Use of Intraoperative Temporary Invasive Distraction to Reduce a Chronic Talar Neck Fracture-Dislocation

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Abstract

Temporary invasive distraction can facilitate fracture reduction in the setting of delayed surgical intervention resulting in shortening and contracted soft tissues.

Many of the complications associated with talus fractures[1-3] are presumed to stem from the delicate blood supply of the talus.[4] Given the risk for osteonecrosis with talar neck fractures, early operative intervention is considered the standard of care.[5]

Although infrequently described, some talar neck fractures are treated with late open reduction and internal fixation (ORIF), often because presentation is late or associated life-threatening injuries delay operative management.[3] Challenges associated with late operative intervention include difficulties with operative exposure and obtaining adequate reduction because of contracted soft tissues.

Temporary invasive distraction[6] (TID) can help address these challenges by restoring length and facilitating fracture reduction through ligamentotaxis. Although initially described for assisting with fracture reduction of the femur, TID has been applied broadly to both the upper and lower extremities.[6-11] This report describes a novel technique for applying TID across the hindfoot and midfoot to aid in reducing a chronic talar fracture-dislocation. The patient provided written informed consent for print and electronic publication of this case report.

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Case Report

A 62-year-old man sustained a closed Hawkins II (variant) fracture-dislocation of the talar neck with combined coronal split of the talar body after a fall of 10 feet (Figure 1). Because of a delay in presentation, as well as a significant cardiac history (to include unstable angina), operative treatment of the talus was delayed 6 weeks from time of injury.

> **"Temporary invasive distraction can help... restor[e] length and facilitat[e] fracture reduction through ligamentotaxis."**

Surgical Technique

After cardiology clearance, ORIF of the talus fracture was attempted through anterolateral and anteromedial approaches with a medial malleolar osteotomy. The talus was approximately 60° externally rotated in the mortise with the talar head pointing almost directly lateral. Attempts to reduce the talar head and neck were unsuccessful

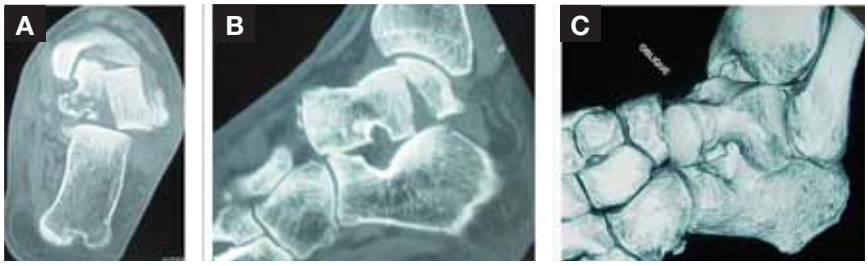

Figure 1. Preoperative computed tomography shows Hawkins II (variant) fracture-dislocation of talar neck with combined coronal split of talar body, which is evident on (A) coronal cut, (B) sagittal cut, and (C) 3-D reconstruction.

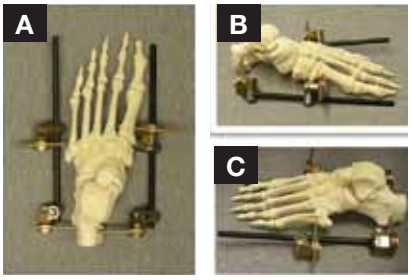

Figure 2. External fixation device after application (A) and fixed to both medial column (B) and lateral column (C).

secondary to a significant amount of shortening and a contracted soft-tissue envelope.

An external fixator was applied both medially and laterally to provide a distractive force across the midfoot. The Synthes Distal Radius Fixator (Synthes, Paoli, Pennsylvania) was used, but the technique can be applied with any fixator. First, a 3.0-mm self-drilling Schanz screw was placed medially in the base of the first metatarsal, perpendicular to the direction of intended distraction. In addition, a 3.0-mm Schanz screw was placed medially in the calcaneal tuberosity parallel to the first screw. Next, the lateral column of the foot was similarly addressed, with a 3.0-mm Schanz screw placed in the base of the fifth metatarsal and lateral side of the calcaneal tuberosity. It is important to ensure that there is enough spread between the calcaneal and metatarsal Schanz screws to be able to fit the distractor. Alternatively, a calcaneal transfixation pin may allow a stronger distractive force, if needed (this pin was not available in the external fixator set used in this procedure). The construct was then assembled using four 4.0-mm adjustable clamps and 2 carbon fiber rods (length dependent on intended distraction) (Figure 2).

The distractor was then fixed to the medial rod with its distal tip in contact with the distal pin-to-bar clamp (Figure 3A). The clamp-to-rod adjustment screw was then loosened. The adjustment ring was then turned to begin to distract the medial column (1 mm of distraction per revolution) (Figure 3B). After several complete evolutions, the clamp-to-rod adjustment screw was tightened, the distractor was placed on the lateral rod, and distraction was performed in a similar manner as done medially (Figure 3C). Obtaining short amounts of distraction and alternating between the medial and lateral columns allowed for a more symmetric distraction. This process was repeated until adequate distraction was obtained, restoring both gross length and alignment.

In this patient's case, the distraction allowed for gradual stretching of the contracted soft tissues. Careful reduction of the talar head and neck was performed using a Freer elevator with minimal applied force. After reduction, TID allowed for a stable platform and internal fixation. After internal fixation, the external fixator construct was loosened to ensure that the reduction was maintained. If necessary, the external fixator can be left in place to augment the internal fixation and removed at a later date.

Postoperative Course

The patient remained non–weight-bearing for 12 weeks after surgery. At 4 weeks, transition to a removable cast boot was made, and ankle range of motion was initiated. With no radiographic evidence of osteonecrosis at 12 weeks, progressive weight-bearing was started. At final (2-year) follow-up, plantar flexion was nearly symmetric, and there was only a 5° loss of dorsiflexion compared with the contralateral side. Subtalar motion was well preserved, though the patient reported hindfoot pain while walking without supportive footwear on uneven surfaces. Radiographs showed complete fracture healing and no evidence of collapse (Figure 4). The patient resumed activity at preinjury levels. His score on the American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Scale was 87/100.

Discussion

Soft-tissue contractures develop within days of injury for untreated fractures or dislocations that result in shortening. TID takes advantage of ligamentotaxis to assist with reduction by restoring length and gross alignment of the extremity. This technique can be used for acute fracture management, but its true benefit is seen in delayed cases, such as the one described here, as traditional techniques may be unsuccessful in obtaining adequate reduction because of the contracted soft tissues.

As early operative intervention remains the standard of care for talar neck fractures, delayed treat-

Figure 3. (A) Distractor fixed to medial rod in position that allows distraction. (B) Medial column distracted. Arrow indicates distraction at talonavicular joint. (C) Lateral column distracted. Arrows indicate distraction at calcaneocuboid and talonavicular joints.

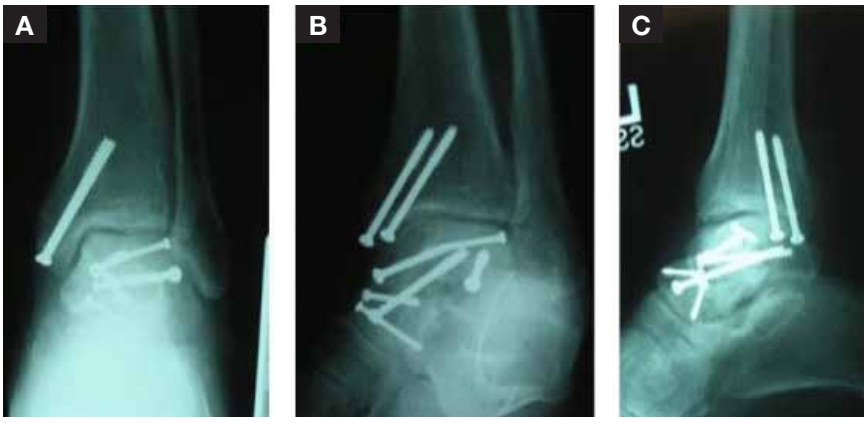

Figure 4. Radiographs at 2-year follow-up. (A) Anteroposterior, (B) oblique, and (C) lateral views of the ankle, show complete fracture healing and no evidence of collapse.

ment of these injuries is seldom reported in the literature. To our knowledge, up until this case report was published, the longest surgical delay of a talar neck fracture (48 days) was reported by Vallier and colleagues.[3] Depending on degree of injury and time to fracture fixation, some authors have recommended primary fusion or talectomy as initial treatment for these injuries.[12-14] In this patient's case, TID helped produce an optimal outcome, and there was no need to pursue reconstructive options.

Although we have described a new application of TID, the principles detailed here can be applied whenever TID is considered. First, the surgeon must know the implants. TID can be used with various external fixator devices, but one must ensure that the set chosen for a particular case has both a distractor tool and rods of appropriate length for anticipated distraction. In addition, it is important to make a preoperative plan, especially when distracting through multiple constructs and/or multiple planes, to determine appropriate Schanz screw and rod placement, as well as the sequence of distraction to meet the intended goal. The surgeon must also be aware of the size of the distractor tool to be used. In the case described here, the Schanz screw was placed in the base of the first and fifth metatarsals, and not in the medial cuneiform or cuboid, to ensure that the distractor would fit on the rod between the clamps (Figure 3A). Last, although TID is typically removed after the operative goal is met, it can be left in place for definitive fixation or as an adjunct to internal fixation.

As with standard external fixation, TID complications involve mainly Schanz screw placement and subsequent damage to surrounding soft-tissue structures, such as nerves, vessels, and tendons,[15] and a thorough understanding of cross-sectional anatomy is needed to minimize these risks. Overdistraction can result in neuropraxia, a traction injury to the nerves. However, distraction used in TID typically does not exceed the distances that can lead to this injury. In addition, when neuropraxia does occur, it is usually transient.[10]

This patient's case demonstrates a new, successful application of TID across the hindfoot and midfoot to reduce a chronic talar neck fracture-dislocation. The principles presented here are not unique to the case described but can be applied whenever TID is considered.

Author's Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article. The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

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