Combined Ankle and Talus Fractures
A Case Report

Justin Weatherall, M.D.,† Ran Schwarzkopf, M.D. M.Sc.,† and Steven Sheskier, M.D.

Abstract
A 50-year-old male patient sustained a supination-adduction type ankle fracture with an associated sagittal split fracture of the talus. The patient was treated initially in a short leg splint, and upon presentation to an orthopaedic surgeon, an external fixator was applied. After the soft tissue swelling improved enough to permit open reduction and internal fixation, the patient was brought back to the operating room for definitive treatment with removal of the external fixator and open reduction and placement of internal fixation. The patient’s postoperative course was uncomplicated. At the 6-week follow-up visit, he was noted to have a radiographic HAWKIN’S sign in the dome of the talus. At 3 months postoperatively, he was weightbearing as tolerated with radiographic evidence of fracture healing, and his ankle range of motion was from 30° of plantar flexion to 15° of dorsiflexion. At 6 months postoperatively, the patient had no complaints and was ambulating in a regular shoe. His plantar flexion was 35° and his dorsiflexion was 15°. His subtalar motion was from 5° of eversion to 10° of inversion. He returned for his one-year follow-up doing well without complaints, and he had returned to his previous activities.

Ankle fractures are a common injury whose incidence has been increasing over the past 50 years, especially in people over 60.1 A Finnish study published in 2000 reported the incidence of ankle fractures in people over 60 years of age to be 174 per 100,000 persons per year.2 Bimalleolar ankle fractures comprise approximately 25% of all ankle fractures.3 Of the four types of ankle fractures classified by Lauge-Hansen, supination-adduction injuries accounted for approximately 10% to 20% of malleolar fractures.4 Compared to ankle fractures the incidence of talus fractures is much lower with an incidence of approximately 0.3%, and they occur more commonly in younger patients. Talar body fractures comprise about 60% of all talus fractures.5,6

The combination of a bimalleolar ankle and talus fracture is very rare with only two reports in the published literature.7,8 Most injuries that involve both ankle and talus include a talar body fracture and a single malleolar fracture.9,10 A combined bimalleolar ankle fracture with an associated talar neck fracture has been reported.7 Only one other case report was found in the literature that refers to a bimalleolar ankle fracture with a talar body fracture in a polytrauma patient.8 The case presented below is a bimalleolar supination-adduction ankle fracture with an associated sagittal split fracture of the body of the talus. Informed written consent was obtained for this report prior to submission for publication. This case report is IRB exempt.

Case Report
Fifty-year-old male patient presented to the emergency room after falling from a five-foot ladder and twisting his right ankle. On exam the patient sustained and isolated right ankle injury, radiographs revealed a supination-adduction ankle fracture (Fig. 1), due to the high suspicion of a talar injury on x-ray the patient underwent CT imaging as well that revealed a sagittal talus fracture (Fig. 2). The patient was treated with a short leg splint in the emergency room and discharged with instructions to follow up with an orthopaedic surgeon. The patient was taken to the operating room 3 days after the initial injury for placement of an external fixator, because the patient’s soft tissues precluded the placement of internal

fixation (Fig. 3). The patient was followed for a period of 17 days, for soft tissue recovery, before he returned to the operating room for open reduction and internal fixation of his ankle and talar body fractures.

The talus fracture was surgically fixed through a medial approach. The fractured medial malleolus was evverted, the deltoid ligament was protected, and the fracture was reduced and fixed with two AO cancellous screws. The medial malleolar fracture was also reduced and fixed with a 7-hole (Synthes USA, West Chester, PA) contoured plate. The lateral malleolus was fixed through a lateral approach, and reduction and fixation was achieved with a 1/3 tubular plate and screws (Synthes USA, West Chester, PA) (Fig. 3). The right ankle was kept in a short-leg posterior splint with a plaster stirrup for 2 weeks, and the patient was instructed to be non-weightbearing during this period. On his 2-week postoperative visit, the splint was removed, and wounds were examined and found to be well healed. The patient was kept non-weightbearing for 4 more weeks in a removable solid boot and instructed to start active range of motion exercises.

Radiographs performed at 6 weeks postoperatively showed the presence of a Hawkin’s sign in the dome of the talus. The patient was instructed to start physical therapy and to gradually begin weightbearing on his right lower extremity.

On the 3-month postoperative follow-up, the patient ambulated with a normal gait without the aid of any assistive devices. On examination, range of motion was 30° of plantar flexion and 15° of dorsiflexion. Radiographs showed continual bony healing. At the 6-month postoperative visit, the patient was ambulating with a regular shoe, and he had no complaints of pain. His ankle range of motion was measured as 35° of plantar flexion and 15° of dorsiflexion. His subtalar motion was from 5° of eversion to 10° of inversion.

At 1 year, radiographs showed complete bony union (Fig.
4) with very early degenerative changes of the ankle joint. The patient had returned to his usual activities and had no complaints.

**Discussion**

Combined fracture of the ankle and talus is an uncommon fracture pattern. The only other report of this type of fracture in the literature was published by Verettas and colleagues in 2008. They proposed a mechanism of inversion, axial loading, and external rotation. We propose that this fracture occurs through a different, but predictable mechanism. Based on the work by Lauge-Hansen, this fracture begins with a supinated foot and an adduction force. As the talus subluxes medially out of the ankle joint, an axial load is then applied onto the talus, which causes the sagittal split in the talus. The classic description of a supination-adduction injury is a vertical split fracture of the medial malleolus with a fracture below the level of the syndesmosis. The supination-adduction mechanism described by Lauge-Hansen involved two stages. The first stage begins with failure of the lateral malleolus or lateral ligaments. The second stage is a vertical fracture of the medial malleolus, which may also involve some impaction of the joint surface on the medial aspect of the tibial plafond (Fig. 5). We propose that this fracture is the third stage of Lauge-Hansen’s mechanism of injury with the addition of the axial load. Therefore, this injury occurs through a supination-adduction-axial force pattern and is the third stage of the Lauge-Hansen classification of supination-adduction injuries (Fig. 5). Based on this presumed mechanism of failure, we planned our choice of fixation. The patient presented with a vertical fracture through the medial malleolus; therefore, this fracture pattern may be treated with...
an anti-glide plate placed at the apex of the fracture with the possible addition of lag screws across the fracture through the distal holes of the plate. Other reported techniques for fixing vertical medial malleolar fractures are to place two transverse lag screws instead of or in combination with an anti-glide plate or to insert screws directed proximally from the tip of the medial malleolus. A study in 2008 compared two screws to a plate and the investigators found the plate construct had a significant mechanical advantage compared to the two screws. In the other case report of a bimalleolar ankle fracture with a talus body fracture, the investigators chose to treat the vertical medial malleolus fracture with one screw inserted at the tip of the medial malleolus directed proximally and neutralization plate on the distal fibula. The talus body fracture was treated with a single transverse lag screw.

The typical mechanism of isolated talus body fractures is an axial load. Most talus fractures will be diagnosed on standard imaging of the foot, but non-displaced fractures of the talus may only be appreciated on CT imaging. CT is the optimal imaging modality in talus body fractures especially in the presence of comminution. A CT scan was obtained in this case to fully appreciate the characteristics of the talus body fracture and to assess the amount of distal tibia articular impaction at the site of the medial malleolus fracture.

Typically, this is a high injury pattern, which requires attention to the soft tissues. Since this fracture involves the articular surface of the talus and the tibial plafond in the ankle joint as well as the subtalar joint, anatomic reduction of these intra-articular fractures is essential in order to preserve normal biomechanical loads through the ankle and subtalar joints. Due to the high energy nature of these types of fractures, extensive damage to the cartilage of both the talar dome, subtalar joint, and tibial plafond is to be expected. Debridement of any loose fragments in the joints should occur at the time of surgery. Major talar body fractures have been shown to be associated with a high incidence of complications. Osteonecrosis of the talus has been reported in up to 50% of patients, and open fractures will typically have a poor prognosis. The bimalleolar component of this injury in isolation will typically have a good outcome. The talar body fracture is at risk of developing osteonecrosis, but mild degenerative changes were present in the ankle joint. Continued regular follow-up in this patient is required to monitor for the progression of his post-traumatic arthrosis.

Conclusion

Based on our case report, the mechanism for associated ankle and talus body fractures involves the adduction force of the supinated foot, which causes a shear fracture of the medial malleolus followed by an axial load on the dome of the talus. When severe enough, it causes a sagittal split fracture through the body of the talus. In a talar body fracture, the fracture line passes posterior to the lateral talar process. Axial compression is the most common mechanism of
talar body fractures. Due to the complex geometry of the hindfoot, CT is often the optimal imaging modality for these fractures, especially when the fracture is non-displaced. These are high-energy injuries, and close attention to the condition of the soft tissues is paramount prior to performing open reduction and internal fixation. Close observation postoperatively is critical since the lateral talar dome may have been devascularized at the time of injury and may develop osteonecrosis.

Disclosure Statement
None of the authors have a financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

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