

Bosworth Fracture–Dislocation of the Ankle

A Case Report and Review of the Literature

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The Bosworth fracture–dislocation is a rare fracture–dislocation of the ankle where the proximal fibular fragment lodges behind the tibia, rendering it irreducible by routine closed manipulations. Clinically the patient’s foot is in severe external rotation. This external rotation makes the initial roentgenograms difficult to interpret. Consequently, the diagnosis is often overlooked, resulting in inappropriate treatment and a disastrous outcome. If properly recognized, these injuries can be successfully treated by closed or open techniques with return of near-normal ankle function. The problem is illustrated in a case involving a 40-year-old woman, as related to a review of the literature and discussion of the treatment rationale.

In 1947, Bosworth¹ described five patients with a rare fracture–dislocation of the ankle that included an irreducible dislocation of the distal fibula behind the tibia. Of the five patients described, the problem was not recognized in two patients, resulting in malunion and eventual arthrodesis. In another patient, the problem was recognized late, resulting in a delayed reduction and a satisfactory result. The remaining two patients had the appropriate treatment with excellent return of ankle function. Since the original description, a Bosworth fracture–dislocation has been described in 28 patients in 12 reports.^{1–12} Despite the literature, the Bosworth

fracture is often an unrecognized entity.^{1,6,8,10,11} If proper treatment is not instituted, the patient will be left with a permanent disability. The purpose of this paper is to present a case report followed by a discussion of the proper diagnosis and treatment of this rare fracture–dislocation.

CASE REPORT

A 40-year-old woman sought treatment at the emergency room with a swollen, deformed right ankle. She had tripped and suffered an external rotation injury to her right ankle. She then came immediately to the emergency room for further evaluation.

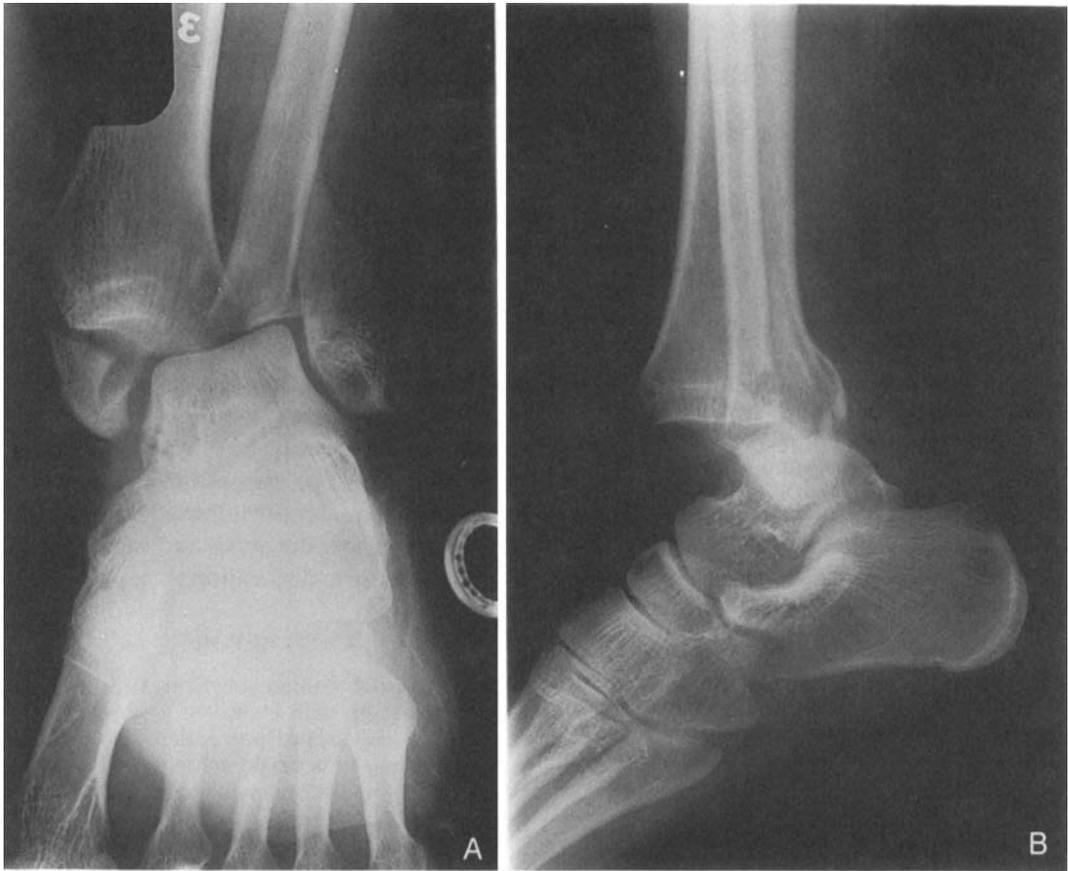
On examination, the patient’s ankle was swollen and externally rotated. Pulses were barely palpable due to the swelling, but the patient’s foot was warm with good capillary refill. Standard roentgenograms of the ankle were ordered, but proper positioning of the patient’s lower extremity was difficult because of the deformity of the foot and the ankle. The initial roentgenograms were interpreted as diagnostic of displaced trimalleolar fracture–dislocation of the ankle (Fig. 1).

A closed reduction was attempted without success. Repeat roentgenograms were obtained that suggested displacement of the distal fibula behind the tibia (Fig. 2). The patient was subsequently admitted and scheduled for surgical reduction and fixation of the right ankle. During surgery, the distal fibula was exposed first through a standard longitudinal incision. The fibula was fractured at the level of the syndesmosis with the distal end of the proximal fibular fragment locked behind the tibia in the posterolateral ridge. The anterior tibiofibular ligament was avulsed from the fibula with a 3-mm fragment of bone attached. The displaced fibula was gently pried into its anatomic position. After this, the distal fibular fragment and

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FIGS. 1A AND 2A. (A) AP and (B) lateral roentgenograms revealing an oblique fracture of the lateral malleolus starting at the level of the mortice. There is also a displaced fracture of the medial malleolus. Because of the oblique nature of these roentgenograms, the posterior displacement of the proximal fibular fragment is difficult to appreciate.

avulsed anterior tibiofibular ligament fragment were easily reducible. The medial malleolar fracture was then exposed through a hockey-stick incision. The ankle joint was examined both medially and laterally. A 7-mm osteochondral fragment from the posterior malleolus was found in the ankle joint and removed. The talar dome was intact. The fibular fracture was initially stabilized with an interfragmentary screw supplemented by a contoured seven-hole semitubular plate. Since the syndesmosis was moderately unstable, a syndesmosis screw was placed in the third hole of the semitubular plate while the ankle was held in dorsiflexion. The avulsed anterior tibiofibular ligament fragment was sutured into position. The medial malleolar fracture was reduced and stabilized using a 0.062-inch Kirschner wire and a 3.5-mm

malleolar screw. Roentgenograms were obtained that showed anatomic reduction (Fig. 3).

The patient was placed in a compressive dressing that was changed to a short-leg cast when the swelling subsided. The patient was limited to toe-touch weight bearing until the syndesmosis screw was removed at six weeks. The patient was then allowed to bear weight as tolerated. At three months, the roentgenograms showed excellent healing. At six months, the patient was ambulating independently with only slight limitation in ankle motion.

DISCUSSION

The mechanism of injury for the Bosworth fracture is a source of debate.^{1,4,7,10,11} The



FIGS. 2A AND 2B. (A) AP and (B) lateral roentgenograms obtained after an attempt at closed reduction and splinting of the patient's lower extremity. These views represent truer AP and lateral roentgenograms of the ankle. Here the posterior displacement of the fibula is more obvious.

most convincing evidence was presented by Perry *et al.*¹⁰ who reproduced the injury in anatomic specimens. That author concluded that the Bosworth fracture is a variant of a Maisonneuve fracture and caused by supination and eversion. Perry's staging of the injury can be found in Table 1. What is important to note is that the syndesmotic disruption and posterior displacement of the fibula occur prior to the fibular fracture and that the disruption of the medial side of the ankle occurs after the fibular fracture. The fibular fracture must also be within 1 cm of the ankle mortise, or the proximal fibular fragment would be of insufficient length to lodge behind the distal tibia. Why similar mecha-

nisms can produce different fracture patterns is not completely understood. However, it is probably due to slight anatomic variations among patients and also to subtle positional changes that occur during injury.

As this case report illustrates, the initial diagnosis of the typical Bosworth fracture is difficult. Fortunately, the pathology in this case was obvious at the time of surgery and the appropriate treatment led to a successful outcome. The difficulty in diagnosis is usually from the inability to obtain good-quality roentgenograms in the emergency room. Since the injured ankle is normally externally rotated more than 45°, poor positioning of the deformed extremity results in



FIGS. 3A AND 3B. (A) AP and (B) lateral postoperative roentgenograms. These views show anatomic reduction of the posteriorly displaced fibula. The talus is concentrically reduced in the mortise. The syndesmosis screw was removed at six weeks, at which time full weight bearing was instituted.

oblique views of the ankle mortise that are nearly impossible to interpret.

For this reason, it is recommended to obtain a roentgenogram that includes the knee and ankle on one film. Interestingly, these films will usually show a concurrent anteroposterior (AP) view of the knee with a lateral view of the talus and a lateral view of the knee with an AP view of the talus. Schatzker *et al.*¹¹ also described the pathognomonic finding of the fibula sweeping behind the tibia from lateral to medial, which is obvious on the AP roentgenogram of the entire leg (Fig. 4).

Once the diagnosis is made, the appropriate treatment can be instituted. When the fibula and lateral ligaments are intact, closed reduction can usually be accomplished by dorsiflexion and internal rotation. However, this kind of injury is exceedingly rare. When a fracture of the distal fibula occurs, closed reduction is much more difficult since there are no structures attached to the upper fragment to pull it from behind the tibia. In these instances, closed reduction can occasionally be accomplished by traction and laterally directed force applied to the proximal fibular fragment. In most cases, however, open re-

duction is necessary. It is recommended to approach the lateral side of the ankle first since relocation of the proximal fibular fragment will facilitate the reduction of any associated fractures. Normally the fibula can be easily levered into its normal position, and it often is associated with an audible snap. The ankle joint is examined, removing any loose osteochondral fragments that may be present. The fibular fracture can be reduced and stabilized by a combination of interfragmentary screws and the semitubular plate. Repair of the avulsed anterior tibiofibular ligament should also be done.

The use of a syndesmosis screw should be based on the intraoperative stability of the syndesmosis. If any doubt exists, the screw should be placed with the ankle held in dorsiflexion. Since disruption of the medial structures occurs last, exposure of the medial side of the ankle is only indicated when intraoperative roentgenograms reveal a displaced medial malleolar fragment or evidence of interposition in the deltoid ligament. Postoperative care is the same as with other bi- or trimalleolar fractures.

In summary, the Bosworth fracture is a rare entity often difficult to diagnose on initial roentgenograms. If unrecognized, this injury can result in inappropriate treatment

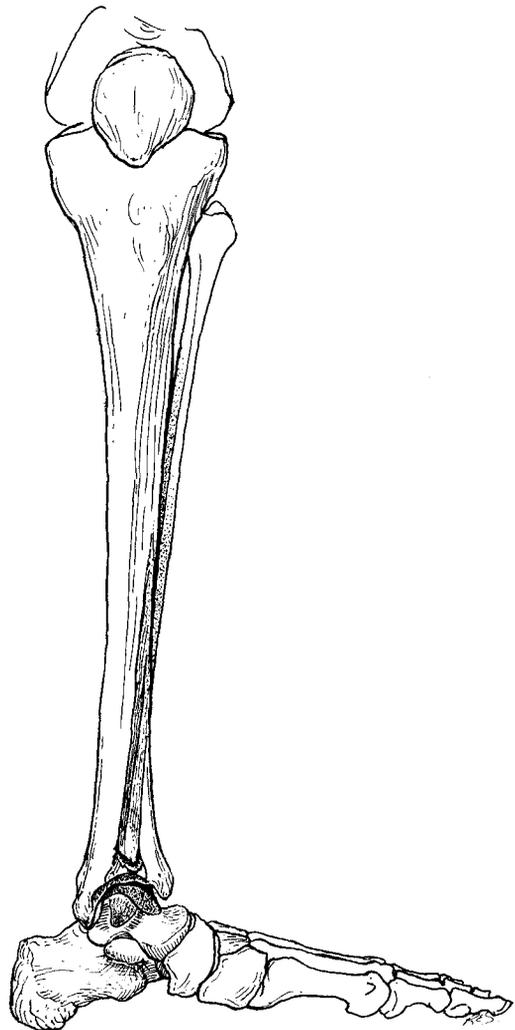


FIG. 4. This diagram illustrates the pathognomonic finding of the fibula sweeping behind the tibia on the AP projection of the deformity.

TABLE 1. Stages of Bosworth Fractures

<i>Stage</i>	<i>Structures Injured</i>
1	Rupture of the anterior tibiofibular ligament or avulsion of one of its attachments
2	Rupture of the posterior tibiofibular ligament or avulsion of one of its attachments
3	Rupture of the anteromedial portion of the ankle capsule
4	Tear of the interosseous membrane
5	Posterior entrapment of the fibula behind the tibia
6	Fracture of the fibula
7	Fracture of the medial malleolus or rupture of the deltoid

and permanent disability. With accurate diagnosis and prompt treatment, excellent results can usually be obtained. By understanding the mechanisms and stages of this injury, intelligent decisions can be made regarding the management of patients with these fractures.

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