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Large heel soft tissue defects managed successfully with reverse medial crural fasciocutaneous flap: A 7-year single-center experience with 21 consecutive cases

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Summary The medial crural fasciocutaneous flap is a reliable cutaneous flap that can be used for soft tissue reconstruction in the extremities. The purpose of this article is to evaluate the application and clinical significance of this surgical technique in the reconstruction of heel soft tissue defects. Twenty-one cases of heel soft tissue defect between March 2005 and March 2012 were included in this study. Wound sizes varied from 5.0 × 5.5 to 7.5 × 10.0 cm. All cases were managed with a reverse medial crural fasciocutaneous flap. Patient demographics and case information were analyzed and are reported. The sizes of the reverse medial crural fasciocutaneous flap varied from 6.5 × 10.0 to 9.0 × 15.0 cm; the average size was 7.7 × 13.8 cm. Out of the 21 consecutive cases, 20 flaps survived intact and one flap underwent partial necrosis. Follow-up observations were conducted for 6—36 months. The cosmetic results were satisfactory, without apparent bulkiness; the weight-bearing outcomes were satisfactory. The donor site can be closed primarily or by skin graft. Reverse medial crural fasciocutaneous flap transfer is appropriate for the reconstruction of heel soft tissue defects. The method is safe and can cover large heel defects.

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Introduction

The plantar heel pad bears 50% of the patient's weight during the early phases of gait. The goals of reconstruction in this area are to maintain biomechanics, balance shear forces, and provide stable coverage to the vital structures that pass through this region. Moreover, it is important to keep in mind the possibility of future recurrent soft tissue problems.[1] Adequate hind foot and ankle area reconstruction can be achieved only when using a flap that is thin and sensate, and has steady blood circulation and sufficient size to cover the entire Achilles tendon and posterior heel.[2]

Many surgical flaps and techniques[3–5] have been reported and applied in the reconstruction of heel soft tissue defects. However, no single flap currently used satisfies all of the above criteria necessary for satisfactory heel reconstruction.[2] Meanwhile, in cases in which a large heel defect is present, these techniques may be ineffective. In addition to sensitivity and bulkiness, some further details should be considered when these flaps are to be applied. These include the steal phenomenon of free flap transplantation,[6] the insufficiency of blood flow after a free flap transplantation in a single-vessel limb, the limited coverage size of local flap transplantation,[7] and a deficit of muscle bulk for muscle flap coverage. Additionally, there is a risk of infection even with the use of advanced adjunctive therapy, such as negative pressure wound therapy (NPWT).[8,9] When a large heel soft tissue defect is encountered, these methods may be unsuccessful and a limited number of techniques can be employed.

Zhang and colleagues first introduced the posterior tibial artery flap in 1983,[10] which has proven to be a reliable flap for reconstructing a variety of defects.[11,12] However, the main flaw of this technique, which limits its application in practice, is that the posterior tibial artery may be sacrificed and may result in insufficient blood delivery to the distal extremity. Moreover, this procedure may need to be abandoned due to the absence of the posterior tibial artery.[13,14] In order to avoid the influence of the blood supply on the distal limb and foot, flaps that use the cutaneous branches or perforators of the posterior tibial artery, rather than the artery itself, were investigated.

Reverse medial crural fasciocutaneous flaps use the cutaneous branches of the posterior tibial artery as their blood supply. This technique has been effectively used in the reconstruction of many soft tissue wounds.[15–17] However, there is a paucity of the literature on this flap being applied in the reconstruction of heel defects. We report the use of a reverse medial crural fasciocutaneous flap, which is safe, easy to perform as a versatile technique, and a valuable choice when reconstructing a large heel defect.

Patients and methods

We retrospectively reviewed consecutive patients who were treated at our institution by means of a reverse medial crural fasciocutaneous flap between March 2005 and March 2012. Our study received Institutional Review Board approval from the First Hospital of Jilin University. Only large heel wounds ($>5 \times 5$ cm) were included in this study; a total of 21 patients who underwent reconstruction by reverse medial crural fasciocutaneous flaps were eligible for inclusion. Demographic information including age, sex, etiology, dimensions of defects, flap size, closure of donor site, and complications was collected from the patients' medical records. Two representative cases are presented.

Surgical methods or approach

A history of previous injury or surgery to the limb, the size and site of the defect, and the presence of the posterior and anterior tibial artery and the dorsalis pedis artery pulses were assessed before the procedure. This flap was planned when the major vessels were palpable. A Doppler ultrasound evaluation of the vascular network was performed to confirm normal blood flow in the peroneal and tibial vessels.

The wound was aggressively debrided and irrigated with normal saline several times, and planning in reverse was done. Surface marking of the posterior tibial artery was completed upon commencement of surgery and the flap was designed on the medial side of the leg. The size of the flap was 1—2 cm larger than that of the wound. The upper and lower margin of the flap could reach 10 cm below the knee and 8—10 cm higher than the medial malleolus joint. Dissection proceeded at the midline of the leg, to the deep fascia, which was freed to fully expose the posterior tibial artery and its cutaneous branches and perforators. The flap was then raised from the distal to the proximal end and from front to back until the marked border of the flap. Distally, a 3—4-cm-width fascia segment was reserved to utilize as a pivot point approximately 4—6 cm from the tip of the medial malleolus, thus preserving the distal-most cutaneous branches from the posterior tibial artery. The blood supply of the flap is shown in Figure 1, and the design of the flap is shown in Figure 2. Care should be taken that the deep fascia and the cutaneous portions are kept intact to guarantee the blood supply. After successful harvest, the island flap was transposed and inserted into the defect, such that the pedicle was not twisted or compressed. The donor site was then covered either by a primary suture or by a split-thickness skin graft. Immobilization of the foot for 3 weeks is essential to avoid pressure on the pedicle and the flap.

Results

Twenty-one patients were included, 12 men and nine women, with an average age of 41 years (25—57 years). The heel soft tissue defects were of variable etiology, including posttraumatic tissue loss (seven cases), frostbite (one case), diabetic foot ulcers (five cases), melanoma (two cases), and burns (six cases). The results of the bacterial culture were negative in 12 cases. *Staphylococcus aureus* infection was present in four cases; *Staphylococcus epidermidis*, *Enterobacter cloacae*, and *Acinetobacter baumannii* infections were present in one case each; and *Pseudomonas aeruginosa* was found in two cases. Selected appropriate antibiotics were administered intravenously based on the result of the drug sensitivity testing of the wound swab culture pre- and post surgery. The size of the reverse medial crural fasciocutaneous flaps varied from