

Double Flap Reconstruction (Abductor Hallucis Muscle and Planter Flap) for Chronic Calcaneal Osteomyelitis

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ABSTRACT

Soft-tissue reconstruction of the heel represents a challenge due to the limited local soft-tissue availability and the special structural and functional characteristics of this particular area. This challenge becomes more problematic when chronic calcaneal osteomyelitis is developed. In these cases it is very difficult to achieve a clinical cure and maintain a functional foot without substantial morbidity. Recently, successful treatment of osteomyelitis has become much more frequent as muscle cover of post debridement cavities has been used more consistently. Seven patients with chronic calcaneal osteomyelitis and heel soft tissue defect were included in this study. All patients were managed by radical debridement followed by two flap coverage, the first is proximally based abductor hallucis muscle flap and the second is fasciocutaneous planter flap. The mean follow-up period was 9.7 months (range, 6-24 months). All flaps were survived completely. No major complications such as total flap necrosis, recurrent osteomyelitis, recurrent sinuses or fracture calcaneus were occurred during the follow up period.

Conclusion: Radical removal of all contaminated tissue with immediate reconstruction by a proximally based abductor hallucis muscle flap and fasciocutaneous planter flap provides an effective single stage treatment of chronic calcaneal osteomyelitis.

INTRODUCTION

Resurfacing the weight-bearing heel and sole with its unique soft tissue architecture presents a challenge to the reconstructive surgeon [1]. The thick glabrous epidermis and dermis and the fibrous septae of the subcutaneous layer provide unique properties for withstanding pressure and shock associated with gait [2]. The calcaneum is involved in 7% to 8% of all cases of osteomyelitis [3]. Until the use of microvascular free tissue transfer the treatment of chronic osteomyelitis was frustrating when this had involved the calcaneus. Partial resection has been used but others have employed below knee amputation [4].

Recently, successful treatment of osteomyelitis has become much more frequent as muscle cover

of post debridement cavities has been used more consistently [5]. Muscle flaps diminish bacterial load in the surrounding tissues and carry antibiotics more efficiently into poorly vascularized and scarred areas [6,7,8]. Attinger et al. [9] advocated the supremacy of intrinsic muscle flaps for coverage of plantar ulcerations. Structural stability and resistance to infection are the main advantages of these muscle flaps that are used for reconstruction of defects on the sole. Many authors [5,10] reported the use of abductor hallucis muscle flap to cover calcaneal defects with osteomyelitis.

In this study, chronic calcaneal osteomyelitis with heel soft tissue defect will be managed by radical debridement followed by double flaps reconstruction, the first is the abductor hallucis brevis muscle, and the second is the planter flap, the technique and the results will be discussed.

MATERIAL AND METHODS

The actual study is designed as a noncontrolled clinical study conducted from 2008 to 2011. A total of 7 patients, 5 females and 2 males, ranged in age from 4 to 45 years (average, 27), two were diabetic and no one was smoker, were consecutively included in the study population. All Patients had chronic calcaneal osteomyelitis and heel soft tissue defect. Most of the patients were presented by pain, discharging sinus and pointing tenderness. Calcaneal osteomyelitis was preceded by neuropathic heel ulcer in five patients and by a history of direct trauma to the heel with fracture calcaneus in two cases. A team of plastic, orthopedic and vascular surgeons was responsible for preoperative planning, flap design and patient information. All study patients were investigated preoperatively by CBC, ESR and CRP, also with plain X-ray A-P, lateral and axial calcaneus views. Doppler examination was used for perforator identification.

Operative technique:

Spinal anesthesia was used for all patients except the youngest one who was operated under general anesthesia. Marking was done for the draining sinus, the planter flap and the medial foot incision. In prone position with pneumatic tourniquet, the sinus track, bursa, infected material, necrotic slough and Sequestered bone, all are removed. Sometimes, only the outer cortical wall of the calcaneus was preserved and all the medulla was curetted. We did not use autologous bone graft or beads of gentamycinopolymethylmetacrylate within the dead space of the bone.

The abductor hallucis muscle was approached through an incision lies just above the medial border of the sole and curves from the heel to the ball of the big toe. The tendon was divided proximally to the metacarpophalangeal joint and dissected proximally. Because the neurovascular bundles enter the muscle from its lateral side, the medial border was mobilized first until the calcaneal origin was reached followed by the lateral border until the neurovascular bundle was localized and mobilized. The muscle can be stripped off the calcaneus to increase its mobility. The muscle was mobilized laterally to be packed into the calcaneus, filling the defect and forming the first flap coverage of the bone.

The second flap coverage was performed by a fasciocutaneous plantar flap. 4 cases were covered by medially based plantar flaps, 2 cases by laterally based plantar flaps and one case by undermining and direct suture.

Before the wound was closed in layers, the tourniquet was released, hemostasis was achieved and viability of both flaps was assessed. Wash with normal saline solution was done. Two suction drains were placed one below and one above the muscle flap. Postoperatively, the patient remained non-weight-bearing for the first 4 weeks postoperatively, with the foot in neutral position and ankle at 90 degree supported by posterior leg slap cast. Suction drain was removed 7 days post operative. Antibiotics were given for one month.

RESULTS

Seven patients with chronic calcaneal osteomyelitis and heel soft tissue defect were included in this study. All patients were managed by radical debridement followed by two flap coverage, the first is proximally based abductor hallucis muscle flap and the second is the fasciocutaneous plantar flap. The mean follow-up period was 9.7 months

(range, 6-24 months). All flaps were survived completely. No major complications such as total flap necrosis, recurrent osteomyelitis, recurrent sinuses or fracture calcaneus were occurred during the follow-up period. No clinical or radiological findings of osteomyelitis recurrence were noted in any patient at the postoperative follow-up period. Wound Dehiscence was occurred in 1 patient and healed by conservative measures without further surgery. Hematoma and seroma were observed in 2 patients early postoperative and managed by conservative measures. Figs. (1-4) represent four clinical cases.

DISCUSSION

Soft-tissue reconstruction of the heel represents a challenge due to the limited local soft-tissue availability and the special structural and functional characteristics of this particular area [11]. This challenge becomes more problematic when chronic calcaneal osteomyelitis is developed. In such cases it is very difficult to achieve a clinical cure and maintain a functional foot without substantial morbidity.

Unfortunately, primary amputation is still considered a good option for calcaneal osteomyelitis. In spite of several reports of infection eradication by partial or total calcanectomy, the successful calcanectomy carries its own morbidity and weight-bearing problems are likely, especially in young patients [12].

However, osteomyelitis in this area is no different other situation. The rule of radical debridement of all contaminated and poorly vascularized tissues followed by obliteration of the dead space with a well vascularized flap should be followed [13,14,15].

Different muscle flaps have been used by many authors to obliterate the dead space, increase the blood supply, carry more antibiotics to the affected area and form stable graftable coverage to the bone. Many authors used the intrinsic local muscle flaps [5,9,10] while others used distant muscle flaps with microvascular techniques [12,13].

Flexor digitorum brevis muscle is a good option for calcaneal osteomyelitis reconstruction but it may limit plantar flexion of the toes and create an unwanted mass that is liable to increased pressure and ulceration as the muscle is folded back on itself [16]. In this study, the abductor hallucis muscle was used for all cases and its efficacy was approved. Its small size is enough for reconstruction. It has easy dissection within the same operative field that

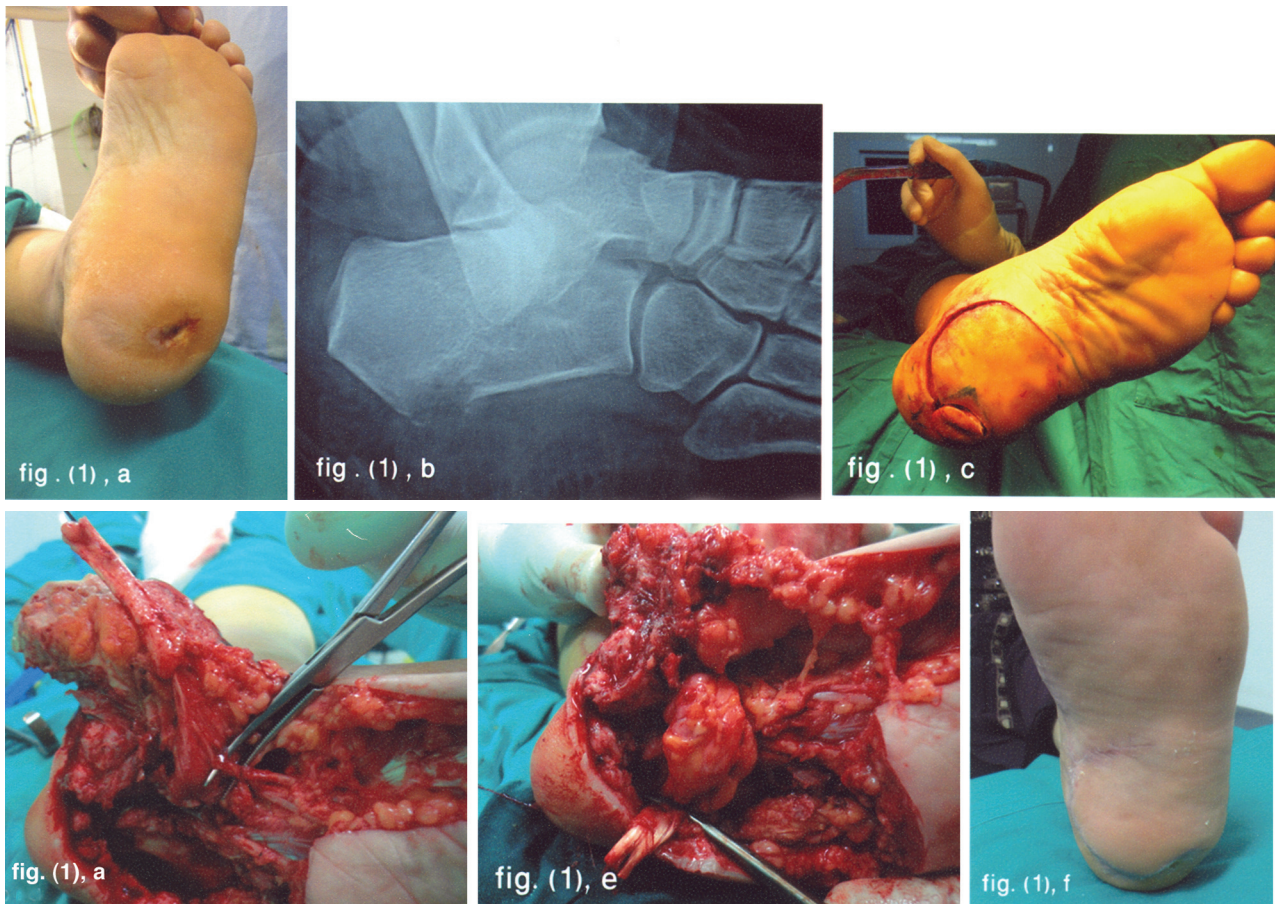


Fig. (1): Female patient, 34 years, had recurrent neuropathic left heel ulcer due to iatrogenic spinal cord injury two years ago and managed by radical debridement followed by two flap coverage, the first is the proximally based abductor hallucis muscle flap and the second is the fasciocutaneous planter flap. (a) Preoperative view shows recurrent heel sinus. (b) Lateral X-ray of the foot with a picture of osteomyelitis (c) Intraoperative view shows excision of the sinus and incision of the laterally based planter flap. (d) Intraoperative view shows the vascular pedicle of the muscle. (e) Intraoperative view shows the muscle flap inside and over the calcaneus. (f) Postoperative view shows good healing.

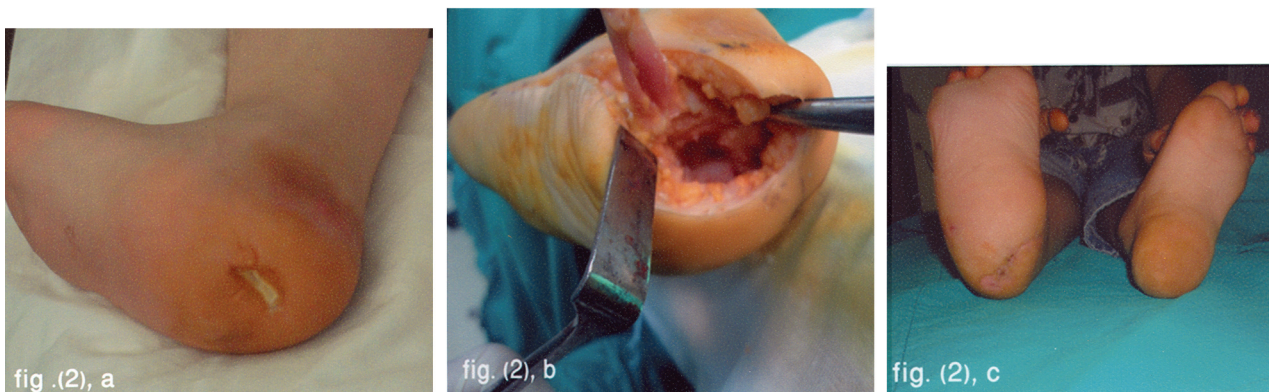


Fig. (2): Male child, 4 years old, has meningomyelocele complicated by neuropathic heel ulcer and chronic calcaneal osteomyelitis and managed by the same technique. (a) Preoperative view shows the sinus. (b) Intraoperative view shows the muscle flap and the bone defect while the tourniquet was applied. (c) Postoperative view shows good healing.



Fig. (3): Female patient, 42 years, has chronic heel sinus with chronic calcaneal osteomyelitis and managed by the same technique. (a) Preoperative view shows the sinus and preoperative marking. (b) Postoperative view shows good healing.

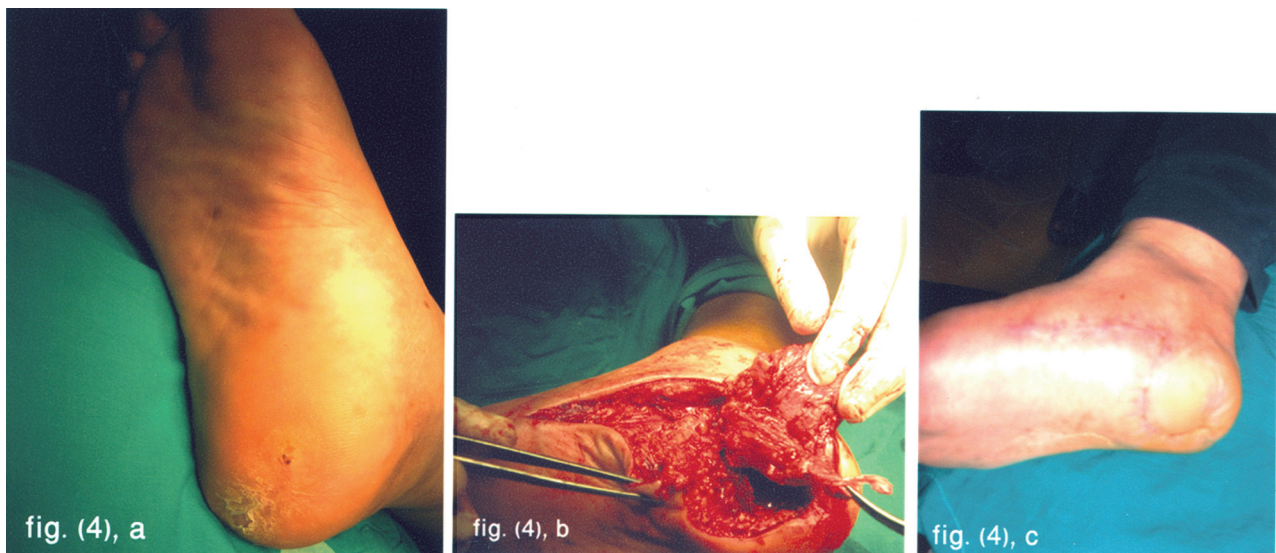


Fig. (4): Female patient, 21 years, has post traumatic chronic calcaneal osteomyelitis with chronic heel sinus, managed by the same technique. (a) Preoperative view shows the sinus with very narrow opening (b) Intraoperative view shows the muscle flap and the bone defect while the tourniquet was released (c) Postoperative view shows good healing.

leads to short operative time. It should be emphasized that if the debridement is not complete, the muscle, by itself, is not able to clear the infection [12].

The second flap coverage was made by the fasciocutaneous plantar flap either medially or laterally based. Although the medially based planter would seem more ideally designed as an axial flap, the resulting skin graft on the lateral donor area would be on the weight-bearing part of the foot. Therefore the laterally based flaps are preferred

[17]; but the site and size of the sinus or the soft tissue defect are other factors that control our selection to the base of the flap. In this study, 4 cases were covered by medially based plantar flaps, 2 by laterally based plantar flaps and one by undermining and direct suture. Curtin [17] recommended use of delay procedures to the laterally based flaps as it considered random flaps; we used it without delay with survival of all flaps.

Use of Planter flap as a second coverage has two advantages; the first, it facilitates debridement

of the calcaneus and dissection of the muscle flap; the second, it provides a fasciocutaneous flap coverage that considered by many authors as the first therapeutic options for soft-tissue reconstruction of heel defects [18,19].

Conclusion:

Radical removal of all contaminated tissue with immediate reconstruction by a proximally based abductor hallucis muscle flap and fasciocutaneous planter flap provides an effective single stage treatment of chronic calcaneal osteomyelitis. This technique provides two different types of flaps, each one of them is considered a good single solution. Calcaneotomy should be preserved for failures or debilitated patients who are unlikely to weight-bear.

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