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The Prevalence of Accessory Ossicles, Sesamoid Bones, and Biphalangism of the Foot and Ankle: A Radiographic Study

Busra Candan, PhD[1], Ebru Torun, MD[2], and Rumeysa Dikici, PT[1]

Abstract

Background: Accessory ossicles, sesamoid bones, and biphalangism of toes are the most common developmental variations of the foot. These bones may be associated with painful syndromes; however, their clinical importance is not well understood because the reported prevalence varies widely. Therefore, we aimed to investigate these variants in Turkish subjects.

Methods: A total of 1651 foot radiographs were retrospectively assessed. Radiographs of feet were examined regarding the prevalence, sex, and bilaterality of accessory ossicles, sesamoid bones, and biphalangism in Turkish subjects.

Results: Accessory ossicles (26.1%) and sesamoid bones (8%) were detected. The most common accessory ossicles were os trigonum (9.8%), accessory navicular bone (7.9%), and os peroneum (5.8%). Also, we detected os supratalare (0.48%), os calcanei secundarium (0.42%) os subfibulare (0.42%), os supranaviculare (0.36%), os vesalianum (0.30%), os subtibiale (0.24%), os intermetatarseum (0.12%), and os subcalcis (0.12%). We observed bipartite hallux sesamoid in 1.8% and interphalangeal sesamoid bone of the hallux in 0.7% of radiographs. Incidences of metatarsophalangeal sesamoid bones were found as 0.6%, 0.06%, 0.6%, and 5.8% in the second, third, fourth, and fifth digit, respectively. We observed biphalangeal toe in 0.5%, 1.7%, 3.5%, and 37.6% in the second, third, fourth, and fifth toe, respectively.

Conclusion: This study is the first detailed report on the incidence of the most common variants of the foot and ankle in a wide-ranging patients' series in Turkish subjects. Our study's findings will contribute to reducing misdiagnosis.

Clinical Relevance: The results of this study may provide anatomical data that could help clinicians in the diagnosis and management of disorders that present with pain and discomfort in the feet. Knowledge of these variants is important to prevent misinterpreting them as fractures.

Keywords: accessory ossicles, sesamoid bones, biphalangism, os trigonum, foot and ankle

Introduction

Accessory ossicles around the foot and ankle and the sesamoid bones are common skeletal variations. Accessory ossicles are usually small, well-corticated, ovoid, or nodular. They might be bipartite or multipartite, unilateral or bilateral, and are found close to a bone or a joint.[18] They may be adjacent or separated from the main bone.[5] The accessory navicular bone, the os peroneum, and the os trigonum are the most common bones. And the os subcalcis, the os supranaviculare, the os supratalare, the os vesalianum, the os calcanei secundarium, the os intermetatarseum, the os subtibiale, and the os subfibulare are less common accessory bones.[22] The clinical importance of accessory bones is often emphasized during acute trauma or in the differential diagnosis from fracture cases.[14]

Sesamoid bones appear partially or completely embedded in tendons. They are the 5- to 10-mm round or oval-shaped

[1]Department of Anatomy, School of Medicine, Alanya Alaaddin Keykubat University, Alanya, Turkey
[2]Department of Radiology, School of Medicine, Alanya Alaaddin Keykubat University, Alanya, Turkey

Corresponding Author:
Busra Candan, PhD, Department of Anatomy, School of Medicine, Alanya Alaaddin Keykubat University, Alanya, Antalya 04750, Turkey.
Email: busra.candan@alanya.edu.tr

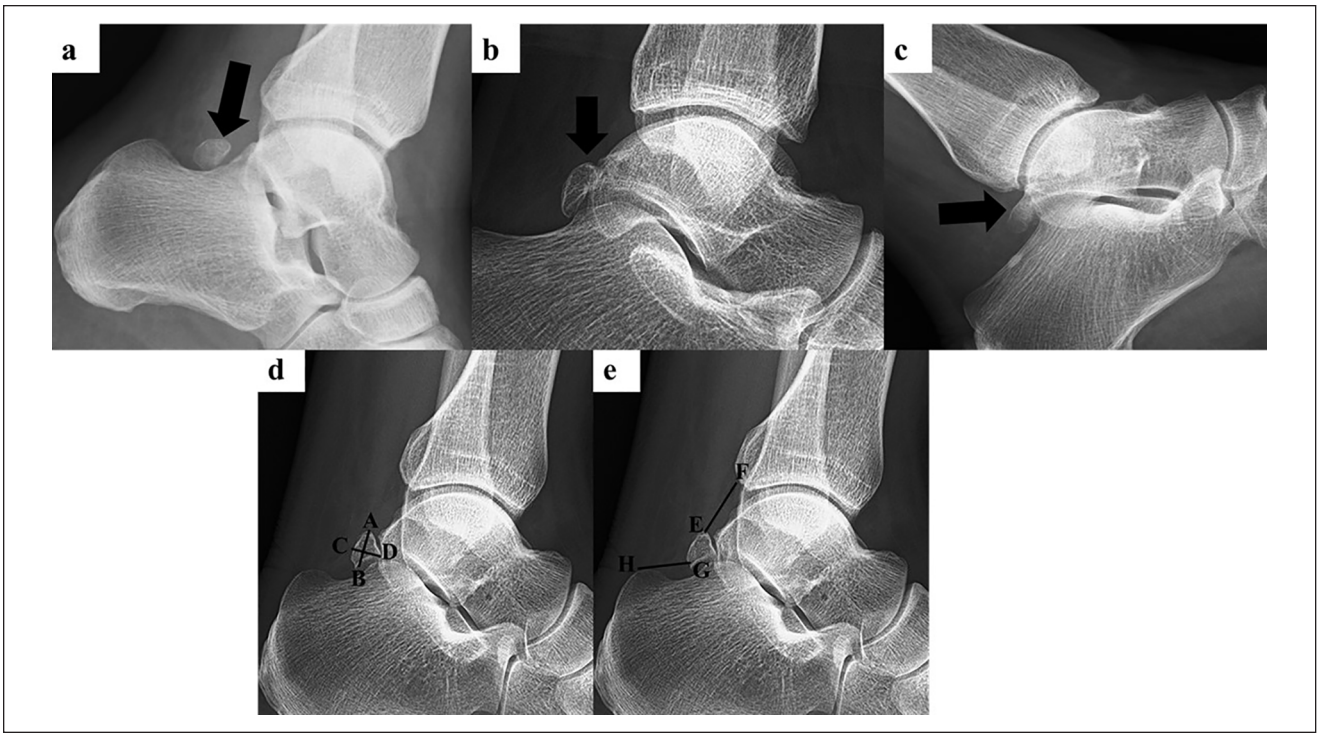

Figure 1. Classification and measurements of the os trigonum: (a) Type I os trigonum. (b) Type II os trigonum. (c) Type III os trigonum. (d) Length (point A to B) and width (point C to D) of the os trigonum. (e) The distance between the os trigonum and the most inferior point of the tibia (point E to F) and the distance between the most posterior point of the os trigonum and the most superior posterior point of the calcaneus (point G to H).

bones that developed from their ossification center. The function of the sesamoid bones is to reduce friction and protect the tendon.[10,15]

Toe symphalangism, also known as biphalangeal toe, is a common variation. It has been evaluated in many studies and shown to be a variation resulting from incomplete segmentation rather than phalangeal fusion.[2,14]

Although the prevalence of accessory ossicles and sesamoid bones has been reported by various studies and case reports, the number of detected bones and range of prevalence vary widely in literature.[5,11,14,15] This may be due to differences in the sample size, age, gender, the race of patients, and measurement method. These bones and their clinical significance should be well known to minimize unnecessary orthopaedic consultations and misdiagnoses.[5] And the number of studies with a large sample of the Turkish population is insufficient in the literature. Therefore, in the present study, we aimed to investigate the prevalence and distribution of accessory ossicles and sesamoid bones and to investigate the biphalangism of toes in Turkish patients on the radiography images.

Materials and Methods

This study was a retrospective, observational study. From January 2018 to December 2020, 1651 feet (847 male and 804 female) were included in this study. After obtaining ethical approval, all observations were taken electronically on radiographs displayed on a PACS. All patients with prior amputation and who were suspected to have cancer in the affected foot or ankle were excluded. Anteroposterior, oblique, and lateral foot radiographs of 1651 feet were examined about the prevalence and distribution of accessory ossicles and sesamoid bones in feet. We classified the os trigonum according to the study of Fu et al,[6] classifying the cases into 3 basic types according to the connection mode: a single piece of bone that was not connected to the talus was classified as type I (Figure 1a); if connected to the posterior talar process, type II (Figure 1b); and when extending beyond the extension line of the lower tibia on the sagittal plane, type III (Figure 1c). Also, we measured the length (point A to B) and width (point C to D) of the os trigonum (Figure 1d). In addition, we measured the distances between the os trigonum and the most inferior point of the tibia (E-F) (Figure 1e). Next, we measured the distances between the most posterior region of the os trigonum and the most superior posterior point of the calcaneus (ie, G to H) (Figure 1e). In this study, 123 feet were excluded for investigation of biphalangism because the phalanges did not appear and biphalangism was evaluated in 1528 feet.

Table 1. Sex, Side, and Prevalence of Accessory Ossicles, Sesamoid Bones, and Biphalangisim in Turkish Subjects in This Study.

	Sex		Side			
Accessory Ossicles	Female, n	Male, n	Bilateral, n	Unilateral Right, n	Unilateral Left, n	Prevalence, %
Os trigonum	63	100	13	64	73	9.87
Accessory navicular bone	71	60	15	47	54	7.93
Os peroneum	43	54	3	35	56	5.86
Os supratalare	4	4	–	3	5	0.48
Os calcanei secundarium	3	4	–	3	4	0.42
Os subfibulare	2	6	–	3	4	0.42
Os supranaviculare	2	4	–	4	2	0.36
Os vesalianum	3	2	–	3	2	0.30
Os subtibiale	1	3	–	2	2	0.24
Os intermetatarseum	2	–	–	–	2	0.12
Os subcalcis	1	1	–	1	1	0.12
Interphalangeal sesamoid bone of hallux	6	7	–	6	7	0.78
Bipartite hallucal sesamoid	13	18	3	13	12	1.87
Fifth metatarsal sesamoid bone	39	58	11	30	45	5.87
Fourth metatarsal sesamoid bone	6	5	3	1	4	0.66
Third metatarsal sesamoid bone	1	–	–	1	–	0.06
Second metatarsal sesamoid bone	5	5	1	5	3	0.60
Biphalangeal second toe	3	5	1	3	3	0.52
Biphalangeal third toe	12	14	2	12	10	1.70
Biphalangeal fourth toe	30	24	2	23	27	3.53
Biphalangeal fifth toe	288	288	58	228	232	37.69

Statistical Analysis

SPSS, version 21.0, was used for statistical analysis. The homogeneity of variance was performed using the Kolmogorov-Smirnov test. One-way analysis of variance was used to compare 3 types of os trigonum. The mean and SD measurements of os trigonum were calculated. A P value $<.05$ was considered statistically significant in all statistical analyses ($P < .05$). All the measurements are expressed as mean $\pm$ SD, and the incidence of each type is described by numbers and percentages.

Results

Accessory ossicles were detected in 432 of the 1651 cases (26.16%). Accessory ossicles were seen in 24% of all female patients and 28% of all male patients. The accessory ossicles were seen in 2% of cases bilaterally, in 10% of cases right unilaterally and in 12% of cases left unilaterally (Table 1). In our study, the most common accessory ossicle of the ankle and the foot region was the os trigonum (Figure 1). It was found in 163 cases (9.87%) (Table 1). When we evaluated the classification of the os trigonum, type I was found in 37 cases (23%) (Figure 1a), type II in 101 cases (62%) (Figure 1b), and type III in 25 cases (15%) of the 163 cases (Figure 1c). When we evaluated the measurements related to the os trigonum, the mean length of the os trigonum was 10.21±2.75 and the mean width of the os trigonum was 6.53±2 (Figure 1d). Also, the mean E-F distance was 8.36±4.05 and the mean G-H distance was 20.49±4.42 (Figure 1e). We also detected the accessory navicular bone in 131 cases (7.93%) (Figure 2a), the os peroneum in 97 cases (5.86%) (Figure 2b), the os supratalare in 8 cases (0.48%) (Figure 2c), the os calcanei secundarium in 7 cases (0.42%) (Figure 3a), the os supranaviculare in 6 cases (0.36%) (Figure 3b), the os subfibulare in 7 cases (0.42%) (Figure 4a), the os subtibiale in 4 cases (0.24%) (Figure 4b), the os vesalianum in 5 cases (0.30%) (Figure 5a), the os intermetatarseum in 2 cases (0.12%) (Figure 5b), and the os subcalcis in 2 cases (0.12%) (Figure 5c) (Table 1).

Sesamoid bones were seen in 132 of the 1651 cases (8%), or in 7% of all female patients and 9% of all male patients. The sesamoid bones were seen in 0.90% of cases bilaterally, in 2.60% of cases right unilaterally and in 3.57% of cases left unilaterally (Table 1). In all cases, hallucal sesamoid bones were present normally. And bipartite hallucal sesamoid was observed in 31 cases (1.87%) in our study (Figure 6a). We observed interphalangeal sesamoid bone of the hallux in 13 cases (0.78%) (Figure 6b). In this study, the most common sesamoid bone of the foot was the fifth metatarsal sesamoid bone. It was found in 97 cases (5.87%) (Figure 6d). And the fourth metatarsal sesamoid bone was in 11 cases (0.66%) (Figure 6d), the third metatarsal

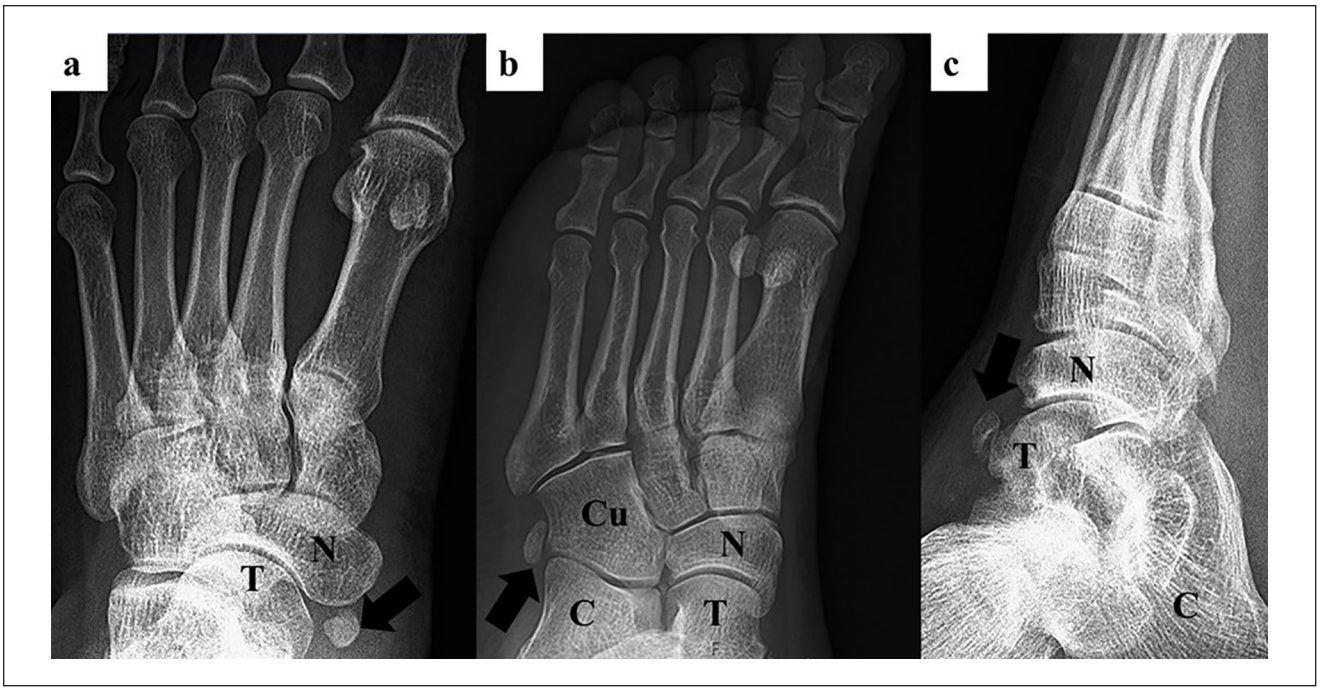

Figure 2. (a) Accessory navicular bone, (b) os peroneum, and (c) os supratalare. Black arrows show the accessory ossicles. C, calcaneus; Cu, os cuboideum; N, os naviculare; T, talus.

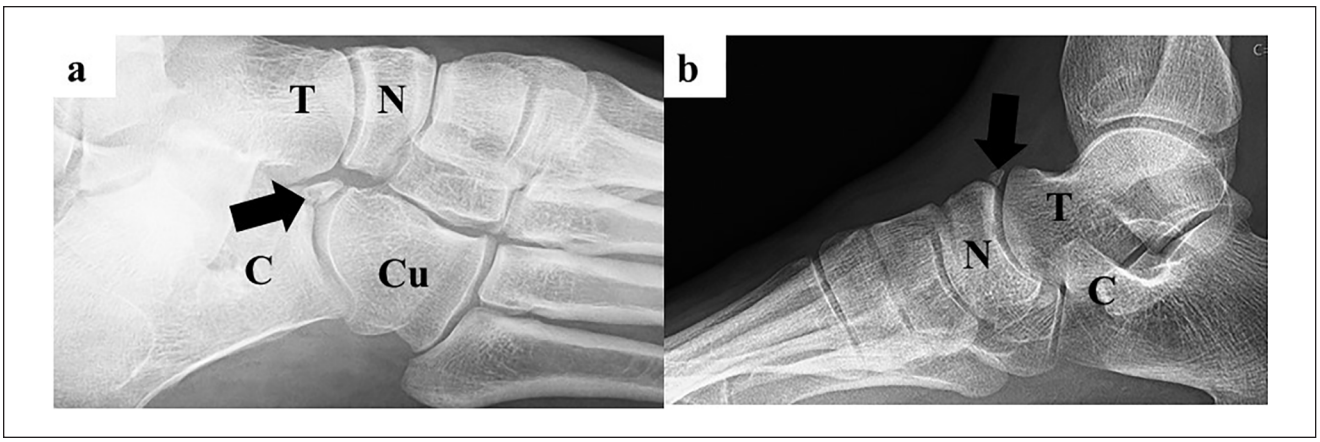

Figure 3. (a) Os calcanei secundarium and (b) os supranaviculare. Black arrows indicate the accessory ossicles. C, calcaneus; Cu, os cuboideum; N, os naviculare; T, talus.

sesamoid bone in 1 case (0.06%), and the second metatarsal sesamoid bone in 10 cases (0.60%) in this study (Figure 6c). Sesamoid bones of the foot region are detailed in Table 1 (Table 1).

We also identified the coexistence of 2 different accessory ossicles in 59 cases (3.57%), accessory ossicles and sesamoid bones in 49 cases (2.96%), and 2 different sesamoid bones in 15 cases (0.90%) in this study (Figure 6d). Differences according to the side, sex, presence or absence of accessory ossicles, and sesamoid bones were statistically analyzed. There was no correlation between the side, unilaterality, bilaterality, or sex with the presence or absence of accessory ossicles and sesamoid bones in the foot.

The 123 feet were excluded for investigation of biphalangism because the phalanges did not appear and biphalangism was evaluated in 1528 feet. When we evaluated the biphalangism of the toe, it was in 664 cases of 1528 feet (43.45%). The biphalangeal toe was seen in 45% of all female patients (743 female) and 42% of all male patients

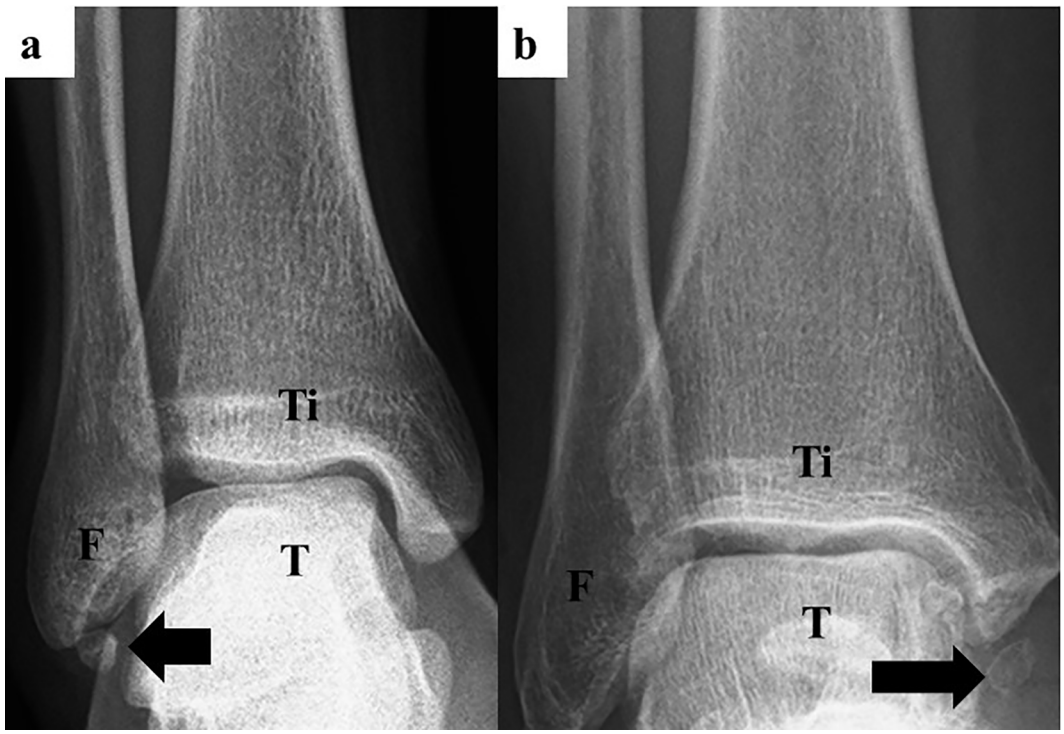

Figure 4. (a) Os subfibulare and (b) os subtibiale. Black arrows indicate the accessory ossicles. F, fibula; T, talus; Ti, tibia.

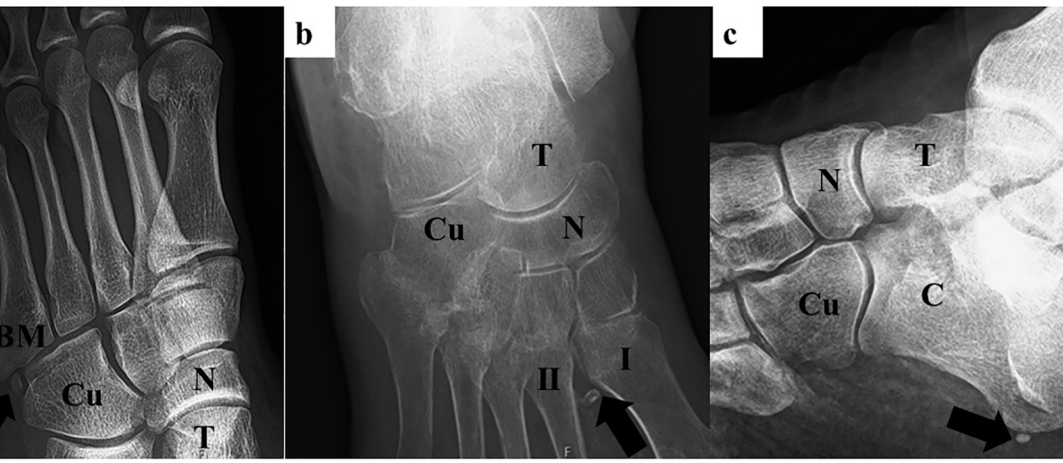

Figure 5. (a) Os vesalianum, (b) os intermetatarseum, and (c) os subcalcis. Black arrows indicate the accessory ossicles. BM, base of the fifth metatarsal; C, calcaneus; Cu, os cuboideum; I, the first metatarsal bone; II, the second metatarsal bone; N, os naviculare; T, talus.

(785 male). The biphalangeal toe was seen in 4% of cases bilaterally, in 17% of cases right unilaterally, and in 18% of cases left unilaterally (Table 1). The biphalangeal second toe was in 8 cases (0.52%) (Figure 7e), the biphalangeal third toe was in 26 cases (1.70%) (Figure 7d), the biphalangeal fourth toe was in 54 cases (3.53%) (Figure 7c). And the biphalangeal fifth toe was observed in 576 cases (37.69%) of all patients (Table 1) (Figure 7b).

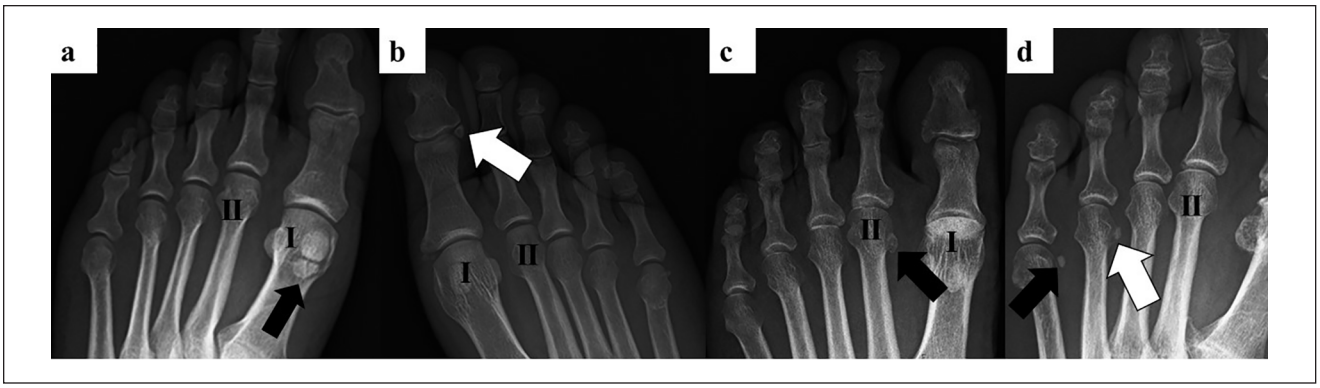

Figure 6. (a) Bipartite hallucal sesamoid, (b) hallucal interphalangeal sesamoid, (c) second metatarsal sesamoid, and (d) fourth and fifth metatarsal sesamoid. Black arrows show the sesamoid bones. The white arrows show the hallucal interphalangeal sesamoid (in panel b) and the fourth metatarsal sesamoid (in panel d).

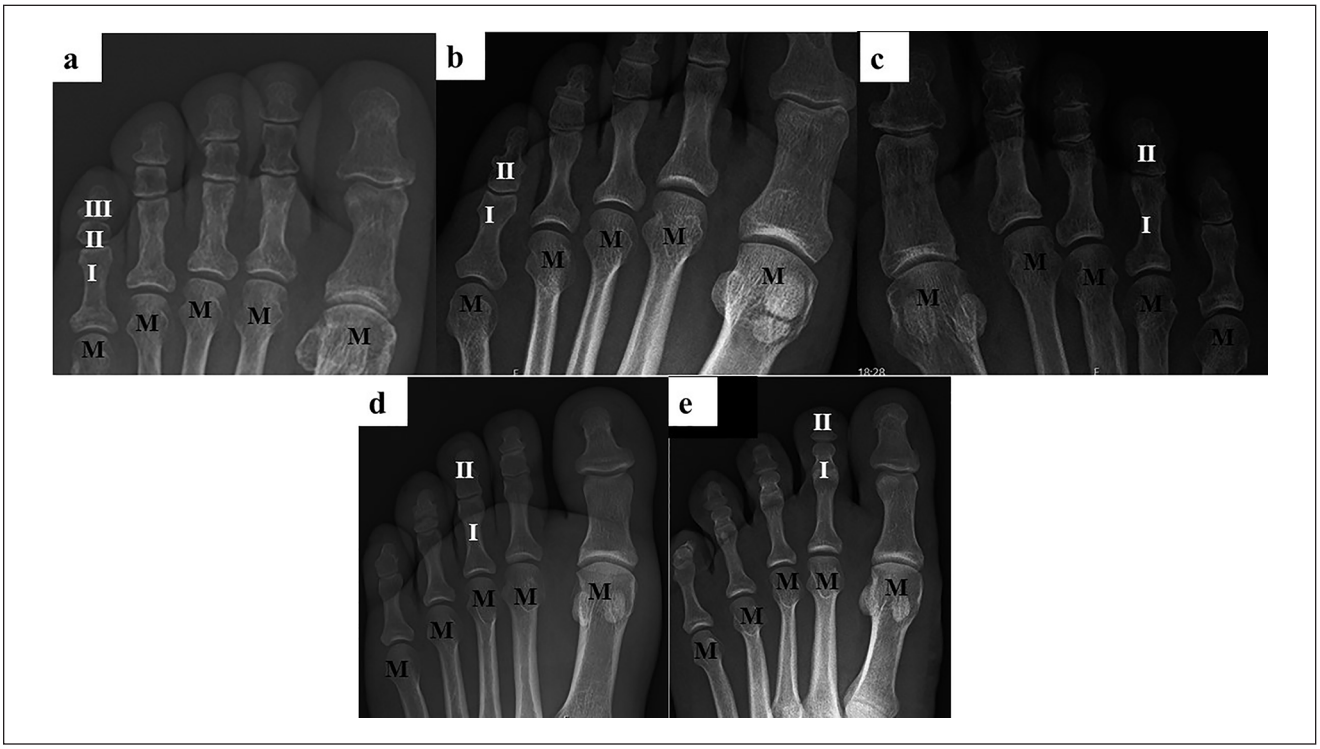

Figure 7. Biphalangism of toes. (a) Normal triphalangeal fifth toe, (b) biphalangeal fifth toe, (c) biphalangeal fourth toe, (d) biphalangeal third toe, and (e) biphalangeal second toe. M, metatarsal bones.

Discussion

Accessory ossicles have considerable variety and are subject to significant morphologic variations.[5] In the literature reported, the incidence of the accessory ossicles in the foot and ankle is 18% to 36.3% in the general population.[15] The incidence of accessory ossicles in Turkish subjects was reported as 18.3% by Cilli and Akcaoglu[3] and as 21.23% by Coskun et al.[5] In the present study, the incidence of accessory ossicles was 26.16%.

Os Trigonum

The os trigonum was the most common accessory ossicle in this study. The incidence of the os trigonum in the general population has been reported to be 1% to 25%.[5,6] The os trigonum is located in the posterolateral aspect of the talus.[15] They are best seen on lateral radiographs of the foot and ankle.[18] The prevalence of os trigonum has been reported quite differently in the literature (Table 2). The prevalence we have reported in our study is consistent

Table 2. Comparison of the Prevalence of Accessory Ossicles With Literature.

		Literature				
Accessory ossicles	This Study %	Coskun et al[5], %	Cilli and Akcaoglu[3], %	Tsuruta et al[22], %	Koo et al[11], %	Lee et al[14], %
Os trigonum	9.87	2.3	23.5	12.7	18.0	5.8
Accessory navicular bone	7.93	11.7	28.3	21.3	23.0	34.0
Os peroneum	5.86	4.7	31.7	9.0	14.0	3.9
Os supratalare	0.48	0.2	2.4	0.9	–	–
Os calcanei secundarium	0.42	–	–	0.6	4	–
Os subfibulare	0.42	–	–	2.1	–	1.7
Os supranaviculare	0.36	1.6	3.5	1.0	–	–
Os vesalianum	0.30	0.4	5.9	0.1	3	–
Os subtibiale	0.24	–	–	0.9	–	–
Os intermetatarseum	0.12	0.2	1.2	2.6	–	–
Os subcalcis	0.12	–	–	–	–	–
Number of subjects	1651	984	464	3460	213	896

with the results of a study conducted on a very large patient series (3460) in the Japanese population[22] (Table 2). Fu et al[6] reported a prevalence of 27.2% in 1011 radiographs and that the incidence of type III os trigonum was the highest among all types in Chinese patients. In our study, the most common os trigonum was of type II. In addition, the morphometric distances we measured related to the os trigonum were higher than those reported by Fu et al. This difference suggests that the classification of os trigonum may be distinctive among races. Os trigonum may be responsible for chronic ankle pain, which is made worse with plantarflexion of the foot or dorsiflexion of the hallux.[8] Therefore, knowledge of the anatomical dimensions, the distance from some landmark points, and the prevalence of os trigonum may be important for the diagnosis and treatment of posterior ankle pain.

Accessory Navicular Bone

The accessory navicular bone, also known as os tibiale, os tibiale externum, and naviculare secundarium, is adjacent to the posteromedial tuberosity of the navicular bone, and the incidence of the accessory navicular bone is 4% to 21%.[5,16] The prevalence of the accessory navicular bone was determined to be lower in this study compared with other studies (Table 2). Lee et al[14] reported that the values widely varied depending on the race and measurement method. It is an asymptomatic accessory bone. This accessory bone may become symptomatic due to stress on the accessory bone itself, leading to osteonecrosis. Radiographically, the symptomatic accessory navicular will appear unremarkable, even when compared to the asymptomatic contralateral side. Both CT and magnetic resonance (MR) imaging methods are required to show symptomatic bone.[5,16]

Os Peroneum

The os peroneum is a sesamoid bone embedded in the peroneus longus tendon, adjacent to the calcaneocuboid joint.[14] The prevalence of this ossicle was 4.7% to 30% in previous studies.[15,22] A comparison of its prevalence indicates the ratio of presence was consistent in the literature (Table 2). Only Cilli and Akcaoglu reported a very high ratio, but they reported that all patients were male in their study and the sample size was insufficient.[3] The os peroneum is a common and generally incidental radiographic finding; however, it may become symptomatic and precipitate painful conditions. The so-called painful os peroneum syndrome causes lateral pain, tenderness, and swelling along the course of the peroneus longus tendon, and lateral pain that results in resistance to plantarflexion of the foot.[5,15,16] Therefore, knowledge of the prevalence of the os peroneum may be important for the diagnosis of lateral lower leg pain.

Os Supratalare

The os supratalare, which is typically located over the ridge along with the talar head/neck, or distally over the head.[15] It has an estimated prevalence of 0.2% to 2.4% and is a rare incidental skeletal variant.[3,5] A comparison of its prevalence in the literature indicates the ratio of presence was consistent(Table 2). Only Cilli and Akcaoglu reported a high ratio, but all patients in their study were male and the number of patients was insufficient.[3] The os supratalare usually remains asymptomatic; however, it can also cause pain or degenerative changes in response to overuse and trauma.[9,15] Therefore, its prevalence should be known.

Table 3. Comparison of the Prevalence of Sesamoid Bones and Biphalangeal Toe With Literature.

		Literature				
Sesamoid Bones and Biphalangeal Toe	This Study %	Coskun et al[5], %	Koo et al[11], %	Kiter et al[10], %	Ceynowa et al[2], %	Lee et al[14], %
Hallucal interphalangeal sesamoid	0.78	2.0	–	–	–	–
Bipartite hallucal sesamoid	1.87	2.7	2.0	4.0	–	–
Fifth metatarsal sesamoid bone	5.87	4.3	14.0	15.0	–	–
Fourth metatarsal sesamoid bone	0.66	0.1	2.0	1.0	–	–
Third metatarsal sesamoid bone	0.06	0.2	2.0	0.5	–	–
Second metatarsal sesamoid bone	0.60	0.4	5.0	2.8	–	–
Biphalangeal second toe	0.52	–	–	–	–	–
Biphalangeal third toe	1.70	–	–	–	0.48	–
Biphalangeal fourth toe	3.53	–	–	–	2.15	16.0
Biphalangeal fifth toe	37.69	–	–	–	41.39	80.6

Os Calcanei Secundarium

The os calcanei secundarium (Figure 3a) is located dorsal to the calcaneus in an interval between the anteromedial aspect of the os calcaneus, the proximal aspect of the cuboid and navicular, and the head of the talus.[12] The prevalence of this ossicle was 0.14%-11% in previous studies.[8,15,22] We found that the prevalence of this ossicle 0.42%, consistent with the literature (Table 2). In a posttraumatic setting, this ossicle can be mistaken for an anterior process fracture of the calcaneus.[12] The os calcanei secundarium is a relevant differential diagnosis in persistent pain after a supination trauma to the ankle.[12] Therefore, knowledge of the prevalence of the os calcanei secundarium may be important for the diagnosis of ankle pain.

Os Subfibulare

The os subfibulare is located beneath the lateral malleolus (Figure 4a). The incidence of the os subfibulare has been reported between 0.2% and 6.6% in the literature.[8,22] Its prevalence was not reported in previous studies in the Turkish population, but we found a rate of 0.42% in the present study (Table 2). In particular, the os subfibulare could be confused with an acute avulsion fracture of the lateral malleolus[8,14]; therefore, knowledge about its prevalence is important.

Os Supranaviculare

The os supranaviculare, also known as os talonaviculare dorsale, talonavicular ossicle, and Pirie bone, is located on the dorsal aspect of the talonavicular joint (Figure 3b). Its prevalence has been reported as 1% to 3.5 % (Table 2).[3,5,22] The os supranaviculare may rarely become symptomatic, thus requiring a radiographic survey and specific clinical assessment.[22] Therefore, knowledge about its prevalence is important.

Os Vesalianum

The os vesalianum is located proximal to the base of the fifth metatarsal, found within the peroneus brevis tendon.[18] It is a very rare accessory bone, with 0.1% to 5.9% prevalence (Table 2).[3,8,22] The os vesalianum is mostly asymptomatic, but it may sometimes cause lateral foot pain.[15] It should also be distinguished from avulsion fractures of the fifth metatarsal. Therefore, its prevalence should be known.

Os Subtibiale

The os subtibiale is located at the posterior aspect of the medial malleolus. It is a rare incidental accessory bone with an estimated prevalence of 0.2% to 1.2% (Table 2).[8,21,22] The prevalence of the os subtibiale has not been reported in previous studies conducted in the Turkish population, but we found os subtibiale in 0.24% of all patients in this study (Table 2). Os subtibiale can easily be misdiagnosed or treated as a medial malleolus fracture.[4] Therefore, its prevalence should be known.

Os Intermetatarseum

Os intermetatarseum (Figure 5b) is found between the medial cuneiform and the base of the first and second metatarsals.[8] The estimated prevalence is 0.2% to 6.8% in radiographic studies (Table 2).[3,5,15,16] The os intermetatarseum should be differentiated from fractures of the base of the second metatarsal, which often occur in Lisfranc dislocations. When evaluating dorsal midfoot pain, the os intermetatarseum should be taken into consideration.[8,18]

Os Subcalcis

Os subcalcis is found on the plantar aspect of the calcaneus (Figure 5c) slightly posterior to the insertion of the plantar fascia. Knowledge of this bone is insufficient because there

are no reported cases in the literature.[8] We found this ossicle in 2 patients (Figure 5c) (Table 2).

Sesamoid Bones

The number of sesamoid bones in the adult human skeleton can vary greatly among individuals.[10] Anatomically, the sesamoid bones of the first metatarsophalangeal joint are considered a normal part of the skeleton. Sesamoids of the other toes are seen rarely.[5,10] In all cases, hallucal sesamoid bones were present normally in this study. The bipartite hallucal sesamoid is difficult for surgeons because they may suffer or simulate fractures.[10,15] The frequency of bipartite hallucal sesamoid is reported to be between 1.8% and 33%.[5,10,11] In this study, the prevalence of the bipartite hallucal sesamoid was consistent with the literature (Table 3). The hallucal interphalangeal sesamoid is an osseous structure associated with the plantar aspect of the interphalangeal joint of the hallux (Figure 6b). Its frequency of occurrence varies between 2% and 13% (Table 3).[5,19] The location of the seemingly innocuous hallucal interphalangeal sesamoid is associated with the development of several anatomical and clinical pathologies.[19] The fifth metatarsal sesamoid bone was the most common sesamoid in this study as the other studies (Table 3). And the second, third, and fourth sesamoid bones were found rarely (Table 3). Localization of the complaints usually points to the localization of the accessory bones and the sesamoid bones, and this is the most important sign in clinical examination. That is why clinicians should have an average level of knowledge about the localization of the accessory bones and the sesamoid bones.[3]

Biphalangism of Toes

Pedal biphalangism is seen at a frequency that cannot be ignored. The incidence of the biphalangeal fifth toe in the adult population has been reported in the literature with a broad range, which varies among populations of different races and ethnicities.[23] In Western populations, the incidence was reported as 46% in the United Kingdom,[7] 41.02% in French adults,[13] 46.4% in Euro-Americans, and 44% in African Americans.[1] Ucpunar et al observed biphalangeal fifth toes in 31.9% of the normal population in a Turkish sample.[23] Our results were consistent with the literature (Table 3). Various investigators have reported the incidence of the biphalangeal fifth toe of populations as between 35.5% and 80.4%.[2,14] However, this information is not widespread among clinicians and can lead to a misdiagnosis, when a fracture of a distal phalanx can be mistaken for a normal triphalangeal toe (Figure 7a). And biphalangism of the fourth toe was reported in approximately 1% to 4% in European and American feet[20] and also in 12% of Japanese feet.[17,23] A comparison of the prevalence of the biphalangeal toe with other studies is given in Table 3. There are not enough studies yet on the prevalence of the biphalangism of the toes. Therefore, it should be evaluated in a patient population with a wider series and detailed disease history.

In conclusion, this study is the first detailed report on the incidence of accessory ossicles, sesamoid bones, and biphalangism of the foot and ankle in a wide patient series in Turkish subjects. We detected accessory bone in 26%, sesamoid bone in 8%, and biphalangeal toe in 43% of all radiographic scans. The most common accessory bones in this study were the os trigonum, accessory navicular, and os peroneum, consistent with the literature. The os calcanei secundarium, os subfibulare, os subtibiale, and os subcalcis, which were not seen in other studies or reported in a very few studies, were reported in this study. Also, biphalangeal toes, which were not considered in other studies but were seen in a large part of the population, were evaluated in a large patient population in this study.

The results of this study may provide anatomical data that could help clinicians in the diagnosis and management of disorders that present with pain and discomfort in the feet. Knowledge of these variants is important to prevent misinterpreting them as fractures.

Ethical Approval

Ethical approval for this study was obtained from the Non-Interventional Clinical Research Ethics Committee from Alanya Alaaddin Keykubat University (approval date and no.: 2021:28-28).

Declaration of Conflicting Interests

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ORCID iD

Busra Candan, PhD, https://orcid.org/0000-0002-5138-5583

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