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Original Research

Short-Term Radiographic Results and Technique of Tibiotalocalcaneal Arthrodesis With a Posterior Anatomic Locking Plate

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ABSTRACT

Tibiotalocalcaneal arthrodesis is a salvage procedure for severe hindfoot/ankle deformities, arthritis, avascular necrosis of the talus, failed total ankle replacement, and Charcot neuroarthropathy. The methods for fixation include anterior and lateral plates, screws, retrograde intramedullary nails, and external fixation. The purpose of the present report was to describe the short-term radiographic outcomes and technique using a posterior approach with an anatomic-specific locking plate for tibiotalocalcaneal arthrodesis. Nine patients underwent tibiotalocalcaneal arthrodesis using a posterior locking plate. The medical records and radiographs were retrospectively reviewed for patient demographics, fusion rate, complications, and patient satisfaction. The mean patient age was 57.89 ± 10.8 years, and the follow-up period was 11.11 ± 4.74 months for the patients undergoing posterior tibiotalocalcaneal arthrodesis. The mean time to weightbearing in a shoe with a brace was 16.68 weeks. The ankle and subtalar joints had healed within a mean duration of 13.61 ± 2.96 weeks. Two patients (22%) developed nonunion, 1 at both the ankle and subtalar joint and 1 at the ankle only. The present report demonstrates an alternative posterior approach to joint preparation and fixation. Direct visualization of both joints and soft tissue coverage provide a viable option for posterior fusion in patients with compromised anterior and/or lateral skin envelopes.

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Tibiotalocalcaneal (TTC) arthrodesis is a common end-stage procedure for patients with debilitating pain in the hindfoot and ankle. Talar avascular necrosis, post-traumatic arthritis, lower extremity deformities, failed total ankle arthroplasty, and Charcot neuroarthropathy are common indications for TTC arthrodesis. A variety of methods of surgical exposure and fixation for this procedure have been previously described (1–6).

A posterior approach to the ankle and subtalar joints offers many advantages compared with the traditional lateral or anterior incision (1,3,5,7,8). Posterior exposure allows the surgeon to avoid previous incisions, provides maximal exposure to both joints with the ability to reduce large deformities, preserves both malleoli, and results in a conducive environment for onlay bone grafting.

Fixation constructs have traditionally been described with retrograde intramedullary nails; however, alternative fixation with locking plates can also provide a solid construct (1–4,6). The use of anterior ankle locking plates, blade plates, humeral locking plates, and femoral locking plates has been described with success. However, limited reports have been published with a posterior-specific anatomic locking plate. The purpose of the present report was to describe the short-term radiographic outcomes and surgical technique using a posterior-specific anatomic locking plate for TTC arthrodesis.

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Conflict of Interest: Gregory C. Berlet and Christopher F. Hyer are consultants for Wright Medical Technology, Inc.

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Patients and Methods

The institutional review board approved the analysis of a retrospective case series of consecutive patients undergoing posterior TTC arthrodesis from June 2012 to February 2014. The inclusion criteria were fixation with a posterior-specific anatomic locking plate (ORTHOLOC® 3Di; Wright Medical Technology, Memphis, TN) and age

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Fig. 1. Posterior incision for tibiotalocalcaneal arthrodesis.

Fig. 3. Flexor hallucis longus muscle belly is identified and retracted medially.

>18 years. Any patients undergoing other methods of fixation and/or aged <18 years were excluded.

The clinical data, including preoperative diagnosis, total follow-up time, time to weightbearing in a shoe with a brace, and complications, were recorded. Serial postoperative radiographs were analyzed for radiographic union across both the ankle and the subtalar joints with bony trabeculation across 3 cortices. The patient population has been described in terms of the demographic and clinical characteristics using frequencies and percentages for categorical data and the mean ± standard deviation for continuous data. The percentage of patients who achieved radiographic union (in weeks) and the frequencies of complications and the need for surgical revision were recorded.

The patient was positioned prone on the operating room table, and a thigh tourniquet was used for hemostasis. A direct posterior midline incision was used for the approach to both the ankle and the subtalar joints (Fig. 1). The Achilles tendon was lengthened using either a frontal or sagittal plane Z lengthening and secured to the skin with suture for retraction throughout the procedure (Fig. 2). The deep fascia was then carefully incised, and the flexor hallucis longus muscle was encountered. The flexor hallucis longus muscle was retracted medially, taking extra care to not disrupt the neurovascular bundle (Fig. 3).

At this point, both the ankle and the subtalar joints were readily accessible for fusion preparation (Fig. 4). The articular cartilage was removed using either curettage or planar resection with a saw, as the deformity necessitated. Fish scaling and fenestration of the subchondral bone plate was performed to promote bleeding within the fusion site. Orthobiologic agents were used as indicated in accordance with the patient's risk factors and at the surgeon's discretion. All 9 patients described in this report received bone marrow aspiration from the ipsilateral calcaneus, combined with demineralized bone matrix and allograft cancellous chips.

Hardware was then inserted using a posterior-specific anatomic locking plate (ORTHOLOC® 3Di) and screws (Fig. 5). Cannulated lag screws were also positioned through plate and/or across the ankle and/or subtalar joints, as necessary, for adjunct or supplemental fixation (Fig. 6).

The soft tissue was then closed in layers, with the Achilles tendon lengthened and repaired with absorbable suture. Dermal and skin closure was performed with care to evert the skin. A soft compression dressing and posterior molded splint was then applied, with the patient in a prone position. Non-weightbearing was instituted for 6 to 8 weeks postoperatively, followed by weightbearing in a walking boot and physical therapy. Radiographic fusion was monitored using serial postoperative radiographs every 4 weeks (Fig. 7).

Results

Nine patients met our inclusion criteria with a preoperative diagnosis of primary degenerative joint disease (4 of 9; 44.4%), talar avascular necrosis (2 of 9; 22.2%), non- or malunion of a previous ankle fusion (2 of 9; 22.2%), and post-traumatic degenerative joint disease (1 of 9; 11.1%; Table). Also, 3 patients (33.3%) had diabetes mellitus, and 2 (22.2%) had peripheral neuropathy (not Charcot neuroarthropathy but alcoholic-induced neuropathy and idiopathic neuropathy). The patient cohort included 6 males (66.7%) and 3 females (33.3%), with a mean age of 57.89 ± 10.8 (range 41 to 77) years and a mean follow-up duration of 11.11 ± 4.74 (range 3.91 to 15.05) months. The mean time to weightbearing in a shoe with a brace was 16.68 ± 5.99 (range 10.43 to 30.86) weeks. The ankle and subtalar joints required the

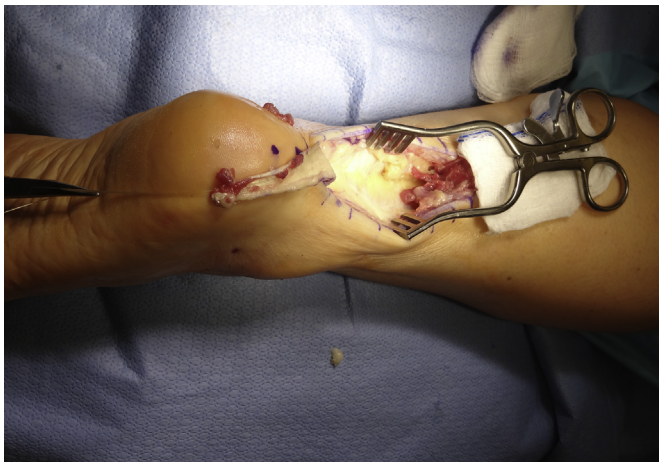

Fig. 2. Z-lengthening of the Achilles tendon showing tag suture used for retraction during procedure.

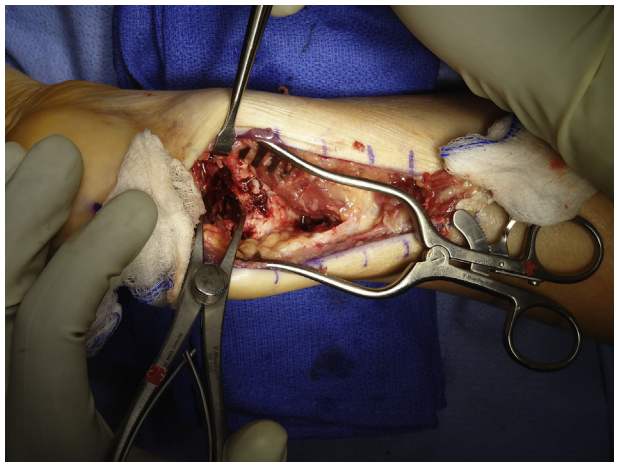

Fig. 4. Access to the ankle joint for fusion preparation.

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