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LATERAL SUPRAMALLEOLAR FLAP FOR RECONSTRUCTION OF THE DEFECTS OF DISTAL LEG

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ABSTRACT The aim of this study is to present our experience with and to evaluate the versatility and reliability of the lateral supramalleolar flap that was used in 20 patients for reconstruction of the distal leg and foot defects. There were 12 males and 8 females and age ranged from 31 to 50 years. In all cases bone, joint or Achilles tendon was exposed. The follow-up period ranged from 9 to 17 months postoperatively. In 7 cases, we used the island flap and in 13 cases peninsular flap. 2 flaps developed partial superficial necrosis. After excision of the necrosed part, the soft tissue defect healed spontaneously. In 2 cases, venous congestion was present but resolved. All the patients were able to leave the hospital within a very short period after surgery (4-day average). Lateral supramalleolar flap is a rapid and reliable procedure and provides an excellent alternative to reconstruct soft tissue defects of the lower extremity.

CONCLUSION: Depending on the requirement of reach, the same flap can be raised based on different stations of the main source vessel for the coverage of distal third defects of leg and foot.Lateral supramalleolar flap is a versatile local flap for distal third defects of leg and foot.

KEYWORDS : Lateral supramalleolar flap, Ramus perforans, Island flap, Peninsular flap

INTRODUCTION

Reconstruction of soft tissue defects in ankle and foot is challenging because of lack of muscle tissue cover due to which bony prominences, tendons, nerves and vessels get easily exposed. Use of skin graft to cover these sites is of not possible and even if possible choice, morbidity results due to cover of mobile structures thereby the function is impaired. Hence use of fasciocutaneous flaps to cover these sites brings in a better vascularity to the site and thereby provides a stable cover to the vital structures.

The lateral supramalleolar (LSM) flap was first described in 1988 by Masquelet et al [1].The lateral supramalleolar flaps have been used in the past two decades as fasciocutaneous flaps for reconstruction of ankle and foot defects. Even though free flaps are an option for reconstruction of such defects, availability of lateral supramalleolar flap obviates the need for microvascular surgery.

AIM

The aim of this study is to present our experience with and to evaluate the reliability of the lateral supramalleolar flap that was used in 20 patients for reconstruction of the distal leg and foot defects.

PATIENTS AND METHODS

From November 2017 to March 2019 , Lateral supramalleolar flaps were used to cover ankle, heel and foot defects in 20 patients. In all cases bone, joint, or the Achilles tendon was exposed. The average size of the skin defect was 10 cm^2(range 6 to 16). Of the 20 patients, 12 were males and 8 were females. The age range was 31-50 years.

SURGERY TECHNIQUE

Position - Supine with a sandbag under the ipsilateral buttock. A tourniquet is applied.

Station 1- Planning in reverse done. Upper limit is at middle of leg. Anterior border is just medial to palpable subcutaneous border of tibia. Lateral border extends upto fibula. Skin paddle marked. Superior incision made. Superficial peroneal nerve identified in the anterolateral septum,divided and tagged with skin paddle. Rest of the incision completed.In peninsular flap, subfascially flap is raised till pivot point(1-2cm above tibiofibularsyndesmosis) where subperiosteal dissection done over fibula at lower one third of the leg to safeguard ramus perforans. In island flap, sub dermal flaps are raised preserving adipofascial layer about 2cm on either side of vascular pedicle.In this blood supply to the flap is by anastomosis of ascending branch of ramus perforans with superficial peroneal nerve artery.

In station 2-Same as the above procedure except, incision extended anterior to lateral malleolus till sinus tarsi and Ramus perforans divided. Here blood supply to the flap is from the anastomosis between descending branch of peroneal artery with anterior lateral malleolar artery, branch of anterior tibial artery.

Closure of the wound - suturing the peroneal and extensor muscles together to provide a well-vascularized bed for the graft. A split thickness skin graft is applied.

FIG:1 Case 1 : Dorsum of foot defect (station -2)

FIG:2 Intra operative

FIG:3Case 2 : Heel defect(station 1)

FIG:4 Case 3 : Amputation stump raw area(station1)

FIG:5Case 4: Medial malleolus defect with hardware exposure (Station 1)

FIG:6Case 5 : Medial malleolus defect (station 1)

Peninsular LSMF

FIG:7Case 6:Lateral malleolar defect(station 2)

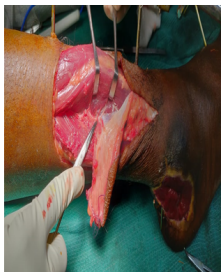


FIG:8 Identification of Ramus perforans

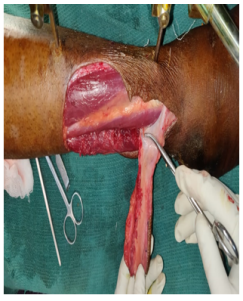


FIG:9 Anterior lateral malleolar artery

FIG:10 Tunelling of flap into defect

FIG:11Flap tunelled to defect

FIG:12 Donor area covered with graft

RESULTS

Lateral supramalleolar flap was used in 20 patients for reconstruction of the distal leg and foot defects.There were 12 males (60%) and 8 (40%) females and age ranged from 31 to 50 years.In all cases bone, joint or Achilles tendon was exposed. The follow-up period ranged from 9 to 17 months postoperatively. In 7 (35%) cases, we used the island flap and in 13 (65%) cases peninsular flap.2(10%) flaps developed partial superficial necrosis. After excision of the necrosed part, the soft tissue defect healed spontaneously. In 2 (10%) cases, venous congestion was present but resolved. All the patients were able to leave the hospital within a very short period after surgery (4-day average).

S.NO	AGE (years)	SEX	AREA OF DEFECT	SIZE OF DEFECT In CM^2	TYPE OF FLAP	VASCULAR SUPPLY STATION	COMPLICATIONS
1.	31	M	DORSUM OF FOOT	8	ISLAND	2	nil
2.	45	F	MEDIAL MALLEOLUS	8	PENINSULAR	1	nil
3.	48	M	DORSUM OF FOOT	6	ISLAND	2	nil
4.	42	M	LATERAL MALLEOLUS	14	PENINSULAR	1	VENOUS CONGESTION
5	52	M	HEEL DEFECT	8	ISLAND	1	nil
6.	44	F	HEEL DEFECT	8	ISLAND	1	nil
7.	38	M	LATERAL MALLEOLUS	16	PENINSULAR	1	PARTIAL NECROSIS
8.	37	F	DORSUM OF FOOT	11	ISLAND	2	nil
9.	41	M	MEDIAL MALLEOLUS	9	PENINSULAR	1	nil
10.	40	F	AMPUTATION STUMP	16	PENINSULAR	1	PARTIAL NECROSIS
11.	48	M	MEDIAL MALLEOLUS	12	PENINSULAR	1	nil
12.	35	F	HEEL DEFECT	16	PENINSULAR	1	nil
13.	37	M	HEEL DEFECT	14	ISLAND	1	nil
14	34	F	LATERAL MALLEOLUS	15	PENINSULAR	1	nil
15	41	M	LATERAL MALLEOLUS	14	PENINSULAR	1	nil
16	45	M	HEEL DEFECT	10	ISLAND	1	nil
17	47	F	DORSUM OF FOOT	14	PENINSULAR	1	nil
18	44	M	MEDIAL MALLEOLUS	12	PENINSULAR	1	VENOUS CONGESTION
19	36	M	LATERAL MALLEOLUS	14	PENINSULAR	1	nil
20	38	F	DORSUM OF FOOT	12	PENINSULAR	1	nil

DISCUSSION

VASCULAR ANATOMY LSMF

Lateral supramalleolar flap is based on the anastomotic arcade of the ankle. Key anatomic vascular structure is the perforating branch of the peroneal artery (Ramus perforans)[2-3]. The peroneal artery lies between Tibialis posterior, the interosseous membrane and flexor hallucis longus muscle in posterior compartment. It enters the anterior compartment of leg by piercing the inter osseous membrane between tibia and fibula 5-7 cm above the ankle joint. At its emergence, the perforating branch of the artery gives a relatively constant skin perforator which divides into two branches superficial or ascending branch and deeper descending branches[5].The superficial cutaneous branch emerges between extensor digitorium longus and peroneus brevis muscle runs superficially and anastomose with the vascular network that accompanies Superficial peroneal nerve (Superficial peroneal nerve Artery–Anterior tibial a tery). Descending branch runs distally in the loose areolar tissue under the deep fascia running over the bones of the tarsus. It anastomoses widely with other vessels principally branches of anterior tibial and dorsalis pedis arteries but also with terminal part of peroneal artery. Based on blood supply of flap it is divided into 3 stations. Skin paddle is same.

STATION 1

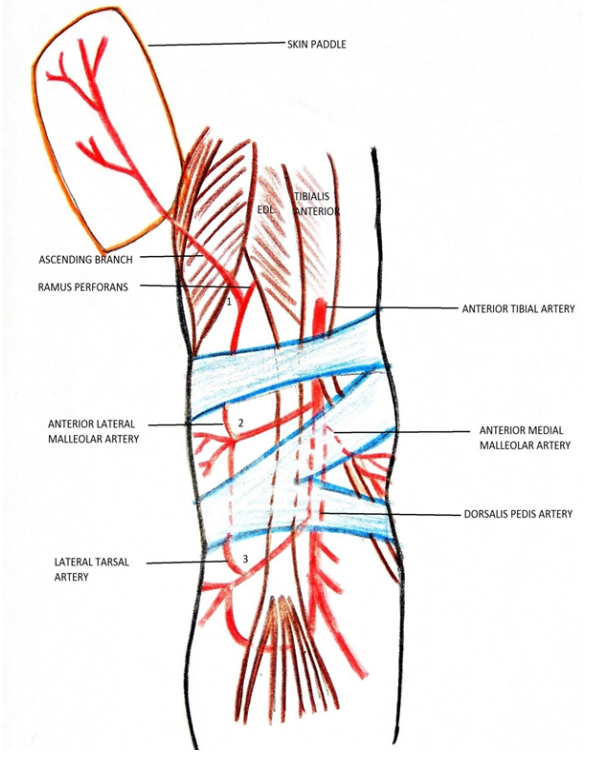
- Ramus perforans –branch of Peroneal artery
- Lies just above tibio fibular syndesmosis.
- When raised based on first station it can cover defects over medial malleolus, lateral malleolus, Posterior heel, Lisfranc and Chopart's amputation.

STATION 2

- Anterior lateral malleolar artery –branch of Anterior tibial artery
- When raised at this level it is based on anastomosis of anterior lateral malleolar artery, branch of anterior tibial artery with descending branch of ramus perforans.
- When raised at this station it can cover defects of tarso metatarsal amputation defects.

STATION 3

- Lateral tarsal artery – branch of Dorsalis Pedis artery
- Lies at the level of Sinus tarsi.
- When raised at this station it can cover defects over base of toes.



MODIFICATION OF PENINSULAR LATERAL SUPRA MALLEOLAR FLAP

ISLAND FLAP

The skin paddle is designed at the middle of the leg. Subdermal dissection allows raising a subcutaneous fascial pedicle.Skin flaps are elevated on either side to delimit the subcutaneous fascial pedicle. Pedicle length can be increased by dividing the vascular pedicle beyond the emergence of the ramus perforans.Vascular pedicle of length upto 15cm can be obtained.

Since the first description of the fasciocutaneous flap by Ponten in 1981, several flaps have been described to cover skin and soft tissue defects of the lower third of the leg and foot.

Some local flaps require the sacrifice of a main artery of the foot e.g. Dorsalis pedis flap (MacGraw and Furlow, 1975),Anterior tibial flap (Wee, 1986) and Peroneal island flap (Yoshimura et ***al.,*** 1986).

The main advantages of islanded lateral supramalleolar flap

1) The length of the fascial-subcutaneous vascular pedicle allows cover of very distal defects on the foot.
2) It is not necessary to sacrifice intervening healthy skin as this is islanded flap.
3) The reliability of this island flap allows one to use small flaps to cover small defects of the lower third of the leg.
4) The donor site has a muscular bed and is reliably resurfaced with a skin graft.

The main disadvantage of lateral supramalleolar flap is venous congestion.[6]It has been studied that the main mechanism of venous return in reverse flow flaps is valvular incompetency rather than veno-venous connections.[7-9]

We have not encountered significant venous congestion with this fasciocutaneous flap.

Resection of the superficial peroneal nerve can cause painful neuroma [7]and anesthesia over the dorsum of the foot, although these have been well tolerated. Burying the proximal cut section of this nerve in muscle prevents the occurrence of a painful neuroma.

CONCLUSION

Depending on the requirement of reach, the same flap can be raised based on different stations of the main source vessel for the coverage of distal third defects of leg and foot. Lateralsupramalleolar flap is a versatile local flap for distal third defects of leg and foot.

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