Initially unidentified soft tissue injuries in the setting of rearfoot and ankle fractures: A pair of case reports

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Posterior tibial (PT) tendon entrapment and superior peroneal retinaculum injuries are among the most common soft tissue injuries to occur in the setting of rearfoot and ankle trauma. Unfortunately, these injuries may go unidentified in the acute setting, leading to the potential need for additional surgical intervention and worse patient outcomes. Two such cases are presented in this paper with the purpose of bringing awareness to the frequency of these injuries and to provide imaging examples to aid the clinician in making the initial diagnosis.

Keywords: fracture, trauma, soft tissue injury, tendon dislocation, tendon incarceration, rearfoot, ankle

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Fractures of the rearfoot and ankle present in a variety of ways based on mechanism of injury, position of the foot at the time of the injury, and energy level of the injury. With these injuries, a diagnosing physician’s focus is often directed primarily towards the osseous component of the presentation. While the osseous injury is clearly of great concern, this may occasionally result in decreased attention paid to critical soft tissue structures which may affect surgical procedures and outcomes. Two cases are presented which demonstrate instances of significant unidentified soft tissue injuries that directly impacted the patient’s outcomes.

Case 1

A 49-year-old male with no significant past medical history sustained a left ankle fracture after falling from a bicycle. He was initially treated non-operatively with a short-leg cast at an outside facility on 12/22/2019 prior to being lost to follow up. About two months later, he presented to a different outside facility on 2/27/2020, where the cast was removed for follow up radiographs. The radiographic images identified a trimalleolar fracture pattern with associated syndesmotic separation, medial displacement of the medial malleolar fracture fragment, mild posterior displacement of the posterior malleolar fracture fragment, diffuse widening of the medial clear space, and mild evidence of healing at medial, posterior, and lateral malleolar fractures. The patient was placed into a splint and referred to our facility for further work-up. Upon presentation on 3/5/2020, the patient was found to have no open wounds, neurovascular compromise, or gross deformity on clinical exam. A computerized tomography (CT) scan of the left ankle (Figure 1) was performed and found to have an unstable injury pattern with a displaced intra-articular fracture of the posterior malleolus (30 x 30 x 15mm posteriorly displaced 10mm) and medial malleolus (20 x 10 x 12mm displaced distally 10mm) with clearly visualized fracture lines. Additionally, depression of the posterior tibial plafond articular surface at the level of the displaced posterior malleolar fracture fragment measuring 3mm, obvious disruption of the ankle mortise with moderate-severe anteromedial subluxation of the distal tibia at the tibiotalar joint, and antero-lateral displacement of the posterior tibial tendon into the gap between the posteriorly displaced posterior malleolar fracture fragment and the distal tibia beginning about 3cm superior to the tibiotalar joint and extending to the level of the joint. Ultimately, the diagnosis of an unstable trimalleolar ankle fracture which was irreducible due to an incarcerated posterior tibial tendon was made around 3 months after the inciting injury.
A 51-year-old male with a prior history of a right calcaneal fracture two years ago presented to the clinic for right ankle pain. The patient reported having pain since his injury and was seeking surgical intervention. On physical exam, the patient was noted to have: tenderness to palpation of the lateral calcaneus and along the peroneal tendons both proximally and distally to the ankle joint, mild edema along the course of the peroneal tendons, painful subtalar joint range of motion, and painful ankle end range of motion with dorsiflexion. A CT scan was ordered for further investigation and the patient was instructed to wear a lace up ankle brace and take over-the-counter NSAIDs as needed for pain.

The CT scan of the right foot and ankle (Figure 2) was performed, and displayed: Healed intra-articular fracture of the calcaneus, moderate-severe degenerative changes of the posterior facet of the subtalar joint with bone-fragments/intra-articular bodies seen in the posterior subtalar joint space, and complete lateral dislocation of the peroneal tendons relative to the fibula at the level of the ankle was found. The diagnosis of subtalar joint arthritis with complete lateral dislocation of the peroneal tendons secondary to presumed tear of the superior peroneal retinaculum was made.

**Discussion**

Rearfoot and ankle fractures are increasingly common injuries, with over five million ankle fractures occurring in the United States annually [1]. Over a three-year period from 1979-1981, ankle fractures were reported to occur at a rate of approximately 187 fractures per 100,000 people each year, with rates rising due to increased involvement in athletic activities and a growing elderly population [1,2]. Although advancements have been made in the management of hind-foot and ankle fractures, they are often still associated with substantial risk for long-term sequelae [3].
Despite the frequency and severity of these osseous injuries, concomitant soft tissue injury can occasionally be overlooked. In the case of ankle fractures, in 1943 Lee and Horan were the first to attribute an irreducible ankle fracture to the interposition of soft tissue within the ankle mortise [4]. This was followed by Coonrad and Bugg in 1954, who reported two cases of posterior tibial (PT) tendon entrapment preventing reduction [5].

Since these initial reports, there have been several reports of posterior tibial tendon injuries either impacting reduction or being initially unidentified, leading to poorer outcomes for the patient. Sato et al., reported a case of PT tendon entrapment by medial malleolar fragments which required open reduction and internal fixation. Postoperatively, ankle inversion was limited and prompted follow-up CT and magnetic resonance imaging (MRI) imaging, revealing an altered course of the PT tendon proximally through the tibiofibular intersosseous space, requiring an additional extensive surgery [6]. Amouyel et al., reported a patient with increasing ankle pain who was ten-years removed from a displaced lateral malleolar fracture that was treated nonoperatively. Upon CT scan, the patient was shown to have a 15mm in length retromalleolar bone tunnel containing the PT tendon, presumably caused by bony callus as a complication of closed-reduction fracture management [7]. The first case presented in this article is another example of PT tendon incarceration negatively affecting a patient’s outcome. The outcome, though certainly affected by failure to follow up, could have been improved with initial identification of PT tendon entrapment on initial presentation.

These cases should demonstrate to diagnosing physicians the importance of suspicion and awareness of these not entirely uncommon injury patterns. In fact, in a retrospective study assessing CT scans in hindfoot fractures, 16.1% of the fractures were shown to have PT tendon entrapment with no cases of false-positive findings at the time of surgery [3]. In this same study, 10.2% of injuries were found to have associated peroneal retinaculum injury. A separate retrospective CT scan study of 312 fractures (91 pilon, 193 calcaneal, and 14 ankles with ipsilateral pilon and calcaneal fractures) found 99 occurrences of PT tendon entrapment or superior peroneal retinacular injury [8]. In this cohort, these findings were statistically significant in injuries with multiple fractures, with multifragmentary pilon fractures being significantly associated with posterior tibial and flexor digitorum longus tendon entrapment. This study also showed only 39% of tendon entrapments or retinacular injuries having been identified prospectively, again demonstrating the importance of careful consideration of the soft tissue components of these types of injuries.

In a Tresley et al., CT study, multifragmentary Sanders type 3 or 4 calcaneal fractures were significantly associated with superior peroneal retinacular injury [8]. Correlating with the second case presented, early identification of peroneal tendon dislocation secondary to a compromised superior peroneal retinaculum can help to influence surgical decision making and promote improved patient outcomes. Dislocated or subluxed peroneal tendons may reduce with calcaneal fracture reduction, though as seen in the case presented, this does not always occur [9].

Injury to the superior peroneal retinaculum can be identified several ways, with the first being via the so-called “fleck sign” [10]. The fleck sign is the result of a bony avulsion of the superior peroneal retinaculum from the fibula which can be identified on plain film radiograph and is strongly associated with superior peroneal retinacular injury [8, 10]. With calcaneal fractures, occurrence of the fleck sign ranges from 4 - 10.5% [8, 10]. Historically, Eckert and Davis classified the presence of a fleck sign as a grade-3 superior peroneal retinaculum injury, involving only osseous disruption, and found this presentation to be the least common among superior peroneal retinacular injuries [11]. In cases where bony disruption of the fibular attachment of the superior peroneal retinaculum cannot be identified, a CT scan may be necessary. In 2001, Ho et al., described the normal positioning of the peroneal tendons as being bounded by a triangle consisting of the lateral malleolus, the superior peroneal retinaculum, and the calcaneofibular ligament [12]. In the case of superior peroneal retinaculum injury, the peroneal tendons will be outside of this triangle, most commonly laterally. This presentation of the peroneal tendons can be seen in figure 2, with the peroneal tendons lying immediately lateral to the fibula on the axial CT scan.

Conclusion

Posterior tibial tendon entrapment and superior peroneal retinaculum injury are two of the most common soft tissue injuries associated with rearfoot and ankle fracture. These cases were presented to bring increasing awareness to these injuries and
provide imaging examples which might aid clinicians in making a diagnosis. It is vitally important to patient outcomes to have a high clinical index of suspicion with regards to soft tissue injury in the setting of these types of osseous injuries, as too often they go initially undiagnosed.

Conflict of Interest/Funding Declaration

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