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Case Report

Irreducible ankle fracture dislocation due to posterior tibialis tendon interposition: Diagnostic and clues for early management – A case report

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ABSTRACT

Irreducible fracture dislocation of the ankle is a rare condition. Multiple cases have been described throughout the literature. Different known etiologies involve the distal fibula, deltoïd ligament and tendons of the posteromedial malleolar region. More specifically, trapping of the Posterior tibialis tendon has been described at several levels from the inside of the ankle joint, through the syndesmosis and in some cases in the fibula tibial interosseous space depending on the energy of trauma. We hereafter propose a case report and a review of previous cases of posterior tibialis tendon dislocation proximally in the interosseous space of the lower leg. The aim of this review is to point out common features and clues for early management in order to avoid overlooking these rare lesions as they may lead to major functional impairment of the ankle joint.

Introduction

Ankle fracture dislocation is common in the emergency department. As for all joint dislocation it requires urgent reduction in order to relieve soft tissues pressure and avoid neurovascular issues. In some cases, dislocation remains irreducible. Several factors responsible have been described in the literature and may be summarized in two groups. The first group includes factors related to fibula: the irreducible ankle dislocation is due to anterior or posterior fibula dislocation as is the case for Bosworth fracture [1–3]. The second group, the soft tissues including deltoid ligament incarceration, posterior tibial tendon (PTT) and extensor digitorum entrapment in the distal tibiofibular joint. In rare cases, PTT entrapment in the distal tibiofibular syndesmosis or higher in the interosseous space can be found. The PTT runs across the anterior aspect of the tibia resulting in an irreducible ankle with anterolateral subluxation of the talus. Six cases have been reported to date from 1936 (Böhler) until recently by Lacasse et al. [4]. For these cases, Anderson and Hansen reported delayed diagnosis, leading to severe ankle osteoarthritis and ultimately an ankle arthrodesis [5].

To our Knowledge, we hereafter describe de seventh case of posterior tibial tendon entrapment in the tibiofibular interosseous space leading to an irreducible ankle dislocation. The aim of this case report is to remind this rare pathology and to review previous cases in order to highlight similarities between the cases and propose hints to allow early diagnosis and proper management.

Case

A 24 years old male was admitted to the emergency department after a traffic accident. He sustained an open fracture-dislocation

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Fig. 1. Pronation-abduction according to Laughe-Hansen classification.

of the right ankle. His neurovascular status was intact but he displayed a large open wound on the medial side of the ankle. X-rays showed a simple fracture of the fibula above the ankle joint, a severe syndesmosis injury with a loss of tibiofibular overlap, an anterolateral displacement of the talus as well as an increased medial clear space. We categorized the fracture as Pronation-abduction according to Lauge-Hansen classification or C-type regarding Danis-Weber (Fig. 1). The open wound on the medial side was a type II as described by Gustillo.

Early management consisted in irrigation and thorough debridement of the open wound, closed reduction and fixation by external device given the soft tissue condition. Unfortunately correct dislocation reduction wasn't obtained (Fig. 2). A second attempt under general anesthesia was finally successful. Internal fixation was delayed and the patient received antibiotics 48 h as recommended for open fracture management.

Surgery was performed under general anesthesia a month (30 days) following the initial trauma. A longitudinal lateral incision, extended distally in order to visualize the syndesmosis and the ankle joint, was performed. Anterior and posterior tibiofibular ligaments were torn such as the interosseous membrane. The fibula fracture was reduced and stabilized by a one third tubular plate. Attention was then driven on the syndesmosis which could not be reduced to its anatomical position. Decision was made to inspect

Fig. 2. 1st attempt for reduction failed.

Fig. 3. CT scan reconstruction showing the PTT dislocated through the interosseous space, crossing the anterior aspect of the tibia. Subsequent inversion of the foot.

the medial aspect of the ankle in order to release any soft tissue jeopardizing reduction. A medial approach revealed the interposition of the deltoid ligament in the medial gutter between the talus and the internal malleolus. After removing the deltoid ligament, the distal syndesmosis was reduced and stabilized by a cortical screw. Further dissection revealed an avulsion of the anterior talofibular ligament which was sutured by anchors. Finally, the deltoid ligament was repaired.

Unfortunately, final fluoroscopy showed a persisting displacement of the talus towards anterior and lateral and a remaining medial clear space.

Clueless, wounds were closed and a plaster cast was applied.

A postoperative CT scan was performed in order to investigate the cause of the persistent subluxation. Our radiology department reported the interposition of the posterior tibial tendon in the tibiofibular space running along the lateral side of the tibia from the medium third of the leg and crossing its anterior aspect in the metaphyseal area ending up at its anatomical insertion on the navicular bone (Fig. 3).

A revision surgery was conducted one week later. First step was to remove all the hardware. Only the sutures of the anterior fibulotalar ligament were kept intact. After careful dissection, the posterior tibial tendon was identified running from its distal insertion towards the ankle joint and disappearing in scar tissue at its anterior aspect (Figs. 4, 5). Further dissection was carried on the anterolateral aspect at the fibular fracture level. The PTT was identified lying underneath the anterior neurovascular bundle of the leg. The tendon wasn't torn or harmed (Fig. 6). After releasing it from the other structures, careful mobilization allowed us to bring

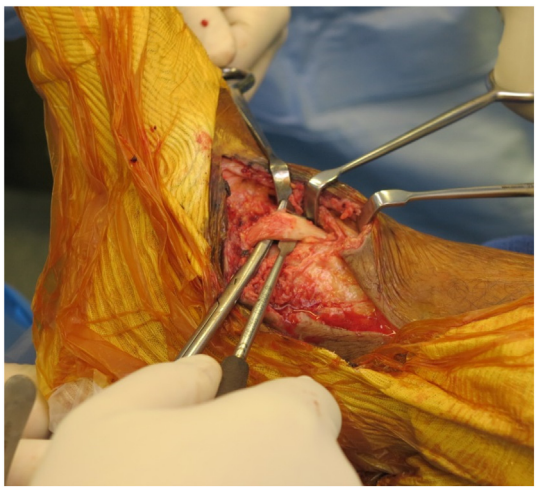

Fig. 4. PTT running anteriorly towards the ankle joint and disappearing in scar tissue.

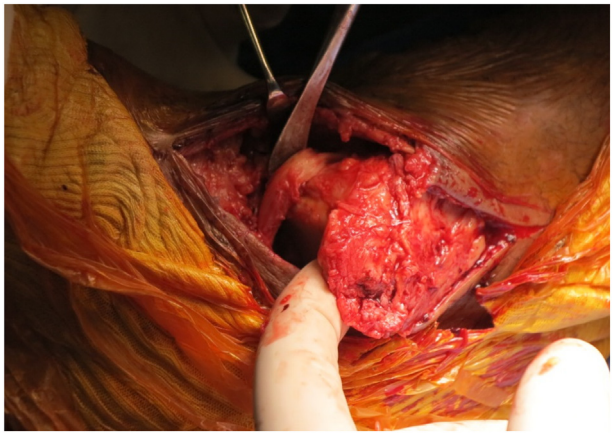

Fig. 5. Further dissection showing PTT running at the anterior aspect of the tibia from the interosseous space to its distal insertion.

Fig. 6. Anterior aspect of the leg: Dissected PTT → Anterior neurovascular bundle marqued in blue, visible running underneath scissors and retractor. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

him back to its normal position. It is important to note that one of the key steps in this procedure was to reproduce the dislocation of the ankle with a slight exaggeration of the deformity in order to allow the tendon to slide back through the ankle joint underneath the tibia. Finally, the fibular fracture was fixed, the distal syndesmosis stabilized and the deltoid ligament sutured. The retromalleolar retinaculum repair ended the procedure. Fluoroscopy showed an anatomical position of all bony elements and adequate stabilization. Unfortunately, the wound on the inner side of the ankle couldn't be totally closed and a final procedure for coverage by a cutaneous flap was done later on.

Discussion

Cases of irreducible fracture dislocation of the ankle have been described and illustrated in several studies and case reports. Different mechanisms are involved with either the fibula or soft tissues responsible for a persistent dislocation despite reduction attempts by the practician. Considering the soft tissues, the PTT is often incriminated in the process amongst with the deltoïd ligament and more rarely, as described by Pankovich, the FHL associated with the FDL tendons and the neurovascular bundle [6].

Entrapment of the PTT has been described in different locations, starting from the fracture site (of the internal or posterior malleoli itself) to the interosseous space between the tibia and fibula. The level of entrapment is correlated to the amount of energy involved during trauma [4]. Only few case reports, such as ours, describe an interosseous location. A review of the cases published in the literature allowed us to identify constant features: high energy trauma, AO 44-C2 fracture, distal tibiofibular dislocation and lateral talar translation with an increased internal clear space (or malleolar fracture) (Table 1).

In our institution, these ankle fracture-dislocations, even closed, often benefit from a two-stage procedure; first closed reduction and external fixation in order to allow soft tissue recovery and a delayed open reduction and internal fixation. If the surgeon, facing a 44-C2 type fracture matching the previous features, does not achieve anatomical reduction by external manoeuvers, further investigations must be carried out being aware that a tendon entrapment is possible. Final diagnosis is mandatory before ORIF in order

Table 1
Common features regarding the fracture identified throughout former cases reported.

Trauma energy	High
Classification	
• Weber	● Weber C
• Lauge-Hansen	● Pronation-external rotation (/Abduction)
• AO	● 44-C2
Rx	● Fibula type C fracture
	● Distal syndesmosis open (loss of tibiofibular overlap)
	● Anterolateral translation of the talus
	● Internal clear space or malleolar fracture.
Open?	+/−

to avoid multiple surgeries, high infection rates, and poor outcome [4,5,7–9]. Furthermore failure to achieve anatomical reduction has been described as the most important cause of ankle disability and therefore must not be tolerated [4].

Intraoperatively, the osteosynthesis aims for anatomical reduction and stable internal fixation by means of plate and screws. Additional sutures of the deltoïd ligament and/or lateral ligament may be carried out using anchors or knotless suture buttons. Repairing the retromalleolar retinaculum is mandatory to stabilize the posterior tibial tendon in the anatomic groove [10]. Because anatomical reduction will fail without a proper reduction of the tibial tendon we emphasize again the importance of a good diagnosis. During surgery, reducing manoeuvers forces the surgeon to recreate the tibio-talar dislocation in order to allow the tendon bundle to slide back to its anatomical position through the ankle joint. If missed, the abnormal position of the tendon will prevent reduction of the internal malleoli and the syndesmosis resulting in a mismatch on the mortise view. A clue to the interposition of the PTT is a persistent antero-lateral translation of the talus within the ankle mortise on the intraoperative AP and profile views which was constantly described in previous cases.

As mentioned previously, the surgeon must be suspicious of a PTT dislocation when facing the fracture pattern described above. Tendon lesions are frequently associated with hindfoot and ankle fracture. Misdiagnosed, it can lead to several negative outcomes: failed reductions, functional instability or tendon damage. One should rely on preoperative imaging to assess tendon involvement during trauma. Three tools are available to characterize tendon location and/or injury. MRI and ultrasonography are well described throughout literature for the tendon and ligament injuries investigation. Despite its accuracy, MRI should be, in our opinion, ruled out given it is hardly accessible and is contraindicated when a non MRI-compatible external fixator has been used in emergency. On the other hand, ultrasonography can be useful thanks to its readiness. Images of the retromaleolar region are easily obtained patient lying supine, hip abducted, knee flexed at 45° and foot on the lateral side. Transverse views of the retromalleolar groove are very effective in evaluating the position of the different tendons into the tarsal tunnel and therefore the presence of any dislocation. Longitudinal views are obtained in the supra and infra malleolar region, last of which shows the tendons insertion and incoming route [11,12]. Despite its advantages, the use of the ultrasonography is limited in acute trauma conditions by edema and presence of air in the soft tissues. Consequently, a lack of accuracy and image artefacts are to be expected. Last but not least, skin condition may compromise the procedure. On the other hand, progress in computerized tomography has been made providing an improved visualization of the soft tissues. Injury to the different tendons of the retromalleolar groove or their displacement from their anatomic position is frequently apparent on CT images [13]. Computerized tomography is routinely used by orthopedic surgeons for fracture pattern analysis and preoperative planning, therefore, early diagnosis of soft tissue incarceration is possible. Unfortunately, CT investigations may not detect all dislocations or tendon entrapment. If a PTT involvement is suspected, we suggest a stepwise analysis of the CT sequences in order to avoid overlooking the dislocation. First, The PTT should be looked after in its anatomical position; the retromalleolar groove. If missing, a careful investigation of its usual dislocation sites should be carried out: anterior aspect of the medial malleolus, inside the internal malleolar fracture site, … (Fig. 7).

Finally, follow the tendon from its distal insertion proximally to describe the precise location or tendon rupture (Fig. 8). We insist that CT sequences must be acquired before any use of hardware to limit the artefacts compromising the radiologic assessment. Temporary stabilization by pneumatic cast is ideal. To conclude, analyzing the preoperative CT scan is crucial for Orthopeadic surgeons and radiologists in order to avoid overlooking any tendon involvement [14].

Proper management leads to a good outcome even though numerous complications occur as described in all the cases reviewed. Anderson et al. described a case in which the management of the previously described fracture pattern led to fixed equinus and clawing of the toes. X-rays showed an anterolateral translation of the talus and a narrowing of the tibio-talar space signing osteoarthritis. They underwent ankle arthrodesis as salvage procedure during which the posterior tibial tendon dislocation was discovered.

Conclusion

Posterior tibial tendon entrapment resulting in an irreducible ankle fracture dislocation is a rare condition. The level of the tendon dislocation is correlated to the amount of energy involved during trauma. Proper management relies on an early diagnosis allowing a unique and accurate surgical procedure. Caution should be made when facing a fracture gathering the exposed features. Early CT scan must be performed before any fixation to avoid artefacts. Stepwise analysis of the preoperative CT images by surgeons and

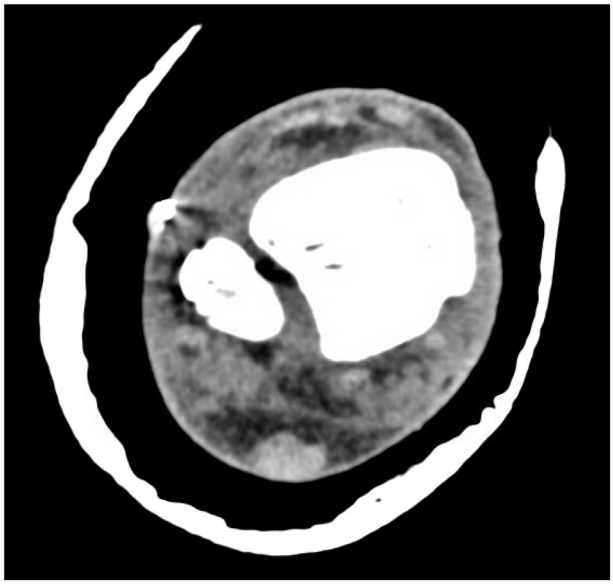

Fig. 7. Axial view of the retromalleolar region with missing PTT.

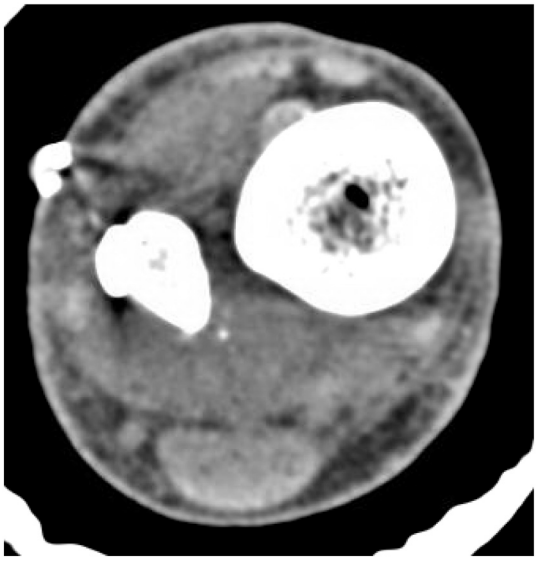

Fig. 8. Following tendon signal from its distal insertion allows identification of the structure at the anterior aspect of the distal tibia.

radiologists is mandatory for soft tissue assessment. MRI and ultrasonography can be considered, depending on patient soft tissue condition and availability in a specific institution.

Conflict of interest

No disclosure.

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