EVALUATION OF THE REVERSE SURAL ARTERY FLAP IN THE PAEDIATRIC AGE GROUP

Plastic Surgery

Dr. Macnol Afonso	Bonded Assistant Professor, Department of Plastic and Reconstructive Surgery, Lokmanya Tilak Municipal Medical College and General Hospital, Sion, Mumbai – 400022
Dr. Amarnath Munoli*	Associate Professor, Department of Plastic and Reconstructive Surgery, Lokmanya Tilak Municipal Medical College and General Hospital, Sion, Mumbai – 400022 *Corresponding Author
Dr. Jinisha Bhanushali	Senior Resident, Department of Plastic and Reconstructive Surgery, Lokmanya Tilak Municipal Medical College and General Hospital, Sion, Mumbai – 400022

ABSTRACT

Introduction: The Reverse sural artery flap can be used to cover soft tissue defects of the distal leg, ankle and proximal foot. The flap has rarely been evaluated in the paediatric age group.

Method: A Retrospective study was undertaken including four children, with soft tissue defects of the distal leg and foot covered using a distally based Reverse sural artery flap.

Results: All flaps survived (100%). Venous congestion did not occur in any patient. Marginal flap necrosis occurred in one patient (25%). Re-insetting of the flap was done in one patient (25%). There was no donor site morbidity.

Conclusions: The reverse sural artery flap can be easily raised, while sparing the major blood vessels and without any major loss of function. As such it can be reliably used to cover defects of the distal leg and foot in the paediatric age group.

KEYWORDS

Reverse Sural Artery Flap, RSA Flap, Fasciocutaneous flaps, Leg defects

INTRODUCTION

In 1992, Masquelet et al.¹ put forth the concept of a neurocutaneous island flap and described the sural neurocutaneous flap building upon the description of a distally based fasciocutaneous flap from the sural region by Donski and Fogdestam² in 1983. The Reverse Sural Artery Flap goes by a variety of names such as distally based sural flap, the sural neuro-veno-fasciocutaneous flap and simply, the sural flap. The reverse sural artery fasciocutaneous flap can be used to cover soft tissue defects of the distal leg, the ankle, or the proximal portion of the foot. An advantage of this flap is that it does not use or need division of any of the three major arteries to the distal extremity. Another advantage is the ease of dissection of the flap. Although the flap is reliable in young adult patients it is less predictable in older people. As such it has rarely been evaluated in the paediatric population. This study is an attempt to evaluate the effectiveness and the various parameters of the reverse sural flap when used in paediatric patients.

ANATOMY OF THE FLAP

The Reverse Sural Artery flap (RSA Flap) is a distally based flap pedicled on the fasciocutaneous structures of the distal posterolateral leg. The sural nerve, the superficial sural arteries and the small saphenous vein are included within the flap and are all divided proximally during elevation of the flap. The arterial supply to the flap is from multiple sources – i) fasciocutaneous perforators from the peroneal artery and the posterior tibial artery and their terminal branches communicating with the superficial sural artery system, ii) neurocutaneous perforators from the vasa nervorum of the sural nerve, iii) venocutaneous perforators from the vasa vasorum of the small saphenous vein, and iv) random-pattern flow through the dermal plexus when the flap is not designed as an island flap.³ The lesser saphenous vein and the deep adipose tissue are necessary for the arterial supply of the sural flap.⁴ The flap relies on communication between the venae comitantes of the superficial sural artery and the lesser saphenous vein for venous drainage, circumventing the valves of the deep venous system; thus being at risk of venous congestion.⁵

AIMS AND OBJECTIVES

- To evaluate the results of the RSA flap in the paediatric age group.
- To indicate any specificities in the operative technique when performing the Reverse Sural Artery flap in children.

MATERIALS AND METHODS

A retrospective study was undertaken at a tertiary health centre in Mumbai. All children with soft tissue defects of the distal leg and foot who underwent a distally based Reverse Sural artery flap surgery from January 2018 to December 2018 were included in the study. Only children below the age of 12 were included.

Data was collected regarding the age, sex, cause of trauma, flap characteristics and post-operative course and was analysed.

OPERATIVE TECHNIQUE

The patients were operated in prone or lateral decubitus position. Initially a hand held Doppler evaluation for perforators around the lateral malleolus along the posterior border of fibula was done and the distal-most perforator was identified and marked. Thereafter under tourniquet control debridement of the defect was done and the final defect was created. The tourniquet was then deflated and thorough haemostasis achieved. The markings of the flap were then done using a lint piece by planning in reverse. The axis of the flap is along a line joining (a) the midpoint between the lateral malleolus tip and the tendoachilles and (b) the midpoint of the knee joint/popliteal crease. The pivot point to be used i.e. the distal-most perforator, was marked and the proximal extent of the flap was defined as per the defect size and location. The incision was started on the cranial edge of the flap. The sural nerve and lesser saphenous vein were identified, ligated and divided. The rest of the flap was then raised sub-fascially in the cranio-caudal direction; the fascia was sutured to the dermis along the edges of the flap to avoid inadvertent supra-fascial dissection or shearing. Care was taken to ensure inclusion of the sural nerve & short saphenous vein in the flap and to preserve the fine mesh of blood vessels between the superficial sural artery and the deep fascia throughout the extent of the flap. The part of the flap distal to the “business area” i.e. the pedicle was narrowed to about 2.5cm. The flap was raised up to the pivot point. The flap was then transposed to the recipient site after assessing its vascularity. The donor site was covered with a split thickness skin graft. Dressings of the donor and recipient sites were done. Post-operative Management & follow-up: In the post-operative period monitoring of the flap was done to check for venous congestion, necrosis, loss of inset, etc. Follow up of the patients was done after discharge on out patient basis until the flap and donor sites were well settled.

Image 1a – Marking of Reverse Sural Artery flap

Image 1b – RSA flap elevated and rotated on the pivot point towards the defect

Table 1. Results of the RSA flap in four children

Sr	Age and Sex	Defect location	Defect Size (cms)	Flap Size (cms)	Pivot point cms from lateral malleolus	External fixator	Venous Congestion	Complications	Adjuvant procedure
1	14 months Male	Dorsum	5x4	10x6	3	No	-	Partial loss of inset	Re-insetting
2	4.5 yrs Male	Dorsum	7x6	12x7	4	Yes	-	-	-
3	6 yrs Male	Lateral malleolus + dorsum	7x 5	12x7	3	Yes	-	Marginal necrosis of skin	Debridement + Split thickness skin grafting
4	3 yrs Female	Medial Malleolus	7x7 Cms	14x9 cms	5	Yes	-	-	-

Image 2a – Pre-operative defect over dorsum and medial malleolus

Image 2b – Post operative result of coverage of the defect with RSA flap

Image 3a – Pre-operative defect over dorsum

Image 3b – Post operative result of coverage of the defect with RSA flap

RESULTS

Of the four patients 2 were males (50%) while 2 were females (50%). The cause of the defect in all 4 patients was trauma. The left leg was involved in all 4 cases. The defect was located on the dorsum in 2 patients (50%), on the dorsum and lateral malleolus in one patient (25%) and over the medial malleolus in one patient (25%). The youngest patient was 14 months old, while the oldest was 6 years old. The flaps ranged in size from 14 x 9 cms to 10 x 6 cms. The lowest level at which the pivot point of the flap was placed was 3 cms proximal to the tip of the lateral malleolus. 3 children had an external fixator (75%). All flaps survived (100%). Venous congestion did not occur in any patient (0%). Marginal flap necrosis occurred in one patient (25%) which was treated later with debridement and Split Thickness Skin Grafting. There was partial loss of inset in one patient (25%) for which Re-insetting of the flap was done. There was no donor site morbidity. There was complete take of skin grafts on the donor area (100%).

DISCUSSION

The Reverse sural artery fasciocutaneous flap can be used to cover soft tissue defects of the distal leg, the ankle or the proximal portion of the foot. Since being made popular by Masquelet et al¹, the Reverse sural artery flap has been extensively evaluated for defects of the foot and ankle in adults, but data regarding usage of the flap in children remains scarce.

In our study all the flaps survived (100%). One flap needed re-insetting (25%) while another had marginal necrosis (25%). This was dealt with adequately by debriding the necrotic tissue followed by split thickness skin grafting. This is consistent with other studies which show similar rates for marginal necrosis and survival for this flap in children.⁶

There was no venous congestion in any flap (0%) which agrees with the findings in other studies that despite large arcs of rotation, venous congestion is uncommon in paediatric patients.⁷

Three of our patients had an external fixator in the limb (75%); this allowed the limb to be positioned such that pressure on the flap pedicle was avoided. The use of an external fixator to position the leg post operatively may help in preventing flap necrosis. In adults the pivot point is usually placed at a minimum distance of 5 cms above the lateral malleolus.⁸ In our study the distal-most pivot point of the flap was placed 3 cms above the tip of the lateral malleolus without any complications. If the flap extends beyond the junction of the upper and middle one-thirds of the leg, line delay of the flap can be done to avoid necrosis of this part.⁹ The donor sites of all flaps healed well with complete take of the split thickness skin graft (100%). Apart from a visible donor site there was no major complication associated with it. The limitation of our study is the small sample size.

CONCLUSIONS

The reverse sural artery flap can be easily raised, while sparing the major blood vessels of the limb and not causing any significant loss of function. It is not a bulky flap and hence the un-aesthetic appearance of bulky free flaps is avoided. Venous congestion of the flap does not seem to be a major problem in children as in adults. As such it can be reliably used to cover defects of the distal leg, ankle and foot in the paediatric age group.

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