

Tibio-talo-calcaneal Arthrodesis Using Intra-Medullary Fibular Autograft and External Fixation in Charcot Limb Salvage

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Purpose

Tibio-talo-calcaneal arthrodesis with the use of intra-medullary nailing is a common procedure in diabetic limb salvage. This case study shows an alternative to using a traditional metal intra-medullary nail. A fibular autograft was harvested on the ipsilateral side and used as an intra-medullary nail supplemented by an Ilizarov external fixator.

Literature Review

Tibio-talo-calcaneal fusion is a limb salvage procedure used in patients with conditions affecting the ankle and subtalar joints. The concept of using the fibula as an intra-medullary nail was first described by Lexer in 1906 using a cadaveric fibula (1). In 1915, Albee modified Lexer's technique by harvesting the fibula from the ipsilateral extremity (2).

Successful use of autogenous intra-medullary fibular graft for tibio-talo-calcaneal fusion has been reported in the literature (4,5,6,7). In 2012, Jeong et al. performed a tibio-talo-calcaneal fusion via autogenous intramedullary fibular graft with external fixation in a revision Charcot case (4). Autograft intra-medullary fibula with supplemental fixation was successfully used to revise infected tibio-talo-calcaneal nails in two cases reported in 2016 (6). A case study performed by Shah et al. with 16 patients showed 81.2% union rate using fibular intra-medullary nailing with supplemental fixation. The case study included patients with previous infection (37.5%) as well as Charcot arthropathy (31.2%) (7).

Procedures

A 62 year old diabetic male with previous Charcot reconstruction of the left foot including medial column, lateral column, and subtalar joint fusion two years prior presented with redness and swelling of the ankle for 1 month. A CT scan showed fracture of the talus, loosening of hardware, and soft tissue abscess (Fig. 1).

Patient underwent an initial surgery to remove all hardware along with biopsies of the tibia, fibula, talus, and calcaneus. An antibiotic spacer was placed into the ankle joint. During the removal of the hardware, roughly 50% of the talus was lost (Fig. 2) The biopsies demonstrated fibular osteomyelitis, and the patient was placed on IV antibiotics for 8 weeks. Patient was brought back to the operating room after eight weeks for new bone biopsies and antibiotic spacer exchange. All biopsies came back negative.

One month later the patient had elected to undergo a tibio-talo-calcaneal fusion as a limb salvage procedure. The autograft fibula was harvested and shaped into an intra-medullary nail with multiple drill holes to allow healing and incorporation into tibia, talus, and calcaneus (Fig. 3). The ankle and subtalar joints were prepped in the usual fashion. The tibial canal was reamed using flexible reamers from a traditional intra-medullary nail system. The fibular graft was packed full of recombinant platelet derived growth factor (rh-PDGF) and inserted into the plantar aspect of the calcaneus and up the tibial canal in a retrograde fashion (Fig. 3). The remaining rh-PDGF was placed into the ankle and subtalar joints. A circular external fixator was placed to provide compression and stability (Fig. 3). The compression was increased every two weeks for the first 8 weeks post-operatively. The external fixator remained intact for 20 weeks post-operatively.



Figure 1 Plain film radiographs and CT scan demonstrate previous Charcot reconstruction with loosening of hardware and fracture of the talus.



Figure 2 Significant loss of talus post debridement.

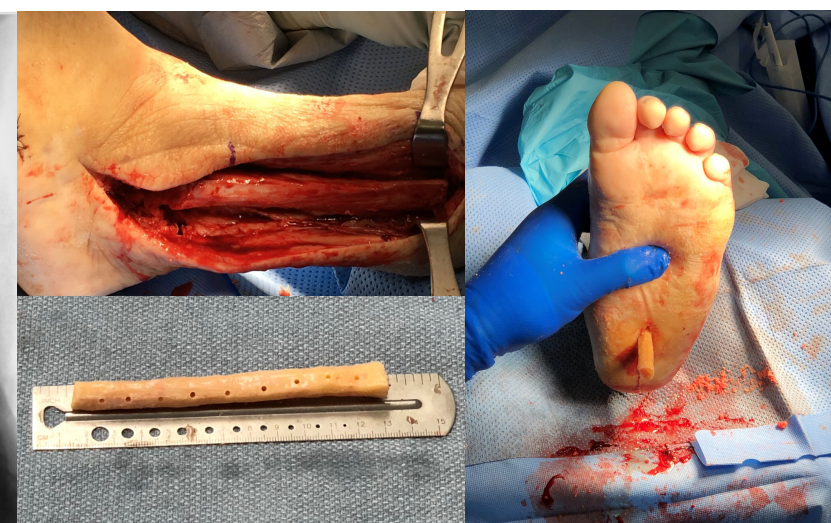


Figure 3 Harvesting and preparation of fibula shown. Fibula was placed from plantar aspect of calcaneus through talus and tibia in a retrograde fashion.

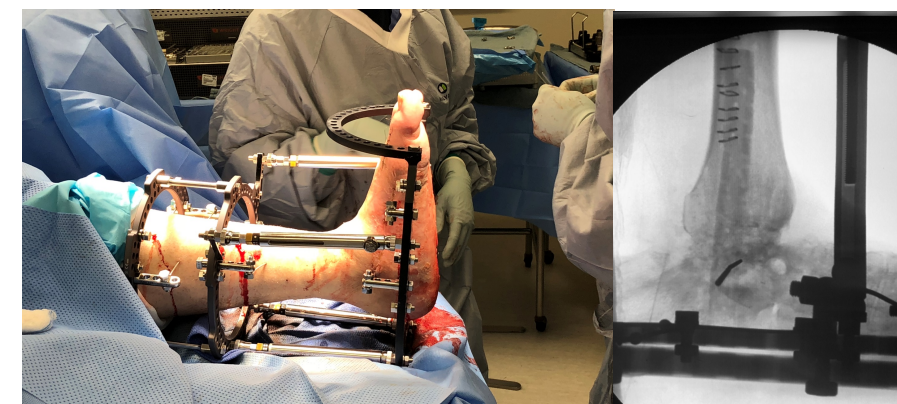


Figure 4 Placement of external fixator shown on left. Right image is radiograph demonstrating intra-medullary fibular placement.

Results

A CT scan performed 5 months post-operatively demonstrated fusion of the ankle and subtalar joints with incorporation of the fibular graft into the tibia (Fig. 5). The external fixator was removed at 20 weeks post-operatively. Patient was walking in a CROW boot at 28 weeks post-operatively.

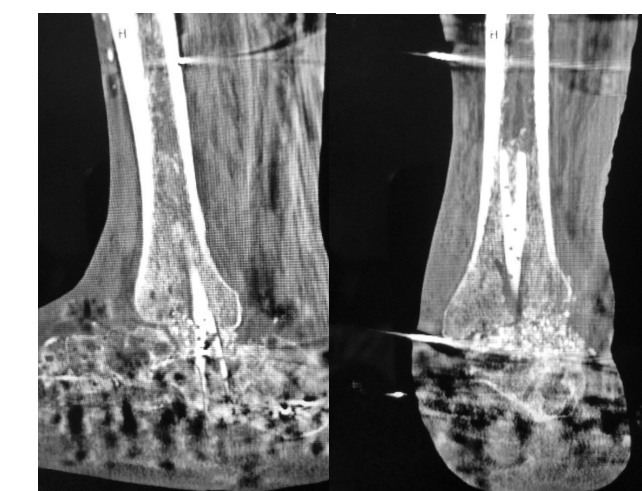


Figure 5 CT scan obtained 5 months post-operatively demonstrating tibio-talo-calcaneal fusion with incorporation of fibular autograft.



Figure 6 Radiographs taken at 1 year post-op.

Analysis & Discussion

Diabetic limb salvage in the setting of Charcot with superimposed infection is a challenge for Foot and Ankle Surgeons. The use of a fibular allograft as an intra-medullary nail with external fixation was able to provide fusion and limb salvage in this case. One advantage of autograft fibula is the osteogenic, osteoinductive, and osteoconductive properties the bone inherently has. There is no increase in morbidity harvesting the fibula when utilizing the standard lateral approach. Potential disadvantages of this approach are the technical difficulty of the procedure, including the potential to break the graft during insertion. This approach is of value due to the avoidance of placing traditional internal fixation where there is a concern for deep infection. If the need arises, a metal intra-medullary nail could be placed.

References

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