CHAPTER **13**

PARTIAL CALCANECTOMY

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INTRODUCTION

Heel ulceration with osteomyelitis has become an unfortunate and common finding in the lower extremity specialist's patient population. Many statistics have been published to project the high incidence of diabetes and peripheral vascular disease (7.8% of the current US population has diabetes).[1] It is estimated that 30% of the adult population in the US has some form of peripheral vascular disease.[2] Perhaps the most serious evidence of the importance of limb salvage was demonstrated in 2004 by Aulivola et al.[3] They found the survival rates of patients with concurrent diabetes or renal disease who underwent major amputations to be 70% at one year and only 30% at 5 years. This data, combined with other studies looking at cardiac stress from leg amputation[4,5] lead one to objective information towards limb salvage.

Partial calcanectomy (PC) can be an alternative to leg amputation under the appropriate conditions. In the largest series of PC, Cook et al produced a variety of data in their study demonstrating how each case is unique, though certain trends were formulated.[6] A number of other smaller studies have looked at PC.[7-14] We will review the current literature and discuss the senior author's preoperative planning and preferred surgical technique.

LITERATURE REVIEW

Partial calcanectomy has been extensively reviewed in the literature, however no studies exist other than case reports or reviews.[6-14] In the largest and perhaps most valuable study to date, Cook et al discussed that there are multiple factors that effect healing rates. Vascular disease, albumin levels, MRSA infections, and preoperative ulcer grade all had a significant influence on patient outcomes. Twenty-eight of 46 patients required vascular intervention before PC, and had a slightly lower closure rate. Closure rate in patients who produced MRSA isolates had a 50% closure rate, compared with 71% for the non-MRSA patients. They also found protein nutritional status to be a significant factor. A serum albumin level >3 g/dl healed 69% of the time compared with 56% for patients with a level <3 g/dl. Wound classification also was a very strong predictor for healing. The Wagner wound classification was used to grade the wounds: 83.3% of Wagner 2 wounds healed in 1 year as compared with 51.5% of Wagner 3 wounds. Of note, they found some factors to bear no influence on healing—body mass index and the wound age before surgery did not seem to affect the healing rate. Finally, patients with a history of smoking had similar closure rates, but it took longer for them to close their wounds.[6]

In a study by Bollinger and Thordarson, they successfully healed all wounds without the need for below knee amputation. However, 11 additional procedures were performed in 9 patients; 5 for soft tissue debridement, 3 for exostosis removal and 1 for skin grafting. Maybe not surprisingly, all 9 of their patients with diabetes had delayed wound healing compared with those without diabetes. They also found two "technical" details concerning the surgical procedure: ulcers >7 cm would not allow for a tension-free closure, and casting in plantar flexion for a minimum of 4 weeks should be performed after surgery.[7]

PREOPERATIVE EXAMINATION AND TESTING

The most important aspect of the preoperative process is the clinical and medical status of the patient. These patients often have comorbid conditions that need attention by multiple specialties. The decision for a partial calcanectomy must also take into account the patient's expectations as well as eradication of any acute infectious process. Partial calcanectomy can be an excellent option prior to leg amputation because the latter procedure will not be compromised.

Imaging for the determination and location of osteomyelitis is beyond the scope of this paper, but a few tests should be mentioned. Imaging modalities will always start with plain films, which will often demonstrate some type of bone involvement, especially in long-standing ulcerations. The lateral view may be all that is necessary, but routine views are recommended in order to rule out multiple areas of infection. Magnetic resonance imaging

(MRI) is a useful tool to rule out soft tissue pathology and determine the extent of bone involvement. Computed tomography scan is another useful tool for determination of bone quality, but is less sensitive for soft tissue destruction. Leukocyte-labeled bone scans may also be helpful to rule out Charcot neuroarthopathy from osteomyelitis.

Of utmost importance is consultation with a vascular surgeon. At the minimum, noninvasive vascular studies should be obtained to determine healing potential. Any intervention beyond this can be determined by the vascular team. Other consultations will be obtained depending on the patient's comorbidities, including internal medicine, nephrology, and infectious disease. Nutrition specialists are routinely consulted due to this population's poor glycemic control as well as their overall poor nutritional health.

Since smoking plays a key role in the overall success rates, the authors routinely enter into a contract with the patient. The patients are randomly tested for nicotine and cotinine levels prior to surgery. The patient is educated on these facts and understands that if they test positive, the procedure is never undertaken. The authors have found this method to be successful in these patients with chronic conditions.

PATIENT AND FAMILY EDUCATION

Preoperative planning should begin with patient and family education and a clear understanding of their expectations. We strongly recommend a discussion on this being a salvage procedure and leg amputation can still occur. Also, permanent bracing with a custom shoe may be needed for a lifetime. Further surgery for debridement is often necessary with the possibility of long-term intravenous antibiotics.

Preoperative radiographs, MRI, bone scans, etc. along with wound presentation and vascular status will determine the extent of bony and deep tissue involvement and eventual incision location. Surgical incision location and shape can depend on several factors, but generally a direct linear posterior or posterior medial approach can be used. Another option is the extensile hockey-stick posterior-lateral approach that provides much more exposure. It is obviously useful if the patient can be in the prone position for this procedure. If not, due to anesthesia concerns, a lateral position with use of a vacuum bean-bag can be used. Any ulceration or nonviable tissue can be excised in a semi-elliptical fashion.

When planning the incision, care should be taken to maintain the skin flaps in full thickness, without undermining the subcutaneous tissue (Figure 1). The skin should also be handled delicately with minimal use of retractors. The clinical appearance of the soft tissue and bone is the most useful guide to determine the extent of tissue resection. The use of a tourniquet is often avoided to aid in the identification of bleeding, healthy tissue.

The Achilles tendon will be detached and any nonviable portions resected. It is important to maintain length for reattachment to the calcaneus. Once the soft tissue is fully dissected free from the calcaneus, power and hand instrumentation is used to remove the posterior calcaneus at an angle from posterior-proximal to plantar-distal, taking care to remove all nonbleeding bone, but leaving enough to reattach the Achilles tendon. The amount of calcaneus is typically one-half to two-thirds of the calcaneal body, but will ultimately be determined by the clinical picture (Figure 2).

Figure 1. Preoperative incision placement to excise ulceration.

Figure 2. Resection of posterior half of calcaneal body.

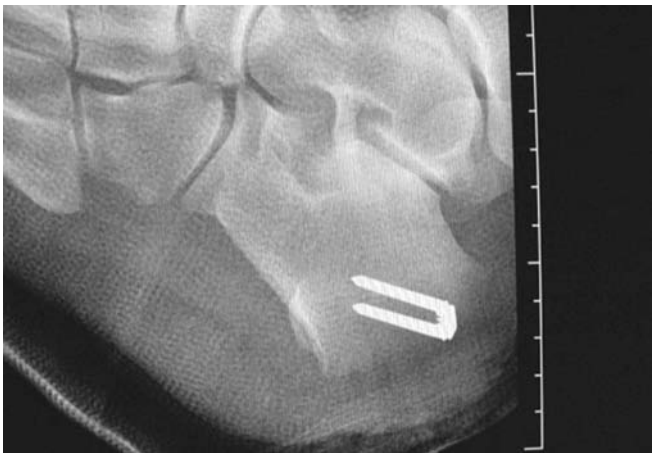

Figure 3A. Many options exist for reattachment of Achilles tendon.

Figure 3B. Options for reattachment of Achilles tendon.

Figure 4. In this case, closure was delayed and a Wound VAC was applied.

Figure 5. Twelve month follow-up view of the patient in Figures 1 and 2.

The Achilles tendon should be re-attached under physiologic tension. A number of options can be used to anchor the tendon to the bone. Suture anchors, plates, or plain suture can be used (Figure 3).

Closure of the wound can be difficult if a significant amount of tension is present. Primary closure is preferable, but not always necessary or even indicated in the presence of acute infection. The use of bolster stitches with rubber catheters to protect the skin is one useful method. If too much tension is present, then closure can be delayed and a Wound VAC can be applied (Figure 4)(KCI, San Antonia Texas).

POSTOPERATIVE TREATMENT

A Jones compressive cast applied in plantarflexion is placed in the operative room. The first dressing change generally occurs in 6 days, unless further debridements are necessary. When the ulcers are fully excised and the wounds are closed primarily, patients are casted non-weight bearing for a period of 6-8 weeks. Casts are changed weekly to check the site and increase dorsiflexion slowly over time. Physical therapy is beneficial once the wounds are closed and ambulation begins in a pneumatic walking boot. Long-term antibiotics are coordinated with the infectious disease team for 4-6 weeks (Figure 5).

SUMMARY

Understanding the complex nature of acute and chronic heel ulcers and osteomyelitis is of extreme importance. A team approach is necessary to treat this high-risk patient population. We believe a very thorough perioperative evaluation regarding smoking history, nutritional status, vascular status, and glycemic control plays a key factor in the overall success rate in this salvage technique.

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