Ankle Fractures

OVERVIEW

Ankle fractures are one of the more common injuries encountered by orthopaedic surgeons and can represent a significant burden in terms of morbidity. The primary concern with these injuries is the long-term risk of post-traumatic arthritis in the ankle. While there are controversies about both diagnosis and treatment for some of these injuries, ensuring the maintenance or restoration of normal anatomy can help to reduce the risk of arthritis.

ANATOMY

The fibula and tibia come together to form the ankle mortise and articulate with the talus. The majority of the stability of the ankle with weight-bearing is conferred by the very congruent bony anatomy. However, ligaments play a role in stability as well, as the large deltoid ligament medially provides a broad connection between the medial malleolus and the talus. On the lateral side the tibio-fibular articulation, or syndesmosis, is stabilized by the anterior and posterior inferior tibio-fibular ligaments (AITFL and PITFL respectively), as well as the interosseous ligament and, to a lesser degree, the interosseous membrane extending proximally. These syndesmotic ligaments can be injured in some ankle fractures.

CLASSIFICATION

Fractures of the distal tibia and fibula as they articulate with the talus are loosely characterized by the mechanism of injury in the sense that rotational ankle fractures are thought of separately from axial loading or pilon fracture type injuries. That being said, there is clearly some overlap between the two general grouping of injuries, and some injuries are hard to cleanly fit into one category. This summary will focus more on the rotational type injuries and what overlap they may have with axial loading injuries.

Ankle fractures as they are traditionally classified by Lauge-Hansen fall into a couple of different categories. Supination-external rotation (SER) fractures represent the majority of these injuries, with the supination describing the position of the foot and external rotation

the applied force. In this scenario, however, it is the foot that typically remains planted while the leg internally rotates relative to the foot. The injury will often proceed in a progressive manner in which injury begins anteriorly and then proceeds clockwise around the ankle. Pronation-external rotation (PER) fractures typically begin medially and then proceed clockwise with a primary difference being that the syndesmosis is often disrupted and the fibula fracture is often a Weber C, "high" fibula fracture. Both of these fractures will often have some degree of posterior malleolus fracture in which the intact posterior-inferior tibio-fibular ligament (PITFL) pulls off a piece of bone.

Supination adduction (SAD) fractures and pronation abduction (PAB) fractures are injuries that typically proceed just in the coronal plane and do not involve rotation. SAD fractures proceed from lateral to medial and start with a low fibula fracture and then the talus can be driven into the medial shoulder of the plafond, creating a characteristic vertical medial malleolar fracture that can often have articular impaction. PAB fractures proceed from medial to lateral with fracture of the medial malleolus and then often a characteristic "high" fibula fracture with comminution.

The rotational fractures and PAB injuries can also injure the syndesmosis with those injuries that have "high" fibula fractures being perhaps more likely to have syndesmotic disruption. The rotational fractures, and indeed any of these fractures, can also be influenced by the relative plantarflexion of the ankle. Posterior pilon variants in which there is some degree of posterior comminution have been described. These fractures can extend more medial or have an entirely separate posteromedial piece than the typical posterior malleolus fracture that is posterolateral.

CLINICAL PRESENTATION/EXAM

Ankle fractures represent a broad spectrum of injury and fitting that into a single clinical presentation is not possible. That being said, patients will typically have swelling, bruising, and global pain about the ankle. Swelling will often not reach its zenith until about 72 hours after injury. The usual physical examination will be limited by pain, and palpating specific structures (i.e. the deltoid ligament) has been shown not to correlate well with injury. Therefore, especially in distal fibular fractures in which it is difficult to tell if there is a medial injury (SER 4 equivalent fractures), external rotation stress radiographs can assist with clarifying the extent of injury.

IMAGING

Plain radiographs with three views of the ankle will provide the most information as the initial diagnostic procedure. A CT scan may also be indicated, especially if there is a posterior malleolar fracture present on x-ray, as the size of the posterior malleolar bone fragment can be very difficult to accurately predict from a plain radiograph. MRI perhaps has less utility for most ankle fractures, although some surgeons suggest that it can provide insight into the ligamentous status of the injured ankle. As noted above, stress radiographs are warranted if there is suspicion of a syndesmosis injury.

DECISION FOR SURGERY

The goal of ankle surgery is restoration of normal anatomy if possible. Approximately 70% of people with ankle arthritis have a history of significant ankle injury. This risk is thought to be related to two things: the impaction at the time of the injury and the possibility of malunion leading to uneven articular loading. The impaction at the time of the injury is a function of the injury itself and cannot be changed with or without surgery. Malunion, however, can often be avoided by fixing the injury surgically. However, we do not operate on all ankle fractures. Ultimately, the decision comes down to whether the injury is felt to have sufficient instability that there is risk of any displacement with treatment by closed means. From a practical standpoint most bimalleolar and trimalleolar fractures are unstable, and, therefore, will benefit from surgical treatment. Rarely, patients will have these injuries (i.e. bimalleolar or trimalleolar fractures) that do not show any displacement, and these injuries can be treated nonoperatively. For isolated distal fibula fractures, as above, a manual radiographic stress test is often performed to assess the structural integrity of the deltoid ligament with medial opening necessitating surgical fixation.

Two areas of fairly intense debate amongst surgeons have been the posterior malleolus and the syndesmosis. The two are related to some degree in the sense that the fractured posterior malleolus almost always has an attached, intact PITFL, which is the posterior component of the syndesmosis and its stoutest constituent. Perhaps the principle difficulty with the syndesmosis simply lies in diagnosing insufficiency of the syndesmotic ligament complex. To be sure, certain fractures alert surgeons to the potential for injury, although the reality is that the surgeon often does not know whether the syndesmosis is unstable until intraoperative stress tests are performed. Even the intraoperative stress test can be somewhat subjective, and one must keep in mind that syndesmotic instability can occur in

any plane. For the posterior malleolus many surgeons rely on the size of the fragment as the decision point for whether the fragment should be fixed. However, when a syndesmotic injury is present, the need for syndesmotic screws can sometimes be obviated by fixing the posterior malleolus fracture and reestablishing the PITFL.

TREATMENT

Once the decision for surgery is made, treatment most often consists of fixing the bony injuries. In a fibula fracture with deltoid ligament insufficiency, the fibula alone is often all that is fixed, providing a lateral buttress to hold the talus underneath the plafond. Repair of the deltoid ligament during the same surgery is controversial. In a bimalleolar fracture most surgeons will fix both the medial and lateral malleoli. In a trimalleolar fracture the medial and lateral malleoli will also be fixed, but fixation of the posterior malleolus is controversial as above. If a syndesmotic injury is present, screws or strong suture that hold the tibia and fibula together, are often required. However, as above, these screws may be obviated if the PITFL can be reestablished.

Post-operative treatment typically involves a period of non-weight-bearing, with a majority of surgeons favoring at least 6 weeks, although there is little consensus about what time period is most appropriate. With syndesmotic injury the time period is often extended to some degree. Once the patient is removed from the post-operative splint and prior to weight-bearing, the patient is allowed to work on ROM exercises, which help provide the cartilage with nutrition and can potentially decrease intraarticular scar tissue.

CONCLUSION

Ankle fractures as a whole represent a significant potential cause of morbidity. However, with timely and appropriate treatment, long term sequelae can often be avoided, and the patient can return to his or her previous lifestyle without restriction.

Written by J. Turner Vosseller, MD
Reviewed by F. Ray Nickel, MD
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