Summary: We present a case of a displaced Hawkins III talar neck fracture with a concomitant distal tibia fracture localized to the medial malleolus and articular surface. Surgical treatment options have increased over the recent years. We demonstrate an example of using mini-fragment fixation to maintain our reduction and lead to a favorable result in the setting of this potentially devastating and life-altering injury.

Level of Evidence: Level V.

Key Words: talus, pilon, mini-fragment, fracture

INTRODUCTION

Fractures of the talus continue to be a challenging problem for the orthopaedic trauma surgeon. There are many attributes of the local anatomy and nature of the injury, which make this a complex situation. First, the blood supply to the talus is tenuous because there are no muscular attachments to the talus and 60% of its surface is covered in cartilage.1 The blood supply is at risk with any displaced fracture and even more so with fracture dislocations.2 Second, the soft tissue envelope is not robust at this level of the leg due to the lack of surrounding muscle bellies and plethora of tendons crossing the ankle joint from the lower leg to the foot.3 Many of these fractures are open on presentation and if not, the skin is at risk for breakdown without urgent reduction of the displaced talus. Third, fractures of the talus frequently occur in polytrauma patients. There is a high incidence not only of ipsilateral lower extremity trauma but also to the other extremities as well, which complicate the surgical timing and rehabilitation.4

Over the years, our understanding of these complex and potentially devastating injuries has increased. We are very cognizant to protect the blood supply with our surgical approaches and maintain the integrity of the skin at all steps of management. We know the most important factor which is in the surgeons control for a good outcome is an anatomic, stable reduction.5 As our understanding of these injuries has increased, so have our implant options. Plate fixation of the talus was first described in 2002 with mini-fragment screw options, but now these plates have evolved and also include locking technology.6

CASE REPORT

A 59-year-old man presents after a 5-foot fall off of a ladder. During the fall, his left foot was entrapped in a ladder rung and his body weight rotated around his ankle. After his fall, he noted immediate pain, deformity, and swelling of the left foot and ankle. He did not have any other complaints on arrival. He had no previous injuries to this extremity. Of note, he smokes 1 pack of cigarettes per day and drinks an average of 21 beers per week.

Physical examination demonstrates a gross deformity of the left foot and ankle. He is in no acute distress. There is no pain in the bilateral upper extremities and right lower extremity. All uninjured joints have full painless motion and no tenderness to palpation. The skin about the left ankle is intact but is severely tented by the displaced bony structures. The dorsalis pedis pulse is palpable. His sensation is normal in all distributions about the foot except for the tibial distribution, which is diminished. Ankle dorsiflexion and plantarflexion were not able to be assessed. The
great toe was in a fixed flexed position. Flicker toe flexion and extension were present.

Standard 3 views of the foot and ankle were obtained, which demonstrated a Hawkins III talar neck fracture. The body was dislocated posterior and medially, and there was also a displaced fracture of the anterior-medial tibial plafond (Figs. 1A, B). Because his skin was at risk and his examination was consistent with impingement of the posterior-medial neurovascular bundle, he was taken emergently to the operating room for open reduction and provisional k-wire fixation. The time from presentation to operating room was 3 hours.

A standard medial approach to the talus was utilized using an incision extending from the base of the first metatarsal, in line with the talar neck, and proximally along the medial malleolus. Using the incision and through the medial malleolus fracture site, the displaced talar body fragment was identified and found to be impinging on the neurovascular bundle. A calcaneal transfixion pain was used for traction and a 4-mm half pin was placed in the talar body. Then, we were able to reduce the talar body while protecting the neurovascular bundle. A delta frame external fixator was applied after the skin was closed.

Immediately postoperatively, his great toe flexion contracture was corrected. Also, his sensation and motor function were normal throughout the foot. A CT of the ankle in the external fixator demonstrated a talar neck fracture and displaced fracture of the anterior-medial tibial plafond, which extended to the medial malleolus (Figs. 2A–C). He was admitted for aggressive ice and elevation to ensure an expedient timeline to his definitive surgery. His swelling was reduced enough at postoperative day 4 to proceed with definitive fixation.

We utilized the previous medial incision and extended it 15 cm proximally along the medial tibia to provide adequate access to the anterior-medial pilon fracture. Then, we made a lateral incision in line with the fourth metatarsal and the fibula shaft to obtain access to the lateral talus. Using both incisions, we obtained an anatomic reduction, which was held by multiple k-wires. Next, a 2.7-mm T plate was contoured to the lateral talus with the T placed distally. The most proximal hole was bent, cut, and tines were created for a spring hook plate. We first placed bicortical non-locking screws into the talus body, then the neck, and finally locking screws in the plate to increase our stability. We then placed a 4.0-mm partially threaded cannulated screw on the medial side of the talus followed by a 3.5-mm fully threaded screw. Finally, we turned our attention to the tibia. A large metaphyseal defect was present at the fracture site and calcium phosphate cement was used to fill the void. The articular pieces were anatomically reduced over it, held in place.
with k-wires, and a 2.7-mm precontoured medial distal tibia plate was used to stabilize the medial malleolus fragment. This plate has spring hook tines to engage the medial malleolus. The plate was fixed using an antiglide technique. Finally, an additional 2.7-mm plate was placed over the anterior distal tibia segment with the tines in the articular fragment. Two locking screws were placed in the distal segment and then non-locking screws proximally to contour the plate. After all fragments were stabilized, the external fixator was reapplied to further protect the ankle because he had multiple risk factors in his social history that could lead to increased complications. Intraoperative fluoroscopic images are shown in Figures 3A, B.

His wounds healed without complication. The external fixator was removed at 6 weeks. At that time, range of motion was initiated and a dynamic range of motion brace was fitted. He remained non-weight-bearing on the operative extremity for 10 weeks, at which time he was allowed 25% weight-bearing, and a Hawkins sign was present (Fig. 4). At 15 weeks, he was full weight-bearing in a fracture boot. His boot was weaned at 19 weeks, and at that time, he returned to work part-time as a laborer. Final follow-up was at 6 months postoperatively, when he had no complaints and was functioning well.

Radiographs demonstrated complete healing of all fractures in great alignment and moderate arthritic changes at the anterior-medial ankle joint (Figs. 5A, B).

**DISCUSSION**

Our patient was very fortunate to have a good outcome after his injury. He was able to return to his previous level of functioning with no major disability. We do not have follow-up at 1 and 2 years, which would tell us if he did get avascular necrosis of the talus. The presence of the Hawkins sign is reassuring that his risk is lower than if it was not present.7

We used the principle of fragment-specific fixation in this case. This has been popularized in the treatment of distal radius fractures, and now implants are becoming available for other periarticular injuries, as we have demonstrated here.8 Conventionally, we have used thick, stout implants with 3.5-mm or larger screws to address these injuries. The major downside is implant prominence because of their thickness in areas where there is minimal muscle between the skin and bone. Now with 2.0-, 2.4-, and 2.7-mm screws and corresponding plates, we have thinner implants to put in these areas. They are of course less stiff than their thicker counterparts, but they are applied specifically to fragments and columns, which are critical to stability of the joint. The targeted use of implants where their impact is greatest allows the use of smaller, less robust implants to provide stability.9 Also, multiple implants can be inserted through the same incision to provide multi-planar stability around the fracture. The use of these thinner plates in multiple planes has been shown to provide the strength and stiffness needed for healing in the clavicle.10 With the use of the thinner implants, we have a decreased need for their removal as a result of being symptomatic to our patients.10 There is also potentially a decreased risk of wound complications because there is less pressure on the already traumatized skin.

As with all new technology, we must adhere to excellent principles to get a good result. There are not any implants that can overcome a violation of the principles of fracture fixation. Also, there is not a single implant that is useful in every situation. We must rely on our training and experience to properly use new
technology as it arises to help our patients through these difficult problems.

REFERENCES


FIGURE 5. A and B, Anteroposterior and lateral of the ankle show healed fractures and maintenance of the anatomic reduction at 6 months with moderate arthritic radiographic changes.