

Limb Salvage for Calcaneal Osteomyelitis with Pin to Bar External Fixation

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Statement of Purpose

The prevalence of heel ulcers is as high as 18% in hospitalized patients.¹ Due to lack of underlying muscle, protective fat pad, and constant pressure, poor tissue perfusion to the area inhibits healing. Concomitant comorbidities such as diabetes, neuropathy, and peripheral arterial disease provide added challenges to limb salvage. The incidence of surgical intervention in a diabetic patient with foot ulcers is 97%, with 71% going on to some form of amputation.² Patients with underlying calcaneal osteomyelitis are often consulted for BKA amputation which increases energy expenditure by 25%, and 33% of BKA amputees do not survive beyond two years.^{3,4} Our study aims to provide a reproducible approach for heel ulcers with underlying calcaneal osteomyelitis. Partial calcaneotomy with primary flap closure and offloading pin to bar external fixation allows for cost-effective fixation, accelerated healing, and a satisfying functional result in true limb salvage cases.

Level of Evidence

Level IV

Methodology and Procedure

Diabetic patients diagnosed with osteomyelitis of the calcaneus were treated with radical resection of the calcaneus with primarily closure and utilization of pin to bar external fixation with the SALSastand method.⁵ A combination of two excisional approaches were utilized based on the location of the ulcer. Straight excisional elliptical excisions for posterior ulcers and a posterosuperior flap for more plantar calcaneal ulcers (Figure 1). The primary wound was excised and the achilles tendon was completely resected at its insertion. Utilizing a large saw, the calcaneus was resected from proximal superior to distal inferior in an oblique fashion (Figure 2). A margin of 0.5 cm of bone was resected from the involved bone via diagnostic advanced imaging. Incision was then closed primarily and the patient was switched to supine. A pin to bar external fixation frame was then applied to the leg for offloading of the posterior flap. In safe zone 4, just distal to the midshaft of the tibia, two 5-0 half pins were placed into the tibial crest.⁶

Methodology and Procedure continued

Two 45 degree elbows were placed in the tibial clamp and 2 bar frames were then extended toward the level of the forefoot and heel. Two more 5-0 half pins were then inserted into the navicular and the cuboid to help construct the offloading frame. Pin to bar mechanism was then utilized to connect the two bars from the elbow to the midfoot pins as well as a large offloading "U" frame that went posterior around the heel (Figure 3).

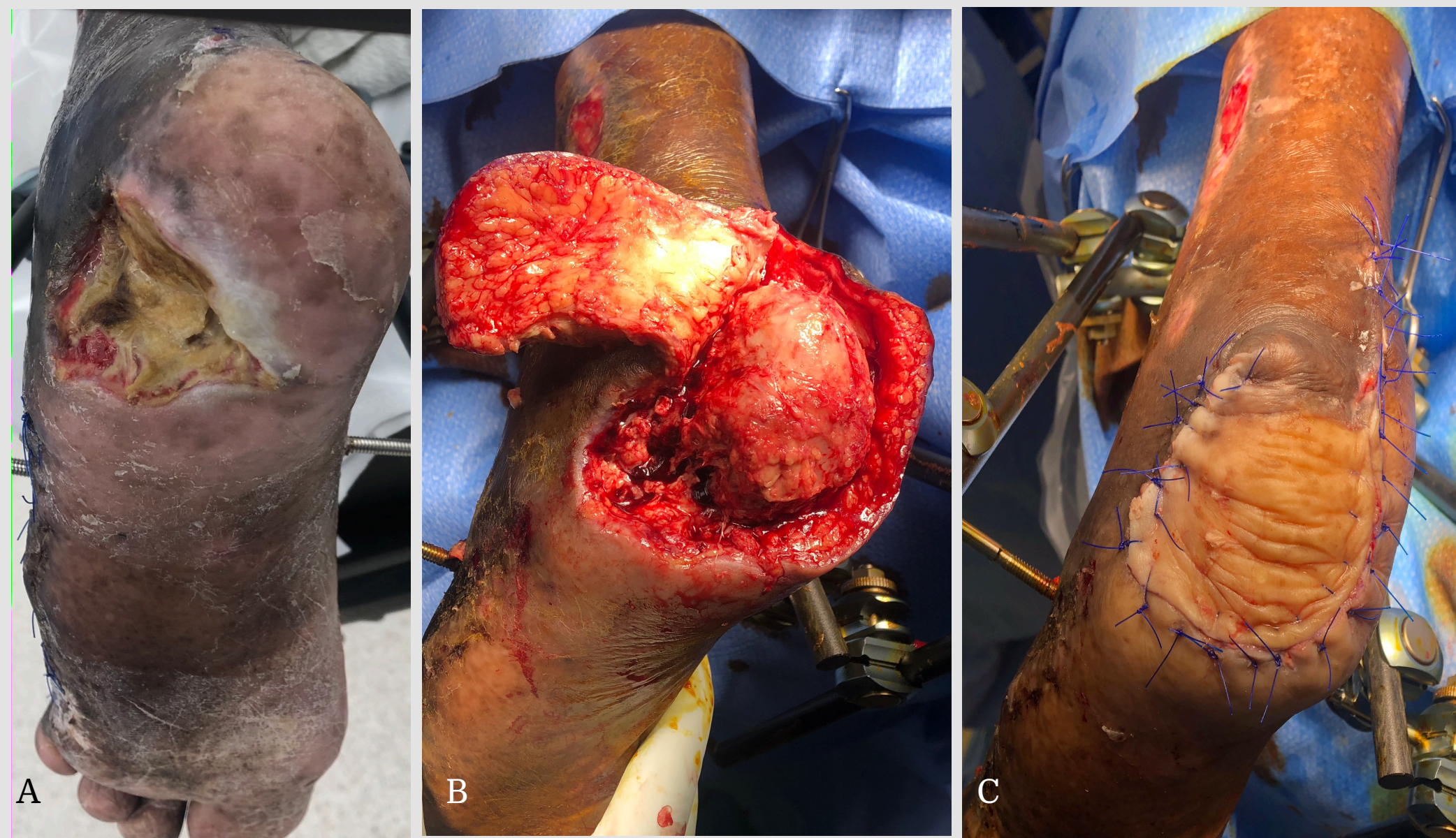


Figure 1. A. Plantar lateral wound probing directly to calcaneus. B. Posterosuperior Flap from achilles area rotated plantarly. C. Sutured flap over deficit, knots tied outside flap.

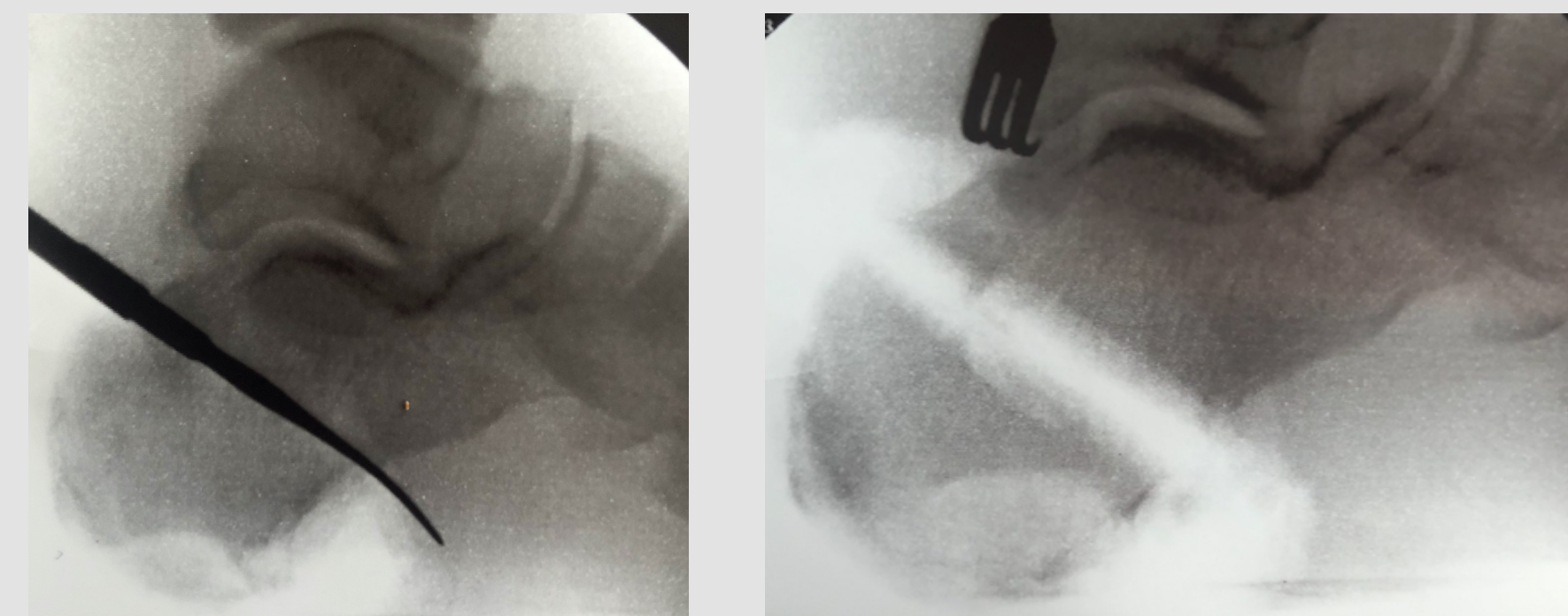


Figure 2. Planned resection of calcaneus with section taken. 0.5 cm margin using MRI guided resection.

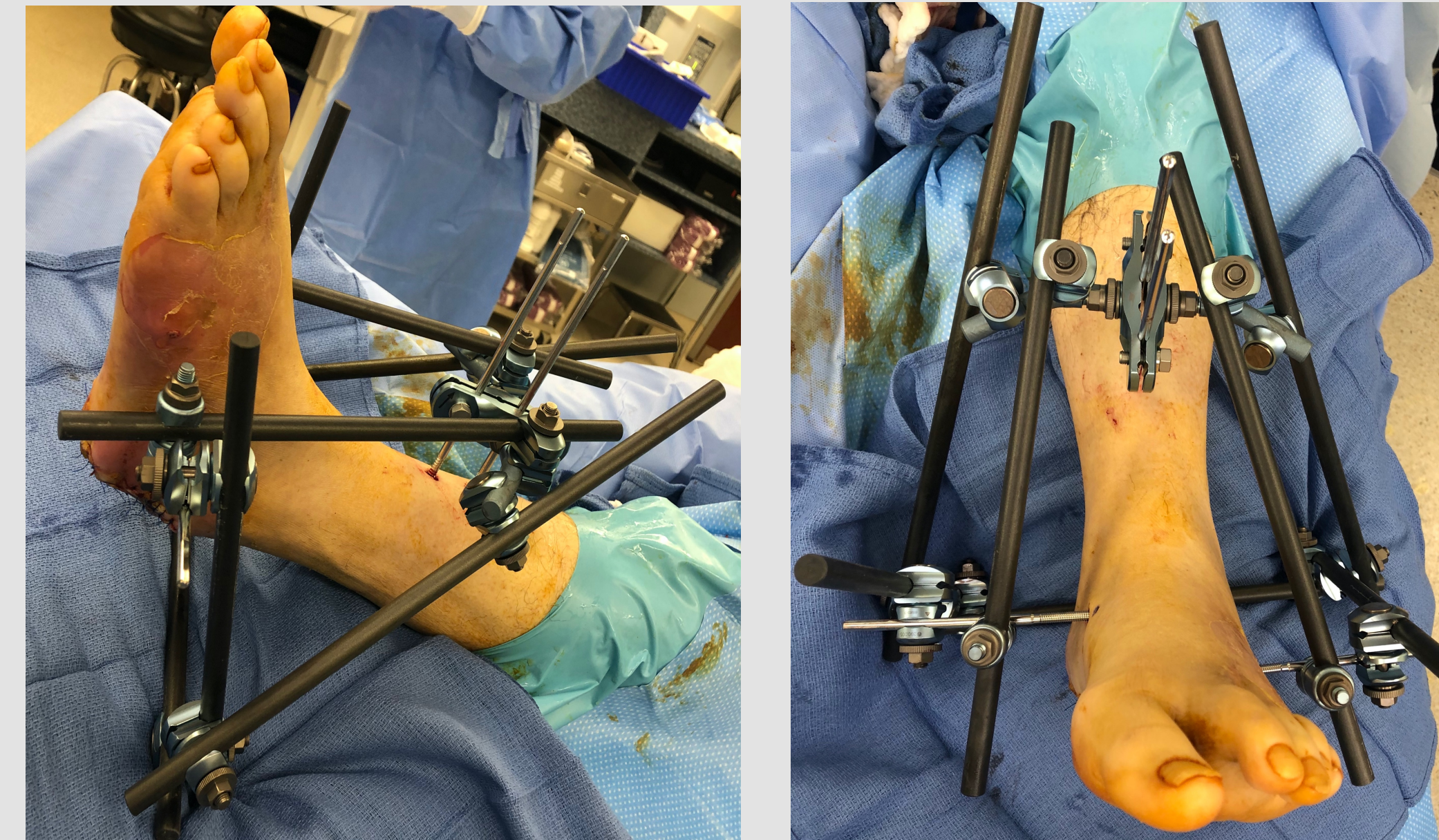


Figure 3. SALSastand method for offloading. Two half pins into tibia and two half pins into midfoot

Results

Our study included 10 patients that met the inclusion criteria. Mean wound size preoperatively was 6.4 cm x 5.6 cm (35.8 cm²), mean size of calcaneal bone resected was 6.6 cm x 4.9 cm x 3.6 cm (116.4 cm³). Primary closure was achieved in all 10 of our patients. Average time to primary closure was 106 days (ranging 43 to 205 days), average days in external fixation device was 41 days (15 to 77 days), and number of operating room visits following initial procedure was 1.5 visits. Average follow up time was 20.9 months (12 to 45 months). Complications encountered included partial wound dehiscence in 5/10 patients and re-ulceration in 2/10 patients. Subsequent adjunctive grafting occurred in 6 patients to aid in healing and 2 patients required rehospitalization. There was no incidence of pin tract infection, revisional bone debridement, or subsequent BKA/KA was observed.

Discussion

Our study showed complete healing in 100% of patients with no BKA/KA, revisional bone debridement, or pin tract infection. We hypothesize utilizing a simple four half pin construct decreases the chance for pin tract infection, subsequent amputation, and decreases overall cost.



Figure 4. Healed rotational flap 12 months post operative.

Discussion continued

Akkurt et al. utilized MRI guided debridement with an Ilizarov external fixation for pedal ulcers and concomitant calcaneal osteomyelitis.⁷ Their wound healed in 18 of 23, partial recovery occurred and subsequent flap operation was performed in three patients (13%), and below-the-knee amputation was performed in two patients (9%). Pin tract infections were the most common complication seen in 16 patients (69.5%). Dalla Paola et al. enrolled 18 patients with calcaneal osteomyelitis. Treatment first included MRI guided resection, application of circular external fixator, and negative pressure wound therapy and subsequent application of split thickness skin graft. Complete healing was achieved in all patients with mean time of 69 +/- 64 days. Total time for maintenance of the circular frame was 78.2 +/- 31.5 days.⁸ Our patients were diagnosed with calcaneal osteomyelitis and treated with radical resection of the calcaneus with primarily closure and with utilization of pin to bar external fixation.

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