



Unusual proximal fragment migration of an os peroneum fracture with associated peroneus longus tendon injury—a tree often hides a forest

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Abstract

We report the case of a 55-year-old male patient who presented to the emergency department after sustaining a right ankle trauma. Swelling and tenderness of the lateral aspect of the right ankle were present on physical examination without evidence of motor or sensory deficit. Ankle radiographs were performed and showed two bony fragments, the first located postero-inferiorly to the cuboid bone while the second was adjacent to the tip of the lateral malleolus. The diagnosis of an os peroneum fracture was made with high suspicion of an associated peroneus longus tendon rupture. Computed tomography (CT) and magnetic resonance imaging (MRI) of the right ankle confirmed the diagnosis of a subtotal retracted tendinous rupture. Successful surgical repair of the injured tendon was performed. This article illustrates the imaging findings of an os peroneum fracture with its associated tendinous injury and reviews the literature.

Keywords Os peroneum · Overlooked fracture · Traumatic injury · Peroneus longus tendon tear

Introduction

Os peroneum is an inconstant accessory ossicle of the foot intertwined between the fibers of the peroneus longus tendon at the level of the cuboid tunnel [1, 2]. Its presence has been associated with higher incidence of peroneus longus tendon injury.

Os peroneum fracture is an overlooked fracture of the foot that can be associated with peroneus longus tendon injury. It can occur following ankle trauma of different mechanisms [1].

An unusual proximal migration of a bony fragment can be misleading, as it may mimic other “more benign” avulsion injuries occurring around the ankle joint [3, 4]. The recognition of this lesion that may be associated with peroneus longus tendon injury is of paramount importance for an appropriate early management of this tendon’s injury (conservative or surgical approach to prevent irreversible tendon rupture) [5, 6].

This report illustrates the fracture of an os peroneum with unusual proximal migration of the proximal bony fragment and an associated incomplete peroneus longus tear, despite the wide separation of the two bony fragments.

Imaging examinations and surgical observations are richly illustrated, and an exhaustive literature review is also provided.

Case report

A 55-year-old previously healthy male presented to the emergency department after he sustained a right ankle inversion

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injury while going down the stairs. Mild swelling and tenderness of the lateral aspect of the right ankle were present. No evidence of motor or sensory deficit was found on physical examination.

Three-view right ankle radiographs (Fig. 1) were performed and showed two bony fragments with at least one non-corticated edge, the first one located postero-inferiorly to the cuboid bone and the second adjacent to the tip of the lateral malleolus. Subcutaneous soft tissue swelling was also noticed around the lateral malleolus.

Presence of non-corticated edges and significant diastasis of the two bony fragments was suggestive of an os peroneum fracture rather than a bipartite variant with a highly likely associated peroneus longus tendon rupture. The proximal fragment was in an unusual proximal location; hence, to confirm the diagnosis, a non-contrast CT scan of the ankle (Figs. 2 and 3) was performed showing fluid in the peroneus tendons sheath with disruption of peroneus longus tendon fibers continuity and a 7-cm gap between the two bony fragments of the fractured os peroneum. No additional post traumatic bone lesion was found.

As part of the pre-operative workup, an MRI of the ankle (Figs. 4 and 5) was also performed showing an almost complete peroneus longus tendon rupture that was retracted along with the proximal os peroneum fragment. Few remaining intact fibers of the injured tendon were visualized representing the thin part of the tendon that was presumably crossing over the distal os peroneum fragment. Bone marrow edema of the proximal bony fragment was noted on fluid-sensitive sequences while the distal one was not clearly individualized at MRI given its small size. The peroneus brevis tendon was intact.

The patient underwent open surgical repair (Fig. 6) with successful restoration of the tendon's continuity.

Discussion

Os peroneum is a foot accessory ossicle intertwined between the fibers of the peroneus longus tendon at the level of the cuboid tunnel [1, 2] (Fig. 7).

Twenty percent of adults have the ossified form of this accessory ossicle, being bilateral in 60% of the cases and showing a bipartite appearance in 30% of them [3, 4].

Predisposition to lateral ankle inflammation and peroneus longus tendinopathy has been described in association with the presence of an os peroneum, falling within painful Os peroneum syndrome (POPS) entity [5, 7, 8].

Higher incidence of peroneus longus tendon injury has been reported in the presence of an os peroneum due to friction of the obliquely oriented tendinous fibers over the bony surface of this ossicle [3, 5].

Moreover, when the tendon is weakened by an underlying disease (i.e., rheumatoid arthritis or diabetes mellitus), an acute tendinous tear can occur with an intact os peroneum [9].

Os peroneum injury can occur following ankle trauma of different mechanisms (direct trauma or indirect stress) [3, 6], with sudden inversion injury being the most common cause. Fatigue fracture of this accessory bone has also been described as a complication of POPS [10].

Given the risk of an associated peroneus longus tendon injury, early and correct diagnosis is essential for an appropriate management in order to prevent late complications [6, 11].

Os peroneum fracture can easily be mistaken for other fractures, accessory ossicles (i.e., os trigonum if the bony fragment located at the level of the tibiotalar joint) or intra-articular bodies. In addition, the non-specific symptoms and the low index of suspicion are additional causes of missing these fractures [1].

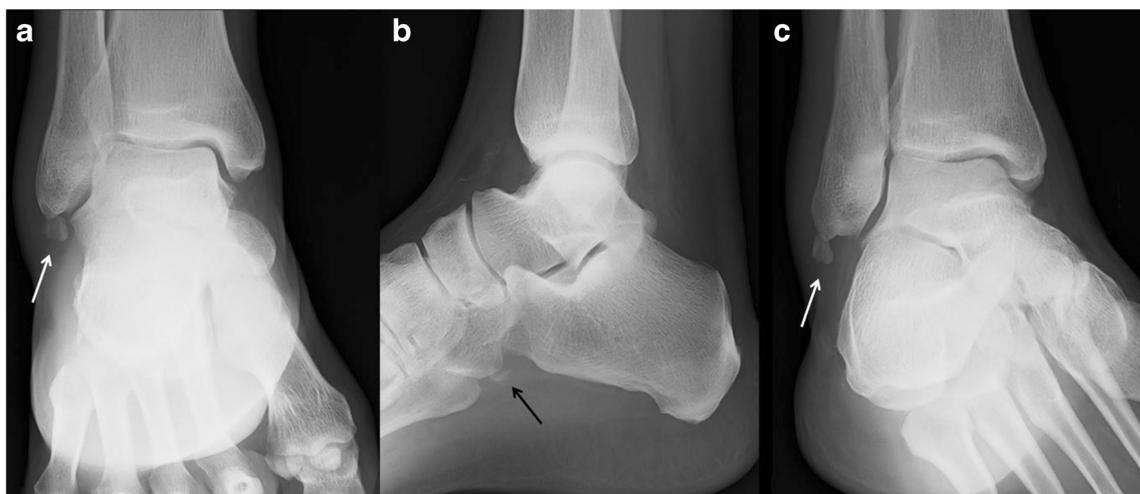


Fig. 1 Antero-posterior (a), lateral (b), and oblique (c) radiographs of the right ankle showing the fractured os peroneum with one fragment located adjacent to the tip of lateral malleolus (white arrows) and the second, postero-inferiorly to the cuboid bone (black arrow)

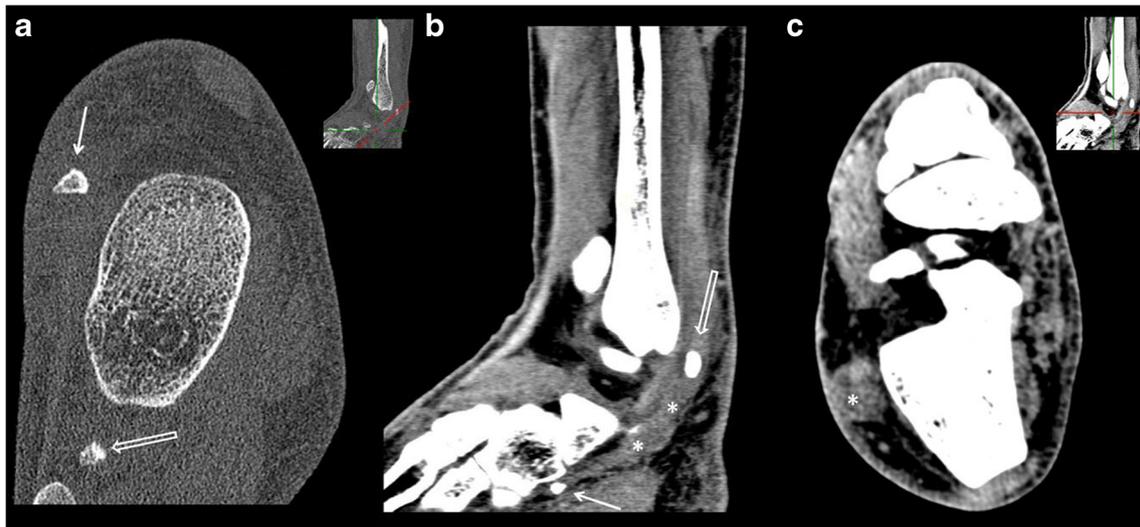


Fig. 2 Non-enhanced CT-scan of the right ankle. Reformatted axial oblique image in bone window (a) and sagittal image in soft tissue window (b) showing diastasis of os peroneum fragments. The fragments are separated by 70 mm with the retracted proximal one (open arrows)

located postero-inferiorly to the lateral malleolus and the distal one (filled arrows) remaining in its anatomical location. Axial image in soft tissue window (c) showing fluid in the peroneal tendons sheath (asterisks) with disruption of peroneus longus tendon fibers continuity (also seen in b)

Differentiating a bipartite os peroneum from a fracture can sometimes be challenging. Yet some clues can help the radiologist to differentiate the two entities [12]. Generally, the two fragments of a bipartite os peroneum are separated by a distance of less than 2 mm, they have smooth sclerotic margins and appear to fit together, in contrast to the irregular non-sclerotic margin of an acute fracture [1, 4].

When dealing with an os peroneum fracture seen on routine ankle radiographs, it should always be kept in mind that there may be a more serious hidden injury in order to avoid missing the forest that is hidden by the tree (tendon's injury hidden by an os peroneum fracture). An associated peroneus longus

tendon rupture must be suggested on lateral radiograph when the distance between the two distracted fragments is 6 mm or more or if the distance between the proximal fragment and the calcaneocuboid joint exceeds 10 mm [1]. A retrospective study conducted by Brigido et al. showed that 100% of patients with these criteria turned out to have a full-thickness peroneus tendon tear [1]. Isolated proximal displacement of an intact os peroneum can be encountered with distal peroneus longus tendon rupture [12].

Tendinous retraction following a full-thickness tear can lead to proximal fragment migration of several centimeters from the calcaneocuboid joint [1].

Fig. 3 Three-dimensional (3D) volume rendering images of the right ankle CT-scan showing diastasis of the os peroneum fragments with the retracted proximal one (open arrows) located postero-inferiorly to the lateral malleolus and the distal one (filled arrows) remaining in its anatomical location

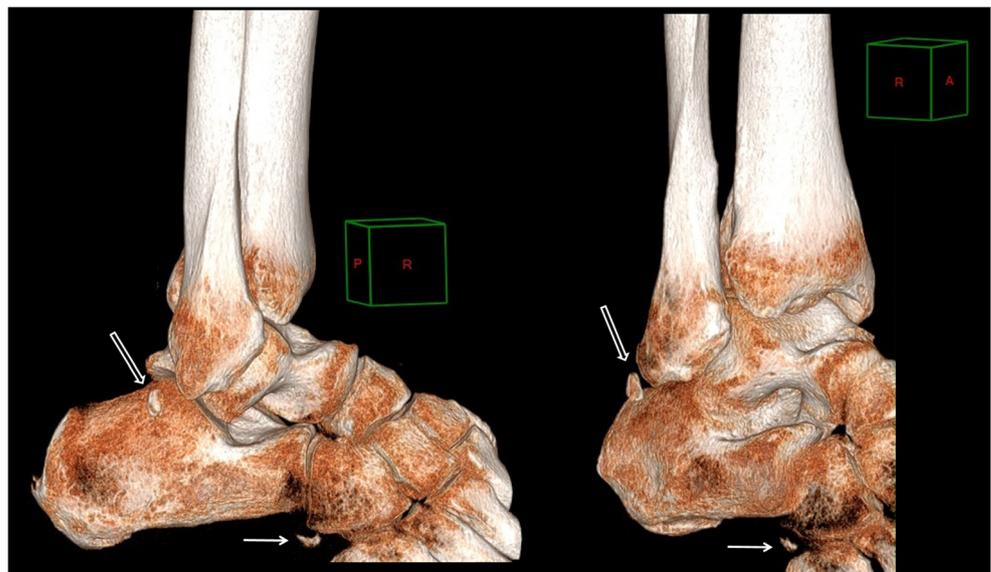
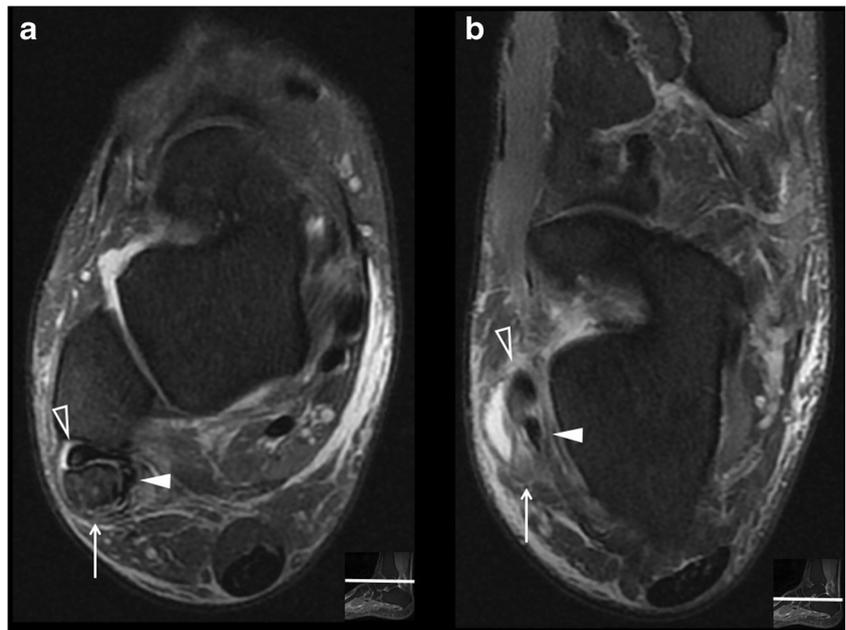


Fig. 4 Transverse fat-saturated proton-density MRI images of the right ankle at the level of the talar dome (a) and at the level of the anterior articular surface of the calcaneus (b). Abnormal intermediate to high signal intensity of the thickened peroneus longus tendon is seen with loss of fibers continuity (arrows). Few remaining intact fibers of the peroneus longus tendon are seen medially (filled arrowheads). Note the intact peroneus brevis tendon (open arrowheads)



Generally, the proximally displaced bony fragment is entrapped anteriorly to the peroneal tubercle at the level of the inferior fibular retinaculum (inferior osteofibrous tunnel) [7]. Less frequently, with further tendinous retraction, the superior fibular retinaculum is injured and the bony fragment is displaced more proximally along the lateral fibula [13].

Differential diagnosis of a fractured os peroneum include any avulsion fracture of the ankle or the foot located in the vicinity of the potential location of the displaced os peroneum fragment along the course of the peroneal longus tendon.

Initial radiologic evaluation of an ankle trauma is generally done by three-view radiographs of the ankle (anteroposterior, lateral, and internal oblique) to rule out potential fractures,

evaluate the bony structure, and identify soft tissue swelling and anatomical variants [5].

As for other fractures, cortical interruption and non-sclerotic borders are the radiographic criteria used to diagnose the os peroneum fracture [1, 10] with “a ‘pieces of puzzle’ appearance” described by Brigido et al. [1].

When os peroneum fracture is suspected or confirmed on conventional radiographs, evaluation of the lateral foot by an ultrasound (US) or an MRI exam is recommended to adequately evaluate the tendons [5].

US exam will show hypoechoogenicity of the injured tendon with surface irregularity, thickening, and partial or total loss of its fibrillar echotexture [14].

Fig. 5 Sagittal T2 weighted IDEAL (fat-suppressed) MRI images of the right ankle (a and b). Abnormal intermediate to high signal intensity of the thickened and retracted peroneus longus tendon is seen (curved arrows) with few remaining intact fibers of the peroneus longus tendon (filled arrowhead). Note the Intact peroneus brevis tendon (arrows) and the proximally displaced bony fragment (open arrow), showing bone marrow edema in (a)

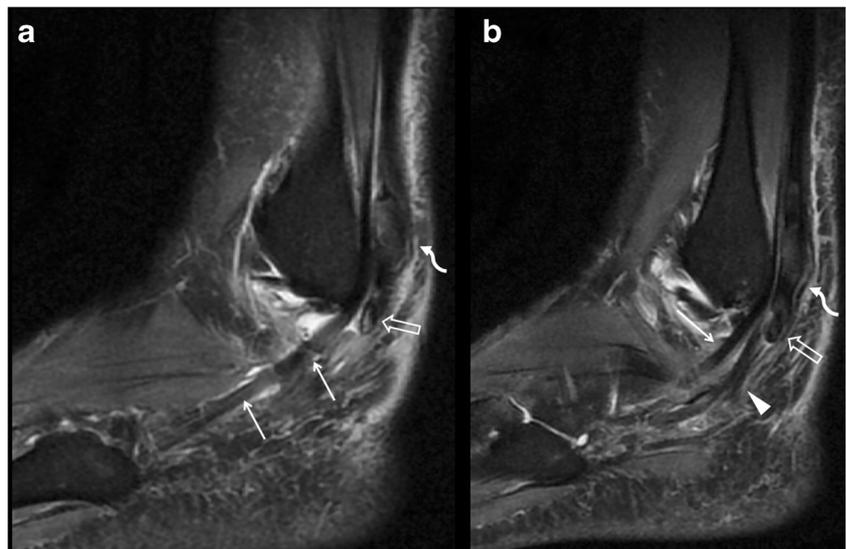
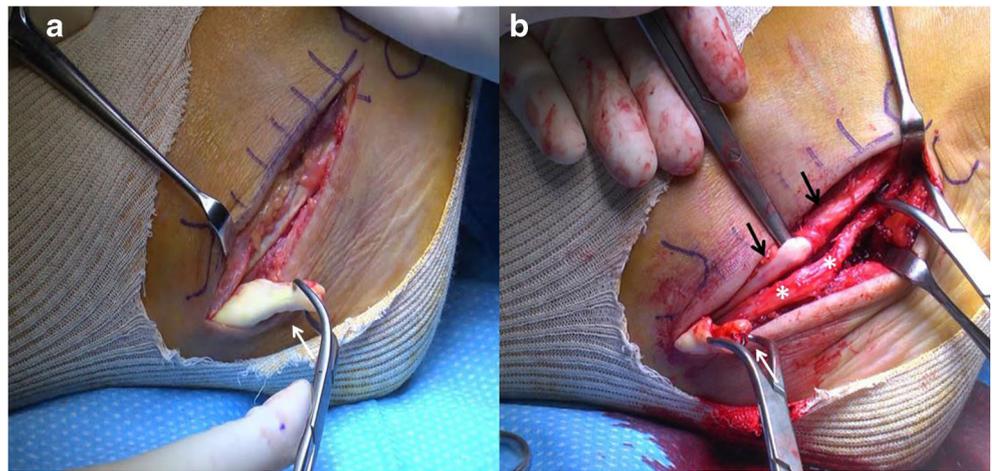


Fig. 6 Intraoperative photographs of the lateral aspect of the right ankle showing the ruptured and retracted main part of peroneus longus tendon (*white arrows*) and the thin residual intact part (*asterisks*). Note the intact peroneus brevis tendon (*black arrows*)



MRI exam will show intermediate or high signal intensity on fluid-sensitive sequences of the tendon's tear site with complete fibers disruption in case of rupture [14]. Bone marrow edema of the lateral aspect of the calcaneus or the cuboid may also be associated [5].

In addition, post-traumatic (fracture or contusion) edema of the ossicle's bone marrow will give a high signal intensity on fluid-sensitive sequences, enhancing thereby its visualization [5]. What should be kept in mind is that identification of an

intact os peroneum on MRI may be difficult giving the fact that when there is no sufficient amount of intrinsic marrow content to give a high T1 signal, it will be difficult to differentiate it from the adjacent tendon [5].

Regarding treatment modalities, multiple approaches are advocated. Conservative treatment is mainly based on immobilization of the ankle with non-steroidal anti-inflammatory drug administration. Surgery consists of removing the bony fragments with restoration of the peroneus longus tendon's continuity [5, 12].

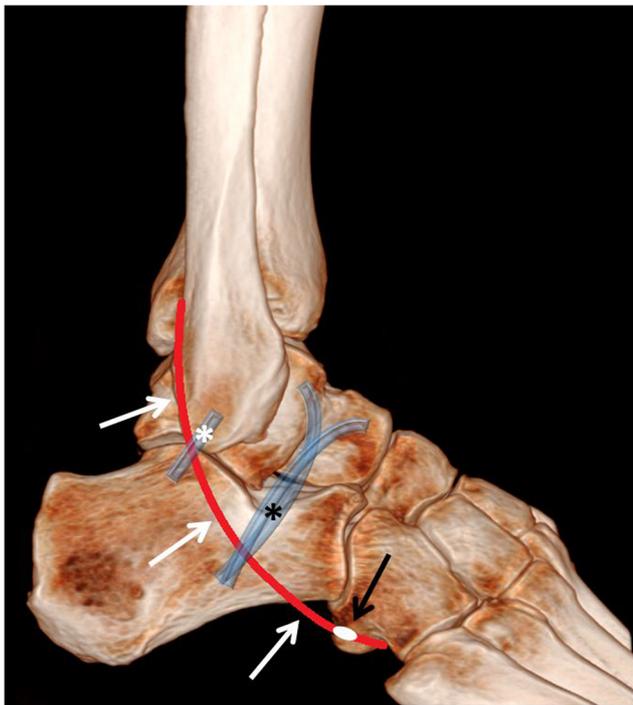


Fig. 7 Illustration of the lateral ankle showing the os peroneum (*black arrow*) within the peroneus longus tendon (*white arrows*) just proximal to the cuboid tunnel. The tendon is running deep to the superior fibular retinaculum (*white asterisk*) and the inferior fibular retinaculum (*black asterisk*)

Conclusions

Os peroneum fracture is a rare and overlooked fracture of the foot with inversion mechanism injury of the ankle being its main cause. Given its association with peroneus longus tendon injury, careful understanding of this ossicle anatomy with its tendinous attachments is crucial for adequate radiological interpretation and subsequent appropriate management.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

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