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RECONSTRUCTION OF PLANTAR SURFACE OF FOOT USING MEDIAL PLANTAR ARTERY FLAP- A CASE SERIES

Plastic Surgery

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ABSTRACT

Background: Reconstruction of weight bearing region of plantar foot defects present a challenge to surgeons because of lack of the options available and requirement of durable tissue. Among the limited options available medial plantar artery flap serve an ideal one. It can be raised in antegrade as well as retrograde fashion. In its anterograde form it is used for heel reconstruction and in retrograde form it is used for the reconstruction of the forefoot defect. **Aim:** The aim of this article is to assess the outcome of using medial plantar artery flap for reconstruction of heel and forefoot defect with a focus on flap survival, donor site morbidity and functional outcome. **Material and method:** In the present study, we present our experience with the use of medial plantar artery flap to cover plantar foot defect in the weight bearing region. Total of 12 patients, those underwent medial plantar artery flap re-construction, from January 2018 to January 2022 were included in this study. **Result:** Out of the 12 patients with the medial plantar artery flaps, 10 were male and 2 were female. The indications for surgery were, traumatic tissue loss, unstable scar over previous grafted skin, neuropathic ulcer. All the flaps survived, without major complications and provided adequate wound coverage with minimal donor site morbidity. **Conclusion:** Medial plantar artery flap for reconstruction of heel and forefoot is associated with a very high flap survival rate with very few flap related complications including donor site complications.

KEYWORDS

Heel and forefoot reconstruction, medial plantar artery flap, retrograde flow.

INTRODUCTION

Reconstruction of the weight bearing region of plantar foot present a great challenge to surgeons because of lack of the options available and requirement of the durable tissue. Among the limited options available medial plantar artery flap serve an ideal one, as it follows principle of like replacement. Its unique composition of the tissue (thick glabrous skin, shock absorbing fibrofatty tissue) makes it a good option for weight bearing region of plantar foot. It provides a reliable option for reconstruction with advantages of minimal donor site morbidity, reliable blood supply. It can be raised in anterograde as well as in retrograde fashion to cover the heel and forefoot defect, respectively. Various other options for reconstruction of this region include skin graft, loco regional flaps, free flaps. Reconstruction with free flap is rising in recent times and also it has reduced utilization of local flaps. But in developing countries like India despite of being aware of free flap, medial plantar artery flap is still used widely because of limitation of the resources, surgery duration, limited manpower. Here in this study, we share our experience of using medial plantar artery flap for plantar foot defect (heel and forefoot) in terms of flap survival, functional outcome, donor site morbidity, patient compliance.

Objective

The objective of this study is to present the results of cases with plantar foot defect who underwent surgical reconstruction with the medial plantar artery flap from January 2018 to January 2022.

MATERIAL AND METHODS

This is a prospective study over a period of 4 years, from January 2018 to January 2022, of patients in which reconstruction of plantar foot (heel and forefoot) using the medial plantar artery flap was done in the Burns and Plastic surgery department of PGIMS Rohtak. In pre operative evaluation, Doppler USG of foot was done to confirm the patency of DPA (Dorsalis Pedis Artery), PTA (Posterior Tibial Artery) along with history recording and physical examination. The dorsalis pedis artery and the posterior tibial artery were found patent in all cases. Medial plantar artery is one of the terminal branches of PTA and arise deep to muscle so could not be traced with hand Doppler. Flap was raised under torniquet control and donor site is covered with SSG. Post operatively sutures were removed on day 14 and weight bearing was also started on day 14. All the patients were followed up for atleast 3 months. In follow up visits flap and donor site were examined for any loss, dehiscence.

Surgical technique

Surgery was done under adequate anesthesia and tourniquet control. Patient was laid in lateral decubitus position. For heel reconstruction, a template of the defect was created after debridement and mapped over instep area. Incision is given over the medial border of instep area parallel to abductor hallucis muscle and flap was raised with deeper plane deep to plantar fascia. Dissection proceeds in distal to proximal direction. The medial plantar artery was visualized and included in flap. The lateral plantar neurovascular bundle was carefully identified and preserved. A sensory nerve arising from medial plantar nerve innervating the flap was identified and cut to gain in arc of rotation. The flap was rotated to cover heel defect and donor site was covered with split-thickness skin graft.

For reconstruction of weight bearing region of forefoot template was created similarly as in antegrade form of flap and mapped over instep area. Incision was given over proximal limit and flap was cut down through the plantar fascia to include the MPA in the flap. Medial plantar artery was identified, ligated, cut and raised with the flap as dissection proceed distally. Flap was raised until it can easily reach the defect. Flap can be raised up to the neck of metatarsal, where communication between MPA and dorsal metatarsal artery exists. The flap was then sutured in place and donor site was likewise skin grafted.

RESULTS

During the study period, 12 patients were treated using medial plantar artery flap. Among these 8 patients underwent anterograde medial plantar artery flap for heel reconstruction while 4 patients underwent reverse MPA flap for having forefoot defect. The indications were traumatic tissue loss in 5 patients, recurrent ulcer over previously grafted skin in 4 and neuropathic ulcer in 3 patients. The age of the patients ranges from 8 years to 47 years, with a maximum number of the 20 to 29years-old age group. There was a predominance of males. Medial plantar artery flap was found adequate for coverage of defect with good aesthetic and functional results. In all cases, skin grafting was done over donor area at the same surgical time. There were no major complications. Two patients required resuturing for flap dehiscence and also there was partial graft loss in 2 patients. Overall, all cases had satisfactory outcome with early mobilization, minimal donor site morbidity and better patient compliance.

Case1:

A 45-year-old female patient presents with complaint of recurrent ulceration over grafted area of heel which was done 3 years back after the patient suffered an accident. After debridement of the weight bearing region of heel, medial plantar artery flap was designed according to the size of the defect and harvested to cover the defect. In

setting of the flap done and secondary defect was covered with SSG. Flap survived fully and after a follow up of 3-months, patient was satisfied with results.

FIG 1A

FIG 1B

FIG 1C

FID 1D

Figure 1: A-. Pre-operative photograph showing mapping of MPA flap for heel reconstruction; 1B-Intra operative view showing dissected flap.; 1C-Immediate post-operative view showing flap inset with SSG of donor site.; D- Post-operative view of case 1 at 1 month follow up.

Case2:

A52 year old patient was admitted with non-healing ulcer over weight bearing region of forefoot. Patient was a known case diabetes and was on insulin for 8 years. After debridement of ulcer, reverse medial plantar artery flap was designed to cover defect. Flap was harvested and insetting done to cover the defect fully. Donor area was covered with SSG. Post op period was uneventful and flap healed well.

FIG 2A

FIG 2B

FIG 2C

FIG 2D

Figure 2: 2A- Pre-operative view of case 2 showing neuropathic ulcer over forefoot & flap mapping of reverse MPA flap.; 2B- Intra operative view of case 2 showing dissected flap.;2C-Immediate post-operative view of case 2 showing flap insetting. 2D-Post-operative view of case 2 at first follow up visit (14 days).

A

B

C

D

E

Figure 3A, 3B, 3C, 3D, 3E. Photographs of medial plantar artery and reverse MPA flaps showing adequate coverage of defect.

DISCUSSION

Plantar skin of foot is unique in composition that can withstand compressive load and shearing force. Skin of the plantar foot has minimal laxity which makes the primary closure possible for very small defects only. Here comes the role of other options in reconstructive ladder. There are variety of options described in literature for reconstruction of planter foot defects1. Reconstruction of plantar foot defect can be achieved with STSG i.e., split thickness skin graft, loco regional flaps and free flaps. STSG is simple to perform for coverage of defect but has post op complications, once weight bearing starts. Recurrent ulceration is common after STSG for which patient seek other reconstructive option later on. Among locoregional flap, Reverse Sural Flap (RSF) has a well-established role in reconstruction of heel. Demerits of using RSA involve lack of similar tissue, insensate flap, staged procedure. In a study by RJ Shree Charan et al2 has concluded that medial plantar flap is a better reconstructive option than reverse sural artery flap in terms of flap viability and functional outcomes2. Reconstruction with free flap has raised in recent times with advancement in technology. Free flap reconstruction is technically demanding and requires expertise in microvascular surgery. Also, it involves longer surgical time, more donor site morbidity, longer hospital stay. Keeping all this in consideration, medial plantar artery flap provides a good option with reliable vascular pedicle, shorter learning curve. This can be raised in antegrade and retrograde fashion to cover the heel and forefoot respectively. MPA flap first used by Shanahan and Gingrass3 which has gradually evolved and underwent various modifications as islanded pedicle flap4 for proximal heel defect, reverse flow flap design for forefoot defect or free flap to cover defects on the contralateral heel5, Advantages of using MPA flap includes less donor site morbidity, persistent vascular pedicle anatomy, less operative duration, shorter hospital stay.

Few disadvantages of using this MPA flap is its limitation in size and deep cavity filling. Also, it is an insensate flap when used in retrograde fashion. Despite of few disadvantages of MPA flap its usefulness cannot be denied for plantar foot defects. Even in this current era of microvascular surgery, it is used widely for coverage of plantar foot defect because of having shorter learning curve, unique tissue composition and durable.

CONCLUSION

The medial plantar artery flap has been found to be a good option for treatment of defect in weight bearing region of foot i.e., heel and forefoot with few complications with acceptable aesthetic and functional outcome.

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Conflict of Interest

There is no conflict of interest.

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