Original Article

Experience with Reverse Sural Artery Flap for Distal Leg and Foot Coverage

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ABSTRACT

Objective: To analyze the complications associated with use of reverse sural artery flap to provide soft tissue coverage for lower third of leg and heel defects.

Study Design: Retrospective study

Place and Duration of Study: This study was conducted at the Plastic Surgery Department at Liaquat National Hospital from February 2014 to December, 2016

Materials and Methods: Patient demographics, physical and clinical examination retrieved. Doppler ultra sonography was used to identify perforating vessels to aid in the planning of a pivot point. The skin island was outlined to match the recipient site defect than the flap was dissected and inset done. Patients were followed for 1 month and outcomes were recorded.

Results: There were 136 patients were included with lower third of leg and heel wound and exposed structures like tendons, bone, nerve and vessels. Out of 136 cases 44 (32.4%) cases had complications. Complete flap necrosis was occurred in 19.1% cases, infection occurred in 11% and partial flap necrosis occurred in 8.1% cases.

Conclusion: The distally based reverse sural artery flap is a better option for coverage of soft tissue defects in the distal 3rd of the leg and proximal foot.

Key Words: Soft-tissue defects; Reverse sural artery flap; Flap necrosis; Ankle coverage; Complications

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INTRODUCTION

Due to an increase in high-energy trauma, the management of soft-tissue defects in the lower limbs has become a very frequent procedure[1]. The limited option of pliable soft tissue coverage in the distal third of the leg, ankle and foot presents a challenge for the reconstruction in this region of the body. The reconstructive options of such defects get even narrower in resource constrained environment where the choice of free tissue transfer is not an option because of the infrastructural challenges and limitation of manpower with requisite skills for microvascular surgeries[2,3]. The soft tissue defects of this region presents a challenging problem because of the paucity of local tissue and poor circulation of skin[2]. Various forms of coverage including muscle, fascial or free flaps are used for reconstruction. Each has their specific indications and inherent disadvantages[2]. Microsurgical reconstruction of lower extremity wounds requires long operative times, a stable patient, and technical expertise[4].

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There is limited expertise with free tissue transfers in many developing countries necessitating consideration of other options for the closure of such defects[3].

A simpler method for reconstruction of the lower leg, heel, and foot is the reverse sural fasciocutaneous flap[4]. The versatility and reliability of sural artery flap have made it a popular option for the reconstruction of such defects[3]. It has become popular since introduction by Donski and Fogdestam, followed by the detailed anatomical description by Masquelet, et al[4]. Among the main indications for the sural fasciocutaneous flap are soft-tissue defects of the heel and the lateral or medial perimalleolar regions [5, 6]. Multiple case series report the reverse sural fasciocutaneous flap as a reliable solution to a variety of reconstructive needs, with low complication rates[4]. In young patients with traumatic injuries, low complication rates have been reported[4]. This flap has a reliable and constant blood supply from multiple sources with a broad range of rotation and provides a less bulky coverage compared to free flap[5]. Distally based fasciocutaneous flaps supplied by vascular axis around sural nerve are extensively researched and constitute another important alternative to lower third and foot reconstruction[2].

In one of the studies involving 166 patients, this procedure was uneventful in 142 (85.5%) cases and 24 (14.5%) cases had some complications. Infection or discharge occurred in 12 (7.2%) cases, partial flap necrosis occurred in 10 (6.0%) cases, with resulting need for minor surgery (debridement and split thickness graft)[2]. In another study of 20 patients, satisfactory healing of the flaps was in 17 (85%) patients. Five

(25%) patients had varying range of minor dehiscence and necrosis of some part of the flap. Three (15%) patients had complete flap necrosis necessitating debridement and secondary wound cover with split thickness skin graft.[3]

MATERIALS AND METHODS

All patients who came to Plastic Surgery Department at Liaquat National Hospital from February 2014 to December, 2016, with lower leg wounds fulfilling the criteria below were selected for the study.

Inclusion criteria:

a) Patients of either gender
b) Patients with age 20 – 60 years
c) Patients with lower third of leg and heel wound, with exposed underlying structures (tendon, bone, nerve, vessel).
d) Size of flap was according to size of defect.
e) Wounds with no evidence of infection (confirmed by wound culture and sensitivity).

Exclusion criteria:

a) Patients who had segmental bone defect and required reconstruction with vascularized bone graft.
b) Patients with poly trauma having severe head injuries along with lower leg injuries
c) Scars and vascular injury at the donor site
d) Prior operations of the leg with impairment of blood supply.
e) Infected wound

After explaining the procedure and written informed consent was taken. Patient demographics, location of wound, time between injury and wound, dimension of wound, and postoperative complications were recorded in a predesigned performa by the principal investigator. X-rays of the injured limb were done to rule out underlying fracture and in case of fracture, fixation was done prior to the procedure. The procedure was performed by the consultant plastic surgeon having experience of at least 5 years.

Patients were followed for 1 month in the clinic and outcomes were recorded. Outcome was assessed in terms of complications, which included wound infection, flap necrosis and need for secondary soft-tissue coverage.

Data was complied and analyzed using SPSS (Statistical Package for Social Sciences) version 18. Effect modifiers were controlled by the stratification of age, gender, site of wound, dimensions of flap, and size of wound to see their effect on outcome by using chi-square test, with 95% confidence interval.

RESULTS

There were 136 patients with lower third of leg and heel wound who had exposed structures (tendons, neurovascular structure or bone). The mean age of the patients was 43 ± 11.01 years, similarly mean size of wound and time interval between injury to wound coverage was 1.51 ± 0.50 cm and 72.4 ± 21.07 minutes respectively.

Out of 136 patients 75 (55.15%) were female and 61 (44.85%) male. Regarding site of wound, 51.47% was on heel and 48.53% on distal third of leg. Tendon was the most commonly exposed structure in the wound followed by bone as presented in figure 2.

Frequency of complications in management of soft tissue coverage of lower third of leg and heel with reverse sural artery flap are presented in table I. Out of 136 cases, 44 (32.4%) cases had complications. Complete flap loss occurred (total flap necrosis) in 19.1% (26/136) cases as compared to partial flap loss (necrosis of more than 1/3 of total flap size), which occurred in 8.1% (11/136) cases. There were statistically insignificant results when rate of complication was compared to age (p-value: 0.09), gender (p-value: 0.4), wound size (p-value: 0.2) or site (p-value: 0.6).

Table No.I: Complications observed with reverse sural artery flap

Complications	N (%)
Partial Flap Necrosis	11 (8.1)
Infection	15 (11)
Complete flap Necrosis	6 (19.1)

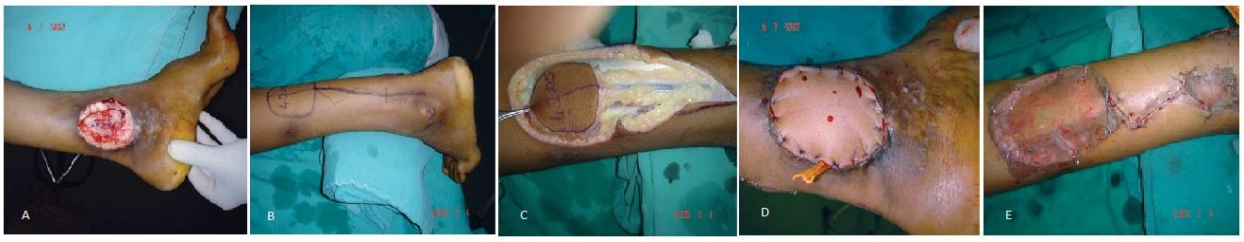

Figure No.I: Defect on the lateral malleolus of left leg (A), was covered with reverse sural flap as marked and dissected in B and C, respectively. Flap had nice tension free inset (D) and donor site was split thickness skin grafted (E).

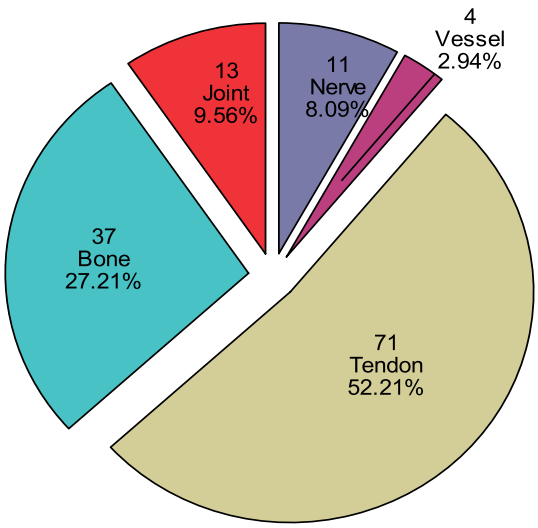

Figure No.2: Structures exposed in the wound (n=136)

DISCUSSION

Reconstruction of the lower leg and foot continues to be one of the most challenging tasks for a plastic surgeon. An unreliable lower limb subdermal plexus results in poor wound healing when cutaneous flaps are used[7]. Following developments in flap surgery, pedicled fasciocutaneous flaps and free flaps had been used. The introduction of distally based sural fasciocutaneous flap provides reliable and effective method to cover skin defects of distal leg, foot and ankle[8].

Fasciocutaneous flaps, first introduced by Ponten in 1981[9], are in use for the reconstruction of soft tissue defects of lower 1/3 of leg and foot. Reversed island flaps like, peroneal artery flap, anterior tibial artery flap, and posterior tibial artery flap can be transferred to the ankle or foot. However, it needs sacrifice of a major artery that constitutes a potentially serious disadvantage. Masquelet et al.[10] in 1992 first described distally based sural artery flap. The distally based superficial sural artery flap is perfused by median superficial artery with reverse flow, as this artery has septocutaneous perforators from peroneal artery.

The aetiology for lower limb wound includes road traffic accidents, non-healing skin wounds, chronic venous ulcers, chronic osteomyelitis in diabetics, contractures, gangrene, unstable scars, cancer resections, and electrical burns[11, 12].

In our study the average age of the patients was 43.24 ± 11.01 years. Out of 136 patients 75 (55.15%) were female and 61 (44.85%) male. Wound on heel was observed in 51.47% and on third of leg 48.53%. While in Olawoye et al[3] study the mean age of the patients was 30 years with a range of 7–58 years. There were 13 (65%) males and 7 (35%) females with a ratio of 1.9:1. The defect was located in the distal third of the leg in 13 patients (65%), ankle in 4 patients (20%), heel in 2 (10%) and dorsum of the foot in 1 patient (5%). In Thawerani et al[13] study 40 patients aged 7 years to 65 years were included with a mean age of 24 years. Among them, 37(92.5%) were males and 3 (7.5%) were females.

In this present study 32.4% cases had complications. Complete flap necrosis occurred in 26 (19.1%) cases, infection in 15 (11%) and partial flap necrosis in 8.1% (11) cases. In another study the complication rate reported was 59% (41 in 70 flaps), partial necrosis was noted in 17% and complete necrosis in 19% flaps [(14)]. Akhtar et al[15] in his study observed flap survival in 78.5%, partial necrosis in 16.5% and complete necrosis in 9.5%.

In Thawerani et al study[13] complications were observed in 8 cases who were operated initially. One patient each developed infection, discharging sinus & complete flap necrosis (7.5%). Two patients each developed partial flap necrosis (5%) and partial graft rejection (5%), respectively; and late recurrent ulcer on the flap occurred in one patient (2.5 %).

In a study, done in 2011 for 166 patients, this procedure was uneventful in 142 (85.5%) cases and 24 (14.5%) cases had some complications. Infection/discharge occurred in 12(7.2%) cases, Partial flap necrosis occurred in 10 (6.0%) cases, with resulting need for minor surgery (debridement and split thickness graft)[2]. In another study of 20 patients, satisfactory healing of the flaps was in 17 (85%) patients. 5 (25%) patients had varying range of minor dehiscence and necrosis of some part of the flap. 3 (15%) patients had complete flap necrosis necessitating debridement and secondary wound cover with split thickness skin graft [(3)]. In Ajmal et al[16] study out of 25 flaps, 20 showed complete survival (80%). Partial flap loss was found in 2 patients (8%), marginal flap necrosis in 2 patients (8%) and complete loss in 1 patient (4%). Hollier L et al[17] in 2002 studied the same flap in 11 patients and observed partial necrosis in 1 patient. He emphasized a broad inferolateral pedicle and the importance of including the short saphenous vein. Singh and Naasan[18] used the reverse sural artery flap to cover acute open fractures of the lower leg. Two out of seven patients had a partial necrosis of the distal tip of the flap.

CONCLUSION

The distally-based reverse sural artery flap is a good available option for coverage of soft tissue defects in the distal 1/3rd of the leg and proximal foot. The main advantages of the reverse sural artery flap are that it can be done in a single stage, is a reliable alternative to free tissue transfer and carries minimal donor site morbidity. In addition, it has a reliable and constant blood supply with a broad range of rotation and provides a less bulky coverage compared to free muscle flaps. It has lesser complications, is less time consuming and has high patient's satisfaction. The result of the study also

provides a base line data so that in future further studies can be done on the basis of this data.

Author's Contribution:

Concept & Design of Study:	Moiz Sadiq
Drafting:	Fahad Hanif Khan
Data Analysis:	Bushra Zulfiqar, Syed Sheeraz ur Rahman
Revisiting Critically:	Moiz Sadiq, Fahad Hanif Khan
Final Approval of version:	Moiz Sadiq

Conflict of Interest: The study has no conflict of interest to declare by any author.

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