

Distally-Based Sural Island Flap for Soft Tissue Coverage of Ankle and Heel Defects

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ABSTRACT

Objective: To determine the outcome of heel and ankle reconstruction with distally-based sural island flap.

Study Design: Case series.

Place and Duration of Study: The study was carried out in Plastic Surgery Department, Chittagong Medical College Hospital, from January 2007 to April 2009.

Methodology: Twenty two subjects with soft tissue defect of heel and ankle requiring coverage were included in the study. The flap was first outlined on the posterior aspect of leg at the junction of upper and middle-third. Having incision made over the designed flap and along the line of the fascial pedicle, the vessels and the nerve were ligated at the proximal margin and severed. The skin island was elevated with the deep fascia. The sub-cutaneous fascial pedicle was then raised, with a width of 2.5 cm to include the sural nerve and vessels. The recipient defect was covered after tunneling the island flap. The donor site was closed directly when the wound was less wide and with a split skin graft when the wound was large. Results were analyzed in terms of graft acceptance and complications determined as percentage frequencies.

Results: Of the 22 patients, 15 had uneventful recovery with almost complete take of flaps. Although 5 patients showed marginal necrosis initially, they later on healed by secondary intention without requiring any secondary graft coverage. The rest two had a marked loss of flap in the peripheral part and required secondary graft coverage. Immediate venous congestion was commonly encountered which disappeared within a few days. There were no delayed complaints regarding sensation of the flaps.

Conclusion: Distally-based sural island flap can be performed as a one-step procedure without sacrifice of any major artery. It is reliable, safe and should be the choice for reconstruction of ankle and heel defects.

Key words: *Distally-based sural island flap. Ankle and heel reconstruction. Soft tissue coverage.*

INTRODUCTION

Soft tissue defects around the ankle and heel are usually difficult to reconstruct. The difficulty emanates from the limited mobility and availability of the overlying skin, the unique weight-bearing demands and the relatively poor circulation of the skin. Reconstructive options like local, distant and free flaps each has their own advantages and disadvantages.¹ The plantar soft tissues have unique functional properties and a full-thickness tissue loss from weight-bearing areas require replacement of tissues whose physical properties are similar to those that were lost. That is why, simple skin grafting cannot address the soft tissue defects of ankle and heel and usually leads to an unstable, painful scar/callus formation in patients whose sensorium is intact.²

To overcome this problem various techniques have been evolved for reconstruction of defects in the distal leg or foot. Inferiorly based muscle flaps continue to be plagued

by a high failure rate due to their variable vascular anatomy distally.^{1,3,4} Reversed island flaps such as the peroneal artery flap,⁵ anterior tibial artery flap,⁶ and posterior tibial artery flap⁷ can be transferred as reconstructive options for the lower legs. However, the need to sacrifice a major artery in the leg constitutes a potentially serious disadvantage. After being popularized by Masquelet *et al.* the sural flap⁸ was well thought-out as an appropriate substitute to microvascular free-flap transfer for soft tissue reconstruction of the lower extremity as far as forefoot.⁹⁻¹² It is generally accepted that microsurgery can solve most of the problems of defects of lower third of the leg associated with open fractures,¹³⁻¹⁸ but it requires the availability of a microvascular team and equipments which is unfortunately lacking in our center. Besides this, microvascular surgery is too costly to be afforded by majority of our people. Therefore, as an alternative to microsurgery, distally based sural island flap has several merits. It is a skin island flap supplied by vascular axis of sural nerve. In about two-third of the patients, the sural artery descends to ankle. Anastomoses with peroneal artery are universal. Several septocutaneous vessels arise from the peroneal artery and anastomose with the vascular network of the nerve. There are also rich anastomoses located in the lower part of the tibiofibular space. These arterial arcades around the ankle nourish

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the fasciocutaneous tissue around the lateral malleolus and supply blood to the sural nerve and its neighbouring skin.⁸ Owing to the presence of such anastomoses around the ankle joint, fasciocutaneous flaps that include perforators from the posterior tibial artery or the peroneal artery can safely be raised and after reconstruction, the failure rate of flap is rare. The objective of this study was to evaluate the outcome of heel and ankle reconstruction with distally-based sural island flap.

METHODOLOGY

Subjects with soft tissue defect of heel and ankle requiring soft tissue coverage were treated from January, 2007 to April, 2009 in the Plastic Surgery Department, Chittagong Medical College Hospital. Cases with absence of peripheral pulses were considered unsuitable for reconstruction with distally-based sural island flap and were excluded. With the patient in a prone position, the flap was first outlined at the posterior aspect of junction of upper and middle 1/3 leg. The incision was made over the designed flap and along the line in which the fascial pedicle was included. At the proximal margin of the flap, the nerve and the vessels were ligated and severed. The skin island was elevated with the deep fascia. The sub-cutaneous fascial pedicle was raised with a width of 2.5 cm to include the sural nerve and vessels (Figure 1-4). The recipient defect was covered after tunneling the island flap. The donor site was closed directly when the flap was less than 4 cm. wide and with a split skin graft when larger than 4 cm.

The test statistics used to analyse the data were descriptive statistics like frequency and corresponding percentage. Outcomes were analyzed in terms of graft acceptance, need for re-grafting and the frequency of complications.

RESULTS

The patients' age ranged from 10 to 65 years with mean age being 33.5 years. There were 17 males and 5 females among the 22 subjects. Sixteen of the wounds were on postero-inferior aspect of heel, 4 on the posterior aspect of the heel exposing Tendo Achilles and 2 on the dorsomedial surface of the ankle. Of the 22 patients, 15 (68.1%) had uneventful recovery with almost complete take of flaps. Five patients (22.7%) initially showed marginal necrosis, they later on healed by secondary intention without requiring any secondary

graft coverage (Table I). The rest 2 (9.1%) had significant loss of flap in the peripheral part and required secondary graft coverage. Immediate venous congestion was invariably encountered and disappeared within a few days. No delayed complaints were received from the patients regarding sensation of the flaps.

Table I: Outcome of the operated patients.

Outcome	Frequency	Percentage
Uneventful recovery	15	68.1
Initially showed marginal necrosis; later on healed by secondary intention	05	22.7
Significant loss of graft and required secondary graft coverage	02	9.1

DISCUSSION

The loss of soft tissue from foot, either from trauma or as a result of diabetic foot is a difficult problem to treat. The plantar soft tissues have unique functional properties integrated with biomechanics of weight bearing that allow them to resist external stress and to protect the architecture of the soft tissue. A full-thickness tissue loss from weight-bearing areas requires replacement of tissues whose physical properties are similar to those that were lost. The distally-based sural artery flap, is a skin island flap supplied by vascular axis of sural nerve.⁸ In 65% of the patients, the artery descends to ankle and in rest 35% cases it is reduced to an interlacing network in the distal third of the leg.⁸ But the septocutaneous perforators of peroneal artery in the distal 1/3 of the calf are constant, reliable and well documented. Three to five septocutaneous vessels arise from the peroneal artery and anastomose with the vascular network of the nerve. There are also rich anastomotic arcade located in the lower part of the tibiofibular space. The tissues in the region of the lateral malleolus are supplied by these arterial arcades around the ankle. In fact, the cutaneous branch of the perforating branch of the peroneal artery nourishes the lateral supramalleolar flap.¹⁸

Jeng and Wei confirmed that the vascular supply of distally based sural island flap comes from the cutaneous perforating branches of the peroneal artery.¹⁹ Hasegawa *et al.* recognized and track the course of the superficial sural artery as described by Masquelet *et al.*, and reported successful treatment of 20 patients with distally based superficial sural artery flaps.^{18,20} Oberin *et al.* recommended using a fasciocutaneous flap based



Figure 1: Heel defects on the postero-inferior aspect.



Figure 2: Showing design of the island flap.



Figure 3: Sural island flap covered the exposed wound.



Figure 4: Uneventful recovery after 6 weeks of operation.

on the satellite vascular networks found accompanying the sural nerve, rather than a defined artery.²¹ They highlighted the need to include in the flap the local sub-fascial fat that contains branches from the peroneal artery, and to have margin of the Achilles tendon up to its distal attachment. This type of flap is very reliable, even in patients with distal arterial insufficiency and thus, is the flap of choice for the treatment of heel necrosis without any need for microsurgical anastomosis. So its success does not seem to depend on the presence of a good peripheral pulse. It may even be useful for patients who have peripheral vascular insufficiency. The morbidity associated with the loss of the sural nerve is minimal. A long pedicle can be designed to allow the flap to be transferred as far as insensate area.

As the present study was conducted on small sample and the sample was purposively drawn, the result must be validated with large scale study.

CONCLUSION

The distally based sural island flap with fascial pedicle, including the branches of the peroneal artery supplying the ankle region, is a dependable source of soft tissue coverage for defects in the ankle and heel, and could be performed as a one step procedure, where microsurgery is neither available nor affordable.

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