The Journal of Foot & Ankle Surgery 54 (2015) 513–516

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Use of a Flexible Implant and Bioabsorbable Anchor for Deltoid Rupture Repair in Bimalleolar Equivalent Weber B Ankle Fractures

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ARTICLE INFO

Keywords:
Danis-Weber classification
deltoid ligament
fibula
open reduction
talus
tibia

ABSTRACT

Supination external rotation ankle fractures are the most common ankle fracture subtype. Deltoid ligament injuries have often been associated with this type of injury pattern. A missed injury can lead to post-traumatic arthritis and persistent pain. The current data do not support acute deltoid rupture repair. This has been based primarily on level III and IV studies in which less than satisfactory results were reported. We believe that acute deltoid rupture repair could be indicated in select cases. We have outlined a new deltoid repair technique for use with bimalleolar, equivalent supination external rotation ankle fractures using a flexible implant and bioabsorbable anchor.

Roughly 14,000 ankle fractures occur in the United States daily (1), with supination external rotation (SER), or Danis-Weber B, ankle fractures accounting for approximately 80% (2). SER type II injuries can typically be treated conservatively with nonoperative management. In cases of deltoid ligament compromise without medial malleolar fracture, termed *bimalleolar equivalent*, SER type IV injuries can be mistaken for their less severe counterpart, the SER type II injury. This is an important distinction, because it has a significant effect on the treatment. The large majority of the published data support operative management of the SER type IV injury pattern. Owing to its inherent instability, it is paramount that a deltoid injury does not go unrecognized. A missed deltoid injury can lead to post-traumatic arthritis (3). The signs of deltoid injury can include medial ankle ecchymosis, pain, and/or ankle instability (4).

A combination of multiple modalities, including physical examination and radiographic analysis, are often used for an accurate diagnosis of a deltoid ligament injury. Tenderness overlying the medial ankle can be indicative of a superficial deltoid rupture only. Because this structure is not the main stabilizer of the ankle joint, the use of this examination finding as a predictor of deep deltoid injury is suspect (2). A recent systematic review of the evaluation of the deltoid ligament in SER ankle injuries showed that the manual stress or gravity stress external rotation test was most accurate in predicting the presence of a deltoid injury. On radiographic evaluation, a medial clear space of greater than 4 mm, with that value at least 1 mm greater than the superior tibiotalar articulation, was most suggestive of deltoid compromise (4).

The published data regarding acute surgical intervention for the repair of a deltoid rupture are sparse. Advocates of repair have cited direct end-to-end repair and allograft and autograft tendon reconstruction (5). Currently, the routine repair of deltoid ligament ruptures has not been well established in published studies. This might be because a stable, reproducible construct has not been developed. With the importance of the deltoid ligament as a stabilizer of the medial ankle, we have outlined a new type of deltoid rupture fixation for use with bimalleolar equivalent, Weber B ankle fractures using the Tightrope® FT (Arthrex, Inc., Naples, FL) technology.

Surgical Technique

A patient presented to our outpatient clinic after experiencing an ankle injury. Surgical intervention was warranted because a Weber B ankle fracture with medial gutter widening was observed (Fig. 1). The patient was placed on the operating table in the supine position and underwent successful general anesthesia. A thigh tourniquet was applied in a standard manner. A standard 3-cm incision was outlined over the medial malleolus for repair of the deep deltoid ligament (Fig. 2). Dissection revealed complete attenuation of the deep deltoid ligament with exposure of the entire medial talar dome and medial ankle gutter (Fig. 3). The guidewire for the 2.7-mm drill bit was placed in the medial body of the talus just lateral to its anticipated articulation with that of the medial malleolus and the deep deltoid fibers (Fig. 4). A drill bit was passed approximately 50% across the body of

Financial Disclosure: None reported.
Conflict of Interest: M. Hardy is a paid consultant to Arthrex, Inc., Naples, FL.
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http://dx.doi.org/10.1053/j.jfas.2014.06.025

Fig. 1. Anteroposterior radiograph demonstrating a Weber B ankle fracture with medial gutter widening.

the talus, followed by use of the 4.5-mm tap (Fig. 5), in preparation for the 4.5-mm bioabsorbable TightRope® FT anchor (Arthrex). The anchor (Fig. 6) was placed in a standard manner. One arm of the suture and the button attached to it were removed.

Next, an oblique hole was drilled through the medial malleolus in the direction of the deep deltoid fibers using a 2.5-mm drill bit (Fig. 7). Using a micro-suture passer (Fig. 8), the loop was passed through the medial malleolus into the medial gutter, capturing the FiberWire® (Arthrex) from the anchor. The wire was drawn out through the drill hole and snapped off close to the tibial cortex. This was done in anticipation of the final security of the button to the tibial cortex after

Fig. 2. Standard incision placement overlying the medial malleolus.

Fig. 3. Exposure of medial talar dome and medial gutter secondary to deltoid rupture.

repair of the fibular fracture. Therefore, attention was next given to the lateral ankle, where a standard lateral incision was made. A fibular fracture was identified (Fig. 9) and reduced back to its normal anatomic position and held in place with an AO (Arbeitsgemeinschaft für Osteosynthesefragen) reduction clamp. A lag screw was inserted across the fracture using a standard AO technique, followed by the application of a lateral, one-third tubular plate. Nonlocking and locking screws were placed above and below the fracture using a standard AO technique, with excellent position and maintenance of reduction of the fibular fracture. This was confirmed using intraoperative fluoroscopy. Attention was then directed back to the medial ankle. The ankle was placed into its 90° sagittal plane position with mild varus positioning to reapproximate the ruptured deltoid fibers. The FiberWire® suture (Arthrex) was secured with the button on the medial tibial cortex. Radiographs were obtained and showed the final

Fig. 4. Radiograph demonstrating guidewire placement.