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Treatment of Soft Tissue Defects of Ankle, Heel and Dorsum of Foot by Reverse Flow Sural Flap

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ABSTRACT

Background: The injuries of foot soft tissues, particularly at heel expose the bones, tendons and especially joints, which clues to risk of necrosis and infections and are usually caused by injuries such as trauma (spokes wheel), venous ulcers, systemic diseases, diabetic foot wounds and tumors. Aim of the study: The objective of the study was to assess the intended benefits of reverse sural artery flap to cover injuries in the foot and ankle. Study design: A descriptive and experimental research. Place and Duration: In the Surgical Department of D.G. khan Teaching Hospital Dera Ghazi Khan for a one-year duration from March 2018 to March 2019. **Methods:** All patients with wounds on the heel and open calcaneus or Achilles tendon were included. By handheld Doppler, peroneal based perforator was recognized, the sural nerve and a superficial vein were encompassed in the pedicle. Patients were followed for the first 6 months after surgery. **Results:** A total of 40 reverse flow sural flaps were made to cover soft tissue of 24 heel defects and 12 ankle defects. 30 patients were male and 10 were females, and their age ranged from 7 to 37 (mean 21). In three cases; Partial flap failure was observed and in 2 cases, there was total flap failure. **Conclusion:** Harvesting reverse sural flap is safe and reliable because it does not end with any of the major postoperative complications at the donor site.

Keywords: Iliac artery perforator, back and foot trauma, Achilles tendon.

INTRODUCTION

Due to modern high-speed vehicles and urbanization, the number of road accidents causing numerous traumatic injuries, major soft tissue defects and fractures are increasing. Full coverage of soft tissue is tremendously difficult; due to trauma and incredible blood circulation on thin subcutaneous tissue in the heel, ankle and lower leg.[1,2] Because other degenerative injuries and trauma often affect the subcutaneous tissue, skin, ligament structures, underlying bone and tendons and bones exposes, which carries the jeopardy of necrosis and infection.[3] Lower limb trauma most frequently happens in two or four-wheeled accidents and tibia is mostly involved. In motorcyclists, spoke wheel injuries are most common. Such injuries usually occur when the foot gets caught in the wheel spoke. The tibia is most commonly affected in skeletal tumors.[4] Confiscation of tumors from the safe edge often causes big lesions with bare tendons, neurovascular structures or bones; In addition, surrounding tissue irradiation doubts closure by primary intention. In systemic diseases patients such as peripheral vascular disease and diabetes, chronic wounds of the lower extremities are seen as a venous ulcer or diabetic foot that does not heal.[5,6] Classification characterizing the tissue damage degree: Type I: Loss of skin with unexposed tendon or bone. Type II: Skin loss due to fracture or exposure of the Achilles tendon. Type III: The defect of the Achilles tendon, loss of skin with fracture or open calcaneus. Type IV: Mangled foot with injury to the neurovascular bundles.

Subsequent the reconstructive ladder selections like primary closure, healing by secondary intention, regional or local flaps, grafts, and distant flaps and lastly free flaps can be applied to shield the defects of lower limb.[7,8] Being on top of a reconstruction ladder; free flaps are the best appropriate choice for treating a mistake, although they require incredibly experienced and trained specialists who can conduct microvascular surgery for extended duration.[9] Few studies show that lifting the pedicle with skin instead of flap islanding is extra reliable and has fewer impediments.

This study was performed to estimate the outcomes of a reverse flap of the sural artery to cover the heel and ankle.

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MATERIALS AND METHODS

This descriptive, experimental study was done in the Surgical Department of D.G. khan Teaching

Hospital Dera Ghazi Khan for one-year duration from March 2018 to March 2019. A total of 40 patients were referred by the general surgeons, orthopedic surgeons and dermatologists, to the Department of Plastic & Reconstructive Surgery, DG khan Teaching Hospital Dera Ghazi Khan. Plastic surgeons cover wounds in the foot and ankle by using the technique of reverse sural artery flap to cover moderate-sized defects. This procedure is easy, quick, and dependable; it also eliminates the sacrifice of significant vessels.

Thirty of them were men and 10 were females; there were defects of soft tissue in the dorsum of the foot, heel and ankle. Gender, ages, duration, cause, location and fault size, flap measurements, pedicel placement under the skin or on the surface, complications and postoperative outcomes were documented. Long bone preoperative radiographs were performed to exclude osteomyelitis in all cases. Patients with external fixator applications, calcaneus fractures, peripheral vascular disease, osteomyelitis and irradiated tissue nearby to the wound are excluded. However, individuals with nearby lesions or above the site of peroneal artery perforators were excluded. Many mechanical cleanings and dressings were performed to formulate the wound for coverage.

For 6 months, all cases were observed in the O.P.D. for flap results and complications. The total flap loss was taken as a severe impediment.

Figure 1: Flap.

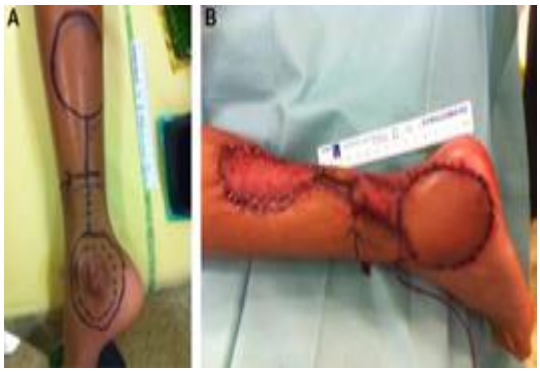

Figure 2: Flap.

Surgical Technique

The patient was brought to the prone or standard lateral position under spinal or general anesthesia and tourniquet control. Before raising the flap, the wound was irrigated and debrided, in reverse sural design the flap was harvested with a pivot point at 5-6 cm from the lateral malleolus at it's the lower end. Handheld Doppler was used to evaluating perforators. The upper flap limit was protracted till the center of middle and high 3rd of the leg, while subjects who requisite lengthier pedicle to shield the upper deficiency limit was stretched till the leg to its proximal third by delay phenomenon 1st in minor operation theatre under local anesthesia and then the inset and elevation of the flap were complete after ten days. Up to the fascia layer, Skin Island was cut. The femoral nerve was proximally separated, buried and ligated between the muscles, and the sural artery and short saphenous vein were ligated. From the proximal to the distal end; the flap was dissected. In most patients, the skin island passes through a widespread subcutaneous tunnel [Figure 1], in few cases, the flap passes through healthy skin to reach the wound, so the tube was not made, and the hard surface of the flap [Figure 2], and the pedicle was separated later to three weeks. The tourniquet was unconfined to confirm vascularization of the flap and control of bleeding.

Figure 3: Flap.

The flap donor area was in all cases enclosed with a partial-thickness skin graft, and the flap was placed in a defect with 3/0 prolene. All patients were done with a dorsal slab. After surgery, patients were brought to the lateral position with the height of the operated limb to reduce pressure on the pedicle. The individuals were allowed to walk 4 to 6 weeks later.

RESULTS

A total of 40 patients with heel defects in 25 patients, ankles in 15 patients were included in the study. The wound area is 4 to 13 cm long and 5 to 11 cm wide. The wounds history diverse from three weeks to approximately two months.

In 27 subjects, the center of middle and upper 3rd of the leg was taken as the upper flap limit, whereas in 11 patients, the proximal leg third was regarded as upper limit by delay phenomenon.

In 31 cases, skin Island was tunneled, though in six subjects, flap was interpolated between recipient and donor areas. [Table 1].

Table 1: Details of patients, mode & site of injury, and outcome of the surgery.

Case No	Age (years)/ Gender (M/F)	Etiology	Site of defect	Size (cm)	Outcome	Secondary Surgery
1	26/M	R.T.A.	Dorsum of foot	10x8	Flap survived	Nil
2	7/M	Spoke wheel injury	Heel	3x4	Flap survived	Nil
3	28/M	Spoke wheel injury	Ankle	5x3	Flap survived	Nil
4	25/F	Spoke wheel injury	Ankle	5x4	Flap survived	Nil
5	10/M	R.T.A.	Heel	4x4	Flap survived	Nil
6	36/F	Spoke wheel injury	Ankle	5x5	Flap survived	Nil
7	15/F	Spoke wheel injury	Heel	4.5x4	Flap survived	Nil
8	12/M	R.T.A.	Heel	3.5x4	Flap survived	Nil
9	20/F	Spoke wheel injury	Heel	4x3	Flap survived	Nil
10	36/M	Diabetic Ulcer	Heel	4x5	Partial failure	Debridement & Skin grafting
11	25/F	Spoke wheel injury	Heel	5x5	Flap survived	Nil
12	35/M	R.T.A.	Heel	5x5	Flap survived	Nil
13	34/M	Diabetic Ulcer	Heel	5x6	Complete failure	Managed conservatively
14	20M	R.T.A.	Heel	4.5x5	Flap survived	Nil
15	33/F	RTA	Heel	5x6	Partial failure	Debridement & Skin grafting
16	11/M	R.T.A.	Heel	5x4	Flap survived	Nil
17	33/M	R.T.A.	Heel	3.5x4	Flap survived	Nil
18	33/M	Spoke wheel injury	Heel	3.5x5	Flap survived	Nil
19	20/M	Spoke wheel injury	Heel	4x3	Flap survived	Nil
20	33/M	R.T.A.	Dorsum of foot	9x7	Flap survived	Nil
21	20/M	R.T.A.	Heel	4x6	Flap survived	Nil
22	22/M	Spoke wheel injury	Heel	4x5	Flap survived	Nil
23	14/M	Spoke wheel injury	Heel	3.5x4	Flap survived	Nil
24	35/F	R.T.A.	Heel	3x4	Flap survived	Nil
25	29/M	Spoke wheel injury	Heel	3.8x5	Flap survived	Nil
26	14/M	Spoke wheel injury	Ankle	5x4	Flap survived	Nil
27	31/M	R.T.A.	Ankle	3x5	Complete failure	Managed conservatively
28	11/M	R.T.A.	Ankle	5x5	Flap survived	Nil
29	33/M	Spoke wheel injury	Ankle	3x4	Flap survived	Nil
30	26/M	Spoke wheel injury	Heel	4.5x5	Flap survived	Nil
31	29/M	R.T.A.	Heel	5x6	Flap survived	Nil
32	27/ M	R.T.A.	Heel	5x5	Flap survived	Nil
33	32/M	Post burn contracture	Dorsum of foot	9x7	Flap survived	Nil
34	31/F	RTA	Ankle	5x5	Partial failure	Debridement & Skin grafting
35	35/M	Post traumatic contracture	Dorsum of foot	9x6	Flap survived	Nil
36	21/M	R.T.A.	Heel	4x3	Flap survived	Nil
37	37/M	R.T.A.	Ankle	8x5	Complete failure	Managed conservatively
38	18/M	Spoke wheel injury	Dorsum of foot	5x4	Flap survived	Nil
39	23/M	Post traumatic contracture	Heel	4.5x5	Partial failure	Debridement & Skin grafting
40	9/M	R.T.A.	Ankle	3x3	Flap survived	Nil

33 flaps endured without any impediments. In two cases, the main reason was a failure of the main flap and compression, and hematoma in this region, while 4 flaps exhibited partial damage that was later skin grafted and complete failure noted in three patients. The mean length of stay in the hospital was about 7-days.

For 3 weeks, a dorsal splint was applied, and the time of wound healing was about 1 month. No patients showed signs of neuroma formation or complications at the donor flap site. The graft donor site, mainly the thigh, exhibited no chief complications. Walking and carrying a weight difficulty not displaying after 3 months.

DISCUSSION

Skin grafts provide the fastest and easiest way to cover every wound, but this meaning cannot be used to cover tendons or bare bones.[10,11] Similarly, local flaps with random patterns in the lower limbs have limited movement and a rotational arc.[12] However, this requires a long operation time and limits the use of microsurgical experience. Expensive infrastructure in more developing countries is not available in all hospitals.[13] For this reason, it offers an easy reconstruction option in our configuration. Although local perforator flaps are gaining tradition. The reverse vasculature of the lower abdominal hemangioma depends on the superficial, middle and lateral superficial abdominal arteries. The iliac artery perforators vascularize this inverted flap. The posterior tibial artery perforators also power the flap. Of the 5 cases where partial or complete necrosis developed, injuries to the ankle followed most often followed by a wound to the back of the foot; and

ended with only one flap that is due to diabetic ulcer and necrosis behind the foot.[14] Therefore, the distal result wound defects have more responsibility than contractures of necrosis, especially in patients with diabetic ulcers. Some patients continued complaints about the numbness of the dorsolateral aspect of the foot15. Although being the reverse sural is collected as an insensitive flap, patients did not appear with trophic ulceration. This consultation requires additional examination. Therefore, the reverse sural facial-cutaneous flap based on peroneal perforators is a fast and versatile method that eliminates the necessity for microvascular surgery.

CONCLUSION

Almost all cases continued their daily routine life after three months of surgery; this shows that the distally based sural artery flap is a reliable and versatile option for covering distal lower limb defects, and the results are equally acceptable with a small degree of complication.

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