



Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/19879
DOI URL: <http://dx.doi.org/10.21474/IJAR01/19879>



RESEARCH ARTICLE

MEDIAL PLANTAR ARTERY FLAP FOR RECONSTRUCTION OF HEEL PAD DEFECTS

Dr. K. Prithivi Raja¹, Dr. G. Gopalan² and Dr. S. Sivakumar³

1. Post Graduate, Department of Plastic and Reconstructive Surgery, Government Mohan Kumaramangalam Medical College Hospital, Salem, Tamilnadu, India- 636001.
2. Assistant Professor, Department of Plastic and Reconstructive Surgery, Government Mohan Kumaramangalam Medical College Hospital, Salem, Tamilnadu, India- 636001.
3. Head of the Department, Department of Plastic and Reconstructive Surgery, Government Mohan Kumaramangalam Medical College Hospital, Salem, Tamilnadu, India- 636001.

Manuscript Info

Manuscript History

Received: 08 September 2024
Final Accepted: 17 October 2024
Published: November 2024

Key words:-

Medial Plantar Artery Flap, Sole Defect,
Foot Reconstruction

Abstract

Introduction: Soft-tissue injury of heel pad is challenging to deal with due to limited reconstructive options. Masquelet and Romana described medial plantar artery flap to reconstruct heel pad with like with like tissue and with lesser donor-site morbidity.

Materials and Methods: The study includes 10 patients with soft tissue defects of the heel pad who presented between 2022- 2024. The patients were followed up for a maximum period of 2 years.

Results: Ten patients with soft tissue defects of the heel underwent medial plantar artery flap were included in the study.

Conclusion: The medial plantar artery flap is a suitable option for the reconstruction of soft tissue defects in the weight-bearing portion of the heel, resulting in excellent functional outcomes.

Source of support: Nil Conflict of interest: None.

Copyright, IJAR, 2024,. All rights reserved.

Introduction:

Soft tissue defects of the foot reconstruction are limited and the option of choice must aim to provide reliable and durable soft tissue coverage with normal walking. Regional flaps are too large and bulky which results in difficult foot wear. It is important to cover these defects early with stable skin cover and also with like with like tissue.

Normal weight bearing is contributed by the heel, lateral border of the foot, metatarsophalangeal joint, and toes. The instep area does not contribute to weight bearing. The skin of the foot is specialized with a thick epidermis and dermis anchored to the plantar aponeurosis by fibrous septa which in turn partition subcutaneous fat between the skin and plantar aponeurosis. This fibrous septum prevents gliding of the skin, and the partitioned subcutaneous fat acts as a shock absorber.

Masquelet and Romanain 1990 described medial plantar artery flap for heel pad reconstruction to provide similar glabrous skin with minimal donor site morbidity which is based on medial plantar artery which is a terminal branch of posterior tibial artery.

Corresponding Author: Dr. K. Prithivi Raja

Address: Post Graduate, Department of Plastic and Reconstructive Surgery, Government Mohan Kumaramangalam Medical College Hospital, Salem, Tamilnadu, India- 636001.

It can be used to cover defects of the medial malleolus, heel pad and tendo-Achilles region. It can be a sensate flap if a proper branch from the medial plantar nerve was included in the flap.

During 2022 to 2024, We performed ten cases of Medial plantar artery flap for heel pad defect at our institute. A written informed consent was taken from all the participants prior to the surgery. In this study, we aim to reconstruct soft-tissue defects of heel pad by medial plantar artery flap which provides stable, supple and durable cover.

Methods:

This was a prospective study which was conducted in government medical college, Salem Tamil Nadu in the Department of Plastic Surgery from September 2022 to October 2024. Total of 10 patients were included in the study.

Inclusion criteria:

Patients above 18 years of age with soft tissue defects of the heel pad following trauma, diabetic ulcer and malignancy.

Exclusion criteria:

Less than 18 yrs of age and more than 60 years of age, peripheral vascular disease. The institute's review board has approved the study design.

Results:

Ten patients with soft tissue defects of the heel were included in the study. There were 7 males and 3 females. Six had post-traumatic heel defect, three were diabetic foot and one case was malignant. Average surface area of the defect was 10x6cm.

Out of 10 patients, there was no flap necrosis and graft loss in any of the patient.

Anatomy

The flap is based on medial plantar artery which is a terminal branch of posterior tibial Artery (Fig.1). It passes distally along the medial side of the foot, medial to the medial plantar nerve. At first deep to abductor hallucis, it runs distally between this muscle and flexor digitorum brevis and supplies both. Near the first metatarsal base its size already diminished by muscular branches is further reduced to a superficial stem that divides to form three superficial digital branches. These accompany the digital branches of the medial plantar nerve and join the first to third plantar metatarsal arteries. The main trunk then runs on to reach the medial border of the hallux, where it anastomoses with a branch of the first plantar metatarsal artery.

Surgical technique:

Pre op Evaluation:

A handheld doppler 8-10 MHz was used preoperatively to localize medial plantar artery and to assess the patency of the vessel. As per the size and location, marking and planning of flap was done in reverse. The line is drawn from mid point of the calcaneum to the head of the first metatarsal which corresponds to the axis of the flap. The flap is centered over the axis and according to the defect size marking done (Figure 2).

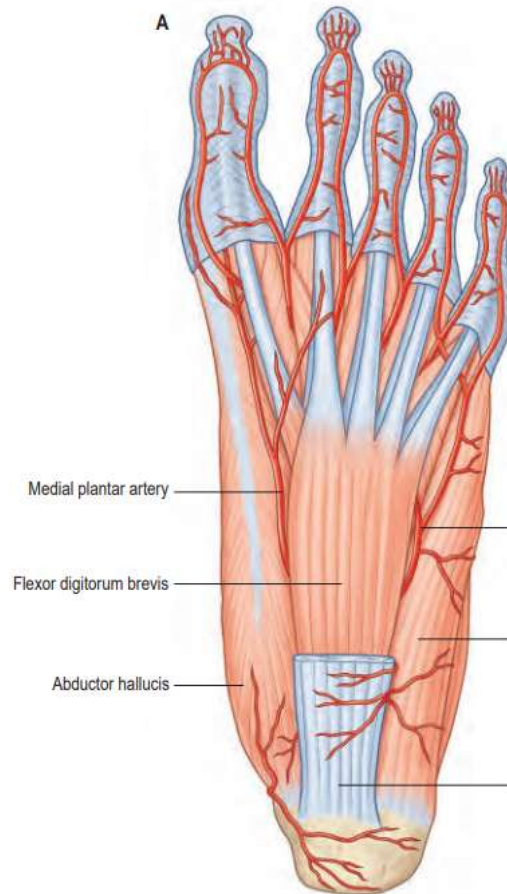


Figure 1: Shows the course of the medial plantar artery from its origin from the posterior tibial artery to the distal sole and its relation to the abductor hallucis and the medial plantar nerve.



Figure 2: Shows the axis of the flap and the flap is centered over the instep area.

Flap Elevation:

Under spinal or epidural anaesthesia, Patient in supine or lateral decubitus position and undertourniquet control without exsanguination wound debridement done. The dissection was carried distally to proximally with plane of dissection being deep to the plantar aponeurosis. Underneath the aponeurosis, vascular pedicle in the second layer of the foot with nerves can be identified. Dissection continued on medial side over the epimysium of the abductor hallucis muscle and dissection continued until reaching the septum. From lateral side, dissection continued over the flexor digitorum brevis muscle and septum reached. The flaps raised from distal end of the flap and plane of dissection is superficial to medial plantar nerve. Distal end of the medial plantar artery is divided and elevated with

the flap (Figure 3). Tourniquet released and vascularity of the flap is assessed and the flap inset given. Donor site grafted after carefully preserving the nerve beneath the muscle (Figure 3).



Figure 3: Illustrates medial plantar artery divided and elevated with the flap.

Master Chart of The Patients Included in The Study

S.NO	DIAGNOSIS
1	diabeticulcer right heel pad
2	diabetic ulcer left heel pad
3	Diabetic ulcer right heel pad
4	Diabetic ulcer right heel pad
5	Melanoma right heel pad
6	Post traumatic raw area left heel pad
7	Post traumatic raw area right heel pad
8	Diabetic ulcer left heel pad
9	Diabetic ulcer right heel pad
10	Diabetic ulcer left heel pad

Case Series

Case -1

52 year old male with right heel pad diabetic foot ulcer which was debrided and defect was covered with medial plantar artery flap (Fig.4)





Figure 4 (A,B): Shows post infective raw area covered with medial plantar artery flap .(C) shows one month follow up with well settled flap and complete graft uptake in instep area.

Case 2

48 year old female with left heel pad diabetic ulcer which was debrided and later covered with medial plantar artery flap.



Figure 5(A,B):Shows post infective raw area covered with medial plantar artery flap .(C) shows 6 months follow up with near normal looking skin in heel pad.

Case 3

51 year old male with right heel pad diabetic ulcer which was debrided and covered with medial plantar artery flap.



Figure 6 (A,B):Shows post infective raw area covered with medial plantar artery flap.

Case 4

47 year old male with right heel pad diabetic ulcer was debrided and later covered with medial plantar artery flap.(Fig:7)



Fig 7 (A,B):-Shows post infective raw area of the heel pad covered with medial plantar artery flap (C) shows 1 yr follow up.

Case 5

55 years old female with right heel pad malignant melanoma which was excised and later covered with medial plantar artery flap.(Fig:8)



Fig. 8:Shows melanoma excision in heel pad with medial plantar artery flap cover.

Results After Long Follow Up: (fig: 9)





Fig. 9: Illustrates long follow up upto maximum of 2 years.

The patients were followed for a maximum of 2 years and showed glabrous skin over heel pad providing stable, supple and durable cover.

Discussion:

The skin covering both the heel and sole of the foot has an specialized tissue structure containing thick glabrous skin, thick epidermis and dermis, fibroadipose tissue, and abundant fibrous septae connecting the skin to the plantar aponeurosis. Reconstruction of this specialized area remains a challenging task due to the scarcity of glabrous local tissue. Various surgical options are available for the reconstruction of the heel such as reverse sural artery, reverse peroneal and free flaps. Disadvantages of reverse sural flap is venous congestion and not provide glabrous skin whereas reverse peroneal is bulky and major vessel of lower limb is sacrificed and free flaps takes longer time and not provide glabrous skin.

The medial plantar artery flap is recognized as an excellent choice for wound coverage in the weight-bearing areas. Since, flap donor area is in a non weight bearing region it causes no disability and provide high patient satisfaction with the cosmetic and overall outcomes of the surgery.

The medial plantar artery flap has several advantages, including similar skin anatomy to that of the surrounding plantar skin, a constant blood supply, and a cutaneous nerve supply for protective and tactile sensation.

The drawback of this flap is its limitation in size to cover larger defects.

Conclusion:

The medial plantar artery flap is a suitable option for the reconstruction of soft tissue defects in the weight-bearing portion of the heel, resulting in excellent functional outcomes.

Acknowledgements:

Entire Department of plastic surgery, ward staffs, hospital management and patients involved in my study.

Declarations

Funding: nil

Conflict of interest: nil

Ethical approval: **yes**

References:

1. Harrison, D. H., and Morgan, B. D. G. The instep island lap to resurface plantar defects. *Br. J. Plast. Surg.* 34: 315, 1981.
2. Shanahan, R. E. and Gingrass, R. P. (1979). Medial plantar sensory flap for coverage of heel defects. *Plastic and Reconstructive Surgery*, 64, 29
3. Masquelet AC, Romana MC. The medialis pedis flap: a new fasciocutaneous flap. *PlastReconstr Surg.* 1990;85:765-72.
4. Siddiqi MA, Hafeez K, Cheema TA, et al. The medial plantar artery flap: a series of cases over 14 years. *J Foot Ankle Surg.* 2012;51:790–794
5. Cormack GC, Lamberty BGH. Medial Plantar Artery. *The Arterial Anatomy of Skin Flaps*. 2nd ed. New York: Churchill Livingstone; 1994. p. 373–376.
6. Mathes SJ, Nahai F. Classification of the vascular anatomy of muscles: experimental and clinical correlation. *PlastReconstr Surg*1981;67:177-87. PubMed
7. Sommerlad, B. C. and McGrouther, D. A. (1978). Resurfacing the sole; long-term follow-up and comparison of techniques. *British Journal of Plastic Surgery*, 31, 107.