Transcuneal Talonavicular Dislocation Secondary to Boating Explosion: A Case Report

Ellys Era, DPM ABFAS 1 Martina Randall, DPM 2 Jasmine Cruz, DPM 3

1Attending Physician, Palmetto General Hospital Department of Podiatric Medicine, Hialeah, FL; Era Foot and Ankle, Miami, FL
2Resident Foot and Ankle Surgery PGY-3, Palmetto General Hospital Department of Orthopedics- Podiatric Medicine, Hialeah, FL
3Resident Foot and Ankle Surgery PGY-2, Palmetto General Hospital Department of Orthopedics- Podiatric Medicine, Hialeah, FL

Statement of Purpose and Review

The talonavicular is the most commonly fractured tarsal bone with a great predominance of intra-articular involvement occurring secondary to falls from a height 1. Plantar dislocation of the talus on the navicular, accompanied with an intra-articular comminuted calcaneal fracture are the hallmark injuries sustained in the uncommon but severe Transcuneal Talonavicular dislocation (TCTND) 2, 3.

Here we present a unique case of TCTND resulting from a boat explosion. To our knowledge this is the first reported civilian case of TCTND sustained by a severe mechanism of inferior implosion in a cephalad direction rather than axial loading. Our injury pattern mimics that of Colhart et al. which were the result of land-mine explosions during WWII 4, 5. Incidence of this injury pattern is rare, as few reports are seen in literature, of which many are associated with a high rate of complications as morbidity is owed to infection, soft tissue compromise, and calcaneal deformation 6, 7. Here we highlight this rare mechanism, fracture pattern, treatment course and outcome.

Case Study

An otherwise healthy 36-year-old male presented to the Emergency Department after being involved in a boat explosion. The patient was launched into the air, after combustion of the gas tank under the floorboard. On physical examination there was circumferential rearfoot ecchymosis, medial midfoot skin tenderness, with no violation of skin (Figure 1a. 1b). A void was noted proximal to the navicular, with the talus heel palpated plantar-medially. Tendinous edema made vascular inspection difficult. Doppler examination revealed triphasic dorsalis pedis pulse with the posterior tibial pulse non-auditory.

Radiographic evaluation (Figures 2a. 2b) revealed a severe talonavicular and talonavicular dislocation with the talus plantar-medial to the navicular. Proximal segmental fracture of the fibula was seen, with relatively anatomic alignment. Computed Tomography (CT) imaging demonstrated intra-articular depression and comminution of the calcaneus with the talus embedded within the posterior facet and calcaneal body (Figure 3a). Additionally, fracture lines were extended into the anterior calcaneus, and sustentacular fragment (Figure 3b).

Figures 1a & 1b - Clinical

Closed reduction of the talonavicular dislocation was unsuccessful, and with combined suspected compromise of the posterior talar artery, the patient was immediately prepared for the operating room with the intention to 1. evert over- and re-establish vascularity. 2. anatomically reduce the talonavicular joint. 3. stabilize fracture components and establish arthrodesis of the subtalar joint.

Case Study Continued - Surgical Procedure Stage 1

Intraoperative access to the talonavicular joint was gained via a dorsal-medial incision, with the talar head visualized deep to the spring ligament. Opposing traction was applied to the calcaneus and forefoot along with manual manipulation of the talar head which successfully reduced the talonavicular joint. The posterior tibial pulse was obtained immediately after the deformity reduction. Intraoperative fluoroscopy confirmed the reduced position and two crossing transcutaneous 0.62 kirschner wires were transfixed across the talonavicular joint to maintain the alignment. Copious irrigation was followed by a layered primary closure.

Figures 2a & 2b - Pre Op X-Ray

A circular external fixator was then applied to the right lower extremity to immobilize the ankle and calcaneal fractures, while concomitantly creating arthrodesis of the ankle and subtalar joint. This was performed to each side allowing for manipulation of the talonavicular in a posterior fashion to re-establish the talonavicular height and adjust the varus attitude. This initial fixation method was utilized to allow the soft tissue envelope to heal, while maintaining ankle and subtalar joint congruity, and calcaneal architecture (Figures 4a, 4b). The patient was monitored post-operatively and discharged non-wearing boot, with instructions to follow-up in the office.

Figures 4a & 4b - Post Op X-Ray

Twenty days after initial surgical intervention soft tissue stability was achieved and the patient was brought to the operating room for removal of external fixation. Follow by open reduction and internal fixation of the talonavicular. A traditional lateral extensile approach was used with a lateral calcaneal plate and screw fixation. A non-technical posterior to anterior screw was used to aid in our reduction of the posterior foot to the shear constant fragment.

Case Study Continued - Surgical Procedure Stage 2

The patient was placed in a below knee OCL splint at 90 degrees for 2 days weeks non weight bearing. At week 2 the patient was transitioned into a CAM boot, remaining NWB for another 4 weeks. The patient began physical therapy, stretching and ROM exercises at week 6 with partial weight bearing in a CAM boot and crutches. At 14 weeks X-rays showed consolidation of the fracture fragments with acceptable alignment (Figures 5a. 5b) and patient weight-bearing in steppers. Clinically subtalar joint and talonavicular range of motion was decreased with ankle joint range of motion without limitations. At 12 months the patient remains ambulating with no pain or restrictions.

Figures 3a & 3b - Pre Op CT

Discussion

Transcuneal Talonavicular Dislocations (TCTND) are challenging due to fracture complexity, unclear vascular compromise and soft tissue complications. To date there are limited studies depicting this injury pattern, with results and treatment greatly varying 4, 5.

The largest study to date by Ricci et al. reports a series of 8 patients with TCTND of which 5 were open grade 3 Gustilo Andrenson with 3 lacerations to the posterior tibial artery. All injuries were treated with staged/delayed open reduction and internal fixation of the calcaneus and fusion of the subtalar joint, after provisional stabilization. The injuries resulted in 4 patients with chronic osteomyelitis, which went on to various levels of amputation (2 below knee, 1 symes, and 1 taloncetsy). Colhart et al. 4 reported on talar injuries associated with calcaneal fractures from 1945-1945 secondary to land-mines injuries. In this study 3 of the 5 patients went on to below knee amputation.

The present case highlights the immense force generated with combination of a gas tank, which mimics the force of an explosion recorded 50 years ago. Here we report the first case of a civilian TCTND as the result of an explosion. Metabolic preservation and management of this precarious soft tissue envelope played a profound role in our surgical selection and staging protocol. In our experience, early reduction and stabilization with joint distraction via external fixation demonstrated a two-fold benefit allowing for optimal soft tissue conditions to support definitive reconstruction, while maintaining subtalar joint congruity and calcaneal posturing. With staged surgical execution we were able to restore the architecture of the rearfoot and recreate a functional, plantigrade foot in an injury traditionally associated with high morbidity. Despite our results, patients with this injury must be counseled to expect functional limitations, chronic pain and/or amputation as the severity of this injury is of critical importance.

References