

Medial Plantar Flap for Reconstruction of Heel Defect

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Background: Heel is subjected to exceed weight bearing and shearing forces. Full-thickness defects to the plantar surface of the foot present a challenge. Variety of procedures have been described for resurfacing this site, but not all achieve normal foot function.

Methods: Reporting two cases, defects of the plantar surface of the heel resurfaced with medial plantar flap, an island fasciocutaneous flap and innervated, thus provide a good replacement.

Results: One patient show good result within 4 weeks, with minimal raw surface on secondary defect. While other patient didn't show up after 2 weeks.

Conclusion: Medial plantar flap was successfully used for heel defect reconstruction. Donor site morbidity was minimal, and patient could walk post-operatively without special devices for the heel.

Keywords: heel defect, medial plantar flap

Latar Belakang: Tumit merupakan daerah yang mengalami tekanan sebagai weight bearing dan rudapaksa. Defek seluruh ketebalan kulit pada sisi plantar kaki merupakan permasalahan yang pelik. Berbagai prosedur telah dideskripsikan untuk merekonstruksi defek ini namun tidak semua fungsi kaki didapatkan kembali.

Metodologi: Melaporkan dua kasus dengan defek pada sisi tumit dilakukan rekonstruksi dengan flap plantar media yang merupakan suatu flap fasiokutan dan terinervasi yang merupakan tindakan rekonstruksi yang cukup baik

Hasil: Satu pasien menunjukkan hasil yang baik dalam 4 minggu dengan defek sekunder minimal. Sementara pasien satu lagi hilang dari follow up setelah dua minggu.

Kesimpulan: Flap plantar media dapat digunakan untuk rekonstruksi defek tumit. Morbiditas di area donor juga minimal dan pasien dapat berjalan pasca operasi tanpa alat khusus pada tumit.

Kata Kunci: defek tumit, flap plantar media.

Resurfacing the sole of the foot, with its unique skin type, presents a challenge to the reconstructive surgeon^{1,2}. The glabrous epidermis and dermis are thicker than in other regions of the body, and a thick subcutaneous fat layer is bound into compartments by strong vertical fibrous septa that are densely adherent to the plantar fascia and the periosteum of the calcaneum³. A full-thickness defect in this area ideally should be reconstructed with durable sensate tissue. The goal of the reconstructive technique is, the higher the likelihood that normal foot function will be achieved. Wide range of techniques

have been used, although few have yielded entirely satisfactory results^{1,2,3}.

We present two cases to illustrate a simple technique for resurfacing defects of the plantar surface of the heel. The medial plantar flap is used at this site and takes advantage of the fact that the skin on the instep of the foot is non-weight-bearing^{4,5}. A split skin graft is required to close the donor site. This report outlines the clinical course and the outcome of this technique.

PATIENTS AND METHODS

Knowledge of vascular anatomy of the foot and ankle and an understanding of the dynamic nature of that vasculature are very

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essential in this technique. The blood supply of the plantar surface of the foot is derived from the posterior tibial artery, which divides into the medial and lateral plantar arteries after passing posterior to the medial malleolus. The medial plantar artery courses deep to the origin of the abductor hallucis muscle and proceeds in the cleft between the abductor hallucis and the flexor digitorum brevis muscles. It supplies the medial plantar skin by means of perforators that pass on either side of the abductor hallucis muscle and as myocutaneous perforators through it^{6,7} (Figure 1).



Figure 1.A. Vascularization plantar of the foot (1) medial plantar artery, (2) lateral plantar artery, (3) cutaneous branch of medial plantar artery. B. Plantar of the foot artery's angiosome.

Preoperative Evaluation

The presence of dorsalis pedis and posterior tibial artery pulses are essential. Calculation of arterial indices is helpful: an ankle to arm blood pressure ratio of more than 0.8 is acceptable. In doubtful cases, Doppler examination and angiography should be performed to assess the functional patency of these arteries.

Technique

The dissection is aided by leg tourniquet and loupe magnification. A skin island is designed based on medial plantar artery angiosome, approximately about 10x10 cm. before raising, locate the medial edge of plantar aponeurosis

by drawing the line between center of the heel posteriorly and medial sessamoid of big toe. This line indicate the area where the perforators emerge from medial plantar artery. The distal edge of the flap is incised and the plantar fascia is transversely divided. The medial plantar neurovascular bundle is identified in the cleft between the abductor hallucis and flexor digitorum brevis. The flap is raised at the level between the plantar fascia and the flexor digitorum brevis muscle, keeping the medial plantar vascular bundle and the cutaneous nerve branches intact with the flap. The flap is raised in a distal-to-proximal and dorsal-to-plantar direction. (see fig.2) Attention should be paid to the cutaneous branches from the nerve to the flap. As the flap is raised proximally, these cutaneous nerve fascicles are retained with the plantar flap by meticulous interfascicular dissection, leaving the nerve trunk in the foot.

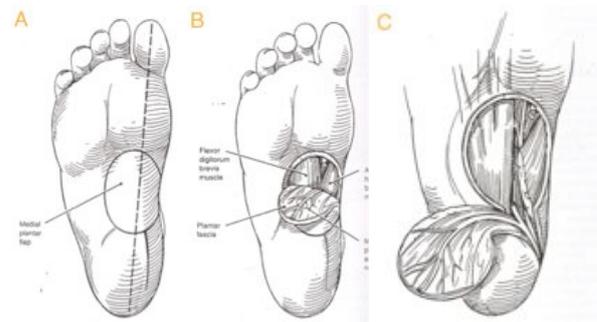


Figure 2. A. The line indicate where the perforator emerge. B. Flap is raised distal to proximal, with plantar fascia included. C. Abductor hallucis muscle is divided.

Tracing the medial plantar neurovascular bundle proximally, dissection was proceeds to expose its bifurcation with the lateral plantar neurovascular bundle. The abductor hallucis muscle is partially or completely divided to liberate the neurovascular pedicle. The flap harvest is completed by a circumferential incision, with the plantar fascia included in the flap.

Once the flap harvest is completed, the divided muscle is reattached, and the donor



defect is covered with a split-thickness skin graft. The foot and ankle is immobilized with a splint.

Post operative care

The leg is elevated and immobilized with a splint for a period of 7-10 days, the dressing is changed based on wound situation. Weight bearing is not permitted for 4 weeks⁸.

Case 1

A 16-year-old female with defect at right heel due to skin avulsion caused by motorcycle accident. (see fig.3) The avulsed skin is sutured back but became necrotic at day 5. At day 6, the wound was debrided and left a defect, down to bone measuring 13x7.5 cm. The plantar defect was resurfaced with a medial plantar neurovascular island flap. She was discharged and advised to refrain from doing weight-bearing activities. At day 7 the flap showed good coverage, but with minimal raw surface at secondary defect, this was managed conservatively with regular dressings and expected to fully epithelialize. After 4 weeks, she was able to mobilize by partial weight bearing with the aid of crutches. On later examination, sensory localization was accurate; light and sharp touch were distinguished. The patient's gait was also normal.

Case 2

A male 56 years old after debridement of chronic ulcer. (see fig.4) Leaving 6x5 cm full thickness defect. The defect was resurfaced with medial plantar flap. The patient discharged from hospital but despite repeated requests, the patient failed to attend further reviews, which may indicate that there have been no further problems with the foot.



Figure 3. Showing case 1. A. Defect measuring 13x7.5 cm and surface anatomy of the flap. B. Forceps showing the pedicle is raised within the fascia and Adductor hallucis muscle is divided so the flap more liberate. C. immediate post operative view, showing the flap is inset and secondary defect is closed using split-thickness skin graft. D-E. One week after operation showing the defect is fully covered, with acceptable deformity at the heel.



Figure 4. Showing case 2. A. Preoperative view showing defect from lateral side. B. Defect from medial side. C. Immediate post operative view. D. One week after operation.

DISCUSSION

A variety of techniques have evolved for reconstructing defects of the plantar surface of the foot. Sommerlad and McGrouther reviewed a number of these and found that no one particular technique was superior or ideal. Most patients walked with an altered gait and avoided weight bearing on the resurfaced plantar area (particularly the heel). Skin grafts^{9,10} have met with limited success and can lead to problems such as skin breakdown and hyperkeratosis,^{1,11} Shanahan and Gingrass were the first to use the skin of the instep when they described the medial plantar sensory flap to resurface the heel² and shortly afterward, this was modified as an islanded pedicle flap.⁵ Further modifications have been the inclusion of muscle,^{5,12,13} a reverse-flow island flap design for more distal defects,¹⁴ and a free flap to cover defects on the contralateral heel¹⁵. Similar flaps based on the lateral plantar neurovascular bundle have also been described¹⁵⁻¹⁸. The medial design is preferable, as it uses the instep skin, has a wide arc of rotation, and maintain intact tissue over the weight-bearing fifth metatarsal head¹⁹.

CONCLUSION

The medial plantar flap, as illustrated in these two cases, successfully resurfaced the difficult plantar heel area with appropriate sensate plantar tissue. This has permitted satisfactory long-term functional results, optimizing restoration of foot function, with minimal donor-site problems. This flap is a useful option that can be considered for reconstruction of the problematic area on the plantar surface of the heel.

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