Chapter 11
Tongue-Type Calcaneus Fractures

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Case Presentation

History/Physical Exam

A healthy, active, 25-year-old male with no significant medical issues presented to our emergency department (ED) complaining of left foot pain and an inability to bear weight on the involved limb following a fall off of a second-story balcony. On physical exam he had pain to palpation over his hind foot, moderate swelling of the soft tissues over his calcaneus with significant ecchymosis, and areas of blanching skin over his posterior heel and was neurovascularly intact (Fig. 11.1). He did not have other complaints, nor any tenderness to palpation anywhere else.

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N.C. Tejwani (ed.), *Fractures of the Foot and Ankle*,
DOI 10.1007/978-3-319-60456-5_11,

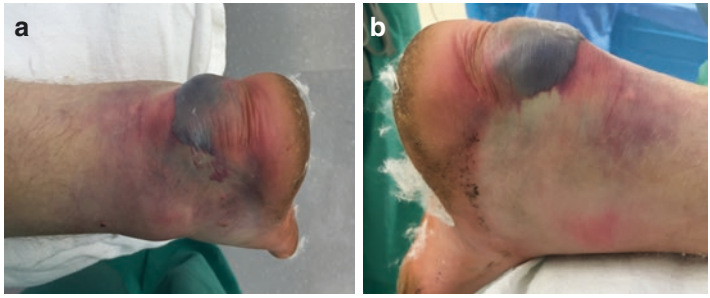

FIGURE 11.1 Soft-tissue appearance at the time of presentation to the emergency department

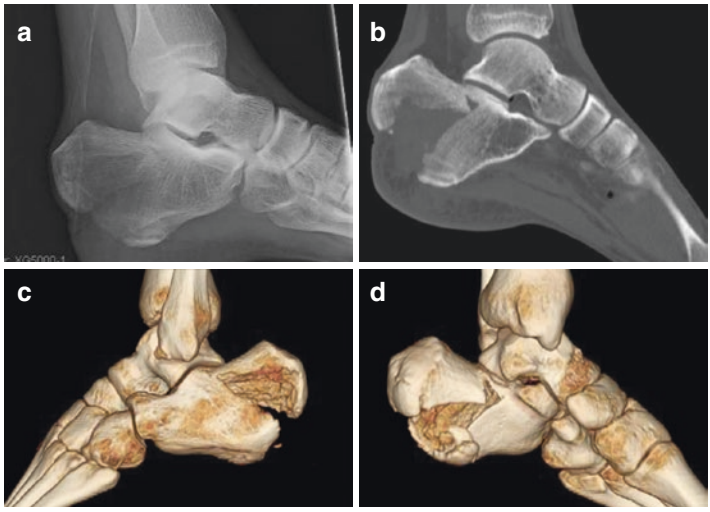

FIGURE 11.2 Plain radiographs and CT injury imaging

Radiographs

X-rays of his foot, ankle, as well as full-length tibia and fibula images (joint above and below) were obtained and showed a displaced calcaneal tuberosity tongue-type fracture. A CT scan was obtained to better delineate the injury and evaluate for any intra-articular extension into the posterior facet (Fig. 11.2).

Treatment and Timing of Surgery

This calcaneus fracture is a tongue-type injury and associated with significant soft-tissue compromise. The pressure of the displaced fragment compromising blood flow to the overlying soft tissues is reflected by the ecchymosis and skin blanching present at the time of presentation. This skin compromise requires urgent reduction and stabilization of the displaced bony fragment in the operating room to try and avoid a full-thickness soft-tissue loss. Due to this soft-tissue injury, we immediately began getting him ready to go to the operating room urgently.

In the ED, the patient was placed in a bulky Jones splint with his ankle in equinus to relax the deforming force of the Achilles tendon on the displaced fragment in the ED. This position may partly reduce the fracture and take some pressure off the soft tissues until the patient can go to the operating room. Patients with this type of fracture are typically admitted to the hospital for close monitoring of their skin envelope and brought rapidly to the operating room.

Surgical Plan

Overall Plan/Goal

Fracture reduction is the key for this case and we planned on using an escalating approach to obtain an appropriate reduction. Ideally this could be done percutaneously, but, if that were not possible we would escalate to a mini-open approach followed by a more extensile approach if needed. The key is to what is to what is necessary to take the pressure off the soft tissues while trying to protect the blood supply of the fracture fragments. In this case we were able to use small percutaneous incisions for reduction, clamp placement, and fixation.

Positioning in the Operating Room

The patient was placed in the prone position on a radiolucent foot extension so C-arm imaging cold be used intraoperatively, and both sides of the calcaneus are accessible.

The patient's foot was positioned at the end of the table to help facilitate access to the foot and for proper imaging. Either blankets or "bone foam" can be used to elevate the injured extremity above the other to facilitate obtaining a lateral image. This setup facilitates access to the posterior aspect of the patient's foot for reduction and fixation of the fracture. Alternatively, the lateral position could be used, but makes access to the medial side of the foot difficult if needed during the procedure.

Fracture Reduction

We began by unroofing and debriding the skin blisters. Fluoroscopy was then used to help plan our incisions by localizing and marking the positions of the fracture line and both fragments. The foot plantar-flexed to see how much that maneuver reduced the displaced tuberosity fragment. Once the fragments were closer together we used a combination of palpation and fluoroscopy to determine the positions of the superior and inferior aspects of the calcaneal tuberosity. The tines of a large Weber clamp were placed where we thought they would clamp the fragments together and their positions checked using a lateral fluoroscopic image prior to making stab incisions. Four 1-cm stab incisions were then made so we could place the tines of two large Weber clamps on the medial and lateral sides of the calcaneus to reduce and compress the fracture fragments. The clamps were positioned so they did not place any pressure on the already compromised soft tissues. The first time we clamped the fracture together we caused skin puckering on the medial side where soft tissue was trapped within the fracture site. After unclamping we made a small incision over this area and used an elevator to sweep the soft tissues out the fracture site. We were then able to re-clamp the fracture site without any soft tissues being trapped within the fracture site. We then obtained lateral and Harris heel views to check our reduction. 1.6 mm K-wires were then placed to help hold the reduction.

Fracture Fixation

Once we were satisfied with our reduction we placed three 3.2 mm guide wires for 6.5 mm cannulated screws from superior to inferior and perpendicular to the fracture line. We prefer to use larger fixation for fixation of the calcaneal tuberosity fixation if the size of the fragments allows this to counteract the strong pull of the Achilles tendon; however, successful treatment using screws as small as 2.7 mm has been described. Once we verified that the guide wires were in the proper positions on lateral and Harris axial heel views, we placed the appropriate length 6.5 mm cannulated screws through stab wounds (Fig. 11.3). We used a washer on one screw to aid in fixation and prevent intrusion of the screw into the tuberosity. Screw "traffic" prevented the use of a washer on all three screws. The stab incisions were closed with nylon sutures, Silvadene and Xeroform were placed over the unroofed blisters, and the patient was splinted in plantar flexion to protect the fixation/reduction.

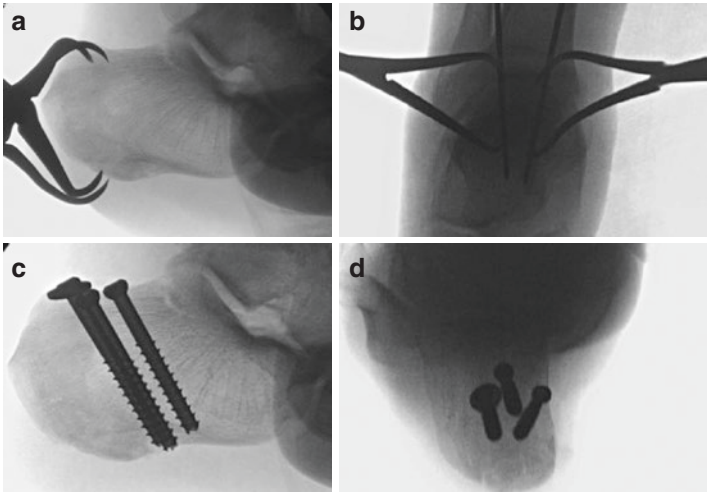

Figure 11.3 Intraoperative imaging

Postoperative Plan

A short leg posterior splint with a stirrup was placed in the operating room with the patient in their "resting" equinus position. Post-discharge follow-up timing is dependent on the condition of the skin at the time of discharge. At a minimum the patient is seen within 2 weeks for a skin check and suture removal. If the skin is questionable the patient will return sooner. If the fixation was felt to be "good" at the time of surgery (good bone and good "bite") and the soft tissues are well healed at 2-week postoperative check, we start the patient on gentle ankle range of motion at that time. If the fixation was less than optimal or the soft tissues need more "rest" we will slowly correct the equinus over the first 8 weeks postoperatively with either serial casting (never if the skin is compromised and/or requires wound care) or a CAM boot with decreasing heel lifts. The patient is kept toe touch weight bearing for the first 8 weeks.

At 8 weeks a radiograph is obtained (Fig. 11.4) and weight bearing is progressed over the next 4 weeks from toe touch to weight bearing as tolerated with pain being the limiting factor. At 3 months postoperative if the patients have been able to progress to full weight bearing and are comfortable, and X-rays show appropriate healing, we will allow the patient to begin strengthening exercises.

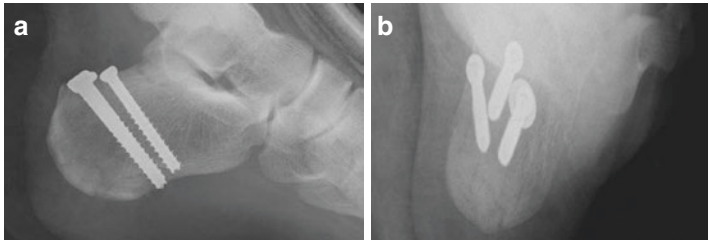

Figure 11.4 Postoperative plain radiographs

Salient Points/Pearls

- This fracture is one of the few remaining true orthopedic emergencies. The condition of the soft-tissue envelope is the key factor that dictates the urgency of treatment. Soft-tissues necrosis can quickly develop due to the blood supply compromise caused by direct pressure of the displaced fragment. Interposed soft tissues may block any provisional reduction that can be obtained with plantarflexion. Soft-tissue compromise has been seen in up to 21% of patients with tongue-type injuries [1, 2].
- Surgical approaches that have been used to address this fracture pattern include posteromedial, posterolateral, extensile lateral, sinus tarsi, direct posterior, and percutaneous approaches. Authors recommend allowing the soft-tissue envelope and the comfort of the surgeon to dictate which technique(s) is needed to obtain fracture reduction and fixation. Surgery is typically performed using either the prone or the lateral position. Fixation options include percutaneous screw placement to plate fixation with more open approaches [1–4].
- The most described reduction maneuver for tongue-type fractures is the Essex-Lopresti maneuver. This involves percutaneously placing K-wires/Steinmann pins into the proximally displaced fragment parallel to the fracture line. The mid foot is the held in one hand and plantarflexed. Simultaneously a proximal to distal force is placed through the wires close down the fracture site. This is held is this position until provisional fixation can be achieved. This method was seen to give an accurate reduction in up to 88% of the cases [2, 3].
- The primary deforming force on the calcaneal tuberosity is the insertion of the Achilles tendon. This needs to be considered for any possible preexisting contractures. Some authors have advocated gastrocnemius recession or tendo-achilles lengthening to help reduce the deforming force on fracture fixation [4].

References

1. Gardner MJ, Nork SE, Barei DP, Kramer PA, Sangeorzan BJ, Benirschke SK. Secondary soft tissue compromise in tongue-type calcaneus fractures. J Orthop Trauma. 2008;22(7):439–45. doi:10.1097/BOT.0b013e31817ace7e.
2. Letournel E. Open treatment of acute calcaneal fractures. Clin Orthop Relat Res. 1993;290:60–7.
3. Tornetta P. The Essex-Lopresti reduction for calcaneal fractures revisited. J Orthop Trauma. 1998;12(7):469–73.
4. Banerjee R, Chao JC, Taylor R, Siddiqui A. Management of calcaneal tuberosity fractures. J Am Acad Orthop Surg. 2012;20(4):253–8. doi:10.5435/JAAOS-20-04-253.