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Case Report

Ankle medial flexor retinaculum avulsion fracture

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ABSTRACT

Medial flexor retinaculum injuries are not uncommon, but medial flexor retinaculum periosteal avulsion injuries are rare. This patient sustained a medial flexor retinaculum tear readily characterized at computed tomography by an associated proximal retinacular avulsion fracture from the posteromedial tibia. Medial flexor retinaculum injury is often also associated with superficial deltoid pathology and/or medial malleolar fracture. An additional significant complication of medial flexor retinaculum tear is anterior dislocation of the tibialis posterior tendon, which heralds a tibialis posterior fibro-osseous tunnel injury.

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Introduction

While less common than lateral ankle injury, medial ankle pathology is a significant cause of disability. In this case report, the medial flexor retinaculum and associated medial ankle structures will be discussed. The tarsal tunnel transmits the tibialis posterior tendon, flexor digitorum longus tendon, posterior tibial vessels and nerves, and flexor hallucis longus tendon. These structures course distally beyond the medial ankle to the foot. The tarsal tunnel is medially and posteriorly enclosed by the flexor retinaculum, a thin fibrocartilaginous structure similar in shape and composition to other anatomic retinacula. The medial and anterior borders of the tarsal tunnel are the posteromedial tibia including the retromalleolar groove, as well as the sustentaculum tali [1]. Small fibrous septa arising from the medial retinaculum undersurface and extending to the calcaneal periosteum subdivide the tarsal tunnel [1]. The deep and superficial deltoid ligament components are additional important and commonly injured medial

ankle soft tissue structures. Medial ankle injuries can damage the above structures in a predictable manner, with implications for treatment.

Case report

An otherwise healthy 43-year-old male tumbled a long distance while hiking and landed in a swamp, sustaining an open and contaminated ankle fracture-dislocation. Initial physical exam demonstrated intact flexor hallucis function, with limited assessment of the other ankle tendons due to joint deformity. Radiographs demonstrated markedly displaced and overlapping subtalar dislocation, posterior talar process avulsion fragment, other scattered smaller ossific bodies, foreign body debris, open wound, and soft tissue gas (Fig. 1). The patient was reduced in the emergency department under conscious sedation. He was then taken to the operating room, where he underwent joint irrigation, removal of numerous

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Fig. 1 – Forty-three-year-old male with medial ankle flexor retinaculum avulsion fracture.

Frontal and lateral radiographs of the ankle demonstrate comminuted fracture dislocation; known medial flexor retinaculum avulsion fragment is not seen.

small osseous and cartilaginous fragments, and external ankle fixation. Three days later a computed tomography (CT) scan was performed, which among other injuries demonstrated an unusual medial flexor retinacular avulsion fracture from the medial aspect of the posterior malleolus, with associated avulsion fragment (Figs. 2–4).

Discussion

This case demonstrates the pathophysiology of a medial flexor retinaculum avulsion injury. In general, the retinacula of the ankle are thin structures composed of an inner gliding layer, thick mid layer, and outer layer of loose connective tissue [2]. Based on cadaver specimens, the average thickness of the medial flexor retinaculum is 0.9 mm [2]. The medial flexor retinaculum forms the roof of the tarsal tunnel, extending from medial malleolus to posterior superior calcaneus (Fig. 5), also blending distally with the tibialis posterior tendon sheath and superficial deltoid ligament [2,3]. This retinaculum splits to envelop the abductor hallucis longus muscle then reunites and blends with the plantar fascia [1]. The common origin of the superficial deltoid fibers at the anteromedial aspect of the medial malleolus is continuous with the medial malleolus periosteum, which is itself contiguous with the medial flexor retinaculum [4].

Forced ankle eversion and forced dorsiflexion with a contracted tibialis posterior tendon is the most common mechanism of tendon subluxation, though the phenomenon is also seen with medial malleolar fractures [3]. Medial flexor retinaculum injuries are also usually associated with deltoid ligament injuries. In fact, approximately one third of acute superficial deltoid ligament injuries have an associated medial flexor retinaculum injury [5]. Medial flexor retinaculum tears usually occur at the insertion of the ligament on the posteromedial tibia [4]. Injury to the medial flexor retinaculum can contribute to medial subluxation of the tibialis posterior tendon, but injury to the tendon fibro-osseous tunnel is usually also required for frank dislocation to occur [6]. The tibialis

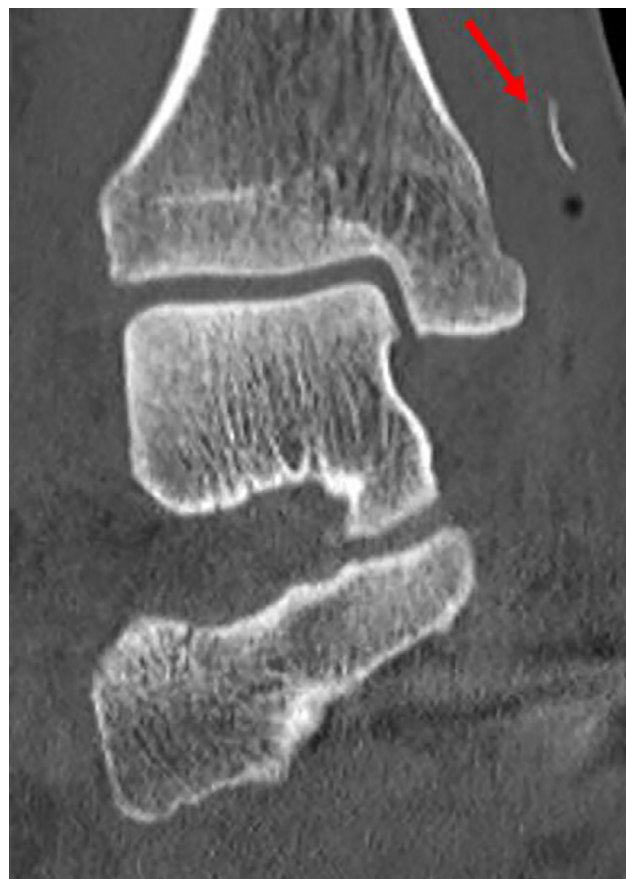


Fig. 2 – Forty-three-year-old male with medial ankle flexor retinaculum avulsion fracture.

Coronal CT demonstrates avulsion fracture fragment (arrow); adjacent foci of gas are related to open ankle fracture dislocation.

posterior normally courses in the retromalleolar groove of the posteromedial tibia. It is the largest, most medial, and most anterior of the tarsal tunnel structures.

In our case, the posteromedial tibia fibrocartilaginous avulsion fragment is seen in a classic and easily recognizable position, and is attached to the avulsed and redundant flexor retinaculum (Fig. 6). The posterior tibial tendon is slightly, but not frankly, subluxed in the medial direction (Fig. 7). Therefore, this finding is equivocal for tibialis posterior fibro-osseous tunnel injury.

Magnetic resonance imaging exam is most sensitive for subluxation of the tibialis posterior, but has been known to miss dynamic subluxations because of positioning [6]. Soft tissue algorithm CT, as in our case, is quite good at evaluating gross integrity and position of the tibialis posterior. The ankle tendons are routinely evaluated and described on CT at our institution.

Medial flexor retinacular avulsion injury in the absence of tendon dislocation does not necessarily require surgical management, and this component of our patient's injuries was thus managed nonoperatively. If clinical concern for tibialis posterior dislocation were to arise in the future, surgical

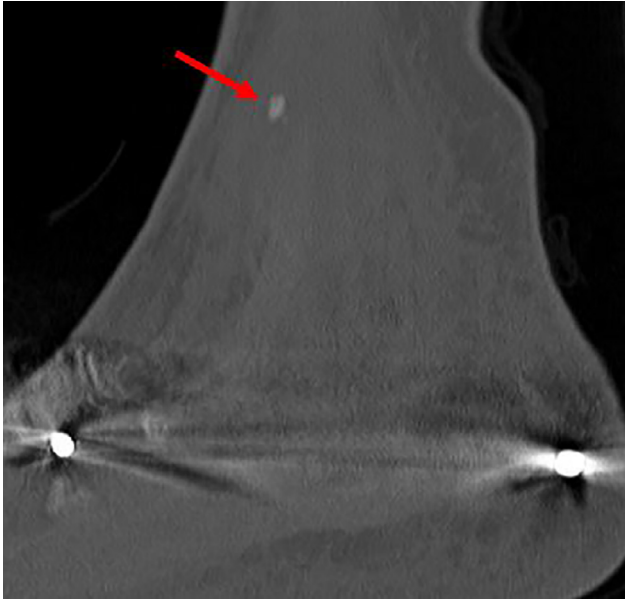


Fig. 3 – Forty-three-year-old male with medial ankle flexor retinaculum avulsion fracture. Sagittal CT demonstrates avulsed bone fragment from the medial malleolar flexor retinaculum attachment (arrow).

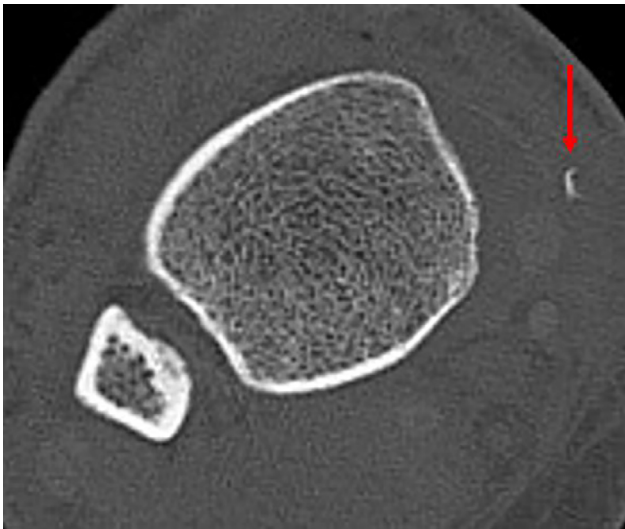


Fig. 4 – Forty-three-year-old male with medial ankle flexor retinaculum avulsion fracture. Axial CT demonstrates avulsed bone fragment from the medial malleolar flexor retinaculum attachment (arrow).

treatment would be considered. The literature has demonstrated conservative management of tibialis posterior dislocation to be inadequate in most or all cases [6]. Several techniques for surgical repair exist, the most common being repair of the medial flexor retinaculum with or without retromalleolar groove deepening [6]. Repair of this retinaculum with suture anchors and reconstruction with Achilles tendon flap or periosteal sleeve is a common and successful technique [3].



Fig. 5 – Forty-three-year-old male with medial ankle flexor retinaculum avulsion fracture. Lateral radiograph with graphic overlay demonstrating position of flexor retinaculum.

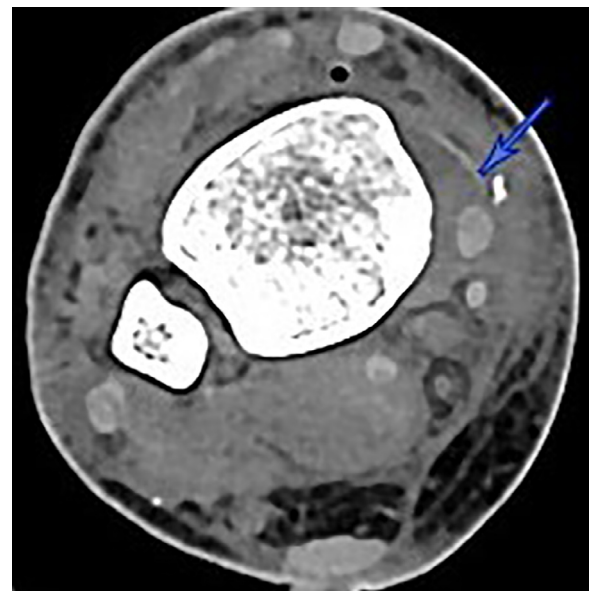


Fig. 6 – Forty-three-year-old male with medial ankle flexor retinaculum avulsion fracture. Axial CT demonstrates flexor retinaculum (arrow) avulsed from its posterior attachment and associated avulsion fracture fragment.

Incidence data on medial flexor retinaculum avulsion fractures is scant in the literature, but in our experience they seem quite rare, and less common than lateral-sided peroneal retinaculum avulsion fractures.

It is curious that while ankle injuries are common, and medial flexor retinaculum injuries are not uncommon, medial flexor retinaculum periosteal avulsions are rare. This may be because, in adults, the retinacular attachment to bone is generally stronger than the retinaculum itself. For our patient, perhaps uncommon forces on soft tissue structures related to

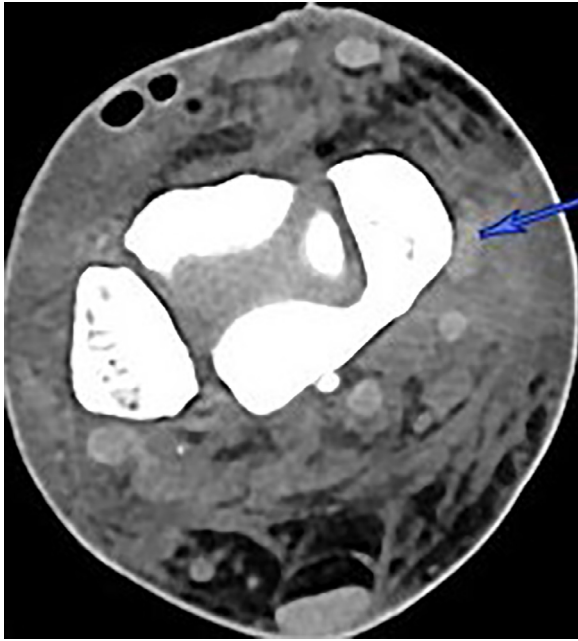


Fig. 7 – Forty-three-year-old male with medial ankle flexor retinaculum avulsion fracture. Axial CT demonstrates partial medial subluxation of the tibialis posterior tendon (arrow).

the extreme joint distortion of the fracture-dislocation led to an avulsion injury rather than a simple retinacular tear.

REFERENCES

- [1] Erickson S, Quinn S, Kneeland J, Smith J, Johnson J, Carrera G, et al. MR imaging of the tarsal tunnel and related spaces: normal and abnormal findings with anatomic correlation. *AJR Am J Roentgenol* 1990;155(2):323–8.
- [2] Numkarunarunrote N, Malik A, Aguiar R, Trudell D, Resnick D. Retinacula of the foot and ankle: MRI with anatomic correlation in cadavers. *AJR Am J Roentgenol* 2007;188(4):W348–54.
- [3] Gluck G, Heckman D, Parekh S. Tendon disorders of the foot and ankle, part 3: the posterior tibial tendon. *Am J Sports Med* 2010;38(10):2133–44.
- [4] Crim J. Medial-sided ankle pain: deltoid ligament and beyond. *Magn Reson Imaging Clin N Am* 2017;25(1):63–77.
- [5] Mengiardi B, Pinto C, Zanetti M. Medial collateral ligament complex of the ankle: MR imaging anatomy and findings in medial instability. *Semin Musculoskelet Radiol* 2016;20(1):91–103.
- [6] Goucher N, Coughlin M, Kristensen R. Dislocation of the posterior tibial tendon: a literature review and presentation of two cases. *Iowa Orthop J* 2006;26:122–6.