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Os Danielis: A Novel Sesamoid-Like Ossicle of the Plantar Fascia at the Midfoot

Elie C. Daniel

drecdaniel@gmail.com

Mendota Princeton Peru Foot and Ankle Clinics

Research Article

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Abstract

A well-defined, corticated, bipartite ossicle embedded within the substance of the plantar fascia at the plantar midfoot is described. The structure was identified as an incidental finding on weight-bearing plain radiographs in an asymptomatic 56-year-old female. Serial imaging spanning five years documented progressive maturation from two faint mineralization foci to a fully formed corticated ossicle, supporting a primary developmental etiology. Digital grayscale pixel intensity analysis confirmed greater radiographic density of the ossicle (mean 45,748 US units) relative to the surrounding plantar fascia (mean 43,953 US units), consistent with organized osseous tissue. Given its mid-plantar location with no adjacent bone of origin, the structure most closely resembles a sesamoid-type ossicle developing within a fibrous structure. The provisional designation Os Danielis (os plantare fasciae midpedis) is proposed. Its intrafascial position may create a focal zone of reduced tensile capacity — a locus minoris resistentiae — analogous to the mechanical vulnerability of the os tibiale externum at the posterior tibial tendon insertion. Clinicians should be aware of Os Danielis in the differential diagnosis of medial plantar midfoot pain.

INTRODUCTION

Sesamoid bones develop embedded within tendons or fibrous soft tissue structures, unconnected to any adjacent bone, and serve to modify the direction of mechanical forces within the structure in which they are embedded (Keles-Celik et al. 2017). Accessory ossicles, by contrast, represent unfused secondary ossification centers of adjacent bones. The plantar fascia is a dense fibrous aponeurosis originating at the medial calcaneal tubercle and extending distally as five fiber bundles toward the forefoot (Vanhoenacker et al. 2014). Its mechanical integrity relies upon the continuity of its parallel-oriented type I collagen fiber network (Bolgla and Malone 2004).

We report an incidental finding of a previously undescribed ossicle within the substance of the plantar fascia at the plantar midfoot, supported by five-year serial radiographic documentation and digital grayscale density analysis. The provisional eponymous designation Os Danielis (os plantare fasciae midpedis) is proposed for this structure.

CASE REPORT

A 56-year-old female presented for routine postoperative radiographic evaluation following extra-osseous talotarsal stabilization (EOTTS) sinus tarsi implantation for recurrent dislocation of the talotarsal joints (Graham et al. 2011). She reported no pain, tenderness, or functional limitation in the plantar midfoot region. Medical history was unremarkable for inflammatory arthropathy, metabolic bone disease, connective tissue disorder, or prior plantar foot trauma.

Physical examination revealed no palpable nodule, focal tenderness, induration, or soft tissue abnormality at the ossicle site. Systematic bimanual palpation with passive digital extension to engage

the windlass mechanism elicited no discomfort. Gait analysis and neurovascular examination were within normal limits.

Weight-bearing plain radiographs of the right foot in lateral, lateral oblique, and axial projections revealed an incidental well-defined osseous structure on the plantar aspect of the midfoot, projecting within the expected course of the medial band of the central plantar fascia, inferior to the naviculocuneiform articulation (Fig. 1). The ossicle demonstrated:

• A well-defined cortical rim with sharp, well-corticated margins and central radiolucency consistent with a medullary cavity, producing a distinctive bullseye radiographic appearance

• A bipartite configuration; the internal cleft may represent a synchondrosis, synfibrosis, or other fibrous interface pending histological examination

• Location approximately 1.5 cm from the medial aspect and 1.5 cm from the plantar skin surface, within a fascia measuring approximately 9 mm in thickness, situated mid-distance between heel and forefoot

• No adjacent bone of origin identifiable on any projection — a point of significance in classification

Digital grayscale pixel intensity measurements using the PACS region-of-interest (ROI) tool yielded ossicle values of 45,075 and 46,420 US units (mean 45,748 US) versus surrounding plantar fascial tissue values of 43,867 and 43,996 US units (mean 43,953 US) — a difference of approximately 4.1%, consistent with greater mineral density of organized osseous tissue relative to dense fibrous connective tissue.

Archival radiographs from five years prior confirmed the pre-existing and independent nature of this ossicle (Fig. 2). Two discrete, faint, poorly corticated mineralization foci were identified in 2021, with progressive coalescence and cortical formation documented through to the fully formed mature bipartite ossicle of 2026. The absence of any precipitating trauma, surgery, or inflammatory event during this period argues against an acquired or heterotopic etiology.

DISCUSSION

Embryological Basis

Sesamoid bones arise through endochondral ossification within fibrous or tendinous structures subjected to repetitive mechanical compression and tension during development. The plantar fascia, as a principal tension-bearing structure of the foot, is subject to substantial repetitive compressive and tensile forces from the earliest stages of weight-bearing ambulation. It is postulated that Os Danielis represents a focal center of endochondral ossification that arose within the medial band of the central plantar fascia in response to the localized mechanical stress environment at the plantar midfoot. This developmental mechanism is analogous to that proposed for sesamoid bones within the flexor hallucis brevis and other fibrous plantar structures, in which repetitive focal loading during gait triggers

chondrification and subsequent ossification of mesenchymal tissue within the fibrous matrix (Keles-Celik et al. 2017). The five-year longitudinal imaging series documenting the progressive maturation of Os Danielis from discrete mineralization foci to a fully corticated ossicle is consistent with this primary endochondral developmental process.

Classification

The absence of any adjacent bone of origin on all radiographic projections argues against the accessory ossicle classification. Os Danielis more closely satisfies the definition of a sesamoid bone — a bone embedded within a fibrous or tendinous structure, unconnected to any adjacent bone (Keles-Celik et al. 2017). We propose it be classified as a sesamoid-type ossicle of the plantar fascia, pending histological confirmation.

Differential Diagnosis

Several entities must be considered in the differential diagnosis of a plantar midfoot osseous density (Table 1). Plantar fascia enthesopathy presents proximally at the calcaneal insertion with a spiculated morphology and no medullary cavity. Plantar fibromatosis presents as an isoechoic fascial nodule without bony architecture on ultrasound (Tomac et al. 2023). The Lisfranc ligament complex is a deep periarticular structure at the tarsometatarsal joint level, significantly deeper than Os Danielis, and Lisfranc pathology is fundamentally articular in nature (Weatherford et al. 2025). Dystrophic calcification produces amorphous mineral deposits without organized cortical architecture. Heterotopic ossification follows a characteristic zonal maturation pattern associated with trauma or surgery — not present in this case.

Table 1. Differential diagnosis of plantar midfoot osseous density and distinguishing features from Os Danielis.

Differential Diagnosis	Key Feature	Distinguishing from Os Danielis
Plantar enthesopathy	Spiculated, no cortex	Proximal calcaneal; no medullary cavity
Plantar fibromatosis	Isoechoic on US; no calcification	No bony architecture
Lisfranc ligament pain	Deep periarticular; diastasis on X-ray	Deeper; joint-based pathology
Dystrophic calcification	Amorphous; no cortex	No organized cortex or medullary cavity
Heterotopic ossification	Zonal peripheral pattern	Trauma history; peripheral-to-central

Biomechanical Implications and Clinical Significance

The intrafascial position of Os Danielis displaces and interrupts the organized collagen fiber network of the plantar fascia, potentially creating a focal zone of reduced tensile capacity — a locus minoris resistentiae. This concept finds a useful clinical parallel in the os tibiale externum, where the ossicle creates a mechanically deficient posterior tibial tendon insertion predisposing to tendon dysfunction and failure (Romanowski and Barrington 1992). Similarly, Os Danielis may represent a site of focal biomechanical vulnerability within the plantar fascia.

In view of the asymptomatic presentation, advanced imaging with CT and MRI is not being pursued currently and is reserved as a contingency should symptoms develop. CT would characterize the cortical architecture and three-dimensional morphology; MRI would assess fatty marrow signal on T1-weighted sequences — the definitive criterion distinguishing a true ossicle from calcification. Custom functional foot orthoses providing triplanar arch support with a plantar fascial groove accommodation beneath the ossicle site are recommended (Landorf et al. 2006). Corticosteroid injection near the site warrants caution given the documented risk of fascial rupture (Acevedo and Beskin 1998) and the additional weakening effect of steroid on collagen (Kennedy and Willis 1976). Serial weight-bearing radiographs at twelve-month intervals are recommended to monitor for interval change.

CONCLUSION

Os Danielis (os plantare fasciae midpedis) represents a potentially novel sesamoid-like ossicle embedded within the medial band of the central plantar fascia at the plantar midfoot. Its organized cortical architecture, bipartite morphology, radiographic density greater than the surrounding fascia, and five-year developmental maturation sequence serve to distinguish it from pathological calcification or heterotopic ossification. Its mid-plantar location with no adjacent bone of origin most closely satisfies the definition of a sesamoid-type ossicle within a fibrous structure. Clinicians should be aware of this entity in the differential diagnosis of medial plantar midfoot pain. Future studies examining prevalence and histological characterization will further clarify its classification and clinical significance.

Declarations

Conflict of interest: The author declares no conflicts of interest.

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Ethics and patient consent: Written informed consent was obtained from the patient for publication of this case report and all associated images in accordance with HIPAA regulations. The signed consent form is retained in the patient's medical record and is available for review upon request.

Artificial intelligence disclosure: Claude (Anthropic, PBC; claude.ai), an artificial intelligence language model, was used as a writing assistance tool during manuscript preparation. All clinical observations,

radiographic findings, data, and intellectual content are entirely those of the author, who takes full responsibility for the accuracy and integrity of all content.

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Figures



Figure 1

Lateral oblique weight-bearing radiograph of the right foot (2026) demonstrating Os Danielis on the plantar midfoot (circle and arrow). The ossicle demonstrates a well-corticated rim surrounding a central radiolucency consistent with a medullary cavity — the characteristic bullseye appearance. The sinus tarsi implant is noted in satisfactory position in the sinus tarsi; its presence is incidental and bears no relationship to Os Danielis.



Figure 2

Lateral radiograph of the right foot (2021, early stage) showing two faint, poorly corticated mineralization foci in the plantar midfoot soft tissue, representing the earliest documented stage of Os Danielis development. No sinus tarsi implant is present in this image, confirming that the ossicle predates any subsequent intervention and is entirely independent.