

## Our Experience with Island Neuro-Cutaneous Lateral Supramalleolar Flap

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Defects in and around the ankle and foot are difficult to reconstruct and often challenging to a reconstructive surgeon. Our experience with island neuro cutaneous lateral supra malleolar flap appears to be the excellent choice and must be considered for the defects in and around ankle and foot, provided the dimension of the defect is small. In our series four cases, were done between 2017 to 2018, for small defects in around the ankle and foot- following trauma and tumor excision, this flap proved to be a better option than reverse sural flap. It has an advantage of long pedicle, adequate reach up to mid foot, consistent perforator from peroneal artery, ease of dissection in supine position and minimal complications.

**Keywords:** Foot island flap, lateral supra malleolar flap, neuro cutaneous flap, defects around ankle and foot.**Copyright © 2019:** This is an open-access article distributed under the terms of the Creative Commons Attribution license which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use (NonCommercial, or CC-BY-NC) provided the original author and source are credited.

### INTRODUCTION

Since the description of Masquelette *et al.* [1] in 1988, lateral supra malleolar flap is proved to be the one of the 'flap of choice' to cover areas of distal leg, ankle, hind foot up to mid foot, apart from sural flap. Even though, the author described rotation flap and reverse flow island supra malleolar flap, we did island neuro cutaneous lateral supra malleolar flap, keeping the pivot point 4 cms proximal to tip of lateral malleolus, in our series. The indication of the flap is almost similar to that of reverse sural flap.

We have planned and executed, island neuro cutaneous lateral supra malleolar flap in four cases for different defects around ankle and mid foot, of variable aetiology and dimensions. In our series, flap survival rate was 100%, except in one case, where there was marginal superficial necrosis and healed by secondary intention.

Even though, reverse sural flap [2] is the option to be considered in all these cases, however, associated change of position of the patient to do the reverse sural flap and simultaneously the size of the defect is small enough to cover, made us to proceed with island neuro cutaneous lateral supra malleolar flap as our first choice.

### MATERIALS & METHODS

We have done four cases in the year 2017 to 2018, in department of Plastic surgery, Government General Hospital, Siddhartha Medical College, Vijayawada. Among four, three were males one was female. The age of the patients was in between 21 years to 62 years. There were no systemic or peripheral systemic or vascular diseases like, Diabetes, Hypertension, Thrombo Angiitis Obliterans (TAO). The cause of the defect was following trauma in three cases and in one case following excision of Marjolin's ulcer. The size of the defect was at maximum, 6X8 cms, minimum 2X4cms.

#### Surgical technique

All the cases were done under spinal anaesthesia. Patients were kept in supine position, with a small pillow underneath the buttock to facilitate internal rotation of the lower limb for ease of dissection. No hand held Doppler was used to locate the perforator. All the cases were done under tourniquet without emptying the limb. Limb was prepared and draped. Surgical wound debridement and wound toilet was done in all the cases depending on the necessity. Then, 'planning in reverse' was done, keeping the pivot point 4 cms proximal to the tip of the lateral malleolus, in the inter malleolar area. Flap was marked, between the tibial crest anteriorly, lateral border of the fibula posteriorly with proximal or upper limit as midpoint of

the leg. Then incision was made all along the island extending onto a lazy's' incision over pedicle up to pivot point. While raising the island part of the flap, the superficial common peroneal nerve was included in all the cases, fixing it to flap subfascially and progressed distally, till peroneal perforator was clearly visible. After harvesting the flap, tourniquet was released; flap was allowed to perfuse adequately before transferring it to the defect. Then the harvested flap was brought either laterally or medially depending on the position and its reach to the defect without tension. Often, incision was made over intervening tissue between the pivot point and the defect to avoid unnecessary tension over the pedicle. In one case it was tunnelled subcutaneously to reach the defect. Flap was sutured to the defect keeping a drain underneath. Donor site was reduced burying the nerve ends under the muscle. Left over donor raw area was covered with split thickness skin graft. Haemostasis was secured throughout the procedure. No donor site was closed primarily because of its size. Plaster cast with adequate padding underneath the pedicle was given in all cases, to provide rest and to minimize tension and mobility over pedicle. Post operatively flap was monitored by its color, warmth, skin blanching and skin pricking for bleeding at regular intervals for first one week.

#### Case1

A 21 year old male patient was presented following trauma with a defect on the medial aspect of mid foot and exposed navicular bone. The dimension of the defect is 2X4cms after wound debridement. To this, island neuro cutaneous lateral supra malleolar flap was planned and executed, keeping the pivot point 4cms

proximal to tip of lateral malleolus. Pedicle was tunnelled subcutaneously by undermining dorsal skin, to reach the defect. Wound healed well with settled flap.

#### Case4

A 62 years old female patient had Marjolin's ulcer on medial aspect of distal leg proximal to medial malleolus. Post exisional defect with an adequate margin was measuring around 6X8 cms with exposed tendo achilles. This defect was resurfaced with island neuro cutaneous lateral supra malleolar flap, planned in a 'sperm' shaped manner to include donor site dog ear within it and also an extending tail over subcutaneous pedicle to avoid tension on the pedicle. Flap brought to the defect by incising the intervening skin and margins were sutured to the pedicle. Settled flap with superficial skin necrosis at the distal tip, which was left to heal by secondary intention.

## RESULTS

All the flaps were survived totally. There was immediate post-operative oedema in all the cases, especially those flaps which have been tunnelled subcutaneously for 48 hrs, which was disappeared by itself with limb elevation. There was marginal necrosis in one case superficially at the distal tip, which was managed conservatively to heal by secondary intervention. There was no donor site morbidity as all wounds healed well. Even though patient lost sensation over dorsum technically, patients themselves were never having complained.

**Table-1: Schematic representation of table showing age, sex, defect dimension and complications**

S.No.	Age (years)	Sex	Site of the defect	Size (cms)	Complication
1	21	M	Medial aspect of mid foot	2X4	Nil
2	40	M	Over tendo Achilles	5X4	Nil
3	38	M	Anterior surface of ankle joint	4X4	Nil
4	62	F	Medial aspect of distal leg proximal to medial malleolus	6X8	Marginal superficial necrosis

## DISCUSSION

Anatomical area of the distal leg and foot are unique in having meagre blood supply, subcutaneous tendons and bones and also articular joints. Being part of peripheral organ system and having mobility, simultaneously providing stability to the body, the reconstructive demands of the distal leg and foot are very significant. Hence the 'should have' factors to consider for reconstruction are following like-stable skin cover having sensation, tough enough to withstand pressure on walking or standing, with absence hair, adequate quantity of tissue to replace the loss and aesthetically pleasing as foot often being most watched part of the body. This throws a big challenge to reconstructive surgeon.

Even though free tissue transfers are fulfilling majority of these demands, due to technical issues, infra structure and expertise needed, the reconstructive surgeon divert himself to look for local and regional tissue that are available from the same limb which can meet the demand and fulfil the needs.

Reverse sural flap[3] is a one which being a subfascial neuro cutaneous flap- with its distal pedicle will reach to the distal most part of the foot satisfactorily. And this flap can be made sensate by anastomosing sural nerve to any nearby cutaneous nerve and expect reasonable sensation in due course of time. The dimension of the flaps are also range from medial margin to lateral margin of the leg, the entire dorsum or sole of foot can be covered reliably in limb salvage surgeries.

Similar to reverse sural flap, peroneal artery perforator flap[4] is also having similar characteristic features and covers large areas even further distal part of the foot. However, this flap cannot be made sensate at least theoretically, as sural nerve is spared in harvesting this flap. The reverse sural flap and peroneal perforator flap carry the similar quality of skin, as they both are from the calf region.

Lateral supra malleolar flap is the versatile flap available locally in and around the ankle to address the reconstructive needs of the surgeon. As an island flap, this flap is on par with the reverse sural flap, covers the ankle, proximal and mid foot. The dimension of the island neuro cutaneous lateral supra malleolar flap is at its maximum width measures up to 6 to 8cms, length up to 12 to 18 cms. Hence as an island flap, with its long subcutaneous pedicle, it will reach upto midfoot easily without much difficulty, especially when the pedicle is tunnelled under the skin. The blood supply to the flap is very consistent from a peroneal artery perforator, which passes through the the interosseous membrane to enter into the anterior compartment, 4-5 cms proximal to the tip of the lateral malleolus, which immediately divides into an ascending subcutaneous branch, that supplies to our flap. Descending branch anastomoses with the network around the ankle. This network after the ligation of the ascending branch form the basis for 'reverse lateral supra malleolar flap'. The presence of this subcutaneous branch is very much consistent, and is present in all of our cases. We have not used hand held Doppler to locate the perforator prior to surgery. Usually perforator with sub cutaneous pedicle passing subfascially can be easily seen the moment the tissue is lifted up between extensor digitorum and peroneus brevis. The boundary of the flap is proximally midfoot, anteriorly tibial crest, posteriorly along the lateral border of fibula distally 4cm proximal to the tip of the lateral malleolus. Even with these limitations, flap will reach medial malleolus, lateral malleols, tendo Achilles, dorsal side of foot up to mid foot region on its sub cutaneous pedicle. Skin over flap region is thin when compared with the calf skin of reverse sural or peroneal flaps. Thus, this part of the skin is more suitable over malleoli, tendo Achilles and on dorsum foot. Hair is also sparse in comparison to calf skin. Being a retrograde flap, on par with any other flap venous congestion is the main constraint. However, this peroneal perforator is accompanied by consistent two venae comitantes, which are the main source of venous drainage. Those flaps which were tunneled subcutaneously under the skin have more edema, might be due to relative compression from the overlying skin. Irrespective of it, post-operative edema was there for first 48 hrs, and had been subside without any intervention. An adequate limb elevation for few days is appropriate enough to manage.

We have limited ourselves to the proximal 4cms point from tip of lateral malleolus. However, if it

would have been extended more distally ligating the cutaneous branch of the peroneal perforator, it is known as 'reverse lateral supra malleolar flap'. The blood supply to this is on anastomotic network in and around ankle, especially over sinus tarsi. In this scenario, flap will reach even to the distal foot, occasionally to the proximal phalanges. But, we have confirmed to proximal to the lateral malleolus and even, by planning in reverse, the island flap is reaching easily to the defect. So no progressive distal dissection was done in our cases. The common peroneal nerve was included in all the cases, to make it as neuro-cutaneous flap, similar to other neuro cutaneous flaps ensuring safe blood supply. We also have noticed that, by including the nerve within the flap, the proximal upper limit of mid leg can be crossed safely if necessary without flap necrosis. However, in original article, author advised to spare common peroneal nerve, as source of blood supply is not from the nerve. It should be included in cases where the neurotisation is planned to achieve sensation at recipient site[5].

We also have noticed one of the major veins of the leg, short saphenous vein is spared by choosing this flap, when compared with either reverse sural or peroneal perforator flaps. This appears to have significance in preventing the distal edema of foot, especially in a traumatic limb, where one or more major veins were compromised. Being technically easy and quick, reliability, single stage procedure made this flap unique and first choice to be considered for all defects in around the ankle.

## CONCLUSION

Island neuro cutaneous lateral supra malleolar flap is a reliable with minimal complications. Prior Doppler study to locate the perforator is not necessary. The peroneal perforator position is very consistent and can be easily identified 4 cms proximal to the tip of lateral malleolus. As an island flap with its long pedicle can reach up to the mid foot comfortably. And as a neuro cutaneous flap, the blood supply is well ensured and proximal upper limit can be extended where ever necessary. Post-operative venous edema which is very common can be easily managed conservatively. Thin skin, sparse hair, sparing short saphenous vein made this flap unique, in choosing as first choice in comparison with reverse sural flap and peroneal perforator flap.

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