

## SUPERNUMERARY BONES OF THE FOOT

AN X-RAY STUDY

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THIS communication is prompted by the comparative frequency with which the writer has observed, in the routine X-ray examination of feet, supernumerary bones as well as marked variations in the outlines of the astragalus and os calcis. The recognition of these conditions is especially important when examining a foot that is the seat of inflammation or that has undergone an injury. Supernumerary bones have been erroneously diagnosed as fractures; and irregularities in outline interpreted as evidence of inflammation.

Some years ago Dwight, in an extensive anatomical study, called attention to the existence of definite accessory bones in the feet and hands, described in detail their usual shape and position, and mentioned that many of these, particularly in the foot, may be readily recognized in radiograms.

In many branches of medicine a physician rarely sees the picture, when sending a patient for an X-ray. He usually accepts the radiographer's opinion and abides strictly by his interpretation. For the orthopædist, however, it is essential to have an accurate knowledge of the radiographic appearance of the foot in order that he may be able to correlate the subjective symptoms with the objective findings.

A brief review of several cases will serve to indicate the practical application of this study.

CASE I.—J. A., male, forty-five years old, was sent to me by his physician for spurs of his heels. The man had for several months been complaining of sensitiveness of his heels, pain in his feet and undue tiredness after moderate exertion. There was no history of any injury, associated illness as arthritis, or venereal disease. Having been treated for rheumatism without relief, an X-ray of his feet was suggested and taken. This showed a sharp spur (see Fig. 16) on the posterior surface of each os calcis at the attachment of the tendo achillis. Though the patient's sensitiveness was on the under surface of the heels, this fact was lost sight of and the presence of the spur influenced the physician to attribute

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the patient's distress to this spur. He was then referred to me. I found that the man had a marked condition of weak foot; there was no tenderness or swelling about the heel cords. The spur was evidently an accidental irregularity in the outline of the posterior surface of the os calcis, a condition not infrequently met with. A pair of Whitman flat-foot braces was applied, the

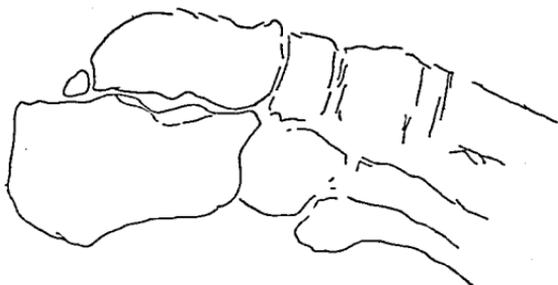


FIG. 1.—L195. Trigonum—separate from the body of the astragalus.

proper shoes and exercises advised, and the man made a rapid recovery.

CASE II.—(Case L340, X-ray series at the New York Hospital for Ruptured and Crippled). Fig. 3 was very interesting. This patient had a fall in which his right foot was injured. The X-ray

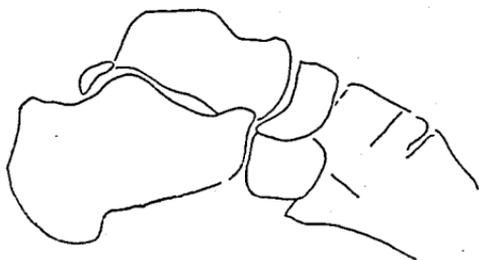


FIG. 2.—L35. Elongated trigonum.

showed a dislocation of the right scaphoid bone; also a mass of bone behind and distinct from the astragalus, which was diagnosed as a fracture of the astragalus. An X-ray of the uninjured foot, however, showed an exactly similar bone in back of the astragalus, the so-called os trigonum, and therefore made it extremely probable that the area of bone, regular in outline, behind the right

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astragalus was also an accessory bone, the os trigonum, not in any way dependent upon the sustained trauma.

Recently I was consulted about an X-ray of a slightly injured foot. The physician thought the case especially interesting because it showed a chipping off of a part of the scaphoid and no other

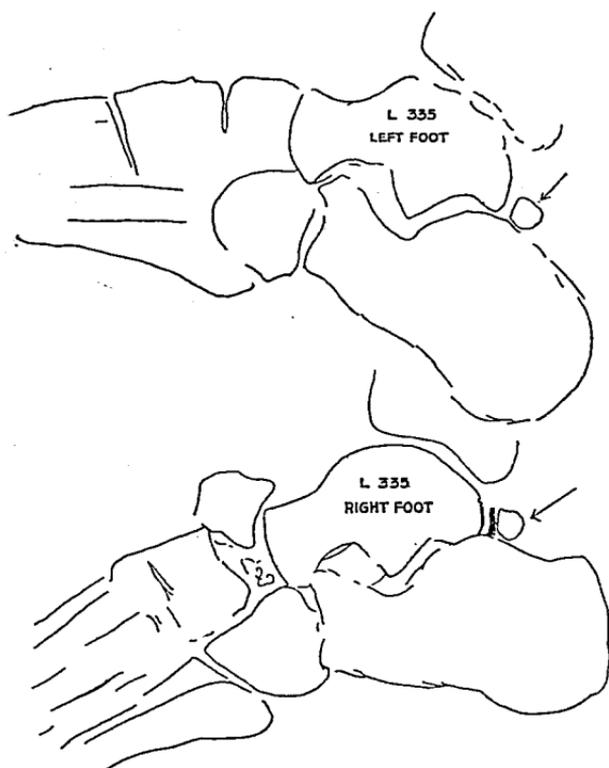


FIG. 3.—L340. Both show trigonum distinct from astragalus. Right foot shows displacement of the navicular, due to injury.

injury. The shadow was perfectly regular in outline and represented the sesamoid in the tendon of the tibialis posticus muscle, called the os tibiale externum.

The irregularities of the dorsal surfaces of the astragalus and scaphoid are interesting because they are sometimes erroneously interpreted as osteo-arthritis.

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From these citations it must be apparent that in the reading of X-rays of feet it is necessary to know the variations in shape of the individual bones, as well as the location and shape of the different supernumerary bones.

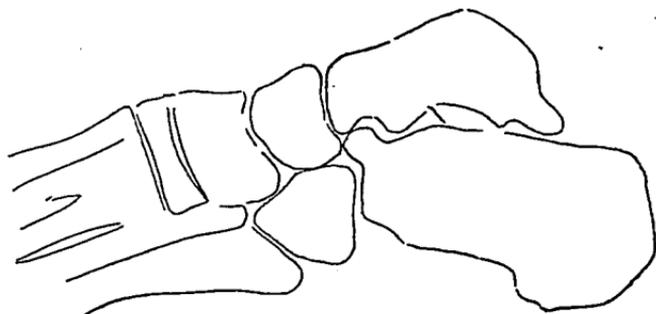


FIG. 4.—L343. Marked projection of posterior tubercle of astragalus. Probably a fused os trigonum.

I am deeply indebted to Dr. Byron C. Darling, radiographer to the New York Hospital for Ruptured and Crippled, for the opportunity to make the study, the results of which are embodied in this article.

Three hundred and fifty X-ray plates of one or both feet were

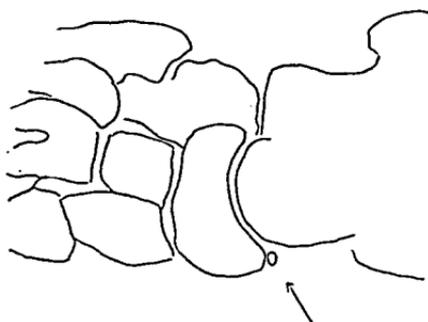


FIG. 5.—L247. Tibiale externum; present only on one side.

examined and of this number 62 showed supernumerary bones. The following table shows their relative frequency:

	Cases	Bilateral	Per cent.
Os trigonum .....	19	6	5+
Os tibiale externum .....	12	4	3½
Os peroneale .....	20	8	5+
Os vesalii .....	4	2	1+
Secondary os calcis .....	7		2



FIG. 6.—Os tibiale externum bilateral. Exceptionally large, overlapping scaphoid.

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There were in addition 4 instances of divided sesamoids of the big toe tendon. This does not represent an accurate proportion, because many of the plates did not include the front of the foot. There were several instances of spurs on the posterior and inferior surfaces of the os calcis unassociated with any history of rheumatism, trauma or

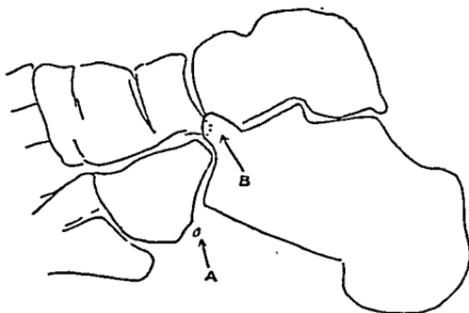


FIG. 7.—L415. Same on both sides. A, peroneum; B, secondary os calcis.



FIG. 8.—L309. Right foot. Very large peroneum.

gonorrhœa, and hence were simply accidental anatomic variations. There were many variations in the outline of the superior border of the astragalus and the posterior and inferior borders of the os calcis. *Variations in the outline of the tarsal bones may be disregarded unless*

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*there is clinical evidence attaching importance to them or there are lesions elsewhere in the foot of which these irregularities may be a part.*

*Os Trigonum* (Figs. 1, 2, 3, and 4).—This bone, like all other super-

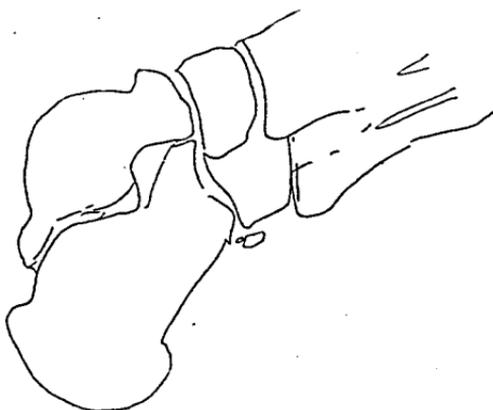


FIG. 9.—K80. Left foot, two "peroneum" bones. Right foot shows only one peroneum.

numerary bones, is characterized by regularity in outline. It may be small or large, may vary in shape from oval to circular or triangular, and may be fused with the astragalus or distinct from it. Of 19 cases,

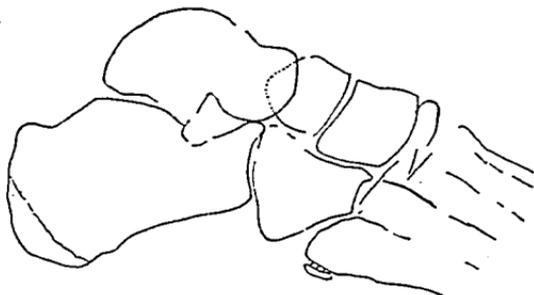


FIG. 10.—L208. Vesalianum.

in 6 it was found in both feet. It may be fused on one side and separated on the other. Its position is constant, being directly behind the astragalus.

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*Os Tibiale Externum* (Figs. 5 and 6).—This bone is usually circular or oval in outline and situated on the inner side of and slightly behind the scaphoid. It is important to remember that when this bone is distinct from the scaphoid, its shadow sometimes overlaps that of

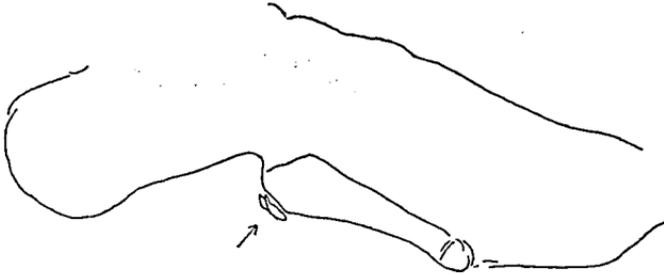


FIG. 11.—K175. Both feet show same finding; bipartite vesalianum.

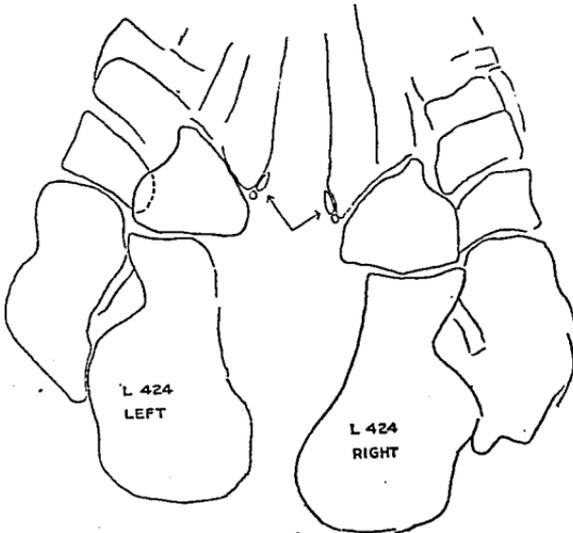


FIG. 12.—L424. Bipartite vesalianum.

the scaphoid. It was found in both feet in 4 of 12 cases. Though it is usually considered as a sesamoid in the tibialis posticus tendon, Dwight believes it to be a true part of the skeleton, since he has found it carti-

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laginous in the second month of the embryo. When this bone is fused with the scaphoid one may infer its presence by the size of the prominence.

*Os Peroneale or Peroncum* (Figs. 7, 8, and 9).—This bone is placed



FIG. 13.—K84. Shows process at anterior superior extremity of os calcis very distinctly, representing probably a fused secondary os calcis.

on the outer side of the cuboid. It is a sesamoid in the tendon of the peroneus longus muscle. In the 20 cases in which it was seen it was always very distinct from the cuboid. It appears to vary in size more

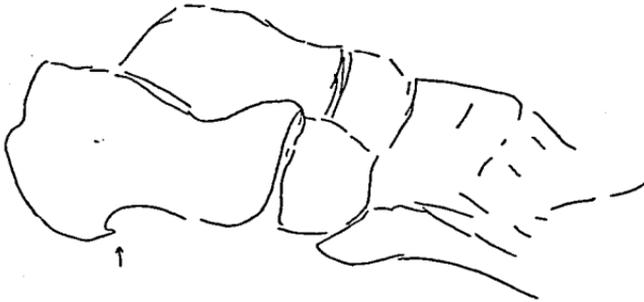


FIG. 14.—L216. Sharp projection of tubercle of os calcis.

than any of the other bones, as is shown in the accompanying illustrations. In 2 instances it was found to be subdivided. It was seen in both feet in 8 of the 20 cases.

*Os Vesalii or Vesalianum* (Figs. 10, 11, and 12).—This bone is

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placed at the proximal extremity of the fifth metatarsal. It was found in 4 cases. In each instance it was distinct and the patient's history excluded the possibility of a fracture. In 2 cases it occurred in both feet and in both instances the bone was subdivided. In one case it was con-

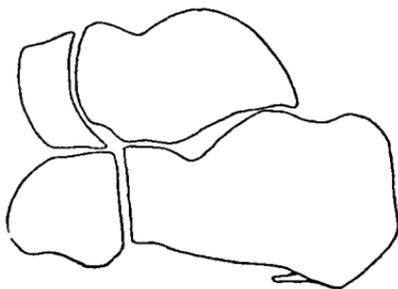


FIG. 15.—L269. Sharp projection of tubercle of os calcis.

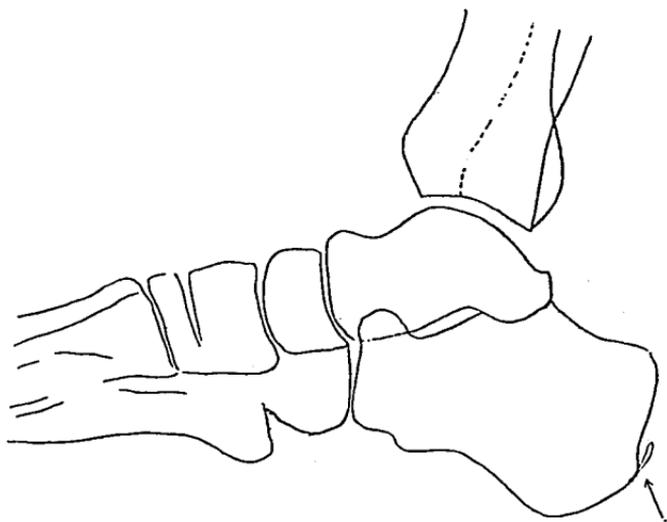


FIG. 16.—Spur on posterior surface of os calcis. Same condition on other foot.

nected with the metatarsal by strands of osseous tissue; in the other cases there was a depression in the metatarsal bone corresponding in size and shape to that of the os vesalii.

*Secondary Os Calcis* (Fig. 13).—This was never seen as a distinct

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bone, but in 7 cases there was an unusually long projection of bone in the interval between the astragalus, scaphoid and cuboid that corresponded with what is described as a secondary os calcis.

*Spurs of the Os Calcis* (Figs. 14, 15 and 16).—Reference to the drawings will show the outline of this bone to be very variable. The



FIG. 17.—L384. Prominence of superior surface of head of astragalus.

inferior surface frequently presents definite spur formation. This also occasionally occurs on the posterior surface. In one case there were two bony spurs on the inferior surface. These must be considered simply as accidental bony projections into the muscle attachments.

*Astragalus* (Figs. 17 and 18).—The upper surface of the astragalus

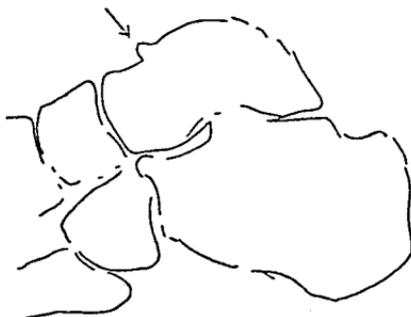


FIG. 18.—L209. Same on both sides—irregularity in outline of superior surface of astragalus.

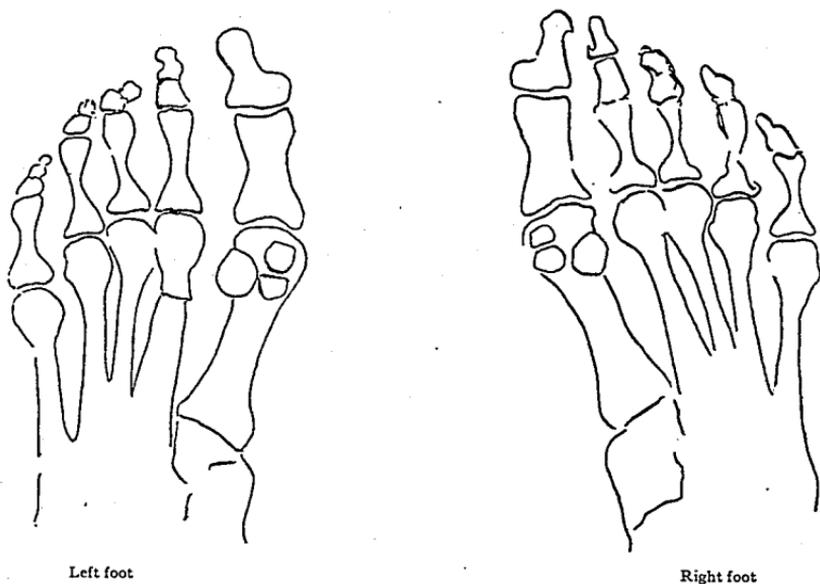
often presents sharp projections which may also be present on the scaphoid. Such projections occurring in a plate that is somewhat indistinct may simulate osseous hypertrophies suggesting osteo-arthritis.

*Sesamoids in the Big Toe Tendon* (Fig. 19).—There are usually two sesamoids near the distal extremity of the first metatarsal bones.

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Occasionally one of these is subdivided. The writer has seen only split inner sesamoids. The division is made by a transverse line into anterior and posterior parts. Subdivision of the sesamoids has been seen in both feet in some cases and only on one side in others.

Though I have tabulated the number of times I have actually observed each bone, the frequency of their occurrence is not so essential as the knowledge of their existence.



Left foot  
Right foot  
FIG. 19.—Bilateral split sesamoid. Note fracture of left second metatarsal. Split sesamoid might be mistaken for a fracture. (Ingaborg Anderson.)

### CONCLUSIONS

1. Supernumerary bones are frequently found in the foot. Though they vary considerably in size and shape, they are constant in position and regular in outline.
2. Irregularities in the outlines of the tarsal bones often occur as variations in anatomical conformation.
3. It is especially important to recognize the presence of accessory bones and variations in outline in a foot that is diseased or has been injured.