CALCANEAL REPLACEMENT

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Introduction

In 1987 we reported on a calcaneal replacement with a fresh frozen donor calcaneus (1). The following will provide some additional detail of the surgery as well as follow-up observations. The patient at this writing (September 1987) is more than 18 months post surgery and is working and walking on the foot without disability.

Case Report L.G.
(Referral from Frank Fortunata, D.P.M., CT)
(Aftercare by Robert Marra, D.P.M., Enfield, CT)

The patient is a white female, originally from Poland. At the time of our original surgery she was 34 years old and living in Connecticut. She had undergone resection of most of the calcaneus more than 15 years earlier in the treatment of osteomyelitis. The resection of the calcaneus had, of course, removed the lever arm for function of the triceps muscle through detachment of the achilles tendon. When initially contacted by the patient's podiatrist we were advised of the severe limitations imposed on the patient by the absent calcaneus and were asked to consider replacing it.

National Search

The patient's radiographs and photographs were studied. The calcaneus of the opposite foot was traced from a lateral radiograph. Measurements were made and recorded on the drawing. The Atlanta Regional Organ Procurement Agency (AROPA) placed the request in the computer and sent the request and the needed dimensions out to other organ procurement agencies throughout the country (Figs. 1, 2, 3).

More than 9 months later a suitable calcaneus was located. The bone was removed under sterile conditions and appropriate cultures and blood test obtained. The bone was frozen for transport and flown to Atlanta.

The patient had been previously alerted to expect call on short notice.

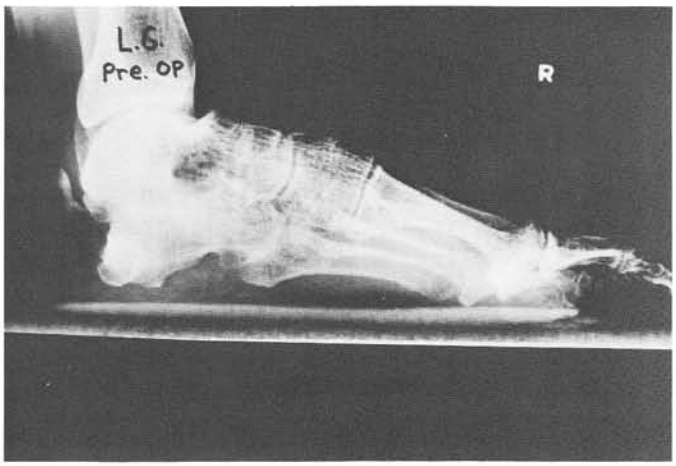


Fig. 1. Patient's calcaneus resected 15 years earlier in treatment of osteomyelitis.

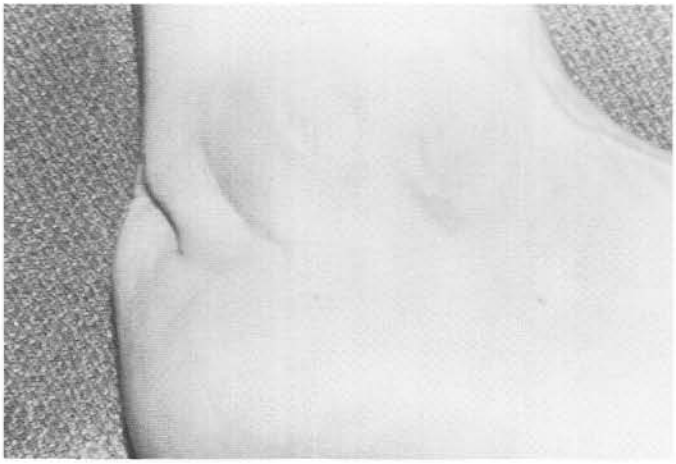


Fig. 2. Lateral view of right heel shows deep adhesion of skin to bone.

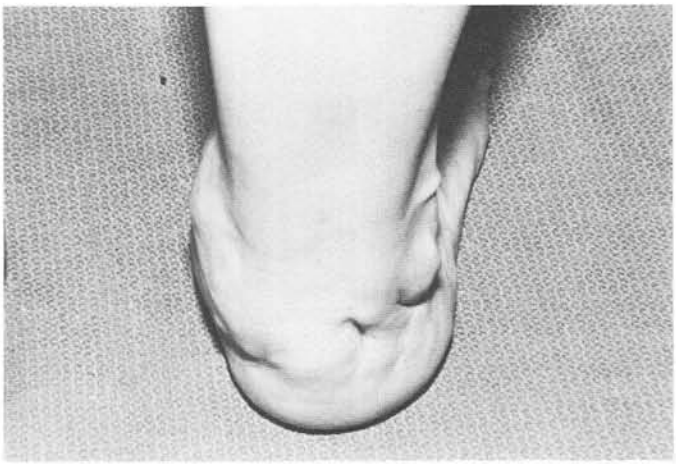


Fig. 3. Posterior view shows splay of soft tissue due to absence of calcaneus.

Three days later the patient was in surgery at HCA DOCTORS HOSPITAL for the replacement.

Presurgical Considerations

A major consideration was the condition of the soft tissue over the posterior and lateral aspects of the heel. Full thickness adhesions existed from the skin to the posterior ankle and lateral talus in several areas (Figs. 2, 3). Several deep folds were present. The patient complained of tarsal tunnell syndrome, possibly due to walking directly on the neurovascular bundle in the absence of a calcaneus. It was determined that delamination of soft tissue layers would have to be extensive in order to provide the soft tissue envelope for the bone.

Whether to reattach the achilles tendon at the same surgery or at a subsequent surgical interval was debated. It was ultimately decided that if this could be done with minimal additional trauma and without placing stress on the graft it would be indeed be attached.

The patient was Rh negative while the donor was Rh positive. It was deemed advisable to provide the patient with a single injection of Rhogam as protection; though it is questionable whether this was really required.

A history of several years of osteomyelitis had been the genesis of difficulty requiring removal of the bulk of the calcaneus. Many clinicians feel that an area of old osteomyelitis is at high risk for reinfection with surgery to the area. It was determined best to resect all sclerotic appearing bone and to attempt to anchor the new calcaneal graft to healthy corticocancellous bone.

A team concensus that rigid internal fixation be used required little debate.

Surgery

Surgery was performed through an "L" shaped incision lateral to the achilles tendon and along the lateral aspect of the foot. The deep fascial level was identified to the extent possible and the layers de-laminated by extensive lysis of scar tissue and deep adhesions. The posterior ankle and plantar talar areas were exposed as was the calcaneocuboid area.

The plantar aspect of the talus and the proximal aspect of the cuboid were resected to normal bone, making sure that raw high quality cancellous bone remained (Fig. 4).

The frozen calcaneus which had been immersed in sterile water to thaw was stripped of all soft tissue attachments. It was positioned against the recipient surface and marked with a sterile skin scribe for fitting. A large oscillating saw blade was used to trim the graft (Fig. 5).

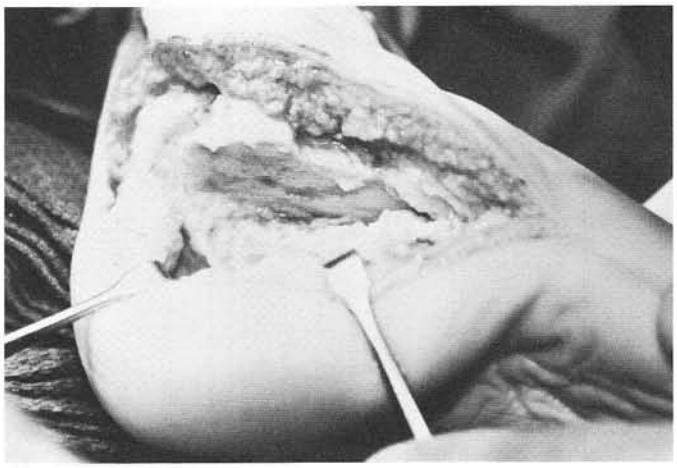


Fig. 4. Bone is resected from plantar talus and proximal cuboid to provide good quality surface for grafting.

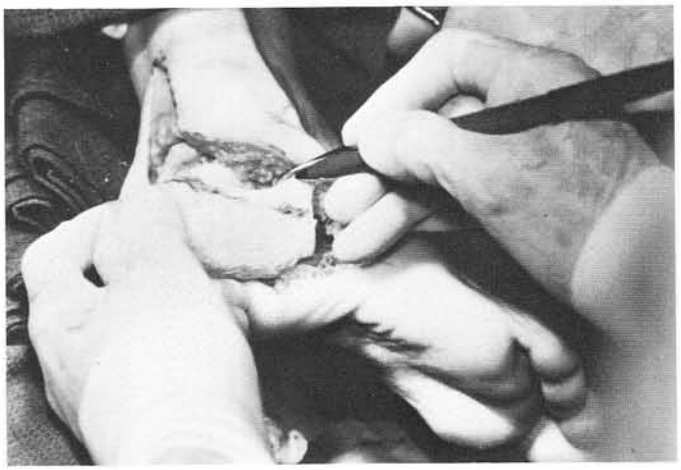


Fig. 5. The freshly thawed calcaneus is held in place and marked for fitting.

The fitted calcaneus was positioned on the recipient surfaces and temporarily fixated with .062 Kirschner wires. After radiographic confirmation of alignment screw fixation was completed with one 6.5mm and one 4.0mm lag screw (Fig. 6, 7).

The achilles tendon was mobilized and easily attached to drill holes in the posterior calcaneus without tension.

Soft tissue closure was effected without tension but with little elastic reserve to accommodate swelling (Fig. 8). There was also some concern for the absence of good quality subcutaneous tissue over the lateral aspect of the heel.

Postoperative Course

The first five days postoperatively were entirely benign. On the sixth day the patient complained of increased pres-

Fig. 6. The fitted calcaneus is temporarily fixated with .062 Kirschner wires for radiographic evaluation.

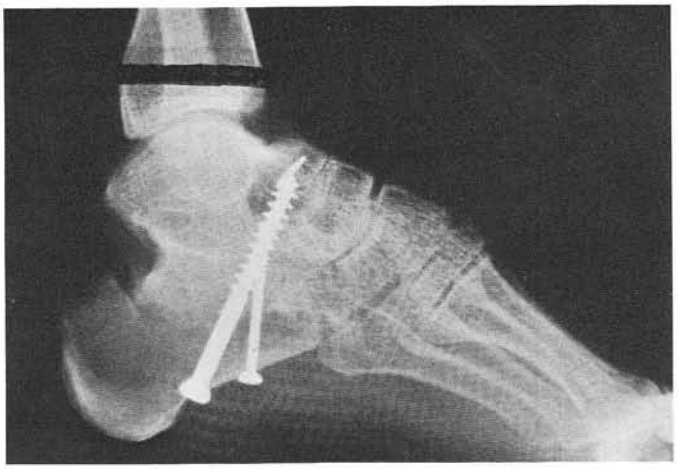


Fig. 7. Rigid internal fixation of graft is achieved with 6.5mm and 4.0mm cancellous screws.

Fig. 8. Soft tissue closure is effected without excess tension but with little reserve.

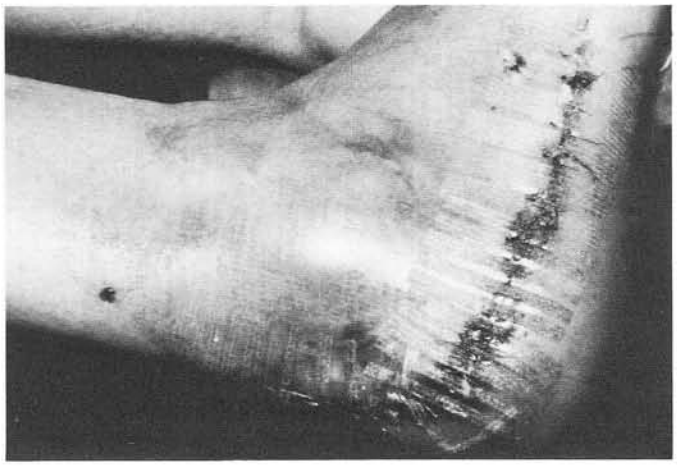


Fig. 9. Six days postoperatively increased pain and pressure signaled presence of hematoma.

Fig. 10. Site of incision and drainage resulted in slough with exposure of graft.

sure. A cast change revealed a sizable hematoma over the lateral aspect of the heel (Fig. 9). Despite concerns for the graft it was concluded that this must be drained and cultured. Pseudomonas aeruginosa was cultured though no real clinical evidence of infection was ever seen. Nonetheless, the patient was treated with appropriated intravenous antibiotics throughout hospital stay and was continued on a new investigational oral antipseudomonal agent for the balance of the year after return home.

The site of incision and drainage sloughed and created a gaping hole over the lateral calcaneus and was kept packed until conclusive evidence of sterile cultures was present (Fig. 10).

Surgery -2

Six months later the patient was returned to surgery at HCA Doctors Hospital to rotate a full thickness neuroar-

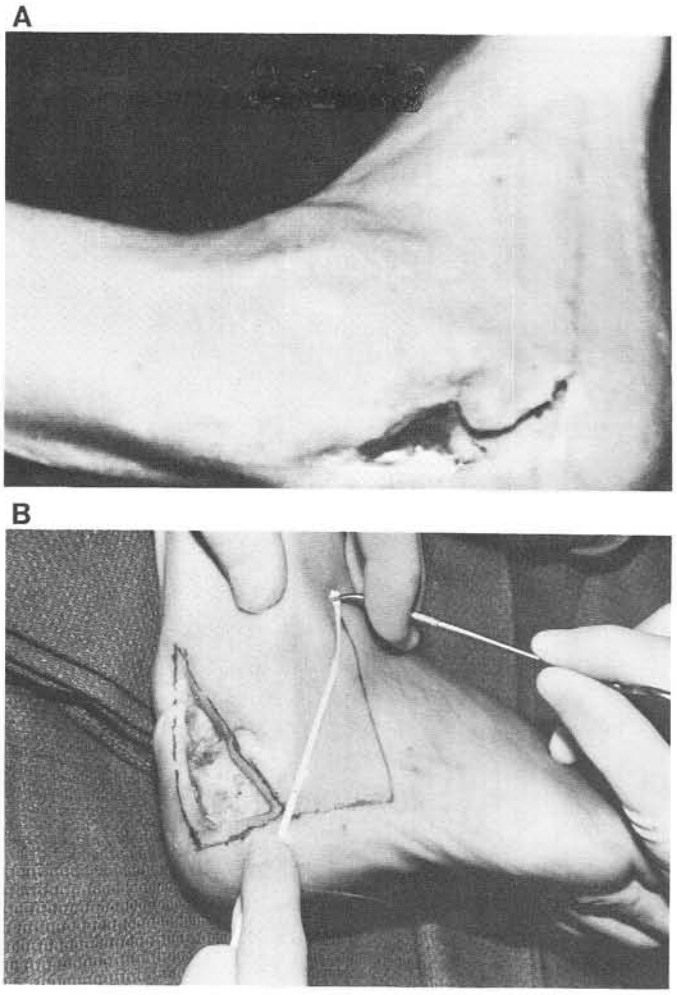


Fig. 11. A, B. Six months post surgery patient returned for full thickness neuroarterial flap.

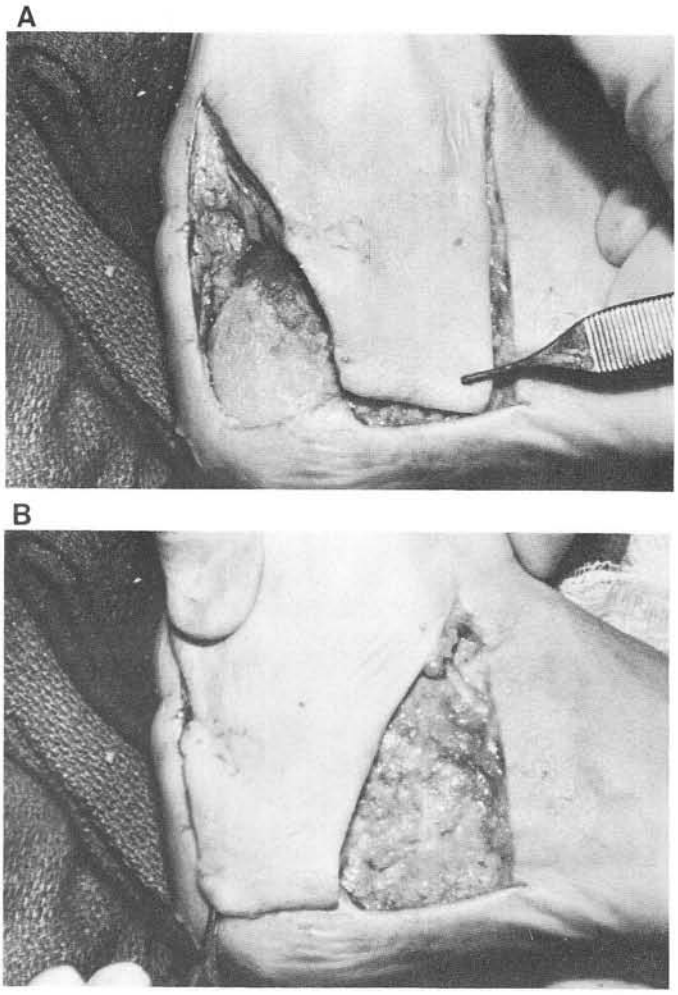


Fig. 12. A, B. Flap rotated from lateral ankle to cover lateral heel defect.

terial flap to cover the slough defect, 1.5 x 4.cm. (Figs. 11 A & B, 12 A & B).

Because of the continuing concerns of infectious disease consultants the internal fixation screws were removed at this surgery (Fig. 13). Serial radiographs had shown solid incorporation of the graft several months earlier.

Postoperative Course

The patient healed well following the rotational flap and the donor site which was covered with split thickness skin from the thigh likewise healed well (Fig. 14). The patient did develop a small slough at the very apex of the flap which proved to be very slow in granulating. Several attempts at currettage proved of little help in speeding granulation. No infection was evident, and it was felt that the meager subcutaneous tissue and the presence of the graft immediately beneath probably contributed to the slow granulation (Figs. 15 A & B)

Crutches were used to maintain non weightbearing on the involved foot for a full year following the initial surgery. Of interest, the tarsal tunnell syndrome present prior to surgery resolved immediately following surgery, tending to confirm the assumption that weightbearing on the neurovascular bundle was probably responsible for the condition.

Ultimately the patient was allowed to return to a shoe and to full weightbearing on the involved foot. She walks without pain though at times she favors the foot slightly (Fig. 16)

Radiographs by sixteen months post operative began to provide some concern in the absorption of cancellous bone along the tract of the internal fixation screws. This continued to be observed in the absence of clinical symptoms and was re-x-rayed monthly (Fig. 17). Eighteen months post surgery the patient indicated that she was experiencing no pain, swelling or erythema, and did not appear clinically affected by the lytic area. The lytic area was, however, of continuing concern lest it provide a weak area for pathologic fracture.

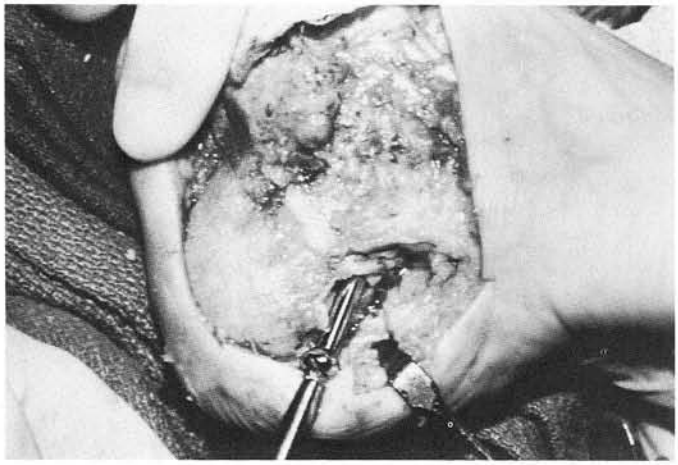


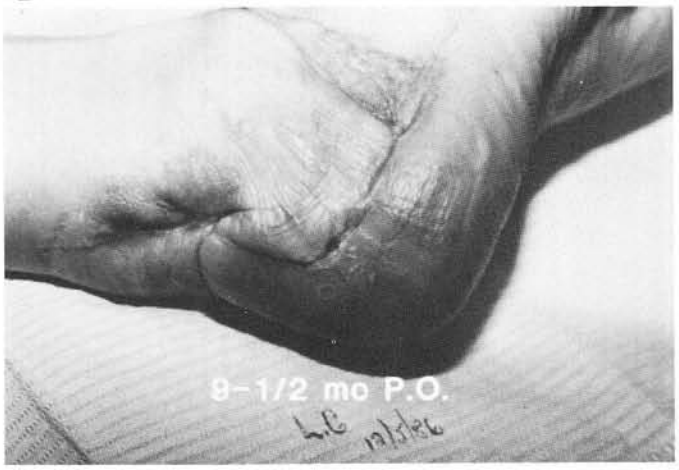
Fig. 13. Screw fixation is removed.

Fig. 14. A split thickness skin graft covers donor site of anterolateral ankle.

A

Fig. 15. A. Nine and one-half months following calcaneal implant radiograph shows satisfactory incorporation.

B



B. Skin is healed except for small sinus at the posterior distal corner of the flap.

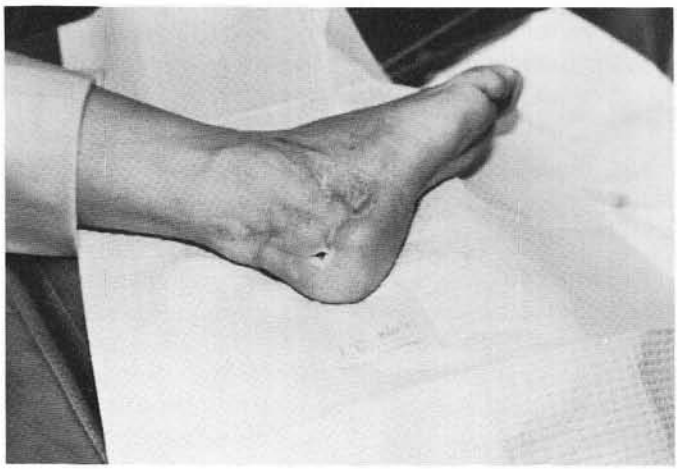


Fig. 16. Appearance at 15 months. Patient has been wearing shoes for several months and now walks with little or no limp. Sinus has again been debrided.

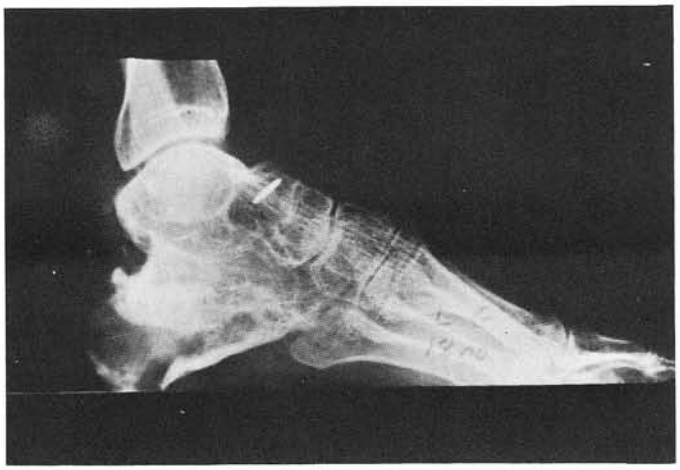


Fig. 17. Eighteen month lateral radiograph shows lytic area within calcaneus approximating screw path. No clinical signs or complaints are present; though concern is present for possible susceptability to pathologic fracture.

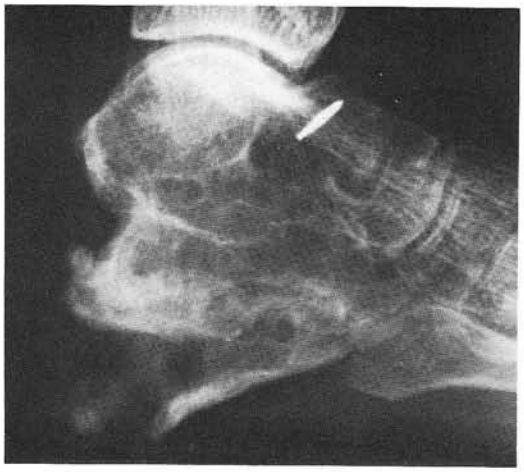


Fig 18. Nineteen months following surgery patient was readmitted with draining sinus tract and apparent osteomyelitis, subsequently confirmed by bone biopsy.

Fig. 19 Radical debridement of osteomyelitic bone was required, but lever arm of Achilles attachment was preserved.

Nineteen months post surgery the patient was readmitted to the hospital with an infected sinus tract which exited the posterior plantar lateral heel, the area which had been slow in healing. Radiographic examination demonstrated what appeared to be osteomyelitis (Fig. 18). Bone infection was confirmed by bone biopsy.

Because the patient was pregnant at the time (16 weeks) it was deemed inadvisable to place her on longterm antibiotics. Radical debridement was therefore required. Nineteen months following the original surgery radical boney debridement was accomplished under ankle block anesthesia (Fig. 19). The wound was packed open to facilitate local wound care since continuing antibiotic coverage would not be possible.

General anesthesia was avoided because of pregnancy. Sufficient bone was preserved as to protect the lever arm for function of the achilles tendon. It is only hoped that further debridement will not be necessary which could sacrifice the attachment and render the ankle unstable.

Conclusions

We believe that replacement of an entire bone of the foot is a viable consideration. The condition of the soft tissue is one of the major concerns of such surgery as well as the condition of the bone to which the graft is to be anchored. Grafts need to be placed without soft tissue tension even if the desired size has to be compromised somewhat. A little reserve tissue elasticity needs to be present to handle anticipated edema and potential complications such as hematoma or infection. Strict adherrance to graft harvesting and utilization is essential.

References

1. Merrill T, McGlamry ED, Mahan K: Osteochondral grafts and bone transplants. In McGlamry ED, McGlamry RC (eds): *Reconstructive Surgery of the Foot and Leg Update 87,* Podiatry Institute, Tucker, GA, 1987.