



Preserve the Lower Limb in a Patient with Calcaneal Osteomyelitis and Severe Occlusive Peripheral Vascular Disease by Partial Calcanectomy

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Heel ulcers in patients with severe peripheral artery occlusive disease represent a challenge to the treating physician. They become more difficult to treat with underlying medical comorbidities. We report a case of 76-year-old man with hypertension, diabetes mellitus, and end-stage renal disease in uremia status presented to our hospital with a 3-month history of a diabetic foot ulcer on his right heel. He was diagnosed with near total artery occlusion below the knee at the local hospital, and vascular reconstruction failed. After admission, surgical debridement was performed with subsequent partial calcanectomy facilitating wound closure without tension. After surgery, the foot was immobilized with a short-leg splint for 2 weeks. Thereafter, ankle immobilization was accomplished using a thermal protective plastic splint and cast shoes with a posterior window for wound care. The wound healed well with no recurrence during the 12-month follow-up period, and the patient may return to an ambulatory status, including a normal gait pattern. In this case, we demonstrate that the partial calcanectomy is practical for the treatment of plantar heel ulcers in a patient with severe comorbidities. With proper surgical planning and postoperative care, partial calcanectomy is a viable alternative to below-the-knee amputation and may better serve the patient who would otherwise be restricted to a sedentary lifestyle.

Key words: Heel ulcer, partial calcanectomy, occlusive peripheral vascular disease

INTRODUCTION

The management of patients with diabetic ulcers and calcaneal osteomyelitis of the heel remains a challenge for reconstructive surgeons because of the lack of locally available tissues for transposition, relatively poor skin circulation, and weight-bearing requirement of the region.¹ Diabetic foot ulcers are difficult to treat because of the range of pathogenic abnormalities in patients with diabetes, which includes ischemia, intrinsic defects in angiogenesis, and impaired immunity against infection.² The lifetime incidence of developing a diabetic foot ulcer is as high as 25%.³ Moreover, osteomyelitis is a common late-stage sequela of deep heel ulceration that frequently complicates wound management.

When contemplating treatment options, the goals to consider include removing the infected bone, healing the wound with durable soft tissue, maintaining limb function for walking or transfer, and avoiding leg amputation.⁴ Patients who develop heel ulcers often have several medical comorbidities such as diabetes mellitus, peripheral vascular disease, and chronic renal failure. It poses a life-threatening risk for patients undergoing long operations and anesthesia.⁵ In addition, documented near total occlusive peripheral vascular disease and failed vascular reconstruction preclude the employment of a pedicle or free-flap reconstruction.⁶

Partial calcanectomy is a simple procedure for the treatment of chronic heel ulcers with limited calcaneal involvement.⁷⁻¹¹ This procedure is an effective option provided specific principles are followed to achieve complete wound coverage and minimize pressure points when the patient is in bed and walking. Here, we present a case with heel ulceration and calcaneal osteomyelitis using partial calcanectomy to facilitate wound closure as an alternative to below-the-knee amputation.

CASE REPORTS

A 76-year-old man with hypertension, diabetes mellitus, and end-stage renal disease in uremia status presented to our hospital with a 3-month history of a diabetic foot ulcer

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on his right heel. He was diagnosed with near total artery occlusion below the knee at the local hospital, and vascular reconstruction failed. A below-knee amputation was recommended, and he was referred to our section because he did not want to amputate his leg. The patient had a 30 years history of smoking but quit 20 years previously. Preoperative ankle-brachial index was measured about 0.4 and a serum albumin level was 2.5 g/dL. Physical examination showed an 8 cm × 4 cm-sized wound of the right heel with calcaneal bone exposure [Figure 1a]. After admission, local wound care using wet-gauze dressings with saline-diluted iodine was performed twice daily to condition the wound bed. At operation, we partially removed the calcaneus about 3 cm × 5 cm in size and 3 cm in height [Figure 1b] leaving the Achilles tendon in position, and the wound was closed primarily without tension [Figure 1c]. Pathology indicated calcaneal osteomyelitis, and wound culture was positive for methicillin-resistant *Staphylococcus aureus*. Subacillin was prescribed initially as 1.5 g/time in every 8 h for 1 week and then changed to vancomycin as 1.0 g/time in every 12 h a day for 4 weeks according to the suggestion of the infection specialist. After surgery, the foot was immobilized with a short-leg splint for 2 weeks. Thereafter, ankle immobilization was accomplished using a thermal protective plastic splint and cast shoes with a posterior window for wound care. Full weight-bearing was permitted approximately 4 weeks after surgery after good wound healing was noted. The wound healed well [Figure 1d] with no recurrence during the 12-month follow-up period, and a plain film of the foot was taken for comparison [Figure 2]. Finally, the patient may return to an ambulatory status, including a normal gait pattern.



Figure 1: A diabetic ulcer of the heel region in a 76-year-old man. (a) Physical examination shows an 8 cm × 4 cm-sized wound of the right heel with calcaneal bone exposure. (b) During the operation, the calcaneus was partially removed. (c) The heel region wound was closed primarily without tension. (d) The wound healed well without recurrence during the 12-month follow-up period

DISCUSSION

Chronic ulcers located on the weight-bearing surface of the foot limit a patient's activities and increase the load on the contralateral foot. Plantar defects may progress to advanced stages in patients with neurological deficits or diabetes, which frequently results in osteomyelitis of the calcaneus. Soft tissue loss at the heel, often accompanied by exposure of the calcaneus and Achilles tendon, represents a challenge for reconstructive surgeons because of the lack of locally available tissues for transposition, relatively poor skin circulation, and weight-bearing requirement of the region.¹ Tissues that provide adequate coverage, stability, and sufficient blood supply to prevent osteomyelitis are preferred for reconstruction of these defects.

With each carrying its own relative benefits and disadvantages, various local and free-flap alternatives have been used for heel reconstruction. Reversed island flaps such as the peroneal artery flap, anterior tibial artery flap, and posterior artery flap have the disadvantage of major leg artery sacrifice.¹²⁻¹⁴ Fasciocutaneous flaps based on the dorsalis pedis island flap, sural pedicle, the lateral calcaneal artery, medial and lateral plantar arteries or peroneal artery perforators and their various modifications have also been used.¹⁵⁻¹⁹ Flaps that provide inherent skin coverage and sensation do not necessitate sacrifice of major vessels or nerves. However, structural instability and vulnerability to infection are disadvantages of all fasciocutaneous flaps.

Several proximally based muscle flaps from the foot have been developed, including the abductor hallucis muscle, abductor digiti minimi muscle, extensor digitorum brevis muscle, and flexor digitorum brevis muscle island pedicle flaps.²⁰⁻²² Limited effective range, lack of significant dimensions, and insufficient padding because of their thin nature are the main disadvantages of these muscle flaps, which are used to reconstruct sole defects. Free-tissue transfer for coverage of foot defects also shows



Figure 2: A plain film of the foot of patient 6 (a) before and (b) after the operation

Partial calcaneotomy for a patient with DM, uremia, and severe PAOD

promising results in achieving coverage because bone and tendon exposure results in a chronic intractable wound.^{16,23-30} Hallock indicated that even a small defect in this region might justify the need for a microsurgical tissue transfer.³¹ However, morbidity and operative time are increased in technically demanding microvascular reconstruction.

Occasionally, peripheral vascular disease precludes the employment of pedicle or free-flap reconstruction. Major limb amputation has been suggested in the past in some subgroups such as patients with ischemic heel ulcers and gangrene accompanied by end-stage renal failure and diabetes as well as those with large (>6 cm) wounds.^{32,33} Reports of vascular reconstruction interventions have revolutionized the treatment of patients with critical limb ischemia in recent years, and a decrease in major amputations with the use of this approach in high-risk patients has been evident.^{34,35} Several studies using various bypass procedures with additional free-flap repairs on patients with heel ulcers and gangrene have been reported.³⁶⁻³⁸

However, severe occlusion with peripheral vascular disease could occur in some patients and failed vascular reconstruction complicates heel ulceration. Adequate preoperative testing of the patient's vascular perfusion and degree of ulceration is important. Moreover, when combined with several medical comorbidities, it poses a life-threatening risk to patients undergoing long operations and anesthesia. In this condition, vacuum-assisted closure device (VAC) therapy has been useful in preparing diabetic ulcers for closure via split-skin grafting. However, prolonged VAC therapy application (3-8 weeks) is sometimes not affordable for patients.³⁹

Partial calcaneotomy is an excellent alternative for the treatment of calcaneal ulceration with or without osteomyelitis. Partial calcaneotomy, first described by Gaenslen in 1931, is simple to perform and clears infected bone, tissue, and ulceration.⁴⁰ Generally 1 cm of dorsal-proximal and 2-3 cm of distal-plantar calcaneus are left intact following the calcaneal resection and the Achilles tendon was reattached to the residual calcaneal bone.⁴¹ Occasionally, the Achilles tendon may not be violated and can remain attached to its insertion in the calcaneus. With proper postoperative protection, the patient may return to an ambulatory status, including a normal gait pattern. Primary reapproximation of the skin edges prevents scar tissue formation that results from secondary intention, which could produce a less supple and immobile skin region. Salvaging the limb of patients with calcaneal symptomatology could decrease morbidity and mortality and increase the quality of life of these patients.

CONCLUSION

This report illustrates that the partial calcaneotomy is practical for the treatment of plantar heel ulcers with underlying

osteomyelitis in patients with severe comorbidities. Morbidity and operative time are increased in technically demanding pedicle flap harvest and microvascular reconstruction. VAC therapy is useful, but prolonged application is sometimes not affordable. With proper surgical planning and postoperative care, partial calcaneotomy is a viable alternative to below-the-knee amputation and may better serve the patient who would otherwise be restricted to a sedentary lifestyle.

DISCLOSURE

None of the contributing authors have any conflicts of interest, including specific financial interests and relationships and affiliations relevant to the subject matter or materials discussed in the manuscript.

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