ORIGINAL ARTICLE

Distal Based Sural Fascio-Cutaneous Flap: A Practical Limb Saviour for Wounds of War and Peace

M. Uzair Ilyas Tahirkheli[1], Irfan Ellahi[2], Muhammad Farooq Dar[2] and Arslan Sharif[3]

Abstract

Objective: To determine the effect of mechanism of injury on wound healing, and on the viability and success of distally based sural flap when used for the coverage of defects of lower leg, ankle and foot.

Study Design: Descriptive study.

Place and Duration of Study: Department of Surgery, Combined Military Hospital, Peshawar and Khariyan, from January 2012 to December 2014.

Methodology: Patients with soft tissue defects over the distal leg, ankle and foot were selected by purposive sampling technique and divided into 2 groups of 19 patients each. Group A (road traffic accidents) and group B (war injuries). Sural fascio-cutaneous flap was the reconstructive tool used in all the cases using single technique by the same surgical team; and time for recipient site preparation, size of the defect, graft survival, its healing time and complications, were studied.

Results: The mean age of the 38 patients in the study was 28.2 ±13.4 years. There were 36 male and 2 female patients. The most common site of injury encountered was leg (n=20) followed by foot (n=11) and ankle (n=5). Maximum wound size seen in group A was 10 x 12 cm and in group B was 15 x 38 cm. Recovery was uneventful in 17/19 cases of group A while 7/19 in group B and with no graft failure. Superficial epidermolysis was seen in 2 and 8 cases in group A and B respectively while edge necrosis of the flap was observed in group B only (n=4). Healing time on average was 2 to 3 weeks in group A, and 4 to 5 weeks in group B.

Conclusion: Soft tissue defects of the distal lower extremity as a result of war injuries and road traffic accidents have different dynamics in terms of wound size, time of wound healing, wound complications and functional outcome; but distal based sural flap has promising results in both situations.

Key Words: *Distal based sural flap. Distal leg. Heel and foot defects. Perforator flap. Mine blast injuries. Road traffic accidents.*

INTRODUCTION

Soft tissue injuries around the lower third of the leg, ankle and foot, is a daunting task for the reconstructive surgery team. Poor circulation with less subcutaneous tissue often exposing bones, tendons and implants, further complicates even simpler lacerations. So large defects in this area, requiring reconstruction, are best catered for by flaps rather than skin grafts.[1] Some of the local flaps around the area include dorsalis pedis artery flap, abductor hallucis and abductor digiti minimi flap in foot, medial planter artery flap, peroneal artery flap, supramalleolar flap and distally based sural flap in leg. Flaps of foot have the disadvantage of inadequate tissue while the flaps of leg compromise the already jeopardized circulation of injured distal limb. The only time-conserving and reliable option with fewer failure rates, requiring less expertise, remains to be the distally based sural facio-cutaneous flap.[2-4]

However, the less studied aspect of these wounds is the effect of the mechanism of injury causing these defects. Mechanisms of injuries can broadly be classified into war injuries, mainly due to high velocity bullet, splinters and mine blast; and non-war injuries as in road traffic accidents.

The aim of this study was to determine the effect of mechanism of injury on wound healing, and on the viability and success of distally based sural flap when used for the coverage of defects of lower leg, ankle and foot.

METHODOLOGY

Patients for this study were selected by non-random purposive sampling technique at 2 tertiary care centers: CMH, Peshawar, and CMH, Khariyan, from January 2012 to December 2014. Patients included in this study had wounds in their lower leg, ankle and foot and were divided into 2 groups, A (road traffic accidents) and B (war injuries including high velocity bullet or mine blast injuries), on the basis of mechanism of injury. All the patients were treated by a single surgical team and all wounds were managed by distal based sural fascio-

[1] *Department of General Surgery, 3 Mtn Med Bn FTC Bhimber, Azad Jammu and Kashmir.*

[2] *Department of General and Plastic Surgery, Combined Military Hospital, Khariyan.*

[3] *Department of General Surgery, Combined Military Hospital, Pano Aqil.*

Correspondence: Dr. M. Uzair Ilyas Tahirkheli, Consultant General Surgeon, 3 Mtn Med Bn FTC Bhimber, Azad Jammu and Kashmir.
E-mail: doc.uzair@gmail.com

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cutaneous flap as a reconstructive tool. Mean and standard deviation were determined for age. Frequencies and percentages were calculated for qualitative variables including gender, wound size, wound preparation preoperatively, and flap complications like superficial epidermolysis, edge necrosis, complete failure, and healing time postoperatively. All the qualitative variables were subjected to cross tabulation using SPSS version 17.0 as statistical analysis software. Patients at extremes of age with other comorbid conditions effecting wound healing were excluded.

As an initial procedure, thorough debridement carried out and wounds were prepared by serial dressings and often VAC (vacuum assisted closure) dressings before receiving flap for covering the skin and soft tissue defects (Figure 1). The sural flap relied on vascular axis of sural nerve including median superficial sural artery getting reverse arterial flow from septo-cutaneous perforators, from peroneal artery and lesser saphenous vein as a principal venous drainage with reverse venous flow resulting from bridging venae-cominants and non-functioning venous valves due to denervation of the vein during the procedure. The skin island (size according to the wound) harvested from posterior side of the calf and the defect produced as a result was covered by skin graft.

Patients were discharged after an average of 7 days of admission postoperatively and were followed up till complete wound healing with or without additional procedures.

Figure 1: Steps of the procedure.

RESULTS

The mean age of patients in the study was 28.2 ±13.4 years. Thirty-six patients were males and only 2 were females who belonged to group A and suffered injury due to road traffic accident.

Among the patients of group B, the majority of the patients were having defects as a result of anti-personal mine (n=10), an IED blast (n=5) or injury to the lower leg and distal area as a result of high velocity bullets (n=4). The most common site of injury in both groups was leg (20, 52.6 %) followed by foot (11, 28.9 %) and then ankle (5, 13.2 %).

Wound defects encountered in group A ranged 3 x 4 cm to 10 x 12 cm while in group B were 6 x 10 cm to 15 x 38 cm. Wound preparation procedure carried out was the same in both groups but VAC dressings were needed in 7 patients (36.8%) of group B while only in 2 patients (10.5%) of group A. Most of the patients of group A had an uneventful recovery 17/19 (89.5%) while only 7/19 (36.8%) of the cases of group B had postoperative recovery with no further sequel. In terms of flap survival and complications to the procedure, no flap failed. However, postoperative flap complications like superficial epidermolysis were 2/19 (10.5%) and 8/19 (42%) in group A and B, respectively; and edge necrosis were 0/19 and 4/19 (21%). In respect to healing time, 2 - 3 weeks were the average healing time in group A while delayed wound healing of 4 - 5 weeks was observed in cases of group B. There was no difference seen in healing time of the graft donor site. However, 1 case (5.2%) had failure of superficial skin graft at donor site which was repeated again. The results of the study are summarized in Table I.

DISCUSSION

Pakistani population, both civilian and army personnel, has suffered lot of devastations in last decade, both in settled areas and in battlefields. However, the economic constraints, as always, had been an issue for provision of best possible health facilities to all. Thus the treating physicians and surgeons are required to discover the solutions which are viable as well as cost-effective to meet the overall requirements of our healthcare system. This study comprises of a small but very significant proportion of the patients who were young, mostly serving soldiers, mean age of 28.2 ±13.4 years, and suffered from limb threatening injuries as a result of road traffic accidents or war injuries like high velocity bullet

Table I: Summary of results.

Group	Preoperative			Postoperative					Total
	Max wound size	Min wound size	VAC dressing used	Normal recovery	Superficial epidermolysis	Edge necrosis	Healing time (Avg)	Donor Site graft failure	
A	10 x 12 cm	3 x 4 Cm	2 (10.5%)	17 (89.5%)	2 (10.5%)	0	14 - 21 days	0	19
B	15 x 38 cm	6 x 10 Cm	7 (36.8%)	7 (36.8%)	8 (42%)	4 (21%)	28 - 35 days	1 (5.2%)	19
									38

injury or in mine blast injury. The common site of injury in both cases is lower leg, ankle and foot or combination. In this study, majority of patients had injury to lower leg (52.6%) as shown in Figure 1. Majority of the patients were male (36) with only 2 female patients, who suffered injuries as a result of a road traffic accident, because of predominant involvement of male population in the accidents and war situations.

The reconstructive tool used in this study was Sural fascio-cutaneous perforator flap. Van Waes *et al*. have also proved the efficacy of this technique for covering complex wounds of war in conflict zone of Afghanistan.[5] The advantages of this flap include its ability to harvest multiple tissue components in various combinations from the same wound.[6] Also it has very promising results in dirty wounds with underlying osteomyelitis[7] and in patients with diabetes[8], so it can be an ideal solution for complicated wounds of mine blast and high velocity injuries. Wounds of size 15 x 38 cm were successfully treated in this study using this flap. There is possibility to harvest skin flaps of various sizes as per requirement of the recipient site,[9,10] because serial debridement and additional procedures of wound preparation render the wound to be large. Four patients from group B, who experienced partial necrosis of the edges and 5/8 of the patients who had superficial epidermolysis, had large size of skin flap for adequate coverage of the wound as probability of partial necrosis of the flap edges significantly increases when top edge of the flap is located in the upper 1/9th of the calf.[11] The same phenomenon is also seen when arc of rotation and pressure on the pedicle is not considered at the time of the procedure. All the large and dirty wounds,[7] mainly in group B, needed VAC dressings preoperatively. An improvised gauze based negative pressure wound therapy was used for purpose of VAC, in which the surgical gauze was used as a filler material instead of traditional reticulated open cell foam. The successful outcome of this procedure has been established in this setup.[12]

Inclusion of relatively young population and careful selection of cases without chronic diseases ensures increased success rate of the procedure. However, Park *et al*. have shown the successful use of this flap in patients with chronic diseases like diabetes, hypertension, and vasculopathies.[13] One study showed its use in successful coverage of a heel wound in a hemophilia B patient with keeping careful level of coagulation factors preoperatively.[14] Local study by Mahmood *et al*. showed efficacy of this flap in children in road traffic accidents with successful outcome in 14/16 cases.[15]

An important observation noticed during the study was the delayed healing of the wounds in group B (average 4 - 5 weeks) when compared to group A (average 2 - 3 weeks), which is a clear indication of different dynamics of wounds on the basis of mechanism of injury. However, both types were managed with adequate success using reverse sural flap.

The success of the procedure can be improved further by precisely locating the perforators and surgical refinements like leaving extra adipose tissue around the pedicle as shown by Tsai *et al*. and Chang *et al*.[16,17] Higueras Sune *et al*. used CT angiography as a perforator locator preoperatively and found it to be highly sensitive and specific.[18] Ramanujan *et al*. proved Duplex scan as an alternative, and cost-effective way for the purpose.[19] A unique study by Sonmez *et al*. who used venous stripper to enhance venous drainage of the flap by destroying valves and preventing venous congestion, has shown encouraging results but this procedure increases operating time and needs expertise to correctly perform the procedure without damaging the only source of venous drainage.[20] For prevention of temporary loss of sensation on lateral aspect of leg, further modification of the procedure, described by Esezobor *et al*., was raising flap without sacrifice of sural nerve,[21] which needs further studies to establish as part of the procedure.

CONCLUSION

Soft tissue defects of the distal lower extremity as a result of war injuries and road traffic accidents have different dynamics in terms of wound and flap healing with dirty wounds, often requiring more healing time and additional procedures like VAC dressings and repeated debridement; but distal based sural flap has an excellent anatomical and functional outcome.

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