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Medial Plantar Artery Flap for Soft Tissue Reconstruction of Heel Defects: A Case Series

Dr. D. Jaadi, Dr. A. Brahmi, Dr. H. El kamch, Dr. S. Tita, Pr. J. Hafidi, Pr. N. Gharib, Pr. A. Abbassi, Pr. S. El Mazouz
Department of Plastic and Reconstructive Surgery, Ibn Sina Hospital, Rabat

Abstract
Reconstruction of plantar heel defects poses a significant challenge due to the specialized glabrous skin required for weight-bearing functions. The medial plantar artery flap (MPAF) has emerged as an optimal solution, offering a sensate, glabrous skin that is essential for the functional restoration of the heel. In this report, we present five cases with heel tissue
defects who underwent reconstruction using the medial plantar flap over an 18-month period. All patients achieved successful healing without major complications, and they demonstrated excellent functional and aesthetic outcomes. The MPAF provides durable, sensate coverage for the heel region, making it a reliable and effective option for
reconstruction. This flap remains a preferred choice for plantar heel reconstruction due to its ability to restore both function and appearance

Keywords: heel defect, medial plantar artery flap, foot reconstruction

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I. Introduction

Plantar Heel soft-tissue defects present a unique reconstructive challenge due to the specialized, weight-bearing structure of the heel pad. Its combination of thick, glabrous skin and fibrous fat compartments resists shear and pressure, making it difficult to replace.

Commonly caused by trauma, chronic wounds, or tumor excision, and often complicated by osteomyelitis, these defects require early, durable, and sensate reconstruction to prevent ulceration and limb loss, while preserving ankle mobility and minimizing donor site morbidity.

The medial plantar artery (MPA) flap is a sensate fasciocutaneous flap ideal for reconstruction of defects involving the plantar foot, heel, and ankle. Harvested from the non- weight-bearing instep, it provides glabrous, durable tissue closely resembling native plantar

skin, with minimal donor site morbidity. Its versatility permits use as a pedicled, free, or cross-foot flap, providing a reliable reconstructive option even in cases with bone exposure.

This study aims to assess the functional outcomes and complications of using the medial plantar artery (MPA) flap for reconstructing plantar heel defects in five patients.

Methods

This is a retrospective, descriptive, single-center study involving five patients with heel tissue defects who underwent reconstruction using the medial plantar flap over an 18-month period. Exclusion criteria included poor diabetic control and the presence of an active infection at the site of the defect prior to surgery.

SURGICAL TECHNIQUE

The harvest site was preoperatively marked, with the skin island outlined over the non– weight-bearing instep, within the medial plantar artery angiosome. The medial edge of the plantar aponeurosis is delineated, marking the zone where the perforators emerge. The flap was designed to match the defect precisely, with no overcorrection needed due to the inherent stability of its fibrofatty structure. Margins were established to avoid weight bearing areas: medially, not exceeding the navicular tuberosity; laterally, limited to the medial

longitudinal arch; proximally, at the distal calcaneal tuberosity; and distally, 1–2 cm proximal to the metatarsal heads.

The procedure is initiated with the patient in the supine position under either spinal or general anesthesia. The affected limb is elevated and exsanguinated, and a pneumatic tourniquet is applied to the proximal thigh to ensure a bloodless field. The flap harvest begins with a distal and lateral incision, which is

carefully deepened to expose the plantar aponeurosis. Caution is crucial to avoid damaging the common digital nerve branches that innervate the toes.

The dissection was carried out in a distal-to-proximal direction, maintaining a subfascial plane beneath the plantar aponeurosis. Initiating the dissection distally allows for direct visualization of the dominant pedicle, ensuring its incorporation into the flap along with the accompanying venae comitantes and nerve. The medial plantar artery and nerve are located deep within the intermuscular septum, between the abductor hallucis and flexor digitorum brevis muscles, typically lateral to the flexor hallucis longus tendon.

The medial plantar artery is ligated distally to the flap, and the neurovascular bundle is meticulously traced in a retrograde manner to its origin from the posterior tibial artery.

Preserving the plantar hallucal branch of the medial plantar nerve permits the maintenance of sensory function in the forefoot while restoring protective sensation to the heel. Once the distal, medial, and lateral borders of the flap are elevated, the dissection proceeds proximally to expose the posterior tibial artery and its bifurcation beneath the flexor retinaculum. For posterior defects, proximal dissection of the neurovascular bundle requires division of the abductor hallucis muscle origin to gain additional length. After elevation and isolation of the flap, the tourniquet is released, and hemostasis is secured.

The flap is transferred to the recipient site and secured with non-absorbable skin sutures. The donor site is then covered with a split-thickness skin graft, either during the same procedure or at a later stage. An incision is made between the donor site and the defect, and subcutaneous tissue is carefully excised to create a tunnel, preventing any compression. At the end of the procedure, the incision is closed primarily.

The leg is elevated and immobilized with a splint for 10 days, and dressings are changed according to the wound's condition. Weight-bearing is prohibited for the initial 4 weeks. The patients were hospitalized for one week. During this period, the flap was closely monitored for any signs of necrosis or infection, with regular assessments conducted to ensure its viability.

CASES

Case 1: A 65 years old male with a history of a traumatic heel injury and partial necrosis of a neurosural flap coverage two years prior, presented with a chronic defect. The patient had no significant comorbidities and was referred for further surgical intervention.

a

b

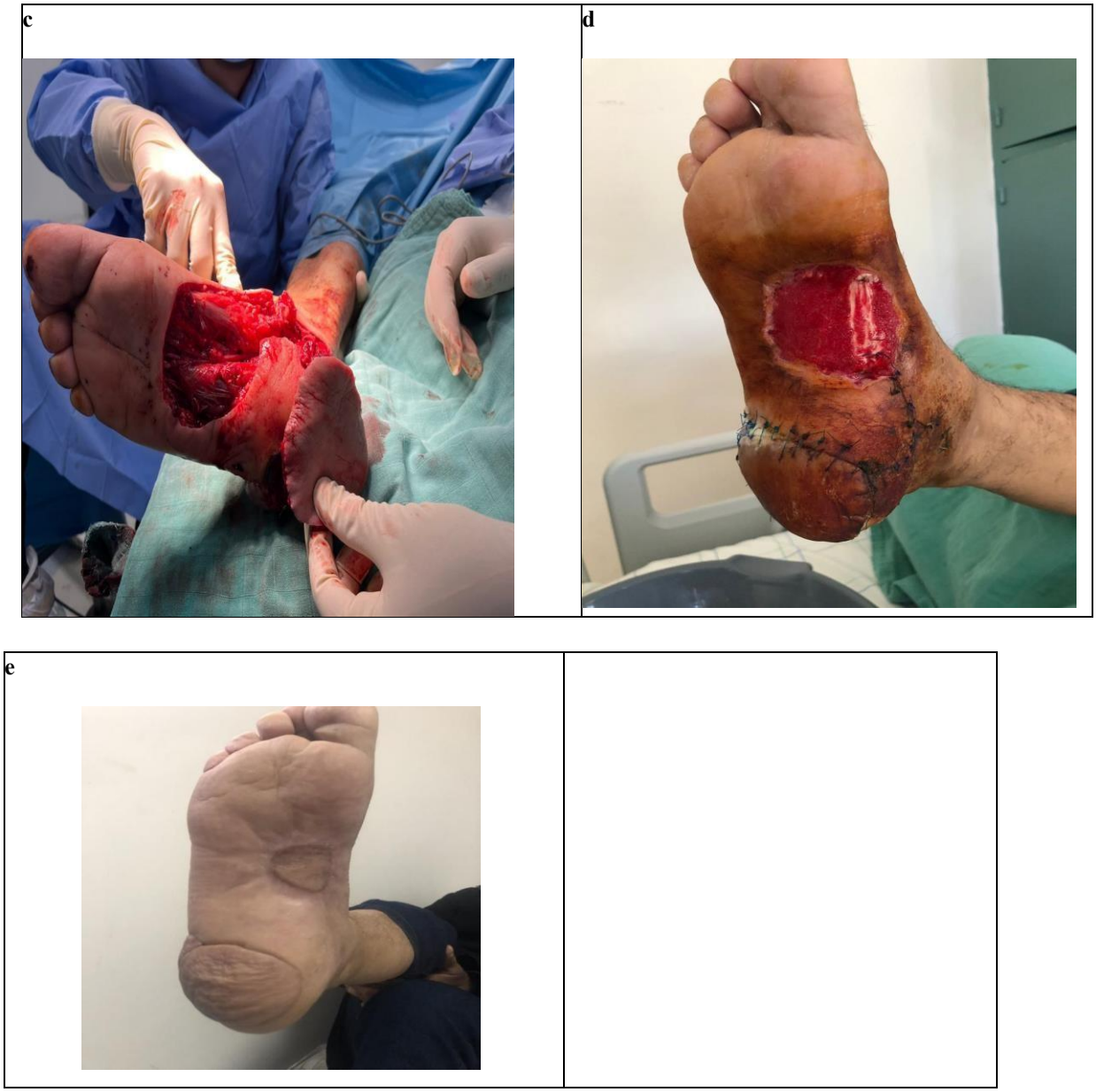

Figure 1: case 1

a. Preoperative marking of the medial plantar artery flap on the instep region.
b. Medial plantar artery flap after harvesting and flipping to expose the vascular pedicle.
c. Transfer of the medial plantar artery flap to the recipient site, ensuring proper alignment and vascular integration for optimal coverage of the heel defect.
d. Postoperative image demonstrating successful flap take and granulation tissue formation at the donor site before grafting.
e. Result after one year

Case 2:
A 47 years old male with a history of well-controlled hypertension presented with a chronic, non-healing heel ulcer measuring 3x2 cm. Despite conservative treatment, the ulcer
persisted, exposing the underlying tissue.

Case 3:
A 54 years old female presented with a 3.6x3.1 cm heel defect following tumor resection. Despite initial wound care, the defect remained unhealed, exposing the underlying soft tissue. The patient had no significant comorbidities and was referred for further surgical management.

Case 4:
A 39 years old male presented with a heel defect resulting from a road traffic accident. The wound had been

debrided after the injury, but healing was delayed, and underlying tissue remained exposed. The patient had no significant medical history and was referred for further surgical management.

Figure 2: case 4

- **a.** Heel soft tissue defect left to heal by secondary intention
- **b.** Elevation of the flap based on its pedicle
- **c.** Placement of the flap over the defect
- **d.** Result after 6 months

Case 5:
A 61 years old male with hypertension and diabetes presented with a pressure ulcer on the heel, developed after an extended ICU stay following a pulmonary infection. The ulcer, approximately 3.5 cm in diameter, exposed underlying tissue and was not healing despite conservative management.

II. Discussion

The anatomy of the plantar heel is uniquely structured to endure the considerable mechanical demands of weight-bearing and locomotion. This region is characterized by a thick, glabrous epidermis and dermis, supported by a dense subcutaneous adipose layer. The fat is organized into sealed compartments, separated by vertically oriented fibrous septa that anchor the skin firmly to the plantar fascia and, in some areas, to the periosteum of the calcaneus. This arrangement allows the heel pad to fulfill its specialized role as a biomechanical cushion, effectively dissipating both compressive and shear forces during ambulation. Similarly, the skin of the instep displays characteristics that restrict displacement, thereby enhancing the overall stability of the foot. Anteriorly, the plantar aponeurosis divides into four distinct slips, each inserting into the bases of the middle phalanges. [1]

The plantar surface of the foot is primarily supplied by the posterior tibial artery, which bifurcates into the medial and lateral plantar arteries about 3 cm distal to the medial malleolus, within the medial retromalleolar space beneath the flexor retinaculum.

The medial plantar artery (MPA), the smaller of the two terminal branches of the posterior tibial artery, courses deep to the abductor hallucis muscle, traversing the medial compartment of the foot. It passes between the flexor digitorum brevis and abductor hallucis muscles, accompanied by the medial plantar nerve. At the midfoot, the MPA bifurcates into superficial and deep branches. The superficial branch supplies the skin and muscles of the medial plantar surface, while the deep branch travels deeper, between the abductor hallucis and flexor hallucis longus muscles, supplying the deeper foot structures. The MPA also forms anastomoses with the first plantar metatarsal artery and the medial tarsal artery, further optimizing blood supply to the plantar foot. Given that the MPA is a non-dominant vessel and its angiosome can be perfused through retrograde flow, it is often considered dispensable.[2,3]

Heel reconstruction presents a considerable challenge for plastic surgeons due to the limited availability of glabrous local tissue. Surgical management typically involves flap-based techniques, which are broadly categorized into local and free flaps. Local flaps such as the medial plantar, lateral calcaneal, reverse sural, and supra-malleolar flaps offer reliable

coverage for heel defects due to their anatomical proximity and tissue characteristics. While free flaps provide greater versatility in defect coverage, they lack the biomechanical properties of native plantar tissue. Their limited shock-absorbing capacity, reduced elasticity, and increased energy dissipation have been associated with a higher incidence of ulcer recurrence and postoperative complications. [4]

The medial plantar artery flap (MPAF) is a reliable reconstructive option due to its consistent vascularization and straightforward dissection, making it suitable for a variety of clinical situations. It has proven effective even in patients with diabetes. The MPAF is typically designed to match or slightly exceed the dimensions of the defect, as its unique fibroadipose tissue structure reduces the risk of contracture. The MPAF can be harvested either as a fasciocutaneous flap or with the inclusion of the abductor hallucis muscle when additional pedicle length or bulk is required. The skin territory of the flap extends from the base of the first metatarsal to the posterior medial heel. The medial and lateral boundaries of the cutaneous area are defined by the midline of the plantar surface and the prominence of the navicular bone. [5,6]

The MPAF is versatile and can be used for covering defects in areas such as the medial ankle, plantar surface, heel, great toe, and even the contralateral foot. It can also address defects in the plantar forefoot, calcaneal, lateral plantar, as well as the palm and wrist. Nevertheless, its primary application is for reconstructing the plantar heel's functional skin unit.[7]

The MPAF is an effective option that provides a reliable blood supply, a wide arc of rotation, and skin similar to the surrounding plantar tissue, ensuring both functional and aesthetic restoration. The flap's design allows for transfer through both superficial and deep pedicles, offering flexibility in coverage. With minimal donor-site morbidity, the flap heals well when covered with a split-skin graft, and the donor site is easily concealed. Additionally, as the flap is innervated by the cutaneous branch of the medial plantar nerve, sensory restoration is a key benefit, crucial for the patient’s ambulation. Overall, the MPA flap is an ideal choice for heel reconstruction, offering excellent outcomes with low complication rates and rapid functional recovery. [8,9]

The MPAF has key limitations. One drawback is the sacrifice of an artery in the foot, although the deep plantar arch provides compensation through anastomoses. Additionally, the flap's

limited size and depth make it unsuitable for covering large or deep defects. It is also less suitable for patients with flat feet, compromised vascular status, or recurrent ulcers.[10]

The medial plantar artery flap (MPAF) is associated with several potential complications, including

venous congestion, flap necrosis, and nerve injury, especially when the deep pedicle is used. Ulceration at the recipient site is a notable concern in heel pad reconstruction, often influenced by sustained pressure from bony prominences, improper flap inset, and inadequate footwear. Other reported complications include partial flap

necrosis, delayed healing, infection, and hematoma. Donor site complications, such as graft loss and hyperkeratosis, are relatively common. To minimize these issues, patients are advised to avoid weight-bearing for the first six weeks postoperatively, followed by gradual weight-bearing, which has been shown to reduce ulceration rates.[11,12]

The reverse flow sural artery flap is another viable option for reconstruction, but it has the drawback of sensory loss in the lateral malleolus, lateral foot, and fifth toe due to the ligation of the sural nerve. Additionally, it tends to leave a more prominent scar compared to the MPAF. Although the MPAF requires longer surgical time, it allows for earlier weight-bearing and is associated with fewer complications than the sural artery flap.[13]

III. Conclusion

The medial plantar artery flap is a dependable option for reconstructing heel defects, offering sensate, glabrous skin with minimal donor site morbidity. It provides both functional and aesthetic advantages, and its versatility, ease of use, and positive long-term outcomes make it a preferred choice for heel reconstruction.

References

[1]. Langat AS, Wan Sulaiman WA, Mat Johar SF: Heel pad reconstruction with medial plantar flap. Cureus. 2021, 13:e13987. 10.7759/cureus.13987
[2]. Macchi V, Tiengo C, Porzionato A, et al. Correlation between the course of the medial plantar artery and the morphology of the abductor hallucis muscle. Clin Anat 2005;18:580–8
[3]. Rodriguez-Vegas M. Medialis pedis flap in the reconstruction of palmar skin defects of the digits: clarifying the anatomy of the medial plantar artery. Ann Plast Surg 2014;72(5):542–552
[4]. Benito-Ruiz J, Yoon T, Guisantes-Pintos E, et al. Reconstruction of soft-tissue de fects of the heel with local fasciocutaneous flaps. Ann Plast Surg 2004;52(4): 380–4.
[5]. Mourougayan V. Medial plantar artery (instep flap) flap. Ann Plast Surg 2006; 56(2):160–3
[6]. Gu JX, Huan AS, Zhang NC, et al. Reconstruction of heel soft tissue defects using medial plantar artery island pedicle flap: clinical experience and outcomes analysis. J Foot Ankle Surg 2017;56(2):226–229
[7]. Acikel C, Celikoz B, Yuksel F, Ergun O. Various applications of the medial plantar flap to cover the defects of the plantar foot, posterior heel, and ankle. Ann Plast Surg. 2003;50(5):498-503.
[8]. Liu L, Zhou Y, Cao X, Cao X, Cai J: Heel reconstruction with free instep flap: a case report. J Med Case Rep. 2014, 8:319. 10.1186/1752-1947-8-319
[9]. Bibbo C: Plantar heel reconstruction with a sensate plantar medial artery musculocutaneous pedicled island flap after wide excision of melanoma. J Foot Ankle Surg. 2012, 51:504-8. 10.1053/j.jfas.2012.04.017
[10]. Ozer MA, Govsa F, Bilge O. Anatomic study of the deep plantar arch. Clin Anat. 2005;18(6):434-42. DOI: http://dx.doi.org/10.1002/ca.20126
[11]. Schwarz RJ, Negrini JF. Medial plantar artery island flap for heel reconstruction. Ann Plast Surg 2006;57(6):658–61.
[12]. Kumar, V. N., Kakola, M. G., Raj, P. S., & Chandrashekar, M. S. (2022). Medial plantar artery flap: An indispensable classic for sensate heel reconstruction. International Journal of Health Sciences, 6(S6), 2977–2983.
[13]. Macedo JLS de, Rosa SC, Neto AV de RF, Silva AA da, Amorim ACS de. Reconstruc tion of soft-tissue lesions of the foot with the use of the medial plantar flap. Rev Bras Or top (Eng Ed) 2017;52(6):699–704.