The case:

A 45-year-old man presented with acute lateral hindfoot pain and swelling and the inability to bear weight after an inversion injury that occurred while he was descending stairs.

Figure: Internal oblique (A) and lateral (B) radiographs of the left ankle.

Your diagnosis?

For answer see page 807
Diagnosis:
Migration of the Os Peroneum Associated With Rupture of the Peroneus Longus Tendon

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A 45-year-old man presented with acute lateral hindfoot pain and swelling and the inability to bear weight after an inversion injury that occurred while he was descending stairs. Initial internal oblique and lateral radiographs of the left ankle revealed a bony fragment lateral to the distal/plantar aspect of the calcaneus, which was possibly an avulsion fracture from an unknown donor site (Figure 1). Subsequently, computed tomography (CT) images showed proximal migration of an intact os peroneum due to a full-thickness peroneus longus tendon tear (Figure 2), which was confirmed by magnetic resonance imaging showing a complete tear of the peroneus longus with retraction of the intact os peroneum (Figure 3).

Acute lateral plantar foot pain has various etiologies, including painful os peroneum syndrome, a term coined by Sobel et al.1 Pain with this syndrome can be either acute, following an os peroneum fracture or diastasis of a multipartite os peroneum, or chronic, due to a healed or healing os peroneum fracture, diastasis of a multipartite os, or regional mechanical pathology. Clinical manifestations related to the os peroneum often coincide with associated peroneus longus tendinopathy. Delayed diagnosis of os peroneum pathology and associated peroneus longus tendon injuries can result in progressive deterioration, including peroneal compartment syndrome and ankle instability.1

ANATOMY
The os peroneum is one of the most common accessory ossicles of the foot. This round or oval-shaped sesamoid is within the substance of the distal peroneus longus tendon at the level of the calcaneocuboid joint.1,2 It has varying degrees of ossification, and can be bipartite. The mature ossicle is seen on radiographs in 5% to 20% of normal patients, with a slight predominance in men.3 Four tethers anchor the sesamoid to the adjacent anatomical structures: the peroneus longus tendon, the fifth metatarsal tubercle, the plantar fascia, and the cuboid bone.4

The peroneus longus tendon passes along the lateral wall of the calcaneus to the cuboid bone. There, the tendon courses plantar in the bony cuboid tunnel to insert onto the lateral plantar surface of the first cuneiform and the base of the first cuneiform bone.5

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The primary action of the peroneus longus muscle/tendon group is plantar flexion and eversion of the first ray of the foot with simultaneous plantar flexion and eversion of the ankle. It is also an important stabilizer of the ankle joint.5

**PATHOLOGY**

Diseases of the peroneal tendons, including tendinitis, tenosynovitis, partial rupture, and complete rupture, are frequently underdiagnosed causes of lateral ankle pain and instability. Although uncommon, an os peroneum may predispose the lateral ankle to inflammation and peroneus longus pathology.5

Peacock et al6 suggested that the presence of an os peroneum may predispose the tendon to wear at the distal junction of the os, and tendon, where the tendon slides into the groove of the cuboid. Mechanical stress on the tendon at the site of the os peroneum, in combination with the oblique course of the tendon in the cuboid groove, can lead to underlying tendon malfunction and chronic dysfunction.5,7

Furthermore, other studies have shown that a fractured os peroneum is associated with a complete or partial peroneus longus tendon tear. A direct blow or indirect stress, such as violent contraction of the peroneus longus muscle in response to a sudden inversion or supination motion, are the most common mechanisms of acute injury.8-12 Such a contraction can compress the os peroneum against the cuboid bone, resulting in subsequent sesamoid fracture and acute tearing of the peroneus longus tendon.6,9

Brigido et al2 reported that 7 of 9 patients with an os peroneum fracture had a complete peroneus longus tendon tear and 1 patient had a partial tear at the site of the fractured os peroneum.6,9

**IMAGING**

**Radiographs**

Three views of the foot (anteroposterior, lateral, and internal oblique) and 3 views of the ankle (anteroposterior, lateral, and mortise) are used for initial evaluation of foot and ankle pain. In addition to common fracture patterns, radiographs can be used to evaluate bone density, alignment, and morphology, as well as variants including accessory ossicles.

Figure 2: Cephalad axial computed tomography image showing a well-corticated triangular bony fragment lateral to the calcaneus (arrow) without fracture and the proximally retracted os peroneum (A). Caudal computed tomography images showing triangular fluid collection (white arrow pointing to the fluid-filled empty sheath) posterior to the cuboid along the expected course of the peroneus longus tendon sheath (B) with amorphous soft tissue anteromedial to the os peroneum (arrow head) at the stump of peroneus longus tendon (C). Lateral 3-dimensional computed tomography surface reconstruction showing the retracted os peroneum lateral to the calcaneus with well-corticated margins (D).

Figure 3: Coronal proton-density weighted magnetic resonance image of the left ankle showing the retracted os peroneum (arrow).
Many studies have demonstrated the value of ultrasound for evaluation of lateral foot pain in patients with a suspected pathology of an os peroneum or an injury of the peroneal tendons. Ultrasound can be used to identify an incompletely mineralized accessory ossicle or a fractured ossicle. Sofka et al.\(^{15}\) noted a higher detection rate of os peroneum with ultrasound compared with radiographs. This was thought to be secondary to variable ossification of the accessory ossicle, with different degrees of cartilage and bone allowing ultrasound to be more sensitive in detecting structures with differing acoustic penetration properties.

As for the peroneal tendons, ultrasound evaluates the location, morphology, and echogenicity of the peroneal tendons throughout the entire course of the tendons. The normal tendon has a uniform hypercholic fibrillar appearance. This contrasts with tendinosis and tears where hypoechogenic swelling, heterogeneous echotexture with hyperreflective foci (calcification), or cleft or discontinuity of the tendon may exist.\(^{15,16}\) Tendon retraction also indicates a complete tear. Larger rounded intratendinous hyper-reflective foci with shadowing at the lateral wall of the distal calcaneus indicate the presence of an os peroneum (Figure 6).

**Magnetic Resonance Imaging**

Magnetic resonance imaging is a valuable modality for evaluation of tendon pathology, including pathologies related to an os peroneum. Normal tendons show consistent diameter with signal void on all pulse sequences. Abnormal findings in peroneus longus tendon tears include increased intrasubstance signal on proton density and T2-weighted images (Figure 7) and morphologic inconsistencies of the tendon, in some cases with frank tendon discontinuity.\(^{17}\)

Secondary findings, such as bone marrow edema of the lateral calcaneal wall or cuboid wall, can be seen at sites where friction can affect the tendon or adjacent to the site of the tendon tear (Figure 8).\(^{18}\) An os peroneum may be difficult to identify if it is composed of fibrocartilage, resulting in it sharing signal void characteristics with the peroneus longus tendon. However, if sufficient marrow content is available, the ossicle will be clearly distinguished due to high T1-weighted signal characteristics of fat (Figure 9). Alternatively, high T2-weighted signal abnormalities of osteitis or fracture may enhance visualization of the ossicle (Figure 10).

**Treatment**

Peroneus longus tendon rupture with a fractured or displaced os peroneum can be conservatively treated with nonsteroidal anti-inflammatory drugs and immobilization by casting followed by physical therapy.\(^{6}\) Surgical treatment is indicated if conservative therapy fails or if dysfunction or debilitating pain affect the patient’s quality of life. Surgical management includes tendon debridement and tenosynovectomy with primary repair of a torn peroneus longus tendon.\(^{1,17}\) Excision of an os peroneum can also be helpful. Surgical treatment of peroneal tendon injuries has been shown to maintain dynamic ankle function and mobility\(^{18}\) and can potentially reduce hallux...
Radiographs can provide valuable diagnostic clues for peroneus longus tendon injuries when the os peroneum is displaced or fractured. Ultrasound and magnetic resonance imaging are secondary modalities that provide more in-depth interrogation of equivocal or recalcitrant cases. Although most cases are managed conservatively, surgical intervention can enhance the outcome in some patients.

**REFERENCES**


