Posterior Approach Using Anterior Ankle Arthrodesis Locking Plate for Tibiotalocalcaneal Arthrodesis

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ABSTRACT

Tibiotalocalcaneal arthrodesis is a successful treatment for patients with severe pain and functional disability due to Charcot joint disease or pain and dysfunction due to arthritis and subtalar joint. The primary goals of performing ankle and subtalar arthrodesis include providing anatomic alignment, pain relief, and a stable, plantigrade foot. Obtaining stable fixation and preserving the surrounding soft tissue is essential for a successful outcome (1). We present a method of fixation that uses an anterior ankle arthrodesis locking plate with a posterior approach for a tibiotalocalcaneal arthrodesis. This technique, which uses the design of the Synthes LCP anterior ankle arthrodesis locking plate (Synthes USA, Paoli, PA), has versatility and provides very good exposure of the articular surfaces for resection and tibiotalocalcaneal fusion. The technique provides a valuable option for patients with compromised skin and soft tissue structures over aspects of the ankle that make other approaches risky and complicated.

The ideal fusion should provide stability through secure fixation, reduce excessive forces through good alignment, preserve the soft tissue envelope, and have a high fusion rate (1). It has been shown that rigid internal fixation has increased rates of union with fewer complications (1,2) compared with other fixation techniques. Care must be taken to minimize the soft tissue damage that occurs with dissection, debride all sclerotic bone to bleeding, use an autologous bone graft, and obtain maximal apposition with stable fixation for an optimal result (3). The preferred position of the ankle and hindfoot is to be fused in neutral flexion, 5° to 10° of external rotation, 5° of valgus, and slight posterior displacement of the talus under the tibia (1,3–5). Misalignment can lead to persistent pain and problems ambulating, as well increased stress to the ligaments of the neighboring joint (3).

Conservative treatment should be the first consideration for ankle and hindfoot arthritis. Nonsteroidal anti-inflammatory drugs or intra-articular corticosteroid injections can provide relief from pain and inflammation (6). The use of the SACH heel, molded ankle-foot orthosis, or a rocker-bottom sole can also assist in ambulation by restricting motion in the ankle and might lessen the pain (7,8).

In preparation for surgery, all efforts should be made to promote postoperative healing. Smoking cessation should be encouraged in patients, because it has been reported to have a 14-fold greater rate of nonunion (3). A rheumatologist can be helpful relative to the medical management of patients receiving steroid therapy for rheumatoid arthritis. Patients should be weaned to an operative dose of less than 10 mg/day, if permitted, and methotrexate or similar antimetabolite drugs should be discontinued 1 week before surgery until about 2 weeks postoperatively (9).
Surgical Technique

Once general anesthesia has been achieved, the patient is placed in a prone position with the foot and ankle slightly hanging off the end of the operating table, allowing the surgeon to position the ankle into a neutral position. A mid thigh tourniquet is used for hemostasis. A large posterior incision is made over the Achilles tendon. Because arthrodesis is being attempted and the Achilles tendon has little vascularity, the tendon is excised and discarded (Fig. 2). This provides a better vascularized environment, allowing for excellent soft tissue exposure and easier closure, with less stress on the soft tissues postoperatively. The deep fascia layer is then incised, providing exposure to the deep soft tissues, in particular the low lying muscle belly of the flexor hallucis longus. Careful dissection is carried deep to the distal tibia and continued proximally and distally to expose the posterior tibia, calcaneus, ankle, and subtalar joint. With outstanding exposure, the ankle and subtalar joints are debrided, removing all the articular surfaces to healthy bleeding bone (Fig. 3). The ankle and subtalar joints are then placed in anatomic alignment and temporarily fixated with large Steinmann pins and guide wires. Using fluoroscopic guidance, two 2.8-mm guide wires are inserted from the posterior-inferior portion of the calcaneus into the distal-anterior portion of the tibia (Fig. 4). The guide wires are measured, and two fully threaded 7.3-mm cancellous screws are inserted from the distal inferior calcaneus into the distal anterior tibia (Fig. 5). The ankle and subtalar joints are then packed tightly with allogeneic bone graft to fill in any voids and to provide a shear strain relief graft (10). The anterior ankle arthrodesis locking plate is inserted and applied to the posterior tibia, talus, and calcaneus. This is fixated to the tibia, talus, and calcaneus with a combination of locking and nonlocking screws (Fig. 6). A drain is inserted, and standard deep soft tissue closure is performed, allowing for coverage of the fixation with the flexor hallucis longus muscle belly, followed with standard skin closure.

Discussion

Ankle arthrodesis using blade plate fixation has shown good clinical results for tibiotalocalcaneal arthrodesis (11,12). Many plate designs exist, allowing a selection to fit the surgeon's preference in achieving stabilization in different configurations and alignments. Locking plates use compression for reduction of arthrodesis and stable internal fixation without the drawbacks of external fixators.
With locking plate technology, the development of an interlocking interface between the screw head and plate achieves high angular stability, and stable anchoring does not depend on direct apposition of the plate to bone (15). The locking screws are placed in different directions, thereby offering stability in multiple planes (14). Rigid fixed angle fixation is obtained as a single beam construct, allowing failure to occur at a greater threshold than with traditional plates (14,16), if it were to fail. This is particularly advantageous in patients with questionable bone stock, because locking plates have a lower, irreversible deformation in osteoporotic bone than an
Intramedullary nail or blade plate (17). Locking plates are not technically difficult to use and have the advantage of ease of use compared with the intramedullary nail when it comes to placing the tibiotalocalcaneal augmentation screw, because the intramedullary canal is not occupied in the fixation construct (13).

In conclusion, we have presented a new method of fixation that uses a posterior approach to tibiotalocalcaneal ankle arthrodesis using the design of the Synthes LCP anterior ankle arthrodesis locking plate (Synthes, Paoli, PA). This technique shows the versatile positioning of the existing design, because it fits anatomically along the posterior surface of tibia and the superior aspect of the calcaneus (Figs. 7 and 8). Stable fixation is achieved with the benefit of a thicker and well vascularized soft tissue envelope provided by the posterior structures. This is an excellent technique to achieve stable fixation for tibiotalocalcaneal arthrodesis in patients with compromised soft tissues that prevent the use of other approaches.

References


Fig. 8. Lateral view demonstrating anterior ankle arthrodesis locking plate applied posteriorly with good anatomic alignment. Preoperative lateral radiograph of patient C demonstrating significant equinus contracture and Charcot arthropathy of hindfoot and ankle.