International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

Comparison between Medial Plantar and Reverse Sural Artery Flap in Reconstruction of Posterior Heel Defects: A Single Institutional Study

Dr R J Sree Charan MS[1], Dr Dexter R Marak MS[2]

[1]Mch Plastic Surgery, Assistant Professor of Plastic Surgery, Chengalpet Medical College, old no 68/new no 12, I block 9th street Tashavan Apartment 4th floor Anna Nagar East Chennai 102, India

[2]Mch Resident, Department of Plastic and Reconstructive Surgery, Chengalpet, Medical College, India

Abstract: ***The reconstruction of soft tissue defects of the posterior heel involving weight-bearing area presents a challenging problems for plastic surgeons. Soft tissues defects, whether from recent trauma or from chronic lesions are difficult to cover and require a well vascularised reconstruction having a good durability and sensation because of its location and repeated friction by footwear. We have done heel reconstruction of 10 patients with the Medial Plantar flap and 10 patients with Reverse Sural artery flap. Results were very much encouraging in terms of flap survival, durability of coverage and functional outcome. All the 10 cases of Medial Plantar flap survived without any flap loss. Among the Reverse Sural Artery flap group two flaps was lost due to vascular insufficiency/kinking in a diabetic patient. In this study we report our clinical experience that Medial Plantar flap is a better reconstructive option for the weight-bearing heel defects than reverse sural artery flap in terms of functional outcome.***

Keywords: Tendoachilles, Medial Plantar flap, Reverse Sural artery flap

1. Introduction

Posterior heel defects are often difficult in their restoration because of poor area vascularization, continuous movement, and high functional demands. Conservative treatment usually fails and use of split or full-thickness skin grafts often leads to unacceptable results while free flaps transfer is technically demanding and presents significant perioperative morbidity[1]. Trauma is the leading cause of soft tissue loss of the heel followed by tumor, infective gangrene and burn[2]. Most of the cases of isolated soft tissue injuries result from degloving type of injury in which, after wound excision, immediate reconstruction can be performed with Medial Plantar flap[1,2]. The medial plantar artery flap has facilitated heel coverage since its development in the 1980s. This flap is an ideal option for the weight bearing heel but its involvement in trauma frequently precludes its use. Then Reverse Sural artery flap is the option for coverage. We have done heel reconstruction with the Medial Plantar flap in 10 cases and with Reverse Sural artery flap in 10 cases. In this study we report our clinical experience with the medial plantar flap to be a better reconstructive option for posterior heel defects.

2. Materials and Methods

Total twenty patients with soft tissue loss from weightbearing heel were treated in the plastic surgery department of Chengalpattu Government medical college Hospital from August 2018 to August 2019. Out of these twenty patients, ten patients were treated with Medial Plantar flap and 10 patients with Reverse Sural artery flap. Medial Plantar flap was done on patients whose defects were between 5 cm to 8 cm in length and breadth, instep area of the sole of the foot is intact and Posterior Tibial artery with its continuation into the Medial Plantar artery is patent. Reverse Sural artery flap was done on patients whose defect were between 9 cm to 15 cm in length and 5 cm to 10 cm in breadth and no injury on the lateral aspect of the lower third of the leg which could interrupt the vascularity of the flap. Majority of the patients were male with age range between 20 to 55 years. Age distribution is described in table-I

Table 1: Age distribution of patients (n=20)

Age of the patient years	No of patients %
20-35	7(35%)
35-45	5(25%)
45-55	8(40%)

Trauma is the main cause of the soft tissue loss of heel in our series. The etiology is shown in Table-II.

Table II: Etiology of posterior heel defects (n=20)

Etiology	No of patients%
Trauma	14(70%)
Tumour	1(5%)
Diabetic infective gangrene	3(15%)
Burn	2(10%)

All the wounds were prepared by wound debridement, daily dressing and antibiotics administered according to culture and sensitivity test. When the wound were adequately prepared they were resurfaced with either medial plantar or reverse sural artery flaps.

Medial Plantar Flap

The medial plantar flap is used for coverage of defects over the heel pad region. The plantar concavity derives its sensory innervations from fourth and fifth lumbar nerve roots. The medial plantar nerve & artery can be used in the design of a plantar transposition flap for restoring sensation to heel surfaces.

Anatomy: The medial plantar artery, branch of posterior tibial artery arises behind abductor hallucis origin and it passes deep to plantar fascia. It supplies skin of the medial two thirds of plantar concavity. The medial plantar nerve a branch from tibial nerve accompanies medial plantar artery. Its sensory branches perforate plantar fasciae and supplies medial two thirds of non-weight bearing area.

Operative Techniques
Using doppler the patency of medial plantar artery is verified. The flap is designed by a template made according to the defects. Distal incision made first. Skin deepened up to plantar fascia between the abductor hallucis muscle and first slip of the flexor digitorum brevis muscle.

At the distal end of this incision medial plantar artery with its venae comitants and medial plantar nerve are identified and dissected proximally beneath the flap up to the defect in the heel or up to the tuberosity of the calcaneous. Then the flap is transposed and set on the defect. Donor site of the flaps were primarily grafted with split-thickness skin graft (fig-1c). All these ten cases of medial plantar island flap healed uneventfully along with their donor sites and functional outcome was satisfactory.

Figure 1 (A): Markings of medial plantar flap

Figure 1 (B): Medial plantar flap raised

Figure 1 (C): Medial plantar flap post op day 3

Reverse Sural Artery Flap
Indication: It is used to reconstruct the posterior aspect of heel and Achilles tendon, anterior and lateral parts of ankle, dorsum foot, anterior aspect of lower third leg.

Anatomy:
Sural artery arises from the popliteal artery. Along with sural nerve it courses between the heads of gastrocnemius and it passes the lateral edge of Achilles tendon. It supplies skin of lower and middle posterior leg. The sural nerve along with lesser saphaneous vein innervates lateral side foot and fifth toe. A large perforator approximately 5cm proximal to lateral malleolus is present which is more reliable and is the pivot point of pedicle.

The skin paddle is marked on the posterior aspect of calf at the function of heads of gastrocnemius. The pedicle should include adipofascial tissue, subdermal tissue, sural nerve and short saphenous vein and deep fascia.

The length to width of pedicle is approximately 4: 1

Operative Technique: A prone position is preferred if the defect is on the posterior aspect heel or lateral ankle. The flap is marked and pivot point marked with dopper ultrasound. Incision made and skin flaps raised subdermally upto pivot point. The flap with fascia, lesser saphenous vein, sural nerve raised upto pivot point. Flap rotated to cover the preferred defects. The donor area covered with skin graft. Postoperative care is essential and excessive pressure on pedicle or flap is avoided.

Figure 2 (A): Posterior heel defect

Figure 2 (B): Reverse sural artery flap covering the heel defect

Figure 2 (C): Reverse sural artery flap postop day 5

Complications: Seven cases of reverse sural artery flap survived without any flap loss, one had distal marginal necrosis which was managed by excision followed by secondary suturing. In two cases the distal third of the flaps were lost due to inadequate post operative management (direct pressure over the pedicle/wound infection) and needed excision of the devitalized part of the flap followed by closure of the defect with alternative procedures like flap advancement and skin grafting.

In medial plantar island flap group, excellent results were obtained in all the ten cases. In reverse sural artery flap group good results were observed in seven patients,moderate result in one case and poor result in two cases.

Table III: Complications

Flap	Survival	Necrosis		
		Marginal	Partial	Total
Medial plantar flap n=10	10	Nil	Nil	Nil
Reverse Sural artery flap n=10	07	01	02	Nil

3. Results

Results were described in terms of flap survival and functional outcome i.e. uneventful walking, and were graded as excellent, good and poor. Criteria for excellent results were flap viability without any flap loss and walking without any aids i.e. artificial heel pads or foam padded shoes. Viability of flap with minimum complications and walking with aids were the criteria for good results. Poor results are those cases where an alternative reconstructive procedure was required. In medial plantar flap group, excellent results were obtained in all ten cases. In reverse sural artery flap group good results were observed in eight and poor results in two.

Name of the flap	Criteria		
	Excellent: Flap survived, no walking aids	Good: Flap survived with Minor complications Walking aids	Poor:Alternative reconstruction procedure required
Medial Plantar	10		
Reverse Sural artery		8	2

4. Discussion

Defects over the posterior heel involving the weight bearing part of the heel have been difficult to cover and require a well vascularised reconstruction having a good durability and sensation because of its location and repeated friction by footwear[1]. There are many possible reconstructive options for this region, including skin grafts, local flaps,distant flaps and free flaps. Skin graft breaks up on repeated stress of weight bearing. Other flaps are often short of length to cover the whole heel[1,2]. Free flap surgery is complex and technically challenging. It is ideally performed at centers of excellence, where the procedures are done in high volume and success, measured by patency rates. Due to the complex nature of the procedure, numerous factors combine to determine the success rate following free flap surgery. But it is of great value when no other local flap is available for reconstruction of heel defects. Distally based fasciocutaneous flap may be an option but it is a two stage surgery, vascularity is not that much reliable as that of other random pattern flap. Random pattern flaps can be raised but they have high incidence of failure[3,4]. Cross-leg flaps is another option reliable tool for the reconstruction of posterior heel defects when local flaps are not available. It offers the possibility of salvaging limbs that are otherwise non reconstructable. By incorporating fascia or muscle, the versatility of the flap can be enhanced and flap can be raised in a proportion up to 3: 1 to 5: 1. This flap is easy to perform and does not require the sophisticated equipment or expertise of microanastomosis. Most of the patient in our series are middle aged men in their active life and loses their weight-bearing heel due to trauma. In case of traumatic loss the option of flap depend on the size of the defect and associated fractures and availability of vascular pedicle[2]. In this series small defect (5cm to 8cm in length and breadth) were covered with medial plantar flap and in larger defects reverse sural artery flaps were used. There was not much difference in the procedural aspect as both flaps have good arc of rotation[2]. Next common cause of soft tissue loss of weight bearing heel is due to wide local excision of tumour. Squamous cell carcinoma is the common tumour in our series one in number and requires wide local excision of the tumor with free margin clearance followed by reconstruction. In our study only one case after excision of critical area was 9 cm in lenght so reverse sural artery flap was used. Diabetic foot infective gangrene of soft tissue of the heel is usually a problematic issue for reconstruction because of late presentation, dealt initially by general surgeons and tissue destruction is more extensive. An aggressive wound excision followed by appropriate antibiotics according to culture and sensitivity test is essential prior to reconstruction. Vascular insufficiency is another problem in this group of patients[3]. Many procedures have been described for resurfacing heel of diabetic patient but axial pattern flaps are suitable and effective. Reverse sural artery flap can be delayed for better vascularity in diabetic patient[5,7]. Medial plantar flap is the flap of choice in terms of sensation and early ambulation[5,6]. Full-thickness burn is another important cause of soft tissue loss from the heel region. Depending on the size of the defect, flaps were chosen but there was no significant difference in the outcome. We have chosen these two flaps for reconstruction of weight-bearing heel, one is medial plantar flap and the other is reverse sural artery flap according to the size of defect. Medial plantar flap is selected for those cases in whom the defect is within 5 cm to 8 cm with intact instep area of the sole and medial plantar artery is patent[2]. Superficial Reverse sural artery flap is reserved for larger defects, with injury to the instep area of sole and patency of medial plantar artery is absent or doubtful. In our series ten

heel pad defects were reconstructed with medial plantar flap, of which excellent results were obtained in all the ten cases. Ten heel pad defects were reconstructed with reverse sural artery flaps, excellent result obtained in seven patients, moderate result obtained in one patient and poor in two patients. There was partial flap necrosis in two reverse sural artery flap group which was managed by alternative method of reconstruction (skin grafting and advancement).

Of all the options for reconstruction of heel medial plantar flap is the best option in terms of tissue type, texture, and function[5,6]. Reverse sural artery flap is fasciocutaneous in nature but very versatile in terms of movement, vascularity and useful in the reconstruction of posterior heel defects whenever we have reasons not to use a microsurgical free transfer. Drawbacks of this flap are the venous congestion, the volume of the flap, which is sometimes not suited for the reconstructed area, and thus the aesthetic appearance, and an additional unsightly donor site defect. In our comparative study between medial plantar island flap and reverse sural artery flap for heel defect coverage revealed significant difference in flap survival. The difference was in early weight bearing in case of medial plantar flap[6]. Medial plantar flap is an excellent flap for small defects which provides the similar tissue of the heel, and preserves all the function in the post-reconstructive period. Reverse sural artery flap is an alternative for large defects and provides less relatively functional heel.

5. Conclusion

Our study has shown that Medial plantar flap is a better reconstructive option than reverse sural artery flap in terms of flap viability and functional outcomes.

References

[1] Post-traumatic posterior heel soft tissue defect reconstruction: M. P. Suri, A. G. Patel, H. J. Vora, S. C. Raibagkar, D. R. Mehta, U. H. Vyas. Indian J Plast Surg July-December 2005 Vol 38 Issue 2.
[2] Reconstruction of Heel: Options and Strategies: MA Kalam, SR Faruquee, SA Rahman, HN Uddin. Bangladesh Journal of Plastic Surgery (2010) Vol. 1 (1).
[3] Demiri E, Dionyssiou D, Antoniou A, Kakas P, Hantes A, Forglou P and Lazaridis L. The use of pedicle island axial flap for reconstruction of diabetic foot defects. Aristotle university M J. 2006; 33(1):93-99.
[4] Eldin AB, Elbassoni L and Elhddy A. Distally Based Sural Fasciocutaneous Flap for Coverage of Foot Defects. Egypt, J Plast Reconstr Surg, July 2006; 30(2):93-99.
[5] Pirwani MA, Samo S, Soomro YH. Distally based sural artery flap: A workhorse to cover soft tissue defects of lower 1/3rd tibia and foot, Pak J Med Sci. 2007; 23(1):103-7.
[6] Rashid M, Hussain S, Aslam R, Illahi IA. Comparison of two Fasciocutaneous Flaps in the reconstruction of defects of the weight - bearing heel. Coll Physicians Surg Pak. Apr 2003; 13(4):216-18.
[7] Tosum Z, Ozkam A, Karacoz Z, Savci N. Delaying the reverse sural flap provides predictable result for complicated wounds in diabetic foot. Ann Plast Surg. 2005; 55:169-173.