

ISLANDED NEURO CUTANEOUS MEDIAL PLANTAR ARTERY FLAP FOR HEEL PAD RECONSTRUCTION – OUR CLINICAL EXPERIENCE

V .Jeyakodish¹, P. Mahesh Kumar², A. Saleem³

Received : 20/08/2025
Received in revised form : 04/10/2025
Accepted : 25/10/2025

Keywords:

Heel reconstruction, Medial plantar artery flap, Heel pad defect, Protective sensation, Foot trauma, Flap survival.

Corresponding Author:

Dr. A.Saleem,
Email: tnpadis@gmail.com

DOI: 10.47009/jamp.2025.7.5.245

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (5); 1287-1290



¹Associate Professor, Department of Plastic Surgery, Madurai Medical College & Government Rajaji Hospital, Madurai, Tamilnadu, India.

²Senior Resident, Department of Plastic Surgery, Madurai Medical College & Government Rajaji Hospital, Madurai, Tamilnadu, India.

³Assistant Professor, Department of Plastic Surgery, Madurai Medical College & Government Rajaji Hospital, Madurai, Tamilnadu, India.

ABSTRACT

Background: Heel pad defects are difficult to manage because of the specialised structure, weight-bearing function, and need for protective sensation of the region. This study aimed to evaluate the clinical and functional outcomes of islanded neurocutaneous medial plantar artery flaps used for heel reconstruction. **Materials and Methods:** A prospective observational case series was conducted on ten male patients with heel defects due to trauma or tumour excision. All patients underwent reconstruction using an islanded medial plantar artery flap, including the cutaneous fascicle of medial plantar nerve. The donor sites were closed with split-thickness skin grafts, and the patients were followed up for up to 18 months. **Result:** All flaps survived without necrosis, and graft take at the donor sites was above 95% in every case. The average flap size was 7.5 × 6 cm, with the largest being 10 × 8 cm in size. Protective sensation returned by 3 ± 2 days postoperatively, and the two-point discrimination averaged 12 mm at 14 days. Patients began full weight-bearing activity at 4 ± 1 weeks. No major flap-related complications, ulcer recurrence, or functional deficits were observed during the follow-up period. The sensory outcomes were stable, with results comparable to those of the contralateral heel. **Conclusions:** The islanded neurocutaneous medial plantar artery flap is a reliable and functionally effective method for heel pad reconstruction. It ensures stable coverage, early protective sensation, and minimal donor site morbidity, making it well suited for moderate-sized posterior heel defects.

INTRODUCTION

The heel plays a critical role in supporting the body weight, absorbing shock, and maintaining balance during standing and walking. Its unique structure, consisting of thick glabrous skin and fibrofatty tissue, provides both strength and protective sensation. Injuries or surgical loss of the heel pad result in significant functional disability and pose a challenge to reconstruction. The main difficulty lies in restoring durable, sensate, and pressure-resistant coverage that closely resembles the original tissue in texture and function.^[1,2]

Heel pad defects are complicated, urging reconstructive surgeons to find an optimum soft tissue cover. The soft tissue cover of the heel pad defects requires replacement of “like with like tissue”, providing glabrous, sensate, and weight-bearing skin with minimal donor site morbidity. Traditional methods, such as skin grafts or random pattern flaps, may not offer sufficient durability or

sensation, particularly under constant mechanical stress. Similarly, free flaps, although effective, require complex microsurgical techniques and may not replicate the natural qualities of heel skin.^[3,4]

The islanded neurocutaneous medial plantar artery flap, first described by Harrison and Morgan in 1981, is harvested from the instep region of the foot and has proven to be highly suitable for heel reconstruction.^[5] This flap provides glabrous and sensate skin similar to the heel, with adequate thickness to withstand pressure and weight. Including the medial plantar artery and its accompanying nerve enhances both blood supply and early sensory recovery. The donor area, being non weight bearing, can be grafted with minimal functional or aesthetic complications, making it a reliable and practical option.^[6]

This flap is particularly beneficial for covering medium-sized defects in the posterior heel and has shown favourable outcomes in restoring protective sensation, preventing recurrent ulceration, and enabling early return to ambulation.^[7] Its design

allows for preservation of foot biomechanics, and its similarity to native heel tissue makes it an appropriate choice in selected cases.^[8] While several reports have described its use, comprehensive clinical experiences remain limited, especially in resource-limited settings or in institutions managing post-traumatic and post-oncologic heel injuries.^[9] Sharing such outcomes can contribute to better understanding and wider acceptance of this technique.^[10]

This study aimed to present our institutional experience with the islanded neurocutaneous medial plantar artery flap for heel pad reconstruction. We analysed flap survival, functional recovery, time to weight bearing, sensory outcomes, and donor site healing in a series of patients who underwent this procedure over a defined period.

MATERIALS AND METHODS

This prospective case series study was conducted on 10 patients in the Department of Plastic Surgery at Madurai Medical College and Government Rajaji Hospital, a tertiary care teaching institution, between January 2024 and June 2025. Informed written consent was obtained from all patients for both the surgical procedure and the use of clinical data for research purposes.

Inclusion Criteria

Patients included in the study had heel pad defects resulting from trauma or oncological excision, with defects suitable in size and location for coverage using a medial plantar artery flap. Only patients who were medically fit to undergo regional flap surgery under spinal anaesthesia and provided written informed consent were considered.

Exclusion Criteria

Patients were excluded if they had peripheral vascular disease affecting flap viability, active infection at the donor or recipient site, or systemic conditions impairing wound healing, such as uncontrolled diabetes or immunosuppression.

Methods

Demographic data, cause of injury, defect size, flap dimensions, and flap viability were recorded. Preoperative localisation of the medial plantar artery was performed using an 8 MHz handheld Doppler. All procedures were performed under spinal anaesthesia and non-exsanguinating tourniquet control in the supine position. The flap axis was marked from the centre of the heel to the head of the first metatarsal. A defect template was used to plan the flap over the instep region. The flap was raised from distal to proximal in a plane just above the abductor hallucis muscle, which included the plantar fascia.

A cutaneous branch of the medial plantar nerve was identified, carefully dissected from its main trunk, and included in the flap. The medial plantar artery, located between the abductor hallucis and flexor digitorum brevis, was also preserved. After adequate mobilisation, the tourniquet was released to assess the flap perfusion. The flap was then inserted into the defect, and the donor area was covered with a split-thickness skin graft. Follow-up evaluations were performed at 2 weeks, 1, 3, 6, and 12 months, along with photographic documentation. Outcomes were measured by the return of protective sensation and time to achieve weight-bearing.

RESULTS

A total of 10 male patients were treated, with 7 cases due to road traffic accidents and 3 following oncologic resection. The average defect and flap size was 7.5×6 cm, with the largest flap measuring 10×8 cm. All flaps survived completely, and the donor sites covered with split-thickness skin grafts had over 95% graft take. Patients achieved weight bearing at an average of 4 weeks, protective sensation by 3 days, and a mean two-point discrimination of 12 mm at two weeks postoperatively. [Table 1]

Table 1: Patient profile and surgical outcomes

Parameter		Value
Etiology of defect	Post-traumatic (RTA)	7 patients
	Post-oncologic resection	3 patients
	Isolated heel pad injury (RTA)	5 patients
Mean surface area of heel defect		7.5×6 cm
Mean flap size		7.5×6 cm
Largest flap dimension		10×8 cm
Flap survival		100% (all 10 flaps)
Donor site coverage		Split-thickness skin graft
Graft takes at donor site		>95% in all patients
Outcome Measure	Mean follow-up duration	1 year (range: 6–18 months)
	Time to weight bearing	4 ± 1 weeks
	Time to appearance of protective sensation	3 ± 2 days
	2-point discrimination (14 th postoperative day)	Mean: 12 mm

Among the 10 patients treated, 7 had post-traumatic cases and 3 had post-oncologic cases, including 1 malignant melanoma and 2 squamous cell carcinomas. The defect sizes ranged from 7×5 cm to 10×8 cm in size. All the flaps survived completely

without necrosis. The majority of traumatic cases had moderate-sized defects, whereas the largest defects were observed in a trauma-related case. No flap-related complications were observed during follow-up.[Table 2]

Table 2: Distribution of cases by etiology, defect size, and flap viability

Cases	Cause of heel pad defect	Defect size	Flap necrosis
1	Trauma	8 × 6 cm	Nil
2	Trauma	7 × 5 cm	Nil
3	Malignant melanoma	9 × 6 cm	Nil
4	Trauma	8 × 6 cm	Nil
5	Trauma	9 × 5 cm	Nil
6	Squamous cell carcinoma	8 × 7 cm	Nil
7	Trauma	9 × 7 cm	Nil
8	Trauma	10 × 8 cm	Nil
9	Squamous cell carcinoma	9 × 6 cm	Nil
10	Trauma	7 × 6 cm	Nil

**Figure 1: A) Heel defect with flap marking B) Flap at 1 yr follow up**

DISCUSSION

This study evaluated the outcomes of islanded neurocutaneous medial plantar artery flaps for heel pad reconstruction. The findings were compared with those of the existing literature to assess the effectiveness of the technique in terms of survival, sensation, and function.

Demographic and etiological profile

In our study, all 10 patients were male. Seven cases followed road traffic accidents (post-traumatic), and three occurred after oncologic resection: one due to malignant melanoma and two due to squamous cell carcinomas. Similarly, Gu et al. reported 11 patients (90.9% males, 9.1% females) who underwent medial plantar artery island pedicle flap reconstruction for heel defects, with causes including melanoma (63.6%), trauma-related necrosis (18.2%), and infection-related soft tissue loss (18.2%).^[11] Siddiqi et al. studied 18 patients (88.9% male, 11.1% female), where medial plantar artery-based sensate fasciocutaneous pedicled flaps were used to treat heel defects caused by trauma (72.2%), unstable scars (16.7%), and pressure sores (11.1%).^[12] Macedo et al. observed 12 patients (83.3% male, 16.7% female) who received medial plantar flaps for traumatic heel defects (83.3%) and dorsal foot defects (16.7%), with full healing in all but one case of partial flap loss.^[13]

Our findings on patient profile and aetiology are consistent with these reports, confirming the flap's suitability for trauma- and tumour-related heel defects.

Defect size and flap dimensions

In our study, heel pad defects had an average size of 7.5 × 6 cm, with the largest measuring 10 × 8 cm. All defects were confined to the heel pad region. Similarly, Sundaramurthy et al. reported 19 patients, with the largest flap measuring 9 × 7 cm; all flaps survived with satisfactory functional and aesthetic outcomes.^[14] Scaglioni et al. documented 28 reconstructions, including 20 heel defects, with flap sizes ranging from 2.5 × 2.5 cm to 5.5 × 9.5 cm, showing high survival rates and good function.^[15] Gu et al. also showed reliable outcomes in smaller heel defects averaging 3.7 × 4.4 cm.^[11] Our results are in agreement with these findings, confirming success across a range of defect sizes.

Flap survival and complications

Our study showed that all flaps survived without necrosis. The donor sites showed more than 95% graft take, and no significant flap-related complications were observed during follow-up. Similarly, Opoku et al. found 98.2% flap survival among 277 medial plantar artery flaps, with minor complications in 9.4% and donor-site morbidity in 5.2%.^[16] Schwarz and Negrini reported 98% flap survival in 51 flaps across 48 patients, with only one case of necrosis and four cases of delayed healing (mean follow-up: 14 months).^[17] Bhandari and Srivastava showed that 28 of 29 flaps survived without ulceration during extended follow-up.^[18] These studies support our findings, confirming the high reliability of the flap.

Sensory recovery and functional outcome

In our study, protective sensation returned within 3 ± 2 days postoperatively. The mean two-point discrimination was 12 mm by day 14. Full weight-bearing was resumed at 4 ± 1 weeks postoperatively. Similarly, Khai and Wan found that deep sensation returned by 6 months and protective sensation by 1 year, with no ulcer recurrence in 7 cases.^[19] Rashid et al. reported that patients achieved full weight-bearing by 6 weeks and returned to work by 8 weeks.^[20] Jung et al. observed no major flap loss in 12 cases, with two-point discrimination comparable to the contralateral heel.^[21] Our outcomes are consistent and, in some aspects, show faster recovery.

Follow-up and sensory durability

Our study showed that patients were followed up for a mean of 12 months (range: 6–18 months). All patients maintained stable coverage with preserved flap function. Similarly, Macedo et al. found similar healing patterns, with only one partial flap loss and no recurrence.^[13] Bhandari and Srivastava noted gradual sensory recovery, with crude touch restored in 2–3 months and continued improvement over 2 years.18 Trevat et al. reported in 8 patients that after one year, two-point discrimination was 33 mm in the flap and 29 mm in normal tissue, with no significant difference ($p = 0.1898$), confirming long-term sensory integrity.^[22] The islanded neurocutaneous medial plantar artery flap is effective for heel pad reconstruction. This ensures flap survival, early return of protective sensations, and long-term function. These outcomes align with published data and support the role of the flap in complex heel defect management.

Limitations

The study included a small sample size of ten patients and the absence of a control group for comparison. The study design was observational and non-randomised, which limited the strength of the evidence. The follow-up duration was limited to 6–18 months, which may not reflect long-term outcomes. Sensory assessment was based on basic clinical tests without advanced neurophysiological evaluations. Additionally, all patients were male, which restricts the generalisability of the results across a broader population.

CONCLUSION

Our study shows that the islanded neurocutaneous medial plantar artery flap is a reliable option for the reconstruction of the heel pad. All flaps survived without necrosis, and the donor sites healed well with minimal morbidity. The patients showed early return of protective sensation and achieved full weight bearing within a few weeks. No major complications or ulcer recurrences were observed during follow-up. Sensory recovery was satisfactory, with good two-point discrimination and stable, soft tissue coverage. These results highlight the effectiveness of the flap in restoring durable, sensate, and pressure-resistant coverage for moderately sized heel defects.

REFERENCES

1. Feng B, Dai G-M, Wang Y-J, Zhang L, Niu K-C. Treatment experience with different types of flaps for repairing soft tissue defects of the heel. *Int J Gen Med* 2021;14:8445–53. <https://doi.org/10.2147/IJGM.S329642>.
2. Langat AS, Wan Sulaiman WA, Mat Johar SFN. Heel pad reconstruction using a medial plantar flap. *Cureus* 2021;13:e13987. <https://doi.org/10.7759/cureus.13987>.
3. Elgohary H, Nawar AM, Zidan A, Shoulah AA, Younes MT. Functional and aesthetic outcomes of reconstruction of soft-tissue defects of the heel with free flap. *JPRAS Open* 2019;19:35–44. <https://doi.org/10.1016/j.jpra.2018.10.008>.
4. Fox C, Beem H, Wiper J, Wagels M, Leong J, Rozen W. Muscle versus fasciocutaneous free flaps in heel reconstruction: A systematic review and meta-analysis. *J Reconstr Microsurg* 2014;31:059–66. <https://doi.org/10.1055/s-0034-1384674>.
5. Elhefnawy AA, Hantash SA, Mahmoud WH, Homouda WI, Khedr MM. Versatility of local fasciocutaneous island flaps for resurfacing soft tissue defects overlying the Achilles Tendon. *World J Plast Surg* 2023;12:20–8. <https://doi.org/10.52547/wjps.12.1.20>.
6. Wan DC, Gabbay J, Levi B, Boyd JB, Granzow JW. Quality of innervation in sensate medial plantar flaps for heel reconstruction. *Plast Reconstr Surg* 2011;127:723–30. <https://doi.org/10.1097/PRS.0b013e3181fed76d>.
7. Yang D, Yang JF, Morris SF, Tang M, Nie C. Medial plantar artery perforator flap for soft tissue reconstruction of the heel. *Ann Plast Surg* 2011;67:294–8. <https://doi.org/10.1097/SAP.0b013e3181f9b278>.
8. Kaura A, Fahrenkopf MP, Do VH. Heel reconstruction utilising a medial plantar artery flap. *Eplasty* 2022;22:ic8. <https://pmc.ncbi.nlm.nih.gov/articles/PMC9181864>.
9. Prithivi Raja K, Gopalan G, Sivakumar S. Medial plantar artery flap for reconstruction of heel pad defects. *Int J Adv Res (Indore)* 2024;12:713–21. <https://doi.org/10.21474/ijar01/19879>.
10. Oon ZS, Kow RY, Ahmad Alwi AA, Ayeop MAS, Low CL, Che Ahmad A. The role of medial plantar artery flap in heel pad reconstruction: A report of two cases. *Cureus* 2023. <https://doi.org/10.7759/cureus.41844>.
11. Gu J-X, Huan A-S, Zhang N-C, Liu H-J, Xia S-C, Regmi S, 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;56:226–9. <https://doi.org/10.1053/j.jfas.2016.11.022>.
12. Siddiqi MA, Hafeez K, Cheema TA, Rashid H-U. The medial plantar artery flap: a series of cases over 14 years. *J Foot Ankle Surg* 2012;51:790–4. <https://doi.org/10.1053/j.jfas.2012.06.003>.
13. Macedo JLS de, Rosa SC, Neto AV de RF, Silva AA da, Amorim ACS de. Reconstruction of soft-tissue lesions of the foot with the use of the medial plantar flap. *Rev Bras Ortop* 2017;52:699–704. <https://doi.org/10.1016/j.rboe.2017.10.009>.
14. Sundaramurthy N, Venkata Mahipathi SR, Durairaj AR, Jayachandiran AP, Selvaa SR. “like for like” reconstruction of heel pad with medial plantar artery flap-functional and aesthetic outcomes in A series of 19 cases. *Indian J Plast Surg* 2021;54:358–61. <https://doi.org/10.1055/s-0041-1735424>.
15. Scaglioni MF, Rittirsch D, Giovanoli P. Reconstruction of the heel, middle foot sole, and plantar forefoot with the medial plantar artery perforator flap: Clinical experience with 28 cases. *Plast Reconstr Surg* 2018;141:200–8. <https://doi.org/10.1097/PRS.00000000000003975>.
16. Opoku-Agyeman JL, Allen A, Humenansky K. The use of local medial plantar artery flap for heel reconstruction: A systematic review. *Cureus* 2020;12:e9880. <https://doi.org/10.7759/cureus.9880>.
17. Schwarz RJ, Negrini J-F. Medial plantar artery island flap for heel reconstruction. *Ann Plast Surg* 2006;57:658–61. <https://doi.org/10.1097/01.sap.0000235426.53175.e3>.
18. Bhandari PS, Srivastava V. Medial plantar artery flap for heel reconstruction: A 22-year follow-up. *Journal of Foot and Ankle Surgery (Asia Pacific)* 2022;10:220–3. <https://doi.org/10.5005/jp-journals-10040-1257>.
19. Khai Luen K, Wan Sulaiman WA. Functional outcomes after heel pad reconstruction: A review of 7 cases. *J Foot Ankle Surg* 2017;56:1114–20. <https://doi.org/10.1053/j.jfas.2017.04.024>.
20. Rashid M, Hussain SS, Aslam R, Illahi I. A comparison of two fasciocutaneous flaps in the reconstruction of defects of the weight-bearing heel. *J Coll Physicians Surg Pak* 2003;13:216–8. <https://doi.org/10.2003/JCPSP.216218>.
21. Jung SY, Kim MB, Lee YH. Sensory reconstruction of a posterior heel defect using a proximally based sensate medial plantar flap with retrograde nerve cleavage technique. *Int J Low Extrem Wounds* 2024;23:372–8. <https://doi.org/10.1177/15347346211055261>.
22. Trevatt AEJ, Fillobos G, Ul Haq A, Khan U. Long-term sensation in the medial plantar flap: a two-centre study. *Foot Ankle Surg* 2014;20:166–9. <https://doi.org/10.1016/j.fas.2014.03.001>.