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Three Cases of Medial Plantar Flap in the Reconstruction of Lower Extremity Soft Tissue Defects: A Case Report

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ABSTRACT

Background and Objective: In reconstructing soft tissue defects of the heel and Achilles tendon, the tissue used must be weightbearing and flexible enough to accommodate gliding movements of the tendon. Additionally, flap volume should not interfere with the patient's ability to wear shoes. Since free flaps require microvascular surgical expertise and equipment, are generally associated with longer operative times, and may not be feasible in some patients, this study aims to report three cases of medial plantar flap for lower extremity soft tissue defect reconstruction.

Case Reports: This study reports the demographic data and surgical outcomes of three patients who underwent reconstruction of heel and Achilles tendon wounds using the medial plantar flap at Imam Reza Hospital, Birjand, from 2016 to 2023. All three patients were male. The etiologies were Marjolin's ulcer (n=1), traumatic wound (n=1), and malignant melanoma (n=1). The mean age was 43.7±25.1 years (range, 16-65 years). The primary soft tissue defect requiring flap coverage was located in the heel in two patients and the Achilles tendon in one patient. The mean defect size was 25±5 cm^2. In all three patients, following defect reconstruction with the medial plantar flap, the donor site was simultaneously covered with a split-thickness skin graft harvested from the thigh. On postoperative follow-up, no flap necrosis was observed in any patient. One patient developed minor necrosis of the skin graft used to cover the donor site, which was resolved with conservative management. Overall, all three patients had a satisfactory healing course with no major complications.

Conclusion: Based on the results of this study, the medial plantar flap is a reliable flap with low complication rates that can be used for reconstruction of soft tissue defects of the heel and Achilles tendon region.

Keywords: *Medial Plantar Flap, Free Flap, Soft Tissue Defects, Lower Extremity*.

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Introduction

Reconstruction of soft tissue defects of the heel is of particular importance due to the weightbearing function of this region. Accordingly, the tissue used must be capable of withstanding weight. In the Achilles tendon region, soft tissue coverage must be flexible enough to accommodate tendon gliding, and flap volume should not interfere with the patient's ability to wear shoes (1). For superficial soft tissue defects of this region, split-thickness skin grafts may be utilized. However, this is not always possible, as in many cases the defect does not provide a suitable recipient bed for grafting (1). Skin grafts are incapable of weightbearing in the heel and also lack sensory innervation (2). Furthermore, when the defect results from tumor resection and postoperative adjuvant therapy is indicated, skin grafts cannot tolerate such treatment (3). For these reasons, flap reconstruction is often unavoidable in many cases. Fasciocutaneous flaps can achieve this objective. Reverse sural, medial plantar, and lateral supramalleolar flaps have commonly been employed for this purpose. Free flaps remain a valid option for soft tissue reconstruction of this region; however, they require microvascular surgical expertise and equipment, are typically associated with longer operative times, and may not be feasible in certain patients with conditions such as diabetes (4).

Despite the relative advantages of the medial plantar flap compared to the reverse sural flap for reconstruction of soft tissue defects of the heel (4), less emphasis is placed on teaching this technique in plastic surgery training centers relative to the reverse sural flap. A search of Persian literature identified only one article describing the use of the medial plantar flap (5). The aim of this case report is to highlight the advantages of the medial plantar flap over other fasciocutaneous flaps in lower extremity reconstruction, based on three patients who referred the surgical department of Imam Reza Hospital, Birjand, from 2016 to 2023 and underwent treatment with this flap.

Case Reports

This study was approved by the Ethics Committee of Mashhad University of Medical Sciences (approval code: IR.MUMS.IRH.REC.1403.190). A retrospective review was conducted of medical records of patients who underwent medial plantar flap reconstruction for soft tissue defects at Imam Reza Hospital, Birjand, from 2016 to 2023. Demographic data, reason for presentation, diagnosis, and defect size were recorded. Postoperative outcomes, including flap necrosis, skin graft necrosis, and complete wound healing as documented by the attending physician during follow-up, are presented.

Case 1: A 50-year-old male presented with a Marjolin's ulcer developing within a previous burn scar on the right heel. The lesion was excised with a 1 cm margin, and sentinel lymph node biopsy was negative; surgical margins were reported as free of tumor. A medial plantar flap was utilized to reconstruct the soft tissue defect, which measured approximately 6 × 5 cm. In the postoperative period, minor necrosis developed in a portion of the skin graft placed at the donor site, which healed with conservative management. Complete coverage of the soft tissue defect was achieved (Figure 1).

Case 2: A 16-year-old male presented with lower extremity trauma following a motor vehicle accident. He had a wound anterior to the medial malleolus that had undergone primary repair. He also had a large wound involving the Achilles tendon region with an associated soft tissue defect. Initial debridement was performed. Traumatic inflammation of the soft tissues of the foot was noted. Doppler evaluation demonstrated patency of both major arteries of the foot. The lower aspect of the Achilles tendon wound was

reconstructed with a medial plantar flap. The upper aspect of the wound, which contained granulation tissue, was covered with a skin graft during the same operative session. The postoperative course was uneventful, with satisfactory healing. The patient was followed for two months postoperatively without any complications and did not return for further follow-up thereafter (Figure 2).

Case 3: A 65-year-old male presented with recurrent melanoma of the heel. Seven years earlier, he had been diagnosed with malignant melanoma of the sole and had undergone lesion excision and skin graft reconstruction performed by another surgeon. During the current procedure, the recurrent melanoma in the heel was excised, resulting in a soft tissue defect measuring approximately 5 × 5 cm. Sentinel lymph node biopsy was performed. After confirmation of negative surgical margins and a negative sentinel lymph node biopsy, reconstruction was carried out using a medial plantar flap, and the donor site was covered with a skin graft. The patient's postoperative recovery was satisfactory. At approximately two years of follow-up, the patient had no significant difficulty with ambulation and no evidence of melanoma recurrence was observed (Figure 3).



Figure 1. Sequential views showing preoperative (1), intraoperative (2 and 3), and postoperative (4) stages, respectively



Figure 2. Preoperative soft tissue defect of Case 2 (left) and postoperative appearance (right)



Figure 3. Preoperative primary soft tissue defect of Case 3 (left) and postoperative appearance (right)

Discussion

In this study, all three patients who underwent medial plantar flap reconstruction of heel and Achilles tendon wounds achieved successful healing. Reconstruction of soft tissue defects involving the heel and Achilles tendon region poses considerable challenges. The scarcity of soft tissue in this area limits the availability of local and regional flaps. The two pedicled flaps most commonly employed for reconstruction of these defects are the reverse sural flap and the medial plantar flap (6). A notable disadvantage of the reverse sural flap is hypoesthesia of the lateral foot resulting from transection of the sural nerve. Therefore, for reconstruction of soft tissue defects of the heel region, the medial plantar flap may serve as a suitable and reliable alternative (7).

The medial plantar flap involves the transfer of skin and fascia from the plantar arch and may be transposed as a pedicled flap, a perforator flap, or a free flap. Vascular supply to this flap is derived from the medial plantar artery, while sensory innervation is provided by the cutaneous branches of the medial plantar nerve (5). When transposed as a proximally pedicled medial plantar flap, it is suitable for covering soft tissue defects of the heel, the distal Achilles tendon, and the malleolus. In cases requiring coverage of more distal foot defects—particularly the first metatarsal region or the great toe—a distally based flap may be utilized (8). In the present cases, a proximally pedicled medial plantar flap was employed. A limiting factor in the use of this flap is the amount of skin available in the plantar arch, which generally precludes its application for large soft tissue defects; thus, it is best suited for small to moderate-sized defects. Mahmoud et al. reported a mean defect size of 22 ± 2.7 cm² (2). Han et al. covered defects with mean dimensions of 9.73 ± 3.55 × 6.43 ± 2.8 cm using a contralateral free medial plantar flap (9). In the present study, the mean defect size was 25 cm².

The medial plantar flap has also been employed successfully in diabetic patients. Given the well-defined arterial anatomy of this flap, its transfer is relatively straightforward. Prior to flap transfer, patency of the posterior tibial and dorsalis pedis arteries should be confirmed using Doppler ultrasonography or angiography (10).

Overall, the medial plantar flap is associated with a low complication rate, and flap necrosis has not been reported in many case series (2, 11). Although necrosis of the skin graft at the donor site has been described, it is typically partial in nature and has not necessitated repeat grafting (11). Among our three patients, one developed partial skin graft necrosis, which resolved with conservative management. All three flaps survived, and no complications were observed in any patient.

Mahmoud divided 30 patients into two groups and reconstructed foot and ankle defects using either the reverse sural flap or the medial plantar flap. Statistical comparison between the two groups revealed that the medial plantar flap offers superior efficacy compared to the reverse sural flap. Additionally, postoperative complications were fewer in the medial plantar flap group. On the basis of these findings, Mahmoud recommended the medial plantar flap over the reverse sural flap for reconstruction of moderate-sized defects (2). In a study by Han et al., foot defects were reconstructed using a contralateral free medial plantar flap, a free latissimus dorsi flap, or a free scapular flap. Han et al. concluded that the medial plantar flap is superior to the other two flaps with respect to sensory recovery, aesthetic outcome, and flap survival; however, for larger defects or those associated with concomitant bone loss, the use of larger flaps may be unavoidable (9).

The advantages of this flap include ease of transfer; preservation of sensation when transferred as a proximally based pedicled flap or as a free flap with neural anastomosis; and favorable flap thickness for reconstructing a wide range of soft tissue defects. The primary disadvantage is the sacrifice of one of the arteries contributing to the plantar arch. However, this contribution is relatively minor, and adequate perfusion of the foot via the remaining arteries can be confirmed prior to flap transfer using Doppler ultrasonography or angiography (10).

Based on the findings of this study, the medial plantar flap is a reliable flap with a low complication profile that can be effectively utilized for reconstruction of soft tissue defects involving the heel and Achilles tendon. Accordingly, greater emphasis should be placed on teaching this flap in plastic surgery training centers.

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