The indications for tibiotalocalcaneal or tibiocalcaneal arthrodesis include pantalar arthritis, neuropathic fracture, osseous necrosis of the talus, failed total ankle arthroplasty, and symptomatic traumatic arthrosis involving the ankle and subtalar joints.

Arthrodesis of these joints can be accomplished in several ways. Using large lag screws and plate fixation or a combination of these techniques has resulted in satisfactory outcomes, however, until consolidation is sufficient, weight bearing must be restricted to avoid hardware failure and mal- or nonunion.

Intramedullary fixation has provided a means by which fusion can be achieved while allowing protected weight bearing 4-to-6 weeks after surgery. Implants designed for use in the distal femur were initially used for this purpose. Soon, many manufacturers produced intramedullary nails specific to the hindfoot and ankle. Almost without exception these devices are straight and are stabilized with locking screws both proximally and distally.

The straight nail design has several inherent pitfalls. If the nail is inserted in alignment with the medullary canal of the tibia, the entry is through the sustentaculum tali, and the neurovascular bundle and flexor hallucis longus tendon are at risk. If one places the nail in the medial/lateral center of the calcaneus, the nail must be angled medially to come to rest in the medullary canal of the tibia in order to avoid a varus position of the hindfoot. Angling of the nail results in a bending stress being applied to the device with weight bearing prior to consolidation. In addition, cantilever stress applied to the calcaneus causes problems with loosening or failure of the distal locking screws, osteolysis around the nail itself or failure of the nail.

The hindfoot arthrodesis nail (HAN) differs from implants currently available on three main points. The first unique point is a 12° valgus bend at the level of the tibial plafond (Fig 1). This design allows the nail to be inserted in the medial/lateral center of the calcaneus and advanced through the talus or graft and into the medullary canal of the tibia. This feature allows for anatomical alignment (valgus) of the hindfoot while allowing axial loading of the implant.

The distal locking options represent another feature unique to the HAN. In addition to distal locking with one or two 6.0 mm screws parallelling the long axis of the calcaneus, a twisted blade can be inserted and locked, creating a fixed, angled device. The blade’s geometry and broad surface equates with

This article considers how the hindfoot arthrodesis nail (HAN) answers requirements presented by complex cases in foot and ankle surgery.

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increased stability, which is paramount to the consolidation of the subtalar joint.

A third unique feature is an oblique screw-hole at the level of the talus providing several options. When aligned with the longitudinal axis, a locking screw can be placed through the body, neck, and head of the talus. A lag screw can be used to achieve compression of graft material and a viable talar head in the case of osseous necrosis of the body of the talus. Another available option is the use of a screw of sufficient length to be advanced through the talus, navicular, medial cuneiform, and across the tarsometatarsal joint as adjunct stabilization of the medial column.

The specific technique can be performed with the patient in prone, supine or lateral position. The tibiotalar and subtalar joints are exposed through a transfibular approach and prepared for arthrodesis. The plantar aspect of the calcaneus is exposed through a longitudinal plantar incision taking care to avoid injury to the plantar nerves.

Reaming the calcaneus, talus, and tibia for nail placement is a two-step process. With the subtalar joint maintained in a weight-bearing position, a guide-wire is advanced with fluoroscopic assistance. The guide-wire is inserted in the medial/lateral center of the calcaneus and advanced to the center of the dome of the talus, aligned with the center of the medullary canal of the tibia from a lateral projection (Fig 2). The guide-wire is over-reamed and removed. The ankle and subtalar joints are then inverted and a defect created in the center of the plafond. A ball-tipped guide-wire is advanced into the medullary canal and the tibia over-reamed to a diameter 1-to-2 mm greater than the diameter of the nail to be implanted. The nail is then inserted and locked, first distally, then proximally. The distal fibula is fixed to the tibia, talus, and calcaneus after removal of the medial cortex and subchondral bone. The fibula acts as a “living plate” and contributes to the fusion mass (Fig 3).

The postoperative protocol is individualized. Generally, patients are non-weight-bearing for the first two weeks and then flat-foot-to-balance in a CAM walker for an additional three-to-four weeks. Weight bearing is increased slowly over the next four-to-six weeks based on x-ray and clinical examination. Once the patient is no longer restricted and wearing regular footgear, he/she is encouraged to have several pairs of shoes modified with a stiff rocker sole. This will help alleviate stresses to the midfoot and tibia.

The HFN is available in three diameters (10, 12, and 13 mm) and three lengths (150, 180, and 240 mm).
Case study 1

A 72-year-old male with a neuropathic fracture/dislocation involving the talus and subtalar joint (Fig 4a–b). The patient had become wheelchair bound due to his pain. His swelling precluded the use of off-the-shelf shoes. His treating physician, who referred him for a second opinion, had recommended an amputation. Arthrodesis of the ankle and subtalar joints was proposed. The patient was informed of the risks and benefits as well as the possibility of below knee amputation in the future. Following surgery, the patient began partial weight bearing at six weeks. At 12 weeks the CAM walker boot was discontinued and he was fitted with a UCBL shoe insert. At his 18-month follow up (Fig 4c–d) he was able to walk with a cane and the UCBL insert. His swelling had resolved sufficiently to wear regular footgear.

Case study 2

A 57-year-old diabetic male sustained a neuropathic fracture dislocation of the right ankle. He had been casted for eight weeks without first reducing the ankle. He was unable to bear weight and could not return to work as a chef. He was treated surgically with the HAN. As illustrated in the lateral x-ray, the anterior plafond had to be removed in order to realign the ankle joint. At his eight-week postoperative visit the patient was instructed to progress his weight bearing as tolerated using the CAM walker. At four months (x-rays) he was released to return to work. At six months his swelling had resolved by 50% (Fig 5a–b).
Case study 3

A 60-year-old male had been involved in a motor vehicle accident three years prior. He had sustained an open, trimalleolar ankle fracture with a comminuted fracture of the left talar body and a closed right trimalleolar ankle fracture. He had undergone open treatment of both injuries. Approximately one year after his accident he developed increasing pain and swelling. X-rays demonstrated collapse of the body of the talus and malunion of the medial malleolar osteotomy (Fig 6a-b). A plan was made to remove the necrotic, infected talar body. The head was maintained. A cement, antibiotic spacer was placed and the patient was immobilized with an external fixator while undergoing IV antibiotic therapy. Six weeks later the frame was removed. The antibiotic, cement spacer was removed in favor of a contoured femoral head allograft. The HAN was inserted and a lag screw used to compress the talar head-graft interface (Fig 6c–d). Weight bearing was begun at three months. The patient walks with a cane and is to be suppressed with long-term oral antibiotic therapy.

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