

Bosworth fracture with proximal fibula entrapped within posterior pilon variant: A case report

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A Bosworth fracture is a rare injury that can result in an irreducible dislocation of the ankle joint. This case study presents a rare form of a Bosworth fracture in which the proximal portion of the fibula was entrapped within the posterior tubercle fracture of a pilon variant. It is important for physicians to be aware of rare variants of ankle fractures in order to diagnose and treat appropriately.

Keywords: Bosworth fracture, posterior malleolar fracture, irreducible trimalleolar fracture

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The Bosworth fracture is described as an irreducible ankle fracture-dislocation in which the proximal portion of the fibula is dislocated posterior to the posterior tubercle of the tibia. Though it has been described in the literature previously, it has become known as a Bosworth fracture due to a paper published in 1947 by Dr. David Bosworth, in which he described 5 patients in a case series. There have been over 60 cases reported since the original article [1].

It is reported in the literature that urgent surgery is required due to the irreducible nature of the Bosworth fracture by closed reduction. This is due to compromise of the soft tissue envelope seen with skin tenting from bone protrusion, neurovascular compromise, and compressive damage to talar and tibial cartilage [2]. The irreducibility has been attributed to an intact interosseous membrane holding the fibula posterior to the posterior tubercle [3].

Repeated attempts at closed reduction has been implicated in poor outcomes as well, causing increased damage to the soft tissue and articular cartilage [4].

There are multiple reasons that a fracture may resist closed reduction, the most common being interposition of soft tissue including the neurovascular bundle as well as the flexor tendons [2]. Fracture fragments may also become interposed in the joint, inhibiting motion [2]. Several variants have been described in the literature, including Bosworth fractures with an intact fibula, medial malleolar fractures, posterior tibial tubercle fractures, and deltoid ligament ruptures [3].

This case report presents a rare case of an irreducible trimalleolar ankle fracture with a Bosworth fracture, in which the proximal portion of the fibula was entrapped within the posterior malleolar fracture.

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Figure 1 Pre-reduction radiographs.



Figure 2 Post-reduction radiographs.

Case Report

A 37-year old female with past medical history significant for obesity presented to the emergency department with right leg pain extending from the knee to the ankle. She had fallen off of an electric bike when she swerved to avoid a car one hour prior to presentation. The patient reported 10/10 pain and inability to bear weight. On physical exam, her right lower extremity was neurovascularly intact. There was ecchymosis noted to the ankle and mild edema consistent with a closed fracture dislocation. The foot appeared to be externally rotated. Even under conscious sedation, it was noted to be a difficult ankle reduction. Post reduction radiographs demonstrated improved alignment with the talus relocated beneath the tibia (Figure 2). A Computed Tomography (CT) Scan was ordered and surgery was scheduled. CT imaging revealed that the proximal portion of the fibula was dislocated behind the posterior lip of the tibia within the posterior tubercle fracture, inhibiting full reduction.



Figure 3 Preoperative CT demonstrating fibular entrapment within the posterior tubercle fracture.

The posterior tubercle fracture was noted to extend through the medial malleolus, with multiple comminuted fragments (Figure 3). There was another fracture noted at the tip of the medial malleolus. The injury appeared to be a supination external rotation type fracture, with blunt trauma from the talus and fibula resulting in a posterior pilon variant fracture.

Surgery was performed in a supine position. A lateral incision was made over the distal fibula. A large bone hook was used to wrap around the mid-portion of the fibula, and the fibula was successfully reduced into the incisura. Due to the degree of comminution, no interfragmentary screw was placed. A locking plate was utilized after fibular length was successfully restored. The posterior malleolus had been successfully reduced at this point. An anterior-to-posterior cannulated screw was advanced across the distal tibia, perpendicular to the fracture line. Next, a medial incision was made. The distal medial malleolar fracture fragment was noted to be comminuted and angled distal medial to proximal lateral, precluding the use of a hook plate. Cerclage wire was used in order to fixate this fracture fragment. A Hook test revealed significant gapping at the syndesmosis. A pelvic reduction clamp was used to reduce the syndesmosis and a fully threaded trans-syndesmotomic screw was placed from the fibula into the tibia.



Figure 4 Postoperative radiograph one week status post open reduction with internal fixation. Cerclage wire noted to be broken.

The incisions were closed and the patient was placed in a posterior splint. She was discharged home with instructions to remain non-weight bearing to her right lower extremity.

The patient was examined regularly post-operatively (Figure 4). In accordance with pre-operative planning, the patient was taken back to the operating room approximately 8 weeks later and the syndesmosotic screw was removed and replaced with a non-absorbable suture button device. By 12 weeks postoperatively the patient was walking in a CAM walker with minimal pain and undergoing physical therapy.

Discussion

Bosworth fractures are uncommon amongst ankle fractures, with one study reporting 51 out of 3,140 patients, or 1.62% [5]. This is the only prevalence study that has been performed due to the rarity of this fracture pattern.



Figure 5 Postoperative radiographs one week status post syndesmosotic screw replacement with tightrope.

There are many variants, associated injuries, and complications reported with the Bosworth fracture, including dislocation with an intact fibula, rupture of the deltoid ligament, medial malleolar fracture, posterior tibial tubercle fracture, increased risk of compartment syndrome, avascular necrosis of the talus, osteoarthritis of the ankle, neurovascular injury, joint stiffness, osteochondral lesions, skin necrosis, and wound infection [3-5].

Radiographic signs of a Bosworth fracture include widening of the medial joint space, posterior displacement of the fibula on lateral radiographs, and overlap of the proximal fibular fracture fragment with the distal tibia on the anteroposterior view [4]. Unfortunately, these signs can all be interpreted as poor radiographic technique in terms of positioning [1]. It has been proposed that external oblique radiographs may be a useful tool to diagnose this injury by measuring the displacement of the fibular shaft [6]. The “axilla sign” has also been described, resulting from the internal rotation of the tibia when the fibula is posteriorly dislocated. It appears on the mortise view at the medial tibial plafond as a cortical radiodensity [7].

There has been conflicting data in the literature in regards to timing of surgery and outcome. One study of 15 patients with Bosworth fractures found that patients who underwent surgical open reduction and internal fixation within 24 hours had better functional outcomes. In addition, this study showed that intermediate-term clinical outcomes were comparable between Bosworth fractures and other ankle fracture dislocation types [4].

Aggressive attempts at closed reduction are not advised due to the possibility of increasing trauma to the fibula, cartilage, and surrounding soft tissues [5]. One study found poorer clinical outcomes associated with multiple attempts at closed reduction [4]. Due to the difficulty of diagnosis on radiographs, general belief that early surgical intervention leads to better outcomes, and poorer outcomes in regard to multiple closed reduction attempts, it is important for physicians to have a high index of suspicion for fracture dislocations resisting reduction and low threshold for CT imaging.

In terms of surgical approach, a lateral incision was made over the fibula in order to reduce the fracture. Although adequate, a posterolateral approach may have allowed more exposure of the deformity for evaluation and correction.

One cadaveric study reported a mechanism for the Bosworth fracture, noting that the mechanism is external rotation on a supinating foot. Stage one and two involve the fibula being posteriorly dislocated out of the fibular notch with rupture of the anterior and posterior tibiofibular ligaments, respectively. In stage three, the anterior medial ankle joint capsule ruptures. Stage four involved tearing of the interosseous membrane, followed by entrapment of the fibula posterior to the tibia in stage five. Finally, further rotation of the talus results in an oblique fracture of the fibula in stage six, and deltoid rupture or medial malleolus fracture in stage seven [8].

There is one other reported case of a Bosworth fracture with the proximal fibular fracture fragment dislocated within the posterior tubercle portion of a pilon fracture [9]. This has been predicted to be a rare form of injury due to the nature of pilon fractures. There is often comminution of the posterior tubercle which can include fracture of the posterior lip of the fibular groove, precluding the possibility of the proximal fibula becoming trapped behind the posterior lip and between large fracture fragments [1].

Conclusion

This case study presented a rare form of Bosworth fracture in which the proximal portion of the fibula was entrapped within the posterior tubercle of a trimalleolar ankle fracture dislocation. It is important for physicians to be aware of rare variants and have a high index of suspicion in ankle fractures that are difficult to reduce in order to diagnose and treat appropriately. Further imaging should be performed to evaluate the deformity, as this form of ankle fracture is easily identified with a CT scan. In these cases, surgery should be strongly considered due to the poor prognosis with conservative treatment.

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