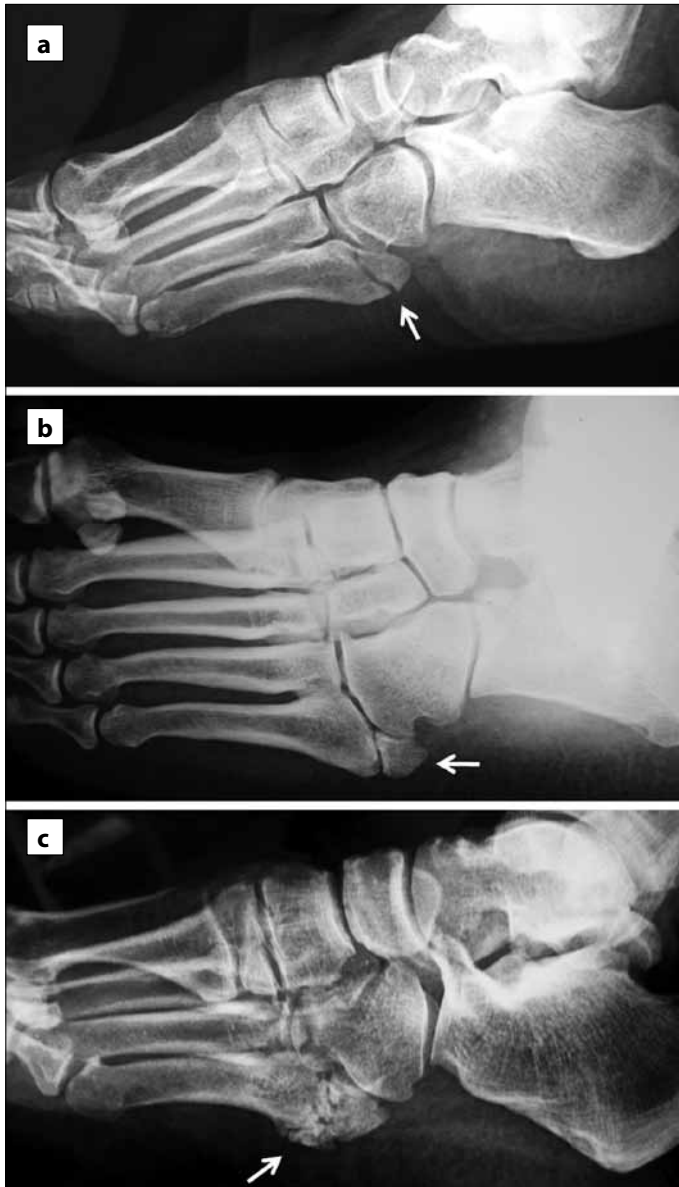


Figure 5. (a) Lateral oblique radiograph of a 37-year-old man with an inversion ankle injury. Avulsion fracture of the fifth metatarsal base is seen (arrow). (b) Forty-two-year-old woman with fore-foot pain. The incidental accessory bone, os vesalianum (arrow), was considered unrelated to the patient's complaint. Note the well-corticated appearance and clear articulation with adjacent cuboid. (c) Fifty-seven-year-old man, a heavy smoker, with a history of acute fracture two years previously, oblique radiograph demonstrates a non-union of the fifth metatarsal base (arrow). Irregular and fragmented fracture line is seen

majority of the people, and incidentally recognized, it may cause lateral foot pain (14).

Os subfibulare

Os subfibulare is a round to elongated shape accessory ossicle located under the tip of the lateral malleolus. There are two different theories regarding the origin of os subfibulare. Some authors have suggested that os subfibulare is not a true sesamoid bone but rather that it is an old non-united avulsion fracture of the lateral malleolus resulting from the traction of the anterior talofibular ligament (15, 16). However, some authors believe that it is a true sesamoid bone formed by an accessory ossification center (17, 18). Radiographic studies have found the incidence of os subfibulare to be between 0.2-2.1% (6, 17). Emergency physicians should be familiar with the os subfibulare in order to be able to distinguish it from an acute avulsion fracture of the lateral malleolus. The clinical distinction between an acute ankle sprain and a true fracture may be difficult, because the pain, swelling, and the localization of the tenderness are similar. However, radiographic findings which are peculiar to os subfibulare may help in distinction (Figure 6). Os subfibulare has a round shape and well-defined cortical margins whereas a lateral malleolar avulsion fracture fills the missing part of the distal tip of the lateral malleolus and has a sharp fracture margin without sclerosis.

Os peroneum

The os peroneum is an oval or round accessory ossicle located within the substance of the peroneus longus tendon at the level of the calcaneocuboid joint. Although it is usually a single sesamoid ossicle, it can be bipartite or multipartite (Figure 7a) (3). It has been hypothesized that os peroneum is a normal part of the skeleton which can be found in cartilagenous, fibrocartilagenous or ossified forms (19). Therefore, the exact prevalence of the os peroneum is unknown, as unossified forms cannot be detected through plain radiography. When ossified, it is visible on 4.7-31.7% of foot radio-



Figure 6. (a) Anteroposterior ankle radiograph of a 25-year-old patient who presented with ankle sprain. Arrow shows the os subfibulare. Note the round shape and well-defined cortical margins of the ossicle. (b) Anteroposterior ankle radiograph of 48-year-old patient presented with ankle inversion injury. Arrow shows the lateral malleolar avulsion fracture. The avulsed fragment fills the missing part of the distal tip of the lateral malleolus

graphs (6-8, 20). The os peroneum is best evaluated in the oblique-lateral view of the foot. Os peroneum should be distinguished from os vesalianum and avulsion fractures of the fifth metatarsal. Os vesalianum and avulsion fractures of the fifth metatarsal are located more distal and adjacent to the fifth metatarsal base. Occasionally, os peroneum itself can be the subject of fracture or diastasis of a bipartite os peroneum. Fractures of the os peroneum can be difficult to differentiate from bipartite sesamoids. Diastasis and proximal migration of the fragment with the traction of the peroneus longus tendon is a helpful radiographic characteristic in fracture of the os peroneum (20, 21). Finally, fracture of the cuboid bone may resemble the os peroneum (Figure 7b). In the case of cuboid fracture, marginal cortical continuity of the cuboid is disrupted, but os peroneum appears as a separate corticated ossicle without obliterating the borders of the cuboid bone.

Os intermetatarsum

The os intermetatarsum is a rare accessory bone that is proximally located at the intermetatarsal space of the first and second metatarsals. The os intermetatarsum can be divided into three basic types; independent ossicle, articulating by a synovial joint, or fused with any of the adjacent bones to form a bony spur (22). Radiographic studies have reported that it is found in between 0.0-6.8% of the population (6-8, 22). The os intermetatarsum should not be confused with a small bony fragment resulting from a fracture of the base of the first or second metatarsal which is called 'fleck' sign in Lisfranc fracture-dislocations (Figure 8) (23). The Lisfranc joint represents the articulation between the midfoot and forefoot and is composed of five tarsometatarsal joints. Lisfranc fracture-dislocation is a rare fracture pattern in which tarsometatarsal joints are disrupted. These injuries can range from high-energy injuries with severe dis-



Figure 7. (a) Os peroneum (thick arrow). (b) Fifty-year-old male presented to ED following a fall from a ladder. Lateral foot radiograph demonstrates a cuboid fracture (thin arrow) mimicking an os peroneum. (Image source for Figure 7b: www.wikiradiography.com, reproduced with written permission to use)

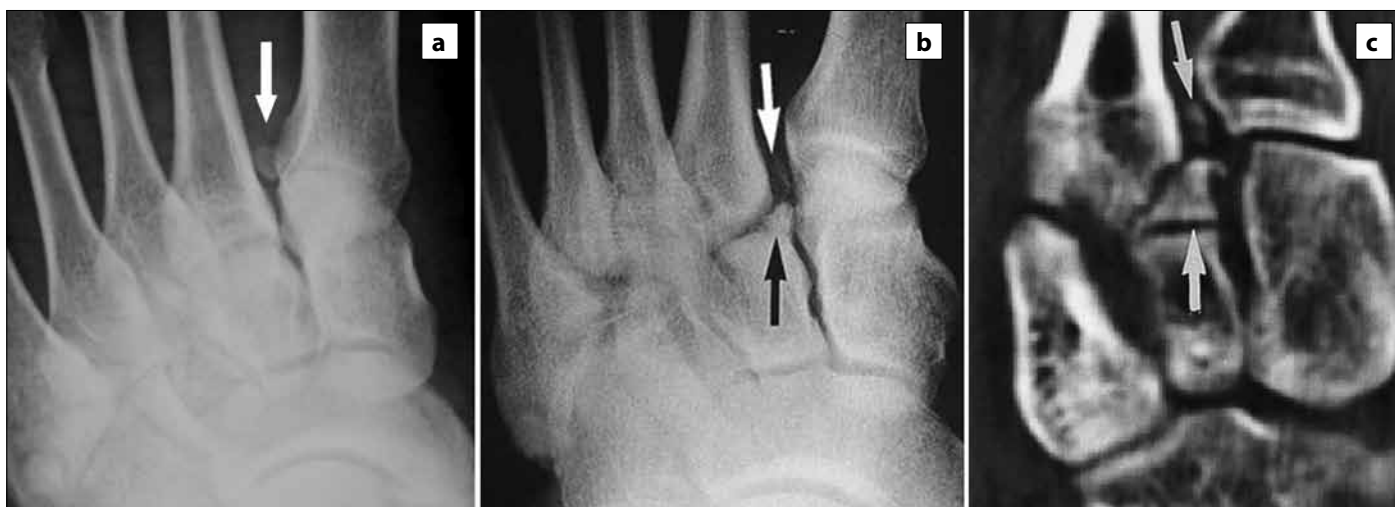


Figure 8. Forty-year-old male with simple ankle sprain. Anteroposterior foot radiographs show a small round ossicle between first and second metatarsal bases which is consistent with os intermetatarsum. (b) Fracture-dislocation of Lisfranc joint of patient after a fall while jogging. Anteroposterior radiograph shows a small avulsion fracture between the bases of metatarsal bones (black arrow) and a slight increase in distance between the bases of first and second metatarsal bones (white arrow). (c) CT section of metatarsal joints confirm the extension of injury with multiple avulsion fractures, including one at the lateral aspect of the cuboid (arrows) (Image source for Fig. 8b and 8c: www.med-cyclo.com by GE Healthcare, reproduced with written permission to use)

ruption of the midfoot to minor trauma with subtle subluxations or sprains that may easily be missed on initial clinic and radiographic evaluation (24, 25).

Accessory navicular bone

Accessory navicular bone is one of the most common accessory bones of the foot with a reported incidence of 4-28.3% (3, 8, 26). It is located on the posteromedial aspect of the foot adjacent to the posteromedial tuberosity of the navicular bone. The terms *os tibiale*, *os tibiale externum* and *naviculare secundarium* have been used interchangeably with accessory navicular bone. Three types of accessory navicular bones have been described in the literature. Type I is considered to be a sesamoid bone lying within the insertion of the posterior tibialis tendon. Type II results from a secondary ossification center adjacent to the navicular bone; it is the insertion site of the posterior tibialis tendon and is connected to the navicular tuberosity by a synchondrosis. Type III accessory navicular bone is the result of fusion of the secondary ossification center with the navicular bone and is also called *cornuate navicular* (27). Avulsion fractures of the navicular tuberosity may be confused with Type II accessory navicular or separation of a Type-II accessory navicular may clinically and radiographically mimic an avulsion fracture (Figure 9) (28, 29).



Figure 9. (a) Twenty-nine-year-old male patient sustained a crush injury to his right foot. Anteroposterior foot radiograph shows an type I accessory navicular (black arrow) together with a navicular fracture (white arrow). (b) Eighteen-year-old male presented with an eversion injury of the ankle. Radiograph showed partial diastasis of type II accessory navicular and a small fracture fragment of the navicular bone (arrow)

Os calcaneus secundarius

The *os calcaneus secundarius* is an accessory ossicle of the anterior facet of the calcaneus located at the border of the calcaneus, the cuboid, the talar head and the tarsal navicular bones. It is a rare accessory ossicle of the foot, with an estimated prevalence of 0.6%-7% (3, 6). Detection of *os calcaneus secundarius* on conventional anteroposterior and lateral foot radiographs may be difficult. Oblique foot radiographs best visualise the ossicle (Figure 10). Fracture of anterior process of calcaneus and *os calcaneus secundarius* have almost similar features in plain radiography. Based on this radiographic similarity, it has been proposed that *os calcaneus secundarius* may be a remote non-united avulsion fracture of the anterior process rather than a normal variant (Figure 11) (30). Anterosuperior process of calcaneus fractures usually present with a history of simple ankle sprains and clinically mimic lateral ankle ligamentous injuries (31). In the context of acute trauma, *os calcaneus secundarius* can be difficult to distinguish from an anterior process fracture with plain radiographs alone. MRI has been suggested for further imaging modality when clinical and radiographic manifestations are unclear. A fracture exhibits bone marrow oedema in the anterosuperior calcaneal process, whereas *os calcaneus secundarius* does not (32).



Figure 10. Lateral oblique foot radiograph demonstrates the *os calcaneus secundarius* (black arrow)



Figure 11. (a) Saggital CT scan of a patient with *os calcaneus secundarius* (black arrow) and (b) acute fracture of anterior process of calcaneus (white arrow)

Hallux and lesser toes sesamoid bones

Sesamoid bones of the first metatarsophalangeal (MTP) joint are considered to be a normal part of the skeleton, however, sesamoid bones of the lesser toes and hallux interphalangeal sesamoid bone are rarely seen (Figure 12a, b) (33). The medial and lateral hallux sesamoids are embedded within the medial and lateral slips of the flexor hallucis brevis tendon at the level of the first metatarsal head. The size and shape of the hallux sesamoids vary considerably. When a hallux sesamoid bone develops from two ossification centres that do not fuse at maturity, it is referred to as a bipartite hallux sesamoid bone (Figure 13a, b) (34). The medial hallux sesamoid bone tends to present a bipartite morphology. Bipartite hallux sesamoid bones should be differentiated from a true fracture (35, 36). A sesamoid bone fracture usually presents with an acute onset of pain and tenderness on direct palpation over the injured sesamoid bone. However, turf toe which is defined as an hyperextension injury to the



Figure 12. (a) Anteroposterior foot radiograph shows hallux sesamoid bones (stars) and fifth metatarsal sesamoid bone (white arrow). (b) Hallux interphalangeal sesamoid bone (thin arrows)



Figure 13. Different types of hallux sesamoid bones. (a) Fused medial and lateral hallux sesamoid bones. (b) Bipartite medial hallux sesamoid bone with oval shaped secondary ossification center. (c) A 40-year-old male patient, history of direct trauma with a stick to his sole in a fight, fracture of lateral sesamoid bone is seen. Note the diastasis (thick arrow) and sharp edges of the fracture line. The medial sesamoid bone shows bipartition (thin arrow) with normal appearance

periarticular structures around hallux metatarsophalangeal joint, should also be included in the differential diagnosis, because a patient with a turf toe and bipartite sesamoid bone may be evaluated as also having a sesamoid bone fracture (37). A fracture tends to show a sharp, radiolucent, uncorticated line and often fit together well, whereas the bipartite sesamoid bone has two corticated fragments with an irregular line of articulation (Figure 13c).

Os supranaviculare

The os supranaviculare is located on the dorsal margin of the talonavicular joint space. This ossicle is also named as talonavicular dorsale, taloavicular ossicle or Pirie's bone (7). It is usually triangular in shape, but it may also be rounded. It is a very rare accessory ossicle with an estimated prevalence of 1% (6). The os supranaviculare is easily detected on lateral ankle radiographs (Figure 14). Cortical avulsion fractures of the tarsal navicular may mimic the os supranaviculare. These fractures usually occur in middle-aged women who wear high-heeled shoes (3). Hyper plantarflexion of the ankle joint leads



Figure 14. Os supranaviculare in two different subjects. (a) a triangular os supranaviculare simulating a cortical avulsion fracture of navicular bone and (b) an oval well-corticated os supranaviculare. Note the normal shape of the navicular bone.

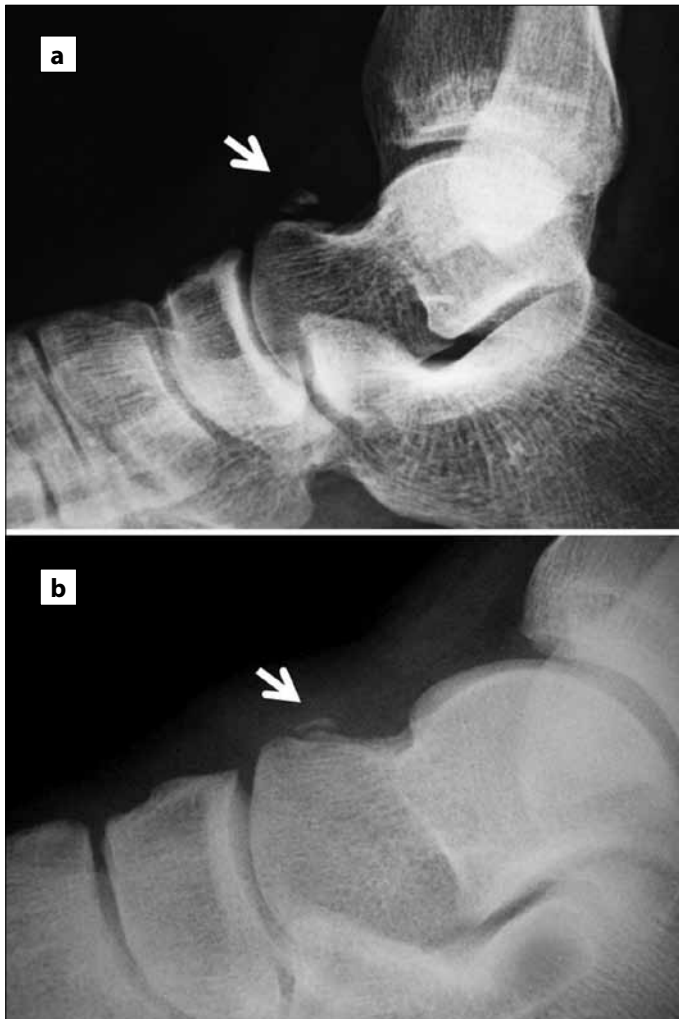


Figure 15. (a) Lateral radiograph of a patient with an asymptomatic os supratalare (arrow). (b) Thirty-two year-old man presented with hyperplantarflexion injury to his ankle sustained while skiing. Note the flake like cortical avulsion fracture over the talar neck

to the separation of talonavicular joint and a hyperextension of the dorsal talonavicular ligament crossing this joint cause the detachment of a bone flake either from the dorsum of the navicular bone or talar head (38). Radiographic distinction between os supranaviculare and cortical avulsion fracture of tarsal navicular may be difficult. Clinical findings and a history of the mechanism of the injury may be helpful. Lack of cortication at the fracture margin of the avulsed fragment in lateral radiograph and tenderness on palpation over the talonavicular joint strengthen the fracture diagnosis (3).

Os supratalare

Os supratalare is a small oval shaped accessory bone located on the dorsal aspect of the talar neck. It is a very rare accessory ossicle with an estimated prevalence of 0.2-0.9% (6, 7). It is best seen on lateral foot and ankle radiographs, where the anterior ankle capsule and dorsal talonavicular ligament attach to the dorsal aspect of the talar neck. This ossicle may be mistaken for flake fractures of the dorsum of the talus resulting from avulsion injuries (38). An avulsion fracture of the talar neck looks like a transverse oriented thin flake of cortical bone, whereas true os supratalare is rounded and irregular on lateral ankle radiographs (Figure 15).



Figure 16. (a) Twenty-five year-old male presented with twisting injury to the ankle. Ankle radiograph shows os subtibiale (white arrow). (b) 34 year-old male with medial malleolar avulsion fracture (gray arrow). (Figure a, is reproduced from Madhuri V, Poonnoose PM, Lurstep W. Accessory Os Subtibiale: A case report of misdiagnosed fracture. The Foot and Ankle Online Journal 2 (6): 3, with written permission to use)

Os subtibiale

Os subtibiale is a very rare accessory ossicle located at the tip of medial malleolus with an incidence varying from 0.2% to 1.2% in different studies (6, 39). An accessory centre of ossification at the tip of the medial malleolus may appear between 7 and 10 years of age. Fusion with the main mass of the medial malleolus is complete in majority of children by the age of eleven. Occasionally, it may persist into adulthood, forming os subtibiale (39). The os subtibiale may be mistaken for an isolated medial malleolar avulsion fracture when radiographs are taken following injury to the ankle (40, 41). Isolated medial malleolar avulsion fractures occur following pronation and external rotation of the ankle. The os subtibiale is a rounded accessory bone of large diameter whereas the medial malleolar fracture has a sharp, radiolucent, uncorticated fracture line, often fitting well to the adjacent medial malleolus (Figure 16).

Conclusion

In the emergency department, foot and ankle trauma represents one of the most common reasons for radiographic examination. Therefore, emergency physicians should be familiar with abnormal and normal variants of the foot and ankle, skeletal development and their radiographic appearances. However, the diagnosis should not be dependant on radiographic examination alone. Initially, a detailed clinical history including mechanism of injury should be obtained, and a complete physical examination should be performed. The site of maximum pain and tenderness should be determined. During radiographic evaluation, compatibility between tender points and radiographic findings should be carefully checked. In general, fractures have sharp, radiolucent lines, often fitting well to the adjacent bone in irregular geometry with an uncorticated margin, whereas accessory ossicles and sesamoid bones usually have well-defined cortical margins and a rounded or oval shape. In case of doubt, advanced imaging modalities such as CT and MRI may be used for further investigation.

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Conflict of Interest

No conflict of interest was declared by the authors.

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