Talus Fracture Fixation With Headless Screws From a Posterior to Anterior Direction—A Case Report

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Summary: The purpose of this report was to demonstrate the use of headless compression screws for fixation of a displaced talus fracture after open reduction. Screws were placed from a posterior to anterior direction away from the approaches used for the reduction. Open reduction with internal fixation is the standard for most displaced talar neck fractures. However, surgeons tend to apply fixation using these approaches with anterior to posterior directed screws and/or plate placement laterally. The posterior to anterior screw direction allows for more perpendicular screw placement that has shown biomechanical advantages.

Key Words: talar neck fractures, talus fractures, headless compression screw, posterior to anterior screw direction

INTRODUCTION

Talus fractures are rare injuries but notable in the challenge to treat and avoid complications. The most common complications are post-traumatic arthrosis and avascular necrosis. These sequelae are often unavoidable, due to the often severe nature of the injury. Regardless, modifiable factors under the surgeon’s control are reduction quality, strength of fixation, and avoidance of excessive dissection to minimize damage to the talar blood supply.

Dual approaches to the talar neck (anteromedial and anterolateral) are often used to maximize exposure and improve reduction quality. Generally, screws are placed from an anterior to posterior direction and at times supplemented with a mini-fragment plate contoured to fit along the lateral talar neck. Screw trajectory for the independent lag screws is challenging because the navicular often prevents screw direction to be perpendicular to the fracture plane.1,2

The advantages of screw placement in the posterior to anterior direction have been reported in the literature.3,4 Screws can be more easily placed perpendicular to the fracture plane without violating the cartilaginous surface of the talonavicular joint. These features contribute biomechanical advantages, although there are concerns listed about damage to nearby structures.

The authors have used a technique of anterior-based open reduction and posterior percutaneous implant placement over the past 8–10 years. Initial exposure typically starts with the anteromedial approach, and the anterolateral approach is commonly added when needed for reduction purposes. Once reduction is obtained and temporary fixation placed, percutaneous placed headless compression screws are positioned perpendicular to the fracture plane for definitive fixation. Scientific evaluation of this fixation strategy is on-going. A single case report using this technique is presented below.

PATIENT INFORMATION

A 27-year-old male patient presented to the emergency department after a motor vehicle versus pedestrian incident. He had loss of consciousness associated with mild traumatic brain injury and a deformity noted to his left lower extremity with pain. Further details of the trauma were unknown. No other relevant medical or surgical history was noted.

Initial radiographs revealed a completely displaced talar neck fracture with subluxation at both tibiotalar and subtalar articulations (Fig. 1). No traumatic open wounds were present, and there was no skin compromise or tenting. There were no gross neurovascular injuries.
A closed reduction in the emergency department was attempted. Sedation was not believed to be safe given the head injury. Intra-articular lidocaine was placed, and a reduction maneuver performed. Despite adequate anesthesia, closed reduction was unsuccessful (Fig. 2).

The patient was planned for surgical reduction and fixation the following morning.

**SURGICAL TECHNIQUE**

The patient was positioned supine with an ipsilateral hip bump and foam ramp. Even after induction of general anesthesia, the talar body was unable to be repositioned appropriately in its articulation with the tibia and calcaneus. The patient was therefore prepared for an open reduction.

An anteromedial approach was first performed, and the fracture site was accessed. Despite good visualization, a reduction was still not attainable. Anterolateral exposure was next performed to access the fracture from a different plane. Fully threaded wires were placed in the body along with traction on the calcaneus. The talar body was repositioned into its articulation.

Reduction was performed using clamps and was determined to be anatomical based on visualized cortical/cartilaginous fracture lines. Temporary k-wires were placed to hold the fracture. Care was taken to place these wires more superior in the talus to help avoid conflicting with definitive screw fixation.

In addition, there was found to be impaction and comminution on the dorsomedial surface. However, there was adequate visualization and stability to maintain appropriate length on the medial column of the talus.

At this point, the extremity was positioned for definitive fixation. The leg was placed into a figure-of-four position. The primary surgeon moved to the opposite side of the table for screw placement from posterior to anterior. The assistant held the leg in position and also placed the ankle in a dorsiflexed position. This allowed for more of the posterior talus to be available for screw starting point. The figure-of-four position allows the c-arm to be brought in, and an adequate lateral image is obtained with minimal manipulation.

Smooth wires from the headless screw system (Acutrak 2 system; Acumed, Hillsboro, OR) were placed into the posterior talar surface. One was placed just medial and one just lateral to the Achilles tendon. The lateral wire was placed first because it is easier to avoid once in place compared with the medial wire. Once a wire was at the fracture site, the leg was manipulated for the other fluoroscopic view. The extremity was brought out over opposite aspect of bed to avoid bending the wires and then rotated while flexing the hip/knee to obtain a Canale view. The wire was adjusted until appropriate position was obtained and then driven across the fracture and into the talar head. Maximum spread at the fracture site was the goal while avoiding penetration of the medial/lateral talar surfaces.

At this point, small incisions were made around the wires. Blunt dissection to bone was performed followed by dilating these sites with guides from the headless screw system. With proper use of the screw length measuring device, soft-tissue dilation is achieved as well. Generally, the authors remove 8–10 mm (instead of guide recommendation of 4 mm) from the measured length to allow for enough distance to bury the proximal aspect of screw and not penetrate the talonavicular joint. A screw width of 5.5 mm was determined by

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**FIGURE 1.** Injury radiographs. Mortise + lateral of ankle, oblique foot/canale view.

**FIGURE 2.** Radiographs/computed tomography postreduction attempt. (A) Lateral ankle and (B) sagittal reconstruction CT image.
placing the various sizes over the skin and determining appropriate size through fluoroscopy.

The proximal aspect (talar body) was overdrilled with a cannulated drill bit. Screws were then inserted. Although screws were tightened sequentially to maximize concentric compression, the lateral screw crossed the fracture site first. This helped prevent varus collapse along the common medial (and dorsal) comminution. Significant care with the measuring device must be used to not place the screws too deep or choose one too long. The design of these headless compression screws does not allow for maximal purchase or full compressive potential if screws are backed out (secondary to their tapered design). Just before final tightening, the k-wires were removed to allow for completion of compression when alignment was secure. Correct placement, depth, and no penetration of talonavicular joint were confirmed through fluoroscopy and direct visualization (Fig. 3).

Layered closure was then performed followed by splint placement. Postoperatively, the patient was told to remain non–weight-bearing for 12 weeks. Range of motion was started at 2-week follow-up when wound was stable and sutures removed. Weight-bearing was initiated at the 12-week visit per adequate healing visualized radiographically (Fig. 4).

Avascular necrosis was discussed with the patient multiple times during his treatment. Although there were no concerning clinical signs, he obtained a magnetic resonance imaging scan from another provider and brought it for our evaluation. The MRI did not show any evidence of significant avascular necrosis or cartilage surface collapse (Fig. 5).

At the final follow-up (15 months), the patient reported full resumption of preinjury activities but a decrease in the ability to perform “longer” load-bearing exercises. Final radiographs showed a well-healed fracture. A small asymptomatic anterior talar osteophyte was present with matching osteophyte of the anterior

**FIGURE 3.** Immediate postoperative fluoroscopic shots. Mortise + lateral of ankle, oblique foot/canale view.

**FIGURE 4.** Three-month postoperative. Mortise + lateral of ankle, oblique foot/canale view.

**FIGURE 5.** MRI (12 months postoperative).
tibial plafond. No evidence of subchondral collapse or severe degenerative signs was noted on these 15-month follow-up films (Fig. 6).

DISCUSSION

Posterior to anterior screw fixation has been shown to have definitive advantages in the fixation of talar neck fractures. Placing screws more perpendicular across fractures and more evenly placed within the talus has proven biomechanical value.\(^3\)\(^4\) This technique has not become standard of care in these injuries likely, as the approaches for reduction are anterior-based and fixation can be applied safely and effectively from these portals. Furthermore, the clinical significance of the benefit with posterior applied screws is uncertain. This case illustrates a technique with minimal added effort to place P-to-A screws after a reduction is obtained and temporarily held.

With good technique, complications regarding damage and impingement to neurovascular and tendinous structures can be avoided. In the authors’ experience, a secondary benefit to the proper use of percutaneous depth gauges and drill guides is protection of the surrounding soft tissues from potential damage during drilling and screw insertion. The headless nature of the screws allows them to be easily buried in bone preventing future impingement. These screws are also often titanium allowing for future MRI if concern for avascular necrosis is present.

The above case describes a technique to safely and straightforwardly place P-to-A screws in a displaced talar neck fracture after open reduction. Careful preoperative planning and meticulous technique are required to achieve anatomical reductions with rigid/compression fixation but also to avoid damage to surrounding structures and talar blood supply. This allows the treating surgeon to optimize modifiable risk factors and thereby decrease risk and severity of complications that are common in these injuries.

REFERENCES


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