Original Article

Use of Sural Flap in Wound Coverage in Lower Limb

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ABSTRACT

OBJECTIVE: To present the experience with sural flap in reconstruction of soft tissue defects of lower leg, ankle and foot.

SETTINGS: Private Practice (Aesthetic Plastic Surgery), Rawalpindi, Pakistan; from June 2005 to February 2008.

PATIENTS AND METHODS: All the patients preceding with wound on foot, ankle or lower leg region were included in the study. Distally based sural neurocutaneous flap was used to cover the defects. The flap was marked in the prone position and it was outlined on the posterior lower 2/3 of leg according to the size and location of the defect. The flap was raised from distal to proximal. Donor site was closed primarily in its proximal part only. The remaining defect was reduced to a smaller size and covered with the split-thickness skin graft.

RESULTS: Distally based sural flap was used in 10 cases for soft tissue coverage. Mean age of the patients was 40.2 years. The flap size varied from 12 × 4 cm to 20 × 6 cm. Average length of the flap was 15.6 cm, and width was 5.3 cm. The flap survived in 90% of the patients. Partial flap loss (3 × 2 cm) was seen in one patient. Partial wound dehiscence was seen in 20% of the patients.

CONCLUSION: The reverse sural artery flap is a reliable option for the reconstruction of defects of lower leg, ankle and heel region.

KEYWORDS: Wounds, Sural Neurocutaneous flap, Sural artery flap, Sural Nerve, Split thickness skin graft.

INTRODUCTION

Soft tissue reconstruction of the lower third of the leg, heel, and ankle region is a challenging problem because of a severe shortage of locally available tissues that could be reliably used for coverage.[1,2] The various cases of these defects include trauma, infection, ischaemia and tumour resection. The limited mobility, poor vascularization and subsequent poor healing encountered, all these demand a detailed knowledge of the local anatomy to select the best surgical alternative for individual cases [3]. Various flaps have been used including local, distant and free flaps [2,4,5].

Because the aim of the reconstruction is to cover the defect in the simplest way and with minimal donor-site morbidity without sacrificing a major artery or nerve, local flaps seem to be a reliable option. With the better understanding of cutaneous vascular anatomy, distally based sural neurocutaneous flap by Masquelet et al in 1992 have become a reliable option [6].

The blood supply of the flap is derived from the small arteries that accompany the sural nerve along its course in the posterior aspect of the distal two-thirds of the lower leg [7]. It is not a sensate flap and the sural nerve is sacrificed with the flap elevation [5]. This flap provides a good option for the coverage of wide range of defects around foot and ankle region. A few studies have been carried out in Pakistan but none has been carried out in private setup [7-10].

The purpose of this article is to share the experience with the use of sural flap in reconstruction of soft tissue defects of lower leg, ankle and foot.

PATIENTS AND METHODS

This prospective study was conducted in a private setup from June 2005 to February 2008 in patients having wound on foot, ankle or lower leg region. Distally based sural neurocutaneous flap was used to cover the defects. All the patients having direct trauma to the lower leg and those who had peripheral vascular disease were excluded from the study. All the diabetic patients were evaluated thoroughly for any peripheral vascular disease. History of smoking was also noted specially.

In traumatic defects, delayed reconstruction following repeated debridements, was planned in 5 patients whereas in 2 patients, flap was performed on emergency basis. The choice between delayed or immediate coverage based on the local condition of the wound, exposure of the vital structures and general condition of the patients. Wound condition, presence of any devitalized tissue and slough was noted. Condition of the underlying wound bed was noted. Any exposure to the underlying bone or tendon was also noted.

Operative technique:

The surgery was performed under general/spinal anaesthesia. A tourniquet was applied. The flap was

marked in the prone position. The axis of flap corresponded to the course of the sural nerve and lesser saphenous vein. The flap was generally centered between the popliteal fossa and mid-posterior leg with a width of up to 12 cm, but the length was extended upto 2cm to the Achilles tendon. The flap was outlined on the posterior lower 2/3 of leg according to the size and location of the defect.

The flap was raised from distal to proximal in the plane beneath the deep fascia and above the gastrocnemeus muscles. The sural nerve and lesser saphenous vein were ligated, divided and elevated with the flap. The pedicle was freed to the level above the lower most peroneal perforator in the posterolateral intermuscular septum located 5cm above the tip of lateral malleolus **(Figure I)**. All the flaps were raised as fasciocutaneous, none as adipofascial. Donor site was closed primarily in its distal part only. The remaining defect was reduced to a smaller size and covered with the split-thickness skin graft. Postoperative flap monitoring was done by visual and needle prick every 6 hourly for the 1st 24 hours and then 8 hourly for the next 48 hours. A splint was used for 3 weeks. Full weight bearing on heel was not permitted before six weeks.

Data Collection Procedure:

Data was collected using a proforma. Personal information about the patients was used to assess age distribution, sex distribution and co-morbid conditions. Cause of the wound , site and size of the wound were noted. Condition of the wound and any involvement of the bone was also noted.

A detailed analysis of the data collected was carried out and inference was drawn. Data were inferenced in the form of tables, figures etc. using Microsoft Excel® ™

RESULTS

Distally based sural flap was used in 10 cases for soft tissue coverage. Mean age of the patients was 40.2 years (range 28-60 years). The male to female ratio was 4:1. The aetiology of the defects included trauma (70%), diabetic ulcers (10%) and infection (20%) **(Table I)**. Underlying bone was exposed in 30% of the cases and 40% of the pateitns had some degree of devitalized tissue/slough in the wound bed which was removed surgically. The flap size varied from 12 × 4 cm to 20 × 6 cm. Average length of the flap was 15.6 cm, and width was 5.3cm.

The flap survived in 90% of the patients. Partial flap loss (3 × 2cm) was seen in one patient, which involved the distal part of the flap which was managed conservatively and later skin grafted. Slight epidermolysis was noted in one patient involving an area of 2 × 1 cm. Partial wound dehiscence was seen in 20% of the patients. The wound coverage was satisfactory after the flap.

Case 1:

A 60 years male had a diabetic ulcer on the heel for the last 2 years. The underlying bone was visible **(Figure II)**. The sural flap was harvested and used to cover the defect. The postoperative result was satisfactory. The weight bearing was started after 8 weeks.

Case 2:

A 28 years male presented with a workplace accident which resulted in a wound on the dorsum of the foot. Sural flap was planned and executed successfully **(Figure III)**. There was a slight postoperative oedema which relieved later on. The flap was a bit bulky initially but later debulking was performed.

TABLE I: DETAILS OF THE PATIENTS

Age	Sex	Cause	Location	Flap Size
29	M	Road Traffic Accident	Heel	15×5
32	M	Workplace accident	Dorsum of foot	20×6
36	M	Road Traffic Accident	Dorsum + Medial Melleolus	12×6
51	M	Infection	Heel	17×6
60	M	Chronic ulcer (diabetic)	Heel	18×5
28	M	Workplace accident	Dorsum of foot	16×5
36	M	Road Traffic Accident	Mid foot	14×5
48	M	Road Traffic Accident	Heel + Mid foot	16×6
39	F	Road Traffic Accident	Dorsum +Lateral Melleolus	15×5
43	F	Infection	Heel	12×4

DISCUSSION

A soft tissue defect of the lower third of leg and foot presents a challenging problem because of the tightness and poor circulation of the skin, and the limited units available for reconstruction. Various local muscle, musculo-cutaneous, fascio-cutaneous and free flap alternatives have all been used. Distally based myofascial flaps are unreliable; intrinsic muscle flaps from the forefoot have limited effective range and lack significant dimensions[12,13]. Reverse island flaps like peroneal artery flap, anterior tibial artery flaps, and posterior tibial artery flaps have the disadvantage of sacrifice of a major artery of the leg [14-16]. Muscle flaps

FIGURE I: FLAP ANATOMY AND LANDMARKS

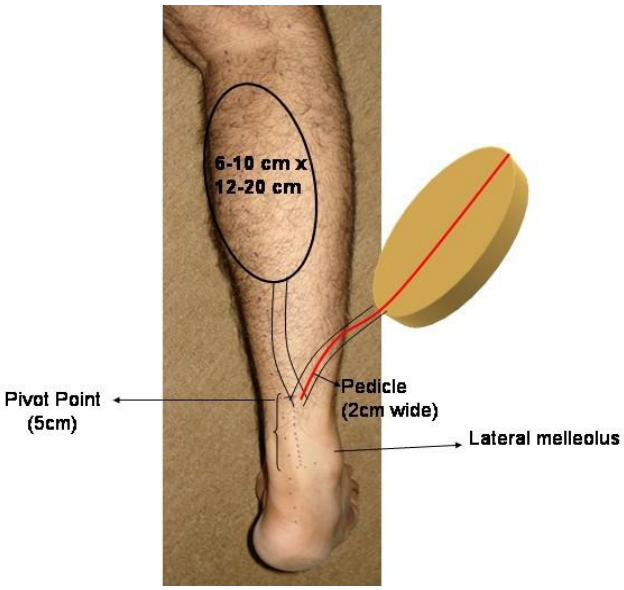

FIGURE II: PRE & POST OPERATIVE PHOTO-GRAPHS

in this region are of restricted use [17]. Microsurgical flaps are a good alternative despite being of laborious execution, as they need skilled personnel and sophisticated equipment[18,19]. Moreover the morbidity and operative time are also increased.

Elaboration of the concept of fascio-cutaneous flaps by Ponten and common use of distally based island flaps limited the use of other techniques in lower leg, ankle and heel reconstruction [4]. Different terminologies such as neurocuateous flap, distally based superficial sural artery flap, reverse sural island flap, and more precisely lesser saphenous sural veno-neurofascial flap have all been used for the same flap described by Mosquelet et al, and subsequently used

FIGURE III: PRE & POST OPERATIVE PHOTO-GRAPHS

by Hasegawa et al [5,20].

The reverse sural artery flap is a distally based, type A, fasciocutaneous flap based on the sural arterial network [20]. Peroneal artery septocutaneous perforators anatomose with the superficial sural arterial network [19]. The subcutaneous network is oriented longitudinally with many transverse anastomoses producing a reliable vascularised flap. Venous drainage of the reverse sural artery flap passes through the superficial venous network of the superficial sural vein, the short saphenous vein, and septo-cutaneous veins of the peroneal vein [20].

Ideal flap thickness and quality, minimal donor site morbidity, the lack of functional loss, short recovery time, and wide arc of rotation and safe vascularity are the significant advantages of the reverse sural artery flap.

The male to female ratio in the present study was 4:1 whereas it was 1.9:1 in the study by El-Din et al [21]. Heel was involved in 50% of the patients in the present study as compared to 64.7% in the study by El-Din et al [21]. Similarly heel was involved in 57.1% of the patients in the study by Mak [22]. Mean patient age was 44.2 years in the present study which is less than the study by Mak (66.3 years) [22]. This is in contrast to the observation by Hassanpour et al [23]. In a study by Chai, 15 flaps were reported [24]. The size in this study ranged from 8 × 9 cm to 13×31cm which is similar to the present study. The pivot point was approximately 5cm above the tip of lateral malleolus. Similarly in the study by Buluc, island flap was designed [1]. The pedicle was dissected to 3 cm and was tunneled through the skin; 73% flap survived completely with no venous congestion in any flap. We used island flap in 9 cases whereas non-island flap was used in one case only.

In a large series of 84 patients by Akhtar et al, the flap survival was 79%[8]. The flap length varied from 5 cm to 15 cm and width was 4– 2 cm. There are two main disadvantages of concern. First is the sacrifice of sural nerve resulting in the numbness in the nerve distribution; but none of the patient in this study complained of any disturbance. Second disadvantage is the skin grafted area.

Another important point is the bulkiness of the flap. Although the flap shrinks to some amount but it may be a problem initially, especially for wearing the footwear. In our series there was no flap necrosis. There was a partial flap necrosis of the terminal part of the flap in one case. One case of epidermolysis of flap margin was also seen.

Similarly, this flap is easy to perform even without microsurgical instruments or anastomoses with a loupe magnification. The principle vascularization of the lower limb is also preserved.

CONCLUSION

The reverse sural artery flap is a reliable option for the reconstruction of defects of ankle, foot and heel region.

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