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Total Ankle Replacement with Severe Valgus Deformity: Technique and Surgical Strategy

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ABSTRACT

Correction of severe valgus deformity of the foot and ankle with ankle replacement is challenging. We describe the controversies and specific issues of surgical management and provide a detailed surgical strategy for management of this common deformity. A reliable technique for deltoid reconstruction is also described and illustrated in detail.

Most osteoarthritic ankles have some degree of coronal plane malalignment (1). Varus deformity occurs in 55% of all arthritic ankles, and the incidence of valgus deformity is 8% (1). Although no clear guidelines exist, 15° of pre-existing coronal plane deformity has been suggested as the limit for ankle arthroplasty, with 20° to 25° suggested as the absolute cutoff point (2,3). Others believe no amount of pre-existing coronal plane malalignment is unacceptable if osseous realignment and ligamentous stability can be achieved (4–6).

Ankle arthroplasty with intrinsic valgus is challenging and often fails because of an insufficient deltoid ligament complex (5). Several techniques for reconstruction of the chronically failed deep deltoid have been described, with inconsistent reliability and undefined limitations (4,7–13). Wide variability exists among these referenced techniques, further clouding our understanding of the optimal ligament reconstruction. Furthermore, longstanding ankle valgus deformation leads to a coiled distortion of the hind- and midfoot, placing additional valgus thrust on the prosthesis.

A durable, reliable, and reproducible method of reconstruction might allow for higher success rates of arthroplasty in valgus osteoarthritic ankles and expand the indications to include those with greater degrees of deformity. We describe a strategy for replacement of the valgus osteoarthritic ankle with medial ligament insufficiency that involves anatomic deep deltoid ligament reconstruction with a double-stranded tendon allograft combined with osseous realignment.

Operative Strategy

In general, correction of the moderate to severe valgus ankle with compensated pedal deformity suggests a 2-stage surgical approach. The first stage of the reconstruction involves talar derotation, restoration of the medial ligamentous structures, and reversal of the coiled pes valgus deformity. Although reversal of this complex segmental osseous malalignment is complicated, it is an obligate maneuver to achieve a plantigrade foot. The fundamental theme of this first stage is to obtain neutralization of the talus within the ankle mortise. Accordingly, the talus serves as the reference to which the rest of the osseous components are repositioned through selective arthrodesis of the mid- and hindfoot joints.

Most often the heel will be in a severe valgus attitude, both from the valgus position of the talus in the mortise and from varying degrees of subluxation of the subtalar joint. Longstanding deformity further potentiates the difficulty of correction. When the talus and heel are realigned to the long axis of the tibia, the varus posture of medial column of the foot worsens. The reversal of this complex deformity represents the most difficult challenge even to an experienced surgeon. The process of uncoiling the medial column down to the supporting surface begins with talonavicular fusion. A significant percentage of the varus position can be eliminated but usually unmitigated residual deformity remains, primarily because of the adapted calcaneocuboid joint and the remaining medial column. Although the “medial double” arthrodesis has gained popularity, in our experience, hind- and midfoot neutrality cannot be achieved with

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Table
Algorithm for a valgus ankle

Protocol
First stage
Perform medial ankle arthrotomy through utility incision (may include lateral gutter incision to release lateral ligaments)
Remove periarticular osteophytes, reduce the talus to neutral or slightly varus in the mortise and maintain with transarticular fixation with or without bone cement
Perform selective hindfoot arthrodeses to neutralize the heel and midfoot; additional medial column fusions can be performed to reduce residual varus deformity
Perform anatomic deep deltoid ligament repair with tendon allograft
Second stage (6 to 8 weeks after first stage)
Perform total ankle replacement with implant of choice through standard anterior incision after removal of transarticular fixation and/or cement
Evaluate the foot for residual planar deformity; if present, perform necessary bony realignment to create a stable plantigrade foot to mitigate any valgus thrust on placement of the implant

this procedure in isolation (14–21). The subtalar fusion from a medial approach enables a medially based wedge resection of the posterior and anterior or middle facets, but it does not allow for medial translation of the calcaneus without incorporation of the calcaneocuboid joint. This is usually necessary to optimize the alignment. Furthermore, the obligate "wedging" created by the medial resection can create a varus rotation to the calcaneocuboid complex.

It should also be noted that curettage preparation of the midtarsal joints is inadequate to reduce the deformities because of the long-standing, coiled adaptation of the hind- and midfoot. Planar cuts of the talonavicular and calcaneocuboid joints are necessary to neutralize the midfoot deformity. Derotation of the midtarsal joint through the axis created by the planar resections often results in a plantigrade foot. In very severe cases, additional medial column fusion could be necessary if residual varus or an unsupportive first ray

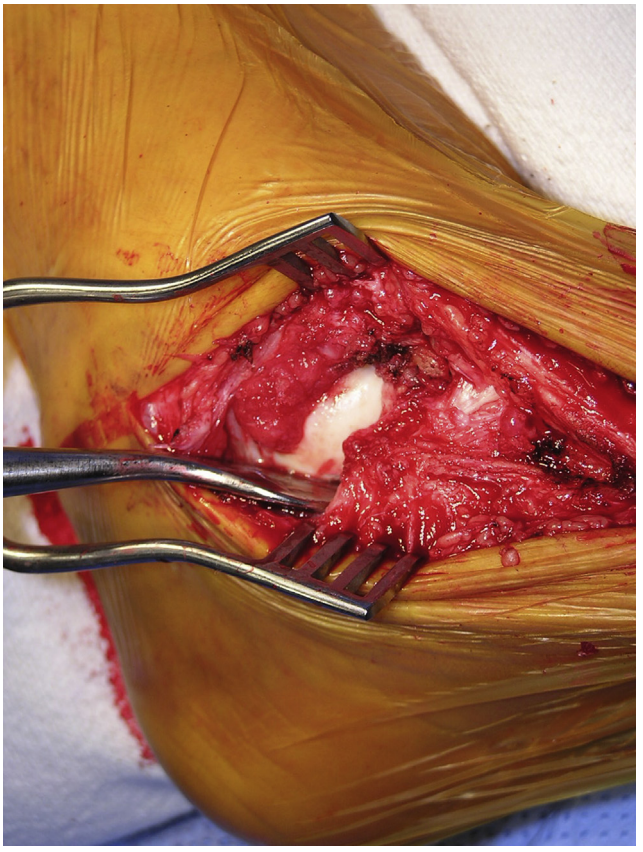

Fig. 1. Utilitarian incisional approach for medial column reconstruction. The incision can be extended proximally to restore the deltoid complex.

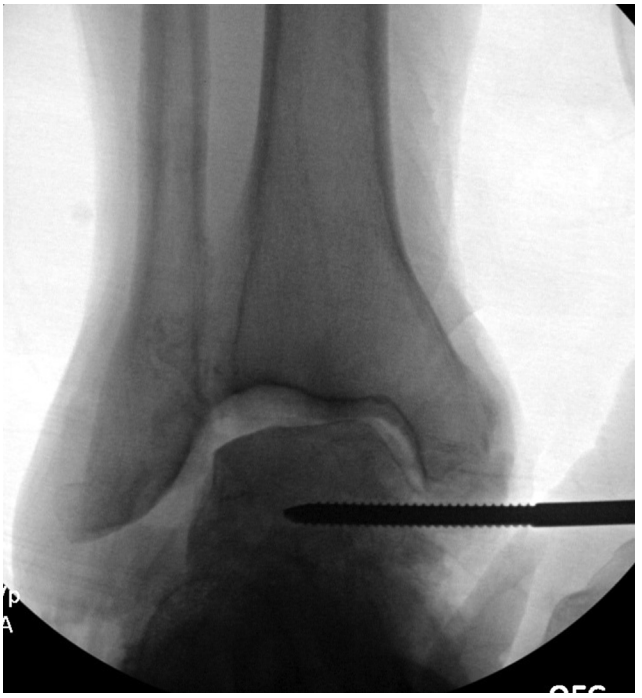

Fig. 2. Intraoperative fluoroscopy showing Shantz pin in the medial surface of the talus. The pin is used to de-rotate the talus from valgus to varus within the mortise.

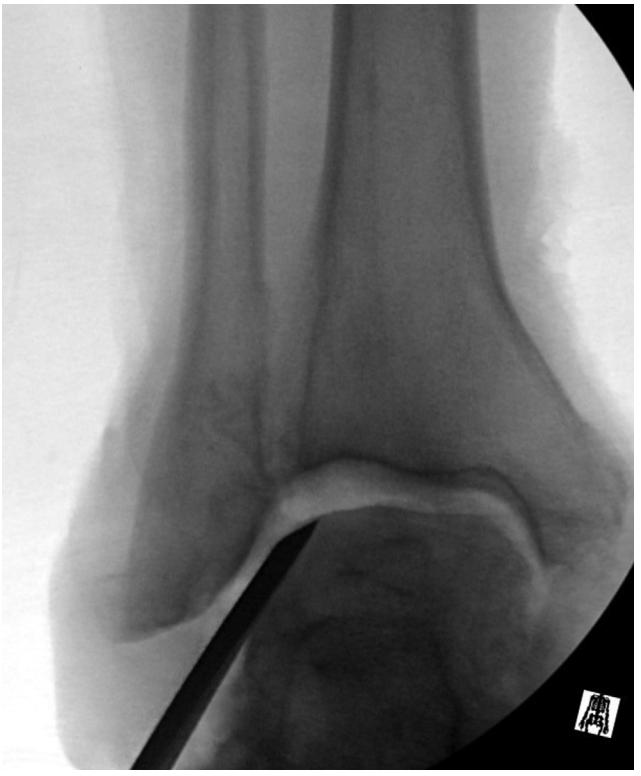

Fig. 3. Intraoperative fluoroscopic view demonstrating release of the lateral soft tissues through a small ankle arthrotomy over the lateral gutter.