

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

Daniel J. Stinner, MD, Eric G. Verwiebe, MD, and Joseph R. Hsu, MD

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 fractures¹⁻³ 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 asso-

ciated 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 (TID) can help address these challenges by restoring length and facil-

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

“Temporary invasive distraction can help... restor[e] length and facilitat[e] fracture reduction through ligamentotaxis.”

itating 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.

talus was delayed 6 weeks from time of injury.

Surgical Technique

After cardiology clearance, ORIF of the talus fracture was attempted through anterolateral and antero-medial 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

Dr. Stinner is Resident, Brooke Army Medical Center, Department of Orthopaedics and Rehabilitation, Fort Sam Houston, Texas.

Dr. Verwiebe is Orthopaedic Surgeon, William Beaumont Army Medical Center, Department of Orthopaedics, El Paso, Texas.

Dr. Hsu is Orthopaedic Surgeon, US Army Institute of Surgical Research and Chief, Orthopaedic Trauma, Brooke Army Medical Center, Fort Sam Houston, Texas.

Address correspondence to: Daniel J. Stinner, MD, Brooke Army Medical Center, Department of Orthopaedics and Rehabilitation, 3851 Roger Brooke Drive, Fort Sam Houston, TX 78234 (tel, 210-916-3410; fax, 210-916-3877; e-mail, daniel.stinner@us.army.mil).

Am J Orthop. 2011;40(4):198-200. Copyright Quadrant HealthCom Inc. 2011. All rights reserved.

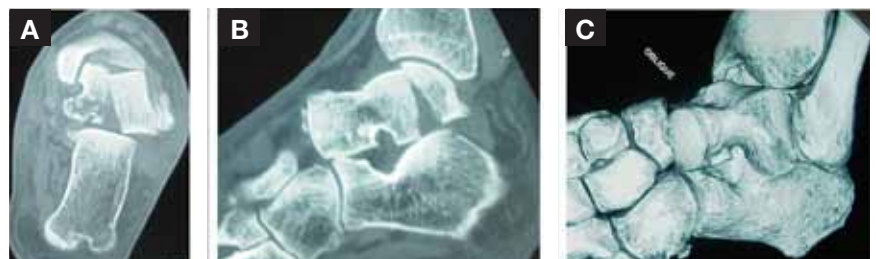


Figure 1. Preoperative computed tomography shows Hawkins II (variant) fracture-dislocation of talar neck with combined coronal split of talar body, which is evident on (A) coronal cut, (B) sagittal cut, and (C) 3-D reconstruction.

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 01 APR 2011		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Use of intraoperative temporary invasive distraction to reduce a chronic talar neck fracture-dislocation				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Stinner D. J., Verwiebe E. G., Hsu J. R.,				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) United States Army Institute of Surgical Research, JBSA Fort Sam Houston, TX				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 3	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

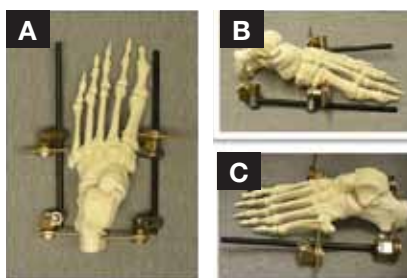


Figure 2. External fixation device after application (A) and fixed to both medial column (B) and lateral column (C).

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 revolutions, 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.

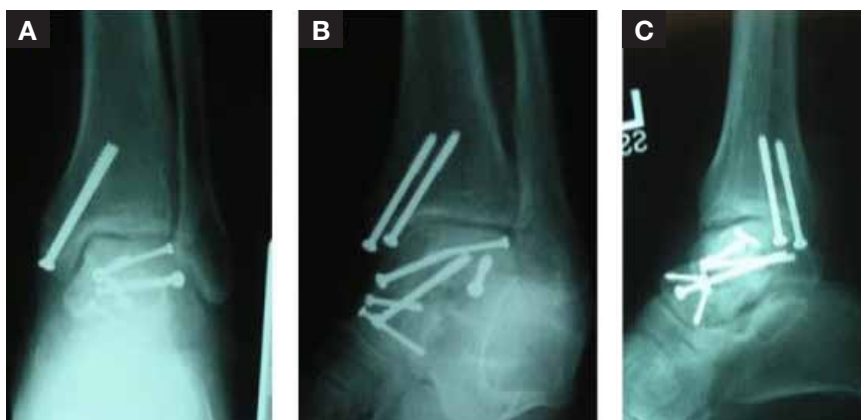


Figure 4. Radiographs at 2-year follow-up. (A) Anteroposterior, (B) oblique, and (C) lateral views of the ankle, show complete fracture healing and no evidence of collapse.

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 distrac-

tor 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.

REFERENCES

- Sanders DW, Busam M, Hattwick E, Edwards JR, McAndrew MP, Johnson KD. Functional outcomes following displaced talar neck fractures. *J Orthop Trauma*. 2004;18(5):265-270.
- Metzger M, Levin J, Clancy J. Talar neck fractures and rates of avascular necrosis. *J Foot Ankle Surg*. 1999;38(2):154-162.
- Vallier HA, Nork SE, Barei DP, Benirschke SK, Sangeorzan BJ. Talar neck fractures: results and outcomes. *J Bone Joint Surg Am*. 2004;86(8):1616-1624.
- Mullinger GL, Trueta J. The blood supply of the talus. *J Bone Joint Surg Br*. 1970;52(1):160-167.
- Fortin PT, Balazsy JE. Talus fractures: evaluation and treatment. *J Am Acad Orthop Surg*. 2001;9(2):114-127.
- Rush JK, Kirk K, Kirby J, Hsu J. Lateral talar dome access utilizing temporary invasive distraction. *Foot Ankle Int*. 2010;31(3):236-241.
- Baumgaertel F, Dahlen C, Stiletto R, Gotzen L. Techniques of using the AO-femoral distractor for femoral intramedullary nailing. *J Orthop Trauma*. 1994;8(4):315-321.
- Moed BR, Watson JT. Intramedullary nailing of the tibia without a fracture table: the transfixion pin distractor technique. *J Orthop Trauma*. 1994;8(3):195-202.
- Calafi LA, Routt ML. Direct hip joint distraction during acetabular fracture surgery using the AO universal manipulator. *J Trauma*. 2010;68(2):481-484.
- Schepers T, Patka P. Treatment of displaced intra-articular calcaneal fractures by ligamentotaxis: current concepts' review. *Arch Orthop Trauma Surg*. 2009;129(12):1677-1683.
- Boykin RE, Baskies MA, Harrod CC, Jupiter JB. Intraoperative distraction in the upper extremity. *Tech Hand Up Extrem Surg*. 2009;13(2):75-81.
- Grob D, Simpson LA, Weber BG, Bray T. Operative treatment of displaced talus fractures. *Clin Orthop*. 1985;(199):88-96.
- Thomas RH, Daniels TR. Primary fusion as salvage following talar neck fracture: a case report. *Foot Ankle Int*. 2003;24(4):368-371.
- Leibner ED, Elishoov O, Zion I, Liebergall M. Primary subtalar arthrodesis for severe talar neck fractures: a report of three cases. *Foot Ankle Int*. 2006;27(6):461-464.
- Topp R, Hayda R, Benedetti G, Twitero T, Carmack DB. The incidence of neurovascular injury during external fixator placement without radiographic assistance for lower extremity diaphyseal fractures: a cadaveric study. *J Trauma*. 2003;55(5):955-958.

This paper will be judged for the Resident Writer's Award