INTRODUCTION

Posterior malleolar fractures are an often overlooked but potentially serious aspect of any traumatic injury to the ankle joint. Posterior malleolar fractures occur most frequently in males with one case series showing a mean age of 31.5 years (1). While typically associated with more complicated injuries, including both soft tissue and osseous, posterior malleolar fractures also occur approximately 4% of the time in an isolated fashion (1). These isolated injuries often occur with a direct axial loading force on the ankle when in a plantarflexed position. The more complex injuries involving other ankle joint structures most often occur in a more rotational fashion. When the ankle is in a plantarflexed position, up to 40% of the total traumatic force can be transmitted through the posterior malleolus alone (2).

Regardless of the mechanism of injury, the talus is forced into the tibia fracturing off the posterior malleolus in varying sizes. These fractures have important long-term implications in these patients, specifically relating to stability of the joint and post traumatic arthritic changes. Posterior malleolar fractures due to their rarity and perceived unimportance, are often misdiagnosed or neglected. Knowledge and understanding of these traumatic injuries and their impact on both osseous and soft tissue components of the ankle joint is paramount. This knowledge should be applied in the decision-making process when deciding if advanced imaging modalities are warranted for surgical planning. In patients with continued pain following diagnosed ankle sprains or ankle fractures with no posterior malleolar fracture noted on plain film radiographs, the modality of choice is often a magnetic resonance image (MRI) to include both soft tissue and osseous examinations. However, if there is a high suspicion for posterior malleolar fracture based on mechanism of injury, a computed tomography scan of the ankle is a more appropriate modality for surgical planning. Either way, the goal of the surgeon should be to fully evaluate these often severe injuries.

CURRENT TECHNIQUES

There have been many different opinions when dealing with how to treat posterior malleolar fractures. Unlike medial and lateral malleolar fractures, there is currently no gold standard for the treatment of posterior malleolar fractures. The debate on when to switch from conservative treatment to surgical management is widely contested. In most of the literature, treatment is determined by the size and displacement of the fracture fragment (3). This is usually defined by the involvement of the articular surface of the distal tibia. The generally accepted algorithm is that if the articular surface is affected by 25% or larger, then the fragment should be treated with fixation. If smaller than 25%, conservative management is typically the treatment of choice (4). In the original study by Nelson and Jensen, posterior malleolar fractures were divided by the size of the fragment determined by radiologic evidence. Determining the size of the posterior malleolar fragment appears to be less and less of a metric used to determine whether fixation is required. Using fragment size alone is too simple of a measurement when evaluating these complex injuries. Many surgeons are now primarily taking into consideration the morphology and presentation of the fracture pattern itself. Those fracture patterns with more medial extensions and more proximal extension are known to have a worse outcome long term and require more aggressive fixation (5).

Most current evidence suggests that fragments larger than 25% are best treated by considering the other aspects of the injury and how those relate to the overall stability of the joint. There are however many other studies that outline when surgical treatment is warranted. Other studies have suggested determining stability of the talus and if stable, then surgical treatment is not needed. If the medial and lateral malleoli are intact or fixated with the talus stable, then the posterior fragment should not affect the stability of the joint. Others have taken the Vassal principle into account stating that if the lateral malleolus is anatomically reduced then the posterior malleolus will heal into place with immobilization. However, fixing the posterior malleolus also leads to greater...
syndesmotic stability and thus a more stable ankle joint (4). Yet another study indicates that in the treatment algorithm of posterior malleolar fractures the main consideration should be not the size of the malleolar fracture but instead whether or not a “step off” exists following reduction of any other potential injuries to the joint (6).

**CASE STUDY**

A 27-year-old man presented to the office for treatment options for a left ankle fracture that occurred approximately 7 months prior to presentation. The patient stated he was riding a motorcycle when he lost control, causing the vehicle to fall onto his plantarflexed and inverted ankle at a moderate speed. He was evaluated and treated at a local emergency department and was placed in a cast and told to follow up with the on-call physician. This physician decided to treat this injury conservatively believing that the fractures would heal effectively without intervention despite MRI and computed tomography (CT) showing a fibular fracture (Figure 1), posterior malleolar fracture (Figure 2), talar dome osteochondral defect, deltoid rupture (Figure 3), and posterior tibial tendon rupture. The patient continued to have pain once he was cleared for weightbearing 8 weeks later and was unable to work or perform daily activities for several months despite bracing. The patient was then referred to the senior authors for treatment. It was decided that a staged procedure was in the patient’s best interest to facilitate healing and prevent future pathologies.

Approximately 8 months following the initial injury, the patient was taken to the operating room for the initial procedure to repair his posterior malleolar fracture. An incision was made just lateral to the Achilles tendon and carried down to expose the fibular fracture paying close attention to and being sure not to violate the peroneal tendons and the neurovascular structures in this area. It was noted that there was a posterior fragmentation that was loosely adhered to the fibula via fibrous scar tissue. This was completely excised from the surgical site and prominent edges resected using a power rasp. At this time the ankle joint itself was exposed via a posterior capsular incision and inspected and noted to have unusually excessive amounts of chronic inflammatory adhesions and synovitis, which were evacuated from the joint. Attention was then directed to the previously seen talar cyst at the posterolateral aspect of the talus, which was drilled in a retrograde fashion and then packed with allograft to repair the defect.

At this time, the focus was shifted to the posterior malleolar fracture. An osteotome was used to recreate the fracture line of the previous injury. The fracture site was opened and noted to not only be a nonunion but also was noted to have intervening soft tissue preventing any true healing of the fracture. The edges of the fracture were freshened up to allow for a restart of the acute healing phases following removal of all soft tissue at the fracture site. Once healthy bleeding tissue was seen and all inter-positional soft tissue was removed, the posterior malleolus was temporary fixated in place before two 4.0 mm cannulated screws were inserted across the fracture site using a modified AO technique. The screws were oriented perpendicular to the fracture itself from posterior to anterior. Proper reduction and fixation were confirmed intraoperatively using C-arm.

![Figure 1. Magnetic resonance image showing distal fibular fracture with minimal displacement.](image1)

![Figure 2. Magnetic resonance image showing posterior malleolar fracture occupying approximately 30% of the articular surface of the ankle joint.](image2)
The patient was placed in a posterior splint and instructed to remain strictly non-weightbearing.

The patient was seen 2 times prior to the second staged procedure. Patient reported good compliance with non-weightbearing status and was kept in a posterior splint. There were no significant postoperative complications. Approximately 6 weeks following stage 1 of the staged procedures the patient was taken back to the operating room for further correction of the left ankle joint involving soft tissue repair. An 8 cm incision was made from the medial tibia to the plantar aspect of the navicular tuberosity. Dissection was carried down through the ankle capsule and the deltoid ligament was exposed. Prior to the procedure, the patient had significant instability to the ankle with a positive talar tilt test. The deltoid ligament was noted to have severe degenerative changes with the remaining healthy ligamentous tissue noted to be quite thin. The healthy remaining tissue was primarily repaired using 3-0 Vicryl and the Arthrex Internal Brace system was used to reinforce the deltoid ligament with anchors in the calcaneus, talus, and medial malleolus. Intraoperatively, the ligament and internal brace were stressed and noted to have reduced eversion with significantly increased stability seen. Lastly, the posterior tibial tendon was noted to be lax with chronic degenerative changes. The redundancy of the posterior tibial tendon was measured to be about 1.5 cm. The tendon was advanced 1.5 cm and anchored into the navicular with fiberwire securing the tendon to the anchor. The patient was again placed into a posterior splint and was instructed to remain non-weightbearing.

The patient remained in the posterior splint for 3 weeks following the second procedure and was then transferred into a CAM boot with progressive weightbearing using his crutches for assistance. No postoperative complications were reported. The patient has progressed to full weightbearing and returned to full time work utilizing only an ASO brace. Follow-up radiographs show excellent healing of the ankle joint, with continued stability of the left ankle and subtalar joint clinically seen. The rapid improvement in pain and function of this patient shows the importance of proficiency in identifying and treating these complicated injuries (Figure 4 and Figure 5).

REFERENCES

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