Case Report

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Rare Bosworth Fracture-Dislocation Variant of an Irreducible Distal Fibula Dislocation of the Ankle Without Fibula Fracture

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Abstract

Background: Irreducible fracture-dislocations of the ankle are rare orthopedic emergencies that should not be missed. The Bosworth fracture-dislocation is a rare fracture where an incarcerated fibula fragment remains locked behind the posterior lateral tubercle of the tibia. We present a case describing a variation of a Bosworth injury, with a dislocation of an intact distal fibula with an associated medial malleolus fracture.

Methods: Our patient is a 55-year old male who presented to the emergency department with a left ankle injury after being involved in a road traffic accident. Radiographs show a posterior dislocation of an intact distal fibula associated with a fracture of the medial malleolus and disruption of the ankle mortise.

Results: An attempt to reduce the dislocation at the emergency department under sedation was unsuccessful. The patient was subsequently taken to the operating theatre for manipulation and reduction and application of an external fixator. Definitive fixation was performed successfully a week later.

Conclusion: A high index of suspicion is critical for diagnosing a Bosworth fracture-dislocation, as this diagnosis is commonly missed. Early diagnosis and proper surgical anatomic reduction are important to prevent chronic ankle instability and evolution towards ankle arthritis.

Level of Evidence: Level IV, case study.

Keywords: ankle injury, dislocation, irreducible, syndesmosis

Acute fracture-dislocations of the ankle occur commonly, but there are only a few reports of those that are difficult to reduce.[5,16,18] The Bosworth fracture-dislocation is an uncommon irreducible dislocation that occurs in conjunction with a supination external rotation (SER) ankle fracture. This injury pattern was first described in 1947 and involved 5 such cases of a fracture-dislocation of the ankle.[4] Subsequently, more than a hundred such cases of the Bosworth fracture-dislocation have been reported in the literature.[2]

Some variants, such as an intact dislocated fibula associated with a medial malleolus fracture, have been described.[11] When poorly managed, Bosworth injuries can lead to chronic ligament injuries, compartment syndrome, and posttraumatic arthritis. Mismanagement of this injury pattern is usually due to a poor understanding of the fracture pattern and its severity. We report a case of a variation of the Bosworth injury, with a dislocation of an intact distal fibula and intact proximal tibiofibula joint and an associated medial malleolus fracture, and discuss the mechanism of injury, workup, and treatment for this rare injury.

Case Report

A 55-year-old man presented to the emergency department in August 2015 after being involved in a road traffic accident

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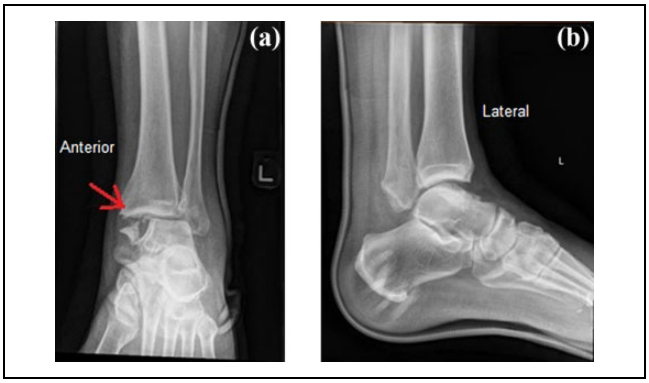

Figure 1. (a) Preoperative anteroposterior radiograph of the left ankle. (b) Preoperative lateral radiograph of the left ankle.

Figure 2. Anteroposterior and lateral preoperative radiographs of the left tibia/fibula.

where his left ankle was caught under his motorcycle. He reported a twisting injury of the ankle and was unable to bear weight immediately after the accident. There was severe pain, substantial swelling, and deformity of the ankle. Sensation and distal pulses of the foot were intact. Radiographs were taken showing a posterior dislocation of an intact distal fibula associated with a fracture of the medial malleolus and disruption of the ankle mortise (Figure 1a,b). Full-length tibia and fibula radiographs did not demonstrate any other fractures or proximal tibiofibula dislocation (Figure 2). Initial attempts at closed reduction under sedation were unsuccessful. The patient was subsequently taken to the operating theater for reduction under general anesthesia and application of an external fixator. Multiple attempts at closed reduction under general anesthesia were made after the Schanz pins were inserted in the calcaneum and traction was applied. However, the fibula was still noted to be posterior in relation to the tibia with a widening of the medial tibiotalar space (Figure 3). A decision was made for application of an external fixator for better stability while waiting for swelling and soft tissue edema to subside.

A computed tomography (CT) scan was obtained the following day to further assess the injury pattern (Figure 4). The scan demonstrated a posterior dislocation of an intact fibula behind the posterolateral ridge of the distal tibia, with a horizontal fracture through the medial malleolus with mild comminution and disruption of the ankle mortise.

Figure 3. Anteroposterior and lateral radiographs after external fixation, showing persistent posterior dislocation of the distal fibula.

Figure 4. Computed tomography scan of the left ankle.

A ligamentous lisfranc injury was also reported on the scan. The patient was monitored closely over the next couple of days for signs or symptoms of neurovascular compromise. He was brought into the operating theater again 5 days post-injury after swelling had subsided. The ankle was approached via an anterolateral incision to the distal fibula, syndesmosis was debrided, and reduction was achieved by using a Hohmann retractor to lever the fibula into place. Open reduction and internal fixation of the medial malleolus fracture was reduced and fixed with 2 partially threaded cancellous screws. Fixation was not ideal, and the medial malleolus was slightly displaced laterally. However, the fracture eventually went on to heal without complications. Due to persistent instability with syndesmosis disruption,

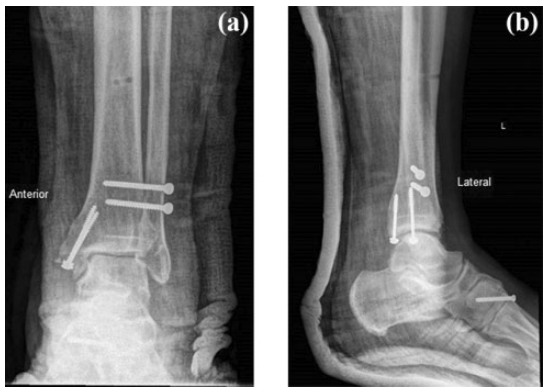

Figure 5. (a) Postoperative anteroposterior radiograph of the left ankle. (b) Postoperative lateral radiograph of the left ankle.

2 tricortical syndesmotic screws were inserted after the syndesmosis was reduced with a clamp. Reduction was checked with an intraoperative image intensifier. Fixation of the lisfranc injury was also performed at the same setting with a single screw. Postoperative radiographs (Figure 5a,b) showed an adequately reduced ankle joint. The patient was kept nonweightbearing in a short leg cast. Due to compliance issues and concern for syndesmotic screw breakage with premature weightbearing, the decision was made to schedule the patient for surgery at 6 weeks to remove the syndesmotic screws. In addition, due to the patient's religious beliefs, all remaining hardware was removed in addition to the syndesmotic screws. He was subsequently started on progressive weightbearing. At his last visit 22 months after the injury, he was ambulating without pain and was able to attain full ankle range of motion with dorsiflexion of 20 degrees and plantarflexion of 40 degrees (Figure 6).

Discussion

Bosworth fracture-dislocations are challenging to recognize and treat appropriately. They can be missed initially and are commonly discovered only after being irreducible. Our case describes a rare variation of the Bosworth fracture dislocation with an intact distal fibula but associated medial malleolus fracture. Few cases have been discussed in the literature describing this similar injury pattern.[1,11]

The Bosworth injury pattern occurs with axial loading of the foot in supination, causing the talus to externally rotate 90 degrees, resulting in the fibula becoming locked behind the tibia in a fixed position.[2,4,17] In a cadaveric study done to scrutinize the mechanism of the Bosworth fracture-dislocation, it was found that in this supination-external rotation injury, the tibiofibular ligaments failed first, followed by the anteromedial capsule, and then the interosseous ligament.[17] With further external rotation, the fibula was pulled posteriorly by an intact lateral ankle ligament complex and became trapped behind the posterolateral ridge of the tibia. With increasing energy, injury to the medial structures was found to occur at the last stage. However, a similar mechanism of injury can lead to different injury patterns in other patients. Our patient had a fracture of the medial malleolus but without a fibula fracture, which has been described in the literature to usually occur prior to the malleolus fracture. In the present case, failure to recognize the complexity of this injury pattern led to a delay in its diagnosis and management.

A high index of suspicion is critical for diagnosing a Bosworth fracture-dislocation, as this diagnosis is commonly missed. History should focus on the mechanism of injury, energy of trauma, and any associated neurovascular symptoms. A case similar to ours has been described in literature, where a 21-year-old woman suffered a twisting injury to her ankle, resulting in a posterior dislocation of an intact fibula and a medial malleolus fracture. Initial attempts at closed reduction were unsuccessful.[11] Open surgery was performed with intraoperative radiographs to initially fix the medial malleolus fracture with 2 cancellous screws. Only then did the surgeons appreciate that the intact distal fibula was posteriorly dislocated behind the posterolateral edge of

Figure 6. Anteroposterior/mortise/lateral radiographs of the left ankle at 22 months of follow-up.

the tibia. A separate lateral incision was made for open reduction of the fibula, and a single syndesmotic screw was inserted. In another report, the patient was discharged after closed reduction of the fracture with a plan for elective surgery after soft tissue swelling had settled.[3] The patient, however, presented back to the emergency department within 12 hours with compartment syndrome of the leg. There have also been reports of vascular compromise of the posterior tibial artery in severe cases with an associated posterior tibial tendon rupture or with posterior dislocation of the fibula.[17] If closed reduction of such an injury pattern is not successful, the patient could be monitored for neurovascular compromise or increased compartmental pressures while waiting for elective surgery.[6] Surgery should be postponed to a later date to allow for soft tissue swelling to subside so as to prevent wound complications postoperatively.[21] It has been reported that patients who presented to the hospital earlier, followed treatment regimens, and were operatively fixed with 2 quadricortical syndesmotic screws recovered faster with better outcomes.[7] Although for this injury, early access to surgical reduction and fixation may seem to lower complications, a study[7] also acknowledged that there needs to be a balance in timing to surgery that is dependent on soft tissue swelling. If there is substantial soft tissue edema, a delay to surgery for several days may be necessary to allow the soft tissue condition to improve and be optimal for surgery. In our case, the patient received inpatient care, and close monitoring of the patient's compartments and neurovascular status was performed, with open surgery planned when swelling had subsided. Tricortical syndesmotic screws were used in our case with good functional outcomes. In hindsight, with a better understanding of this condition prior to management of this case, quadricortical screws could have been used as supported in literature.

The recommended imaging for the diagnosis of such Bosworth fracture-dislocations is a full-length tibia and fibula radiograph.[14,15] A visible cortical radiodensity on the medial tibial plafond on postinjury radiographs has been described to be unique to this injury.[12] This can be visible on standard anteroposterior and mortise radiographs (Figure 1a), and this finding has been called the "axilla sign." This is due to persistent internal rotation of the tibia as a result of locking the proximal fibular shaft behind the posterior tibial tubercle. Computed tomography can be performed for such injury patterns to further assess fracture patterns and determine if the distal syndesmosis is intact.[10]

Closed reduction of the Bosworth fracture dislocation injury is often difficult. The first injury that leads to the posterior motion of the fibula is the rupture of the anterior tibiofibular ligament.[17] With further external rotation, this results in the disruption of the deltoid, anterior, and posterior inferior tibiofibular ligaments, and there is as much as 7.3 mm of posterior displacement of the fibula in relation to the tibia.[20] Closed reduction of a Bosworth fracture-dislocation is challenging and often impossible (>70% of cases) due to the presence of an intact interosseous membrane and lateral ankle ligaments with entrapment of the distal fibula behind the posterior tibial tubercle.[17] Impingement of the fibula on the calcaneus is usually the cause for complete lack of motion at the ankle joint and extreme equinus. It has been suggested not to attempt closed reduction multiple times since this may worsen soft tissue injury.[8] If closed reduction is unsuccessful, open reduction and internal fixation would be necessary. The lateral ankle is generally approached first. Using an elevator, the fibula is usually easily reduced by using the tibia as a fulcrum. Another technique involves disimpacting the fibula from the posterior tibia with reduction forceps. If reduction is still difficult, an additional anteromedial incision may be made to assess the anterior joint capsule, releasing and removing any torn capsule from the joint, thus making reduction possible.[19] Syndesmotic fixation is almost universally required, as the syndesmotic ligaments must fail prior to fibular dislocation.[2]

As this injury is often associated with a high amount of energy, this can lead to complications such as osteochondral dessicans of the talus or tibial plafond. Rotation of the talus can cause impingement on the anterior part of the medial malleolus, leading to lesions in the medial shoulder of the talus.[9] Up to 40% involvement of talar dome lesions has been reported to be associated with ankle fracture dislocation injury.[13] These complications should be assessed intraoperatively to avoid further need for surgery. In our case, there was no talar dome lesion on CT scan or intraoperative assessment.

Conclusion

Bosworth fracture-dislocations are a rare occurrence and are frequently missed initially. Variations of this injury pattern (such as the present case) occasionally present, which further confound diagnosis. A high index of suspicion is critical for diagnosing a Bosworth fracture-dislocation. Ideal management consists of rapid assessment, accurate diagnosis, close observation, and operative fixation. Such management can help to avoid neurovascular complications, chronic ankle instability, and posttraumatic ankle arthritis.

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