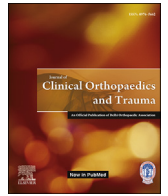




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Total calcanectomy: Treatment for non-healing plantar ulcer with chronic osteomyelitis of the calcaneus

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ABSTRACT

Non-healing neuropathic heel ulcer provides a challenge to salvage the limb from a below-knee amputation. Total calcanectomy can prove a reliable option for limb salvage. Given a well-designed orthosis, patients with total calcanectomy do well at any age. We present two case examples of non-healing neuropathic heel ulcers with chronic osteomyelitis of the calcaneus, which were salvaged with total calcanectomy and returned to all activities of daily living.

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1. Introduction

Non-healing neuropathic heel ulcers prove a real challenge of salvaging the limb from a below-knee amputation^{1,2}. Long-standing diabetes mellitus, neuropathy, peripheral vascular disease, and advanced age make the scenario worse.¹ Total calcanectomy is a reliable alternative to below-knee amputation in such patients with chronic osteomyelitis of calcaneus.² We present two cases of non-healing neuropathic heel ulcers, successfully treated

with total calcanectomy.

2. Case presentation

Case 1. A 12 years old male child, known case of myelomeningocele, operated at the age of one year for spinal dysraphism, presented to us with a non-healing left heel ulcer since six years. Multiple treatment modalities were tried over the past six years, all of which failed.

On examination, ulcer measured 5 × 5 cm in dimensions with the floor of the ulcer covered with slough. The skin around achilles insertion was erythematous and warm, with multiple pus draining sinuses. Sensory neuropathy was present. Except for grade four power of dorsiflexors, the power of other foot muscles was grade zero. Plain radiographs of the foot showed the destruction of the calcaneus (Fig. 1). MRI showed near-complete resorption of the

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Fig. 1. (Case 1): 1a showing lateral foot radiograph with complete destruction and necrosis of calcaneum. 1b showing non healing plantar heel ulcer with multiple sinuses.



Fig. 2. (Case 2): 2a showing lateral foot radiograph with pathological fracture of calcaneum. 2b showing non healing plantar heel ulcer with granulation tissue.

calcaneus. Blood tests showed significantly raised CRP and ESR with normal total white cell count. A pus swab showed the growth of *Pseudomonas aeruginosa*. Two weeks before surgery, culture-sensitive antibiotics were administered intravenously, and a total calcaneotomy was planned.

Case 2. A 72 years old diabetic patient suffering from non-healing neuropathic heel ulcer from two years presented to us. After the failure of multiple treatments over two years, the patient was advised a below-knee amputation for which he was unwilling.

On examination, ulcer measured 8×8 cm in dimensions with the floor covered with pale granulation tissues draining sero-anguinous discharge. The foot was swollen, insensate but with good vascularity. The radiograph showed a beak type of calcaneus fracture with changes of neuropathy (Fig. 2). Susceptible antibiotics and non-weight-bearing were advocated for three weeks before a total calcaneotomy was undertaken. No ethical clearance was taken, as it is a descriptive retrospective case study and an informed consent was taken from both the patients for surgery and use of their clinico-radiological data for publication.

Surgical procedure: Patients were positioned prone, and a midline Gaenslen heel splitting approach was used to expose calcaneus³ (Fig. 3). Achilles tendon was severed 1.5 cm proximal to insertion and was allowed to retract. Complete extra-periosteal excision of the calcaneus was done. The wound was lavaged and closed in layers over the drain. In Case 1, the wound cavity was filled with absorbable calcium sulfate crystals impregnated with 1 g vancomycin.

Postoperatively, patients were put on a non-weight bearing below-knee posterior slab, and periodic dressings were done. The susceptible antibiotics were given for four weeks. Wound healing took seven weeks in Case 1 and four weeks in Case 2, following which both patients were allowed weight-bearing in a custom made orthosis^{4,2}. The custom-molded ankle-foot orthosis (AFO) had extra depth, provided total contact, and had good cushioning (Fig. 4). AFO functioned on a concept of a three-point pressure system.⁵ AFO was light in weight, cosmetically acceptable, and energy-efficient.⁶ Both cases underwent rigorous physiotherapy and gait training with regular follow-ups. At eighteen months of follow up, our patients had no problems in carrying out all activities of daily living with the use of orthosis.



Fig. 3. 3a and 3b showing incision marking for modified heel splitting approach for total calcaneotomy. 3c demonstrates modified heel splitting incision exposing entire calcaneum.

3. Discussion

Chronic osteomyelitis of calcaneus is one of the most dreaded complications of long-standing plantar heel ulcers, more so with an association of neuropathy. The risk of amputation increases four times in chronic diabetics with neuropathy, which prolongs the duration of antibiotic therapy, hospital stay, and adds to the hospital costs.⁷ Nonsurgical treatment becomes furthermore complicated with the hypercatabolic nutritional state, peripheral vascular disease, diabetes mellitus, acute renal status, low ejection fraction, and smoking.^{4,5} Management approaches like the use of skin or collagen grafts, hyperbaric oxygen therapy, heel off-loaders, and negative pressure wound therapy have a high risk of failure. The presence of *Pseudomonas* organisms have decreased preoperative ulcer closure rates at one year from 83% to 51%.¹ Nonsurgical treatments in these cases have been disappointing as they do not



Fig. 4. Customised light weight ankle foot orthosis.



Fig. 5. 5a and 5c showing complete healing of surgical wound for Case 1 and Case 2. 5b and 5d showing weight bearing posture for Case 1 and Case 2.

address the underlying etiology. Total calcaneotomy with or without complex soft tissue reconstruction such as free tissue transfer is the way out.¹

However, total calcaneotomy has its own limitations. Fear of revision *trans*-tibial amputation, iatrogenic calcaneal gait because of achilles tendon detachment and retraction, talonavicular joint subluxation and recurrent osteomyelitis because of inappropriate resection of calcaneum are some of the risks that loom around.¹

Table 1
Pre and Post-Operative foot scores.

	Case 1		Case 2	
Scores	Preoperative	Postoperative	Preoperative	Postoperative
AOFAS ¹⁰	42	75	30	75

AOFAS: American Orthopaedic Foot and Ankle Score.

Decreased muscle strength and ankle movement have also been reported in the past.⁸ In chronic cases with complicated diabetes, microvascular compromise allows the antibiotic to reach target tissue only in peak plasma concentration that suppresses rather than eradicate infection. Another disadvantage of total calcaneotomy is life-long dependence on orthosis.¹

In our two cases, total calcaneotomy was an inevitable choice looking at the extent of calcaneal involvement and physiological demand of the patients. Our results proved that age had no impact on the choice of procedure. Though the focus on post-surgical rehabilitation helped our cases, energy expenditure could be saved for both the age groups by considering a foot salvage procedure. Total calcaneotomy proved to be an excellent choice for the eradication of infection, primary wound closure, and preservation of functional ambulation. We encountered none of the complications of the procedure that have been reported in the literature. Following an uneventful wound healing (Fig. 5), both the patients were given custom made orthosis. Strengthening of lower limb muscles and gait training hastened the rehabilitation process. At eighteen months, both patients were functionally assessed using an ambulatory status scale² modified from Volpicelli et al.⁹ to compare pre and post ambulatory status. Both patients performed very well with grade 6 status. American Orthopaedic Foot and Ankle Score (AOFAS)¹⁰ also improved significantly from preoperative to postoperative state (Table 1).

4. Conclusion

Total calcaneotomy is a preferred option to amputation for the cases of non-healing neuropathic heel ulcers and must be given consideration. Focus on rehabilitation with a proper orthosis is the key to success.

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Declaration of competing interest

None.

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