CHAPTER **25**

SUPINATION-EXTERNAL ROTATION FRACTURES

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INTRODUCTION

Supination-external rotation injuries represent the most common pattern of ankle fractures. They are consistent with the Danis-Weber Type B fracture.[1,2] Supination-external rotation fractures are divided into 4 stages.[2,3] Stage I is rupture of the anterior inferior tibiofibular (anterior syndesmotic) ligament; Stage II is spiral fracture of the distal fibula at the level of the syndesmosis; Stage III is rupture of the posterior inferior tibiofibular (posterior syndesmotic) ligament or fracture of the posterior malleolus; and Stage IV is rupture of the deltoid ligament or fracture of the medial malleolus.

STAGE I

Stage I presents as a disruption of the anterior syndesmosis and can fail in 1 of 3 ways. It presents most commonly as a midsubstance rupture of the anterior syndesmotic ligament. This ligament can be easily exposed during reduction of the fibular fracture and primarily repaired. The least common mechanism of failure is avulsion of the ligament off its boney attachment. This can be repaired by suturing the ligament back to the periosteum or reattachment using soft tissue anchors. The third possible failure mode is an avulsion of bone leaving the ligament intact. If the bone fragment is from the tibia, it is called a Chaput fracture and if off the fibula it is a Wagstaffe fracture.[4] It is more common to involve the fibula. The bone fragments can vary in size, which will dictate the surgical repair. Small fragments may require Kirschner-wire (K-wire) stabilization, while larger fragments can be fixated with an appropriate size screw.

STAGE II

Stage II presents as a fracture of the distal fibula at the level of the syndesmosis. The configuration has been described as spiral or oblique spiral. While this description can be true, it is many times more accurately described as a curved fracture. However, we do not really use this term. It starts at the superolateral aspect of the ankle joint and extends posteriorly and superiorly. It is fairly uniform in its configuration with the main difference being its length. This fracture has been treated in the United States conservatively when displacement is less than 2-mm.[5]

A short leg cast (SLC) is applied for 7-8 weeks. Radiographic evaluation in 10-14 days checks for maintenance of reduction. Bauer et al demonstrated satisfactory outcome with up to 3-mm displacement and a 1% rate of arthrosis in a 30-year follow-up.[6] Fractures that are 2-mm or more displaced are generally managed with open reduction and internal fixation (ORIF).[5,7,8] Surgical intervention places a lateral incision with exposure of the fracture, anterior syndesmosis rupture, and the lateral aspect of the ankle joint. The distal fibular segment is usually externally rotated and shortened. The fibular fracture is anatomically reduced and fixated with one or two 3.5-mm cortical lag screws placed from anterior to posterior.

This is followed by the application of a 1/3 tubular plate to the lateral aspect of the fibula for neutralization. The plate is usually of a 5, 6, or 7 hole construction, and can be either locking or nonlocking. The plate can also be applied to the posterior aspect of the fibula as an anti-glide plate.[9] This is a useful technique in osteoporotic patients in which distal screw purchase in the lateral malleolus is problematic. However, it is slightly more technically challenging to place and can cause peroneal tendon irritation. If a lag screw can be placed through the plate and angled superiorly to engage the anterior cortex of the distal fibula shaft, then construct stability will be enhanced. A long fibular fracture may be fixated with multiple cortical lag screws without a plate. One concern is confirmation that a stage II fracture is not really an occult stage IV injury. Clinically, the presence of edema, ecchymosis, and tenderness medially should raise the suspicion of stage IV injury. Stress external rotation radiographs are performed under fluroscopy to ascertain any medial joint or syndesmotic widening.

STAGE III

Stage III presents a ruptured posterior syndesmotic ligament (more commonly) or a fracture of the posterior malleolus. The posterior syndesmotic ligament's location prevents primary repair. A fracture of the posterior malleolus is reduced and internally fixated only if it represents 25-30%

of the tibial articular surface as seen on the lateral view.[5,7,8,10] However, sometimes it is difficult to truly estimate the size of the posterior malleolus fracture on the radiographs. A computed tomography scan can be utilized to aid in the determination of the size of the fracture.

The posterior malleous fracture is usually approached through a posteromedial incision along the tibia. The posterior tibial tendon is retracted posteriorly and the posterior malleolus fracture identified. With the fibula fixated, the posterior malleolus is supposed to reduce through the vassel phenomenon. This occasionally happens but reduction of the posterior malleolus usually requires direct manipulation of the fragment. This normally requires pulling the posterior malleolus inferiorly and rotating the fragment. If there is a medial malleolus fracture, it can be retracted inferiorly and the posterior aspect of the inferior tibial plafond can be visualized aiding in reduction of the fracture. Once reduced, the posterior malleolus is fixated with one or two 3.5-mm cortical lag screws delivered from anterior to posterior. This can be done percutaneously or by retracting the incisions. The less common and more difficult approach to reducing and fixating the posterior malleolus fracture is through a posterolateral incision. Dissection proceeds between the peroneal and Achilles tendons to expose and reduce the fracture with 4.0-mm partially threaded cancellous screws being placed from posterior to anterior.

STAGE IV

Stage IV presents as a ruptured deltoid ligament or fractured medial malleolus. There are occasions when you can have a combined lesion. This can happen when the fracture of the medial malleolus involves only the anterior colliculus. A stage IV injury requires surgical intervention. Any displacement of the fibula must be corrected and is fixated as decribed previously. Harper's research indicates that the deltoid ligament does not necessarily need primary repair if the fibula fracture is reduced anatomically and the syndesmosis is stable.[11] Normally, the deltoid ligament is not repaired if the ankle joint is just subluxated. Reasons to open the medial side include osteochondral fragments on the radiographs or if the medial joint space is still widened after reduction and fixation of the fibula indicating possible soft tissue entrapment. Normally, the medial side is opened on fracture dislocations of the ankle as many times there is osteochondral damage on the medial talar dome that may not be evident from the lateral incision. If the medial side is opened, then sutures are placed in the deltoid ligament for primary repair. One must understand that the sutures are placed in the superficial deltoid and actually add no strength to the stability of the ankle. It is not possible to place sutures in the deep deltoid ligament, which is the more important of the two components. If the medial side is to be opened, it is done first and the lateral side opened second.

Normally, the fibula is reduced and fixated followed by repair on the medial side. If there is a medial malleolus fracture, it is usually tranverse but its size can vary. A large medial malleolus fracture is fixated with two 4.0-mm partially threaded cancellous screws. A smaller fracture can be fixated with a tension band wire, two smaller cancellous screws (3.0- or 2.4-mm), or one screw and an adjacent K-wire for rotational stability. Comminuted fractures and osteoporotic fractures are best fixated with a tension band wire placed over a hanging screw which engages both tibial cortices. In healthy bone, the hanging screw can be unicortical or a drill hole can be employed (Figures 1, 2).[5,7,8]

After fixation of the supination-external rotation fracture, the stability of the syndesmosis needs to be ascertained. Normally, anatomic reduction and fixation of the fibular fracture along with primary repair of the anterior syndesmotic ligament results in a stable ankle mortise. However, this can be misleading as a percentage of fractures may still have syndesmotic instability. After repair of the fracture, stress external rotation testing under fluoroscopy will help assess the stability of the syndemosis. Instability will be manifested with increased tibia-fibular spacing and widened medial joint space. The hook test is inadequate as it tests the syndesmosis only in the frontal plane. If the syndesmosis is unstable, then transyndesmotic fixation is required either with a screw (traditional method) or button-suture device (new technology).

Postoperative management can be either a SLC or fracture brace. If a fracture brace is used, then the patient can start active and passive range of motion exercises in 2-3 days. Weightbearing is at the discretion of the surgeon. Immobilization time is usually 6-8 weeks but can be increased if there is delayed healing. Radiographs at 6 or 8 weeks will evaluate osseous consolidation.

Figure 1. A, Mortise and B, lateral views of SER IV fracture with spiral fibular fracture at level of the syndesmosis and a widening of the medial joint space. C, Mortise, and D, lateral views of ORIF with fibular fracture fixated with a 3.5 mm cortical lag screw and a six-hole one-third tubular locking plate. The deltoid ligament was not repaired.

Figure 2. A, Mortise, and B, lateral view of a SER IV fracture dislocation with fibular fracture and medial malleolus fracture. This is a Wagstaffe fracture. C, Mortise, and D, lateral views of ORIF with the fibular fracture fixated with two 3.5-mm cortical lag screws and a seven-hole one-third tubular plate. The medial malleolus is fixated with two 4.0-mm partially threaded cancellous screws.

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