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A clinical study of reverse sural artery flap cover for compound wounds of lower third of leg and foot.

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Abstract:

Background*: Compound wound management around the lower-third of the leg, and foot is a challenge faced by a majority of surgeons. There are many possibilities for coverage of defects in these regions such as skin graft, reverse muscle flap with skin graft, reverse fascial or adipofascial flap with skin graft, reversed flaps using a major artery and cross leg flap.*

Methods: *Prospective study was carried out at our institute, compiling data for 02 years. A total of 20 patients with compound defect over the lower third of leg and foot were included in this study. Patients with diabetic ulcers, venous ulcers and neuropathic and trophic ulcers were excluded from our study.*

Results: *We performed fasciocutaneous reverse sural artery flap in 20 patients, out of which 08 were used for reconstruction of lower third leg defects, 09 for foot defects and 03 for heel defects. Six patients underwent prior flap delay as the flap dimensions mandated extension into the upper third of leg. Our largest flap dimensions were 10 x 20 cm for a lower third leg defect.*

Conclusion: *Distally based reverse sural artery flap is a reliable method for soft tissue defects in lower third of leg and foot. The advantage of this flap is that it is easy and fast to execute with reliable blood supply and without any injury to major arteries. This flap can be used where microsurgical reconstruction is not feasible.*

Keywords: *Reverse sural artery flap; lower third leg defects; fasciocutaneous flap; ischemic preconditioning; vascular delay; delay phenomenon.*

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I. Introduction

Compound wound management around the lower-third of the leg, and foot is a challenge faced by a majority of surgeons. Problems in reconstruction of lower third of leg defects include poor vascularity and limited mobility of skin. Most desired option for covering such defects would be a durable flap with reliable vascularity, good skin texture, good arc of rotation and ease of dissection with minimum donor site morbidity [1].

There are many possibilities for coverage of defects in these regions such as skin graft, reverse muscle flap with skin graft, reverse fascial or adipofascial flap with skin graft, reversed flaps using a major artery and cross leg flap.

Locoregional flaps for lower leg defects based on anterior tibial artery, peroneal artery and posterior tibial artery have disadvantage of sacrificing a major artery [2, 3, 4].

Coverage of wounds of the lower one third of the leg are usually best treated using microvascular free tissue transfer, but the availability and facility might not be widely available. In comparison to more demanding microsurgical free flaps, a common practice used for similar indications, the reverse sural artery flap bears several advantages, including low donor site morbidity and a shorter operative duration.

The reverse sural artery flap is a safe to perform technique to cover soft tissue defects of the lower leg [5, 6, 7, 8].

The reverse superficial sural artery flap is a distally based fasciocutaneous or adipofascial flap. It was first described by Donski and Fogdestam[9] and later championed by Masquelet et al [10].

Over the past decade several modifications have been reported to improve flap viability in order to decrease complications and increase the viability of the flap, this study is being performed to study the viability of the flap with varying dimensions and to study their outcome.

II. Materials And Methods

The study was conducted in the Department of Plastic & Reconstructive Surgery at a tertiary care centre from September 2019 to September 2021.
A total of 20 patients were included in this study.
This is a clinical, prospective and observational study conducted over a period of 02 years.

Inclusion criteria:
Patient with compound defects in the lower third of leg, and foot due to road traffic accidents, assault, chronic osteomyelitis and electric burns admitted in the Department of Plastic & Reconstructive Surgery, Gandhi Medical College, during the study period.

Exclusion criteria:
- Patients with diabetic ulcers,
- Patients with venous ulcers,
- Patient with neuropathic ulcers,
- Patients with trophic ulcers.

Operative technique:
- All patients underwent lower limb fracture fixation prior to flap surgery.
- Surgeries were performed under spinal anaesthesia.
- All defects were thoroughly debrided and washed.
- Defect size measured.
- Peroneal perforators were marked (midpoint between the tip of lateral malleolus and TendoAchille's tendon).
- Flap markings done by planning in reverse.
- Flap was raised from proximal to distal.
- Deep fascia elevated and included within the flap.
- Short saphenous vein and sural nerve identified between the two heads of gastrocnemius muscle and were ligated and included within the flap.
- Flap raised until the pivot point.
- Inset given over the defect with Proline 3-0.
- Split thickness skin grafting harvested from thigh of the opposite limb.
- Flap donor site covered with split thickness skin grafting and secured.
- Bolster dressing done over flap donor site.
- Undersurface of flap covered with skin graft to avoid contracture.
- Aseptic dressing done.
- Three weeks post operatively, delay procedure was performed.
- One week following delay, division and inset was performed.

III. Results

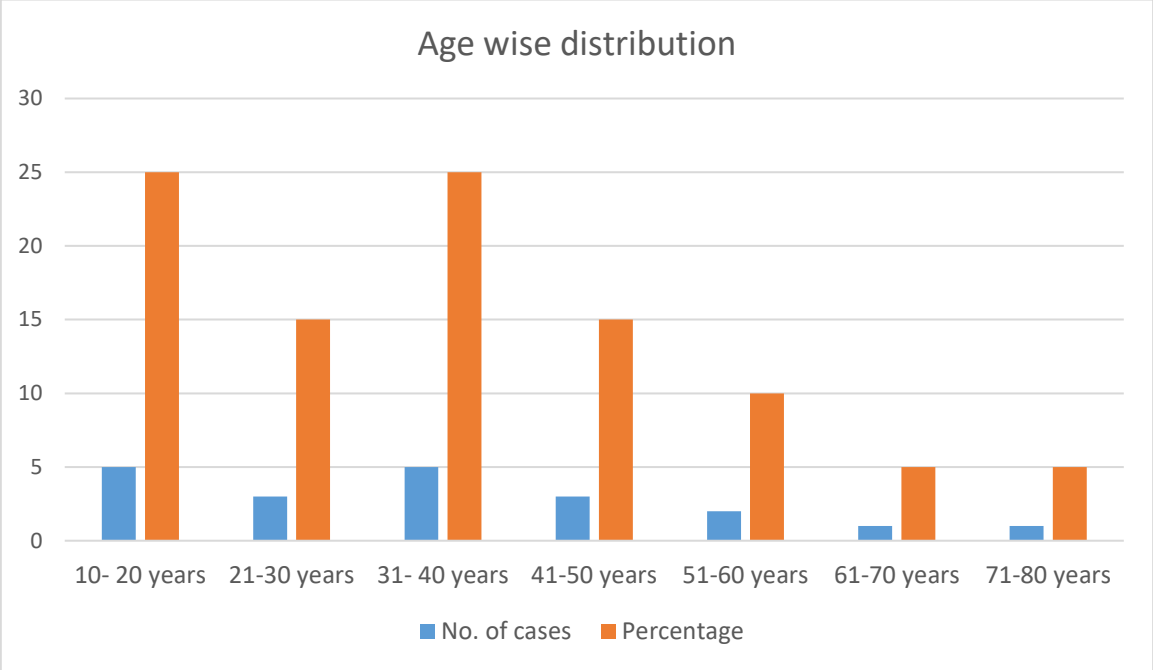
In this study a total of 20 patients were studied.

To avoid study bias, we have analyzed all the cases based on specific site of injury (foot; heel; ankle; distal/ proximal leg) or localization of the defect, incidence of complications and detail of complications, and flap survival rate. The following variables were also documented for each patient: age, gender, and indication for reconstruction.

Table 1 - Age incidence

Age group	Reverse Sural Artery Flap	
	No. of cases	Percentage
10 - 20 years	5	25%
21 - 30 years	3	15%
31 - 40 years	5	25%
41 - 50 years	3	15%
51 - 60 years	2	10%
61 - 70 years	1	5%
71 - 80 years	1	5%

Figure 1 – Age wise distribution of patients

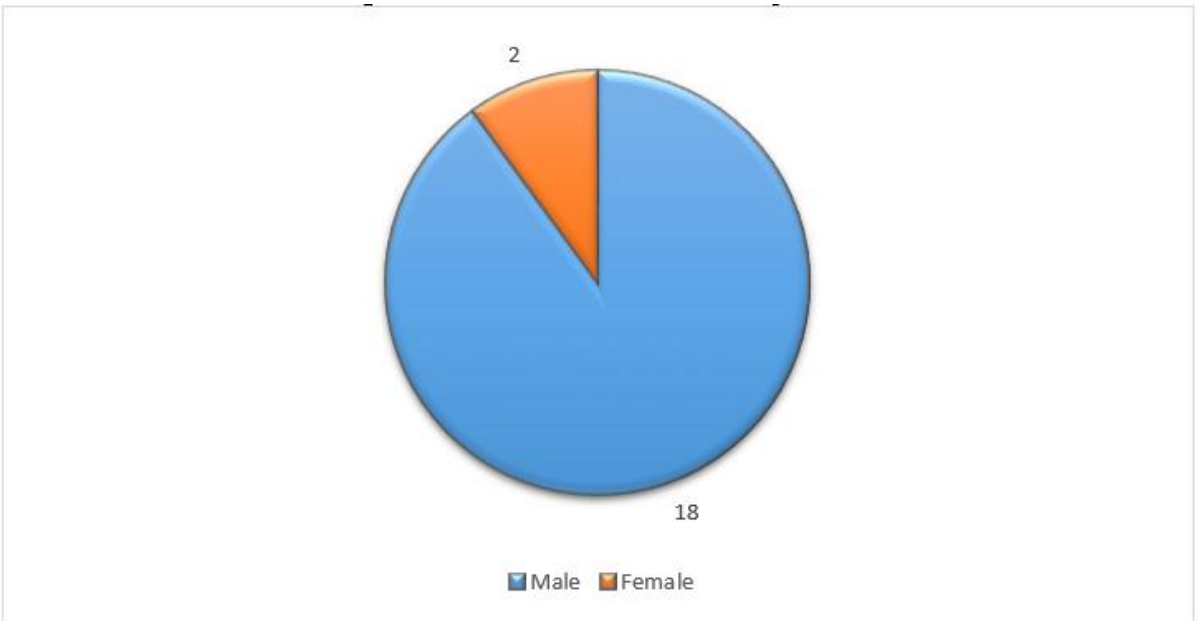


In this study of 20 patients, 13% were in the age group of 10 to 40 years.

Table 2 - Gender wise distribution

	Number	Percentage
Male	18	90%
Female	2	10%
Total	20	100%

Figure 2 – Gender wise distribution of patients

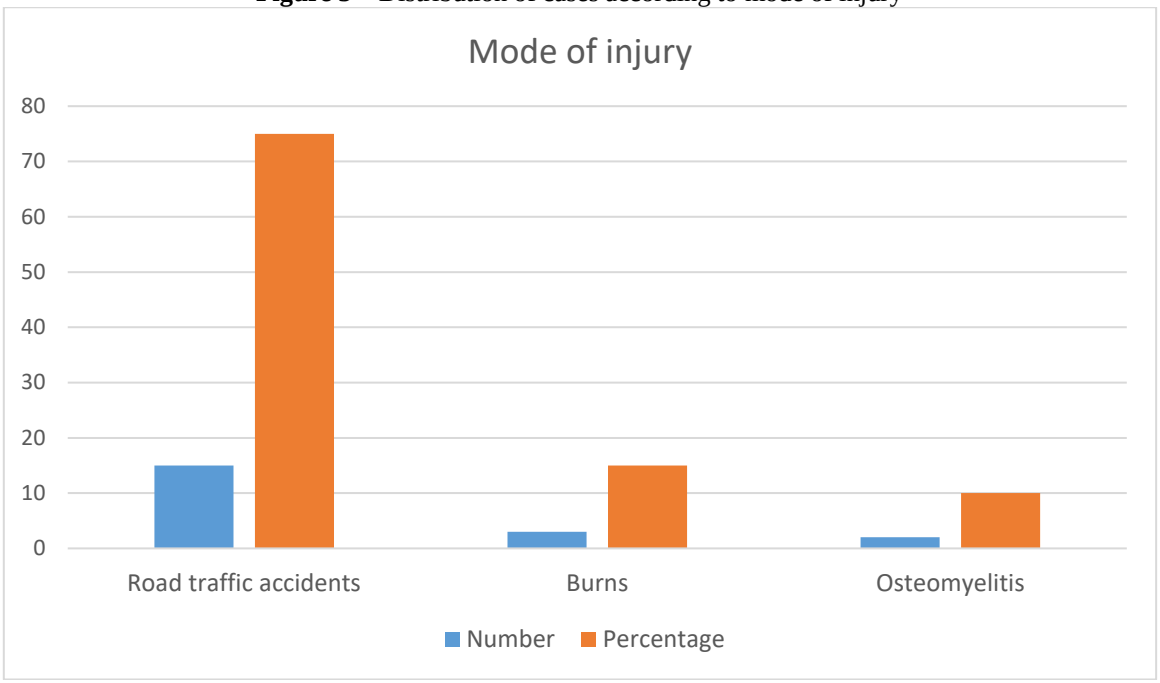


In this study, 18 out of 20 patients were male patients which shows male predominance.

Table 3 - Mode of injury

AETIOLOGY	NUMBER	PERCENTAGE
Road traffic accidents	15	75%
Burns	3	15%
Osteomyelitis	2	10%

Figure 3 – Distribution of cases according to mode of injury

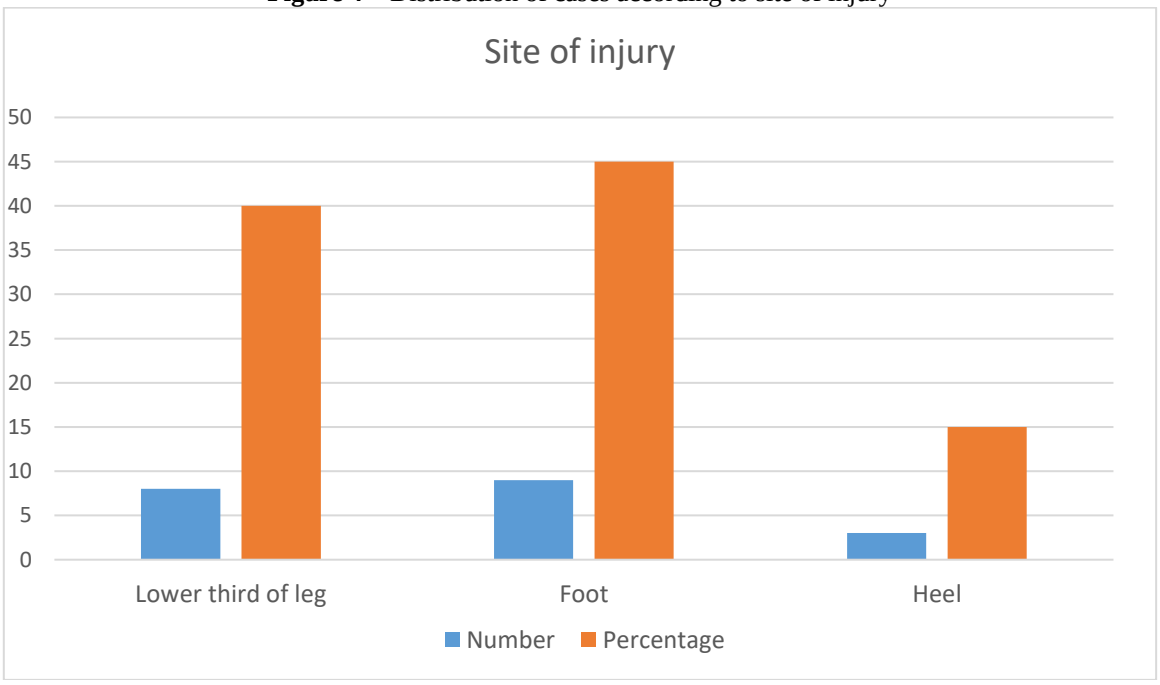


In this study, majority of the patients had leg defects due to road traffic accidents i.e. 75%. Fifteen percent patients were due to electric burns and ten percent patients were of osteomyelitis.

Table 4 - Site of injury

Area	Number	Percentage
Lower third of leg	8	40%
Foot	9	45%
Heel	3	15%

Figure 4 – Distribution of cases according to site of injury



We have used reverse sural artery flap for mostly foot defects (45%) and for lower third of leg defects (40%).

Table 5 - Site of perforators

Perforator (Peroneal artery perforators)	Number of flaps
5 cm	11
7 cm	7
9 cm	2

Figure 5 –Distribution of flaps according to the site of perforators

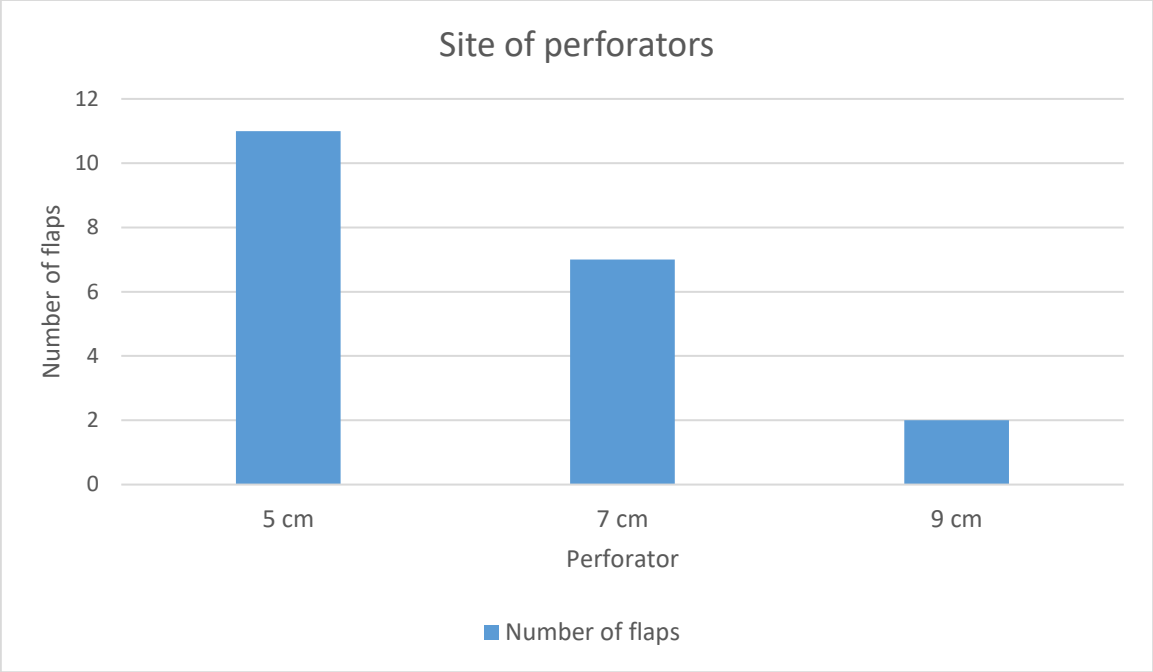


Table 6 - Cases which underwent prior delay

Number of delays	Number of patients
1 (Primary delay)	4
2 (Secondary delay)	2

Figure 6 – Cases which underwent prior delay

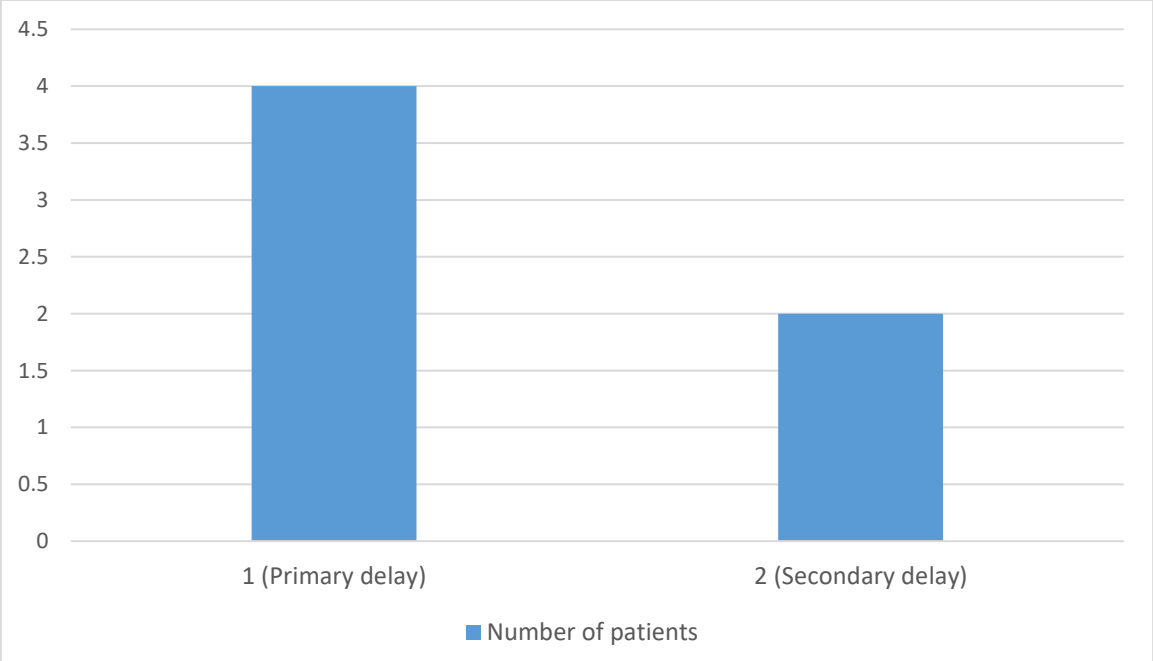


Table 7 - Time interval between procedures

Procedure	Timing
Time between primary delay and flap harvest	3 weeks
Time between primary delay and secondary delay	2 weeks
Time between secondary delay and flap harvest	2 weeks

Table 8 - Flap dimensions

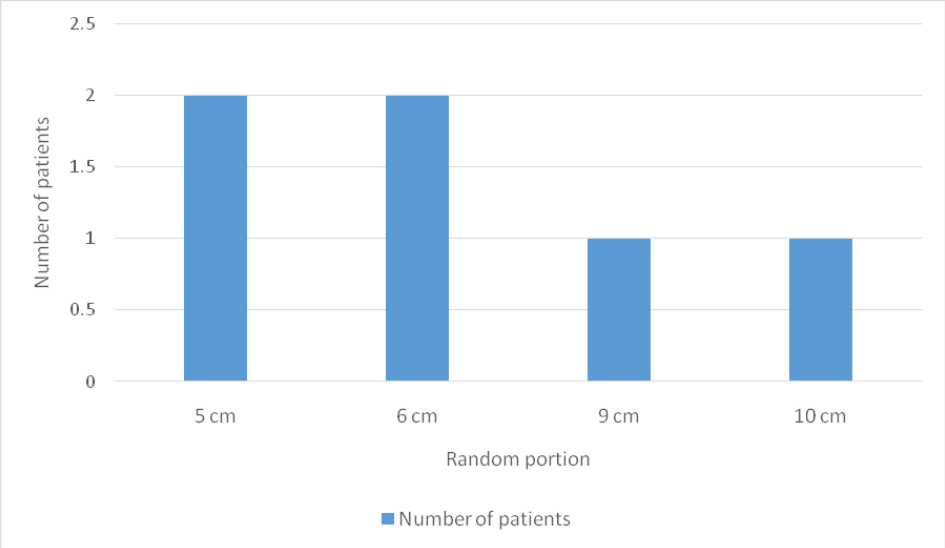
S.No.	Flap dimensions (excluding the pedicle) in centimeters (cm)
1.	5 x 18 cm
2.	7 x 15 cm
3.	6 x 18 cm
4.	10 x 14 cm
5.	9 x 16 cm
6.	6 x 18 cm
7.	8 x 14 cm
8.	10 x 17 cm
9.	6 x 15 cm
10.	8 x 15 cm
11.	10 x 20 cm
12.	10 x 15 cm
13.	12 x 15 cm
14.	10 x 19 cm
15.	8 x 15 cm
16.	9 x 18 cm
17.	7 x 16 cm
18.	6 x 18 cm
19.	8 x 16 cm
20.	6 x 18 cm

In this study, the maximum flap dimension was observed to 10 x 20 cm. The average width of the flap was 8.05 cm and average length of the flap was 16.35 cm.

Table 9 - Delay dimensions

Random portion	Number of patients
5 x 5 cm	2
6 x 6 cm	2
9 x 9 cm	1
10 x 10 cm	1

Figure 7 – Distribution of flaps with delay dimensions

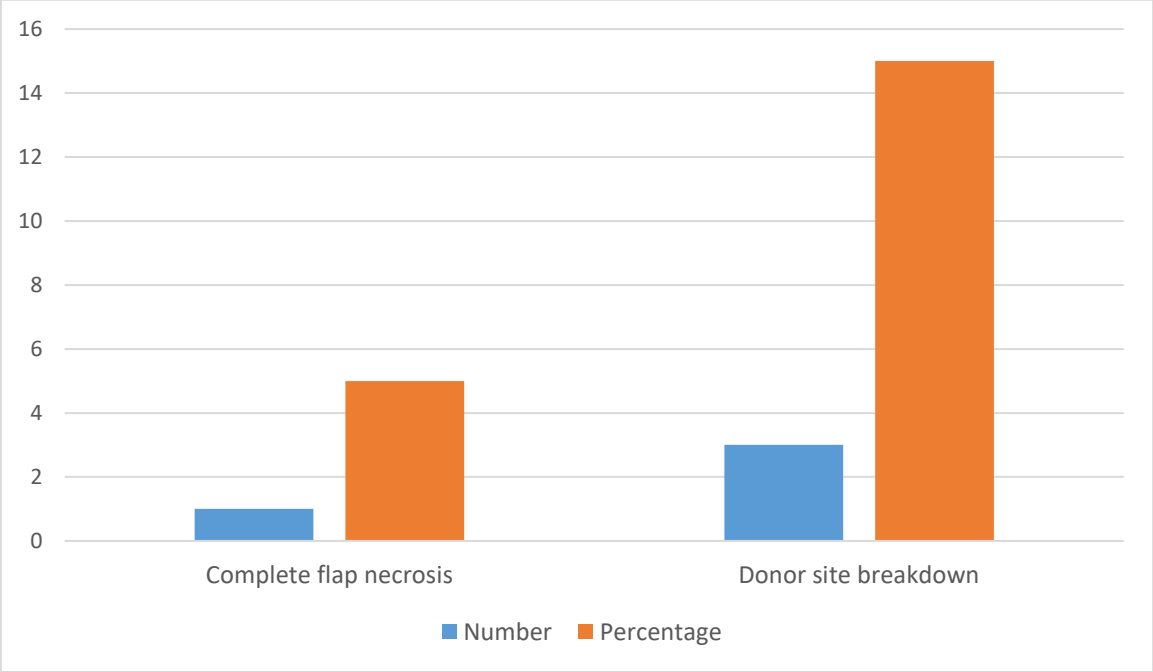


Dimension of the flaps extending into the upper third of the leg and the number of patients with the same random portion.

Table 10 - Complications

Complications	Reverse Sural Artery flap	
	Number	Percentage
Complete flap necrosis	1	5
Donor site graft loss	3	15

Figure 8 – Complications seen in the study



Only one major complication in the form of flap failure was seen in one patient due to non-compliance of patient in the post-operative period. All the three cases of donor site breakdown were seen in electric burns cases.

We also saw four cases with mild venous congestion which was not significant and subsided with proper post-operative care within two to three days.

IV. Discussion

Demographics

In this study, the mean age of the patients was 36.45 years. In a study of 36 patients conducted by Jorge Reis et al, the mean age of the patients was 39.7 years [11]. In a study of 20 patients conducted by Morimasa Hasegawa et al, the mean age was 46.8 years [12].

In this study, the youngest patient operated was 15 years old and the oldest patient was 74 years old. In a study conducted by RL Huisinga et al, the youngest patient was 4 years old child [13]. In a study conducted by Marcelo Figueiredo Almeida et al, the oldest patient operated was 92 years old [14].

In this study, male predominance was noted with 18 male patients and 02 female patients. Similarly, most of the studies in literature show similar demographics.

Aetiology

In this study, trauma was the commonest cause of compound defects with road traffic accidents accounting for 15 (75%) cases. In a study conducted by Marcelo Figueiredo Almeida et al, 40 out of 71 patients were of road traffic accidents [14]. In a study conducted by Antonio Costa Ferreira et al, 21 out of 36 patients were trauma cases [11].

In this study, electric burns was one of the causes of compound defect in the lower third of leg and foot and accounted for 03 (15%) cases. Similar observation was made by Mustafa Yilmaz et al, where electric burns was the cause in 15 % cases [15]. In a study conducted by Marcelo Figueiredo Almeida et al, only 01 out of 71 patients had compound defect following burns injury [14].

Site of injury

In this study, reconstruction with reverse sural artery flap was done for compound defect over dorsum of foot in 09 (45%) cases, followed by lower third of leg in 8 (40%) cases and heel in 03 (15%) cases. In a study conducted by Antonio Costa Ferreira et al, posterior surface of heel was operated in 11 patients, distal third of leg in 10 patients and dorsum of foot in 5 patients [11]. In a study conducted by Marco Fraccalvieri et al , defects over the heel with exposed Achilles' tendon was covered in 08 patients, lateral malleoli was covered in 03 patients, heel defect was managed with reverse sural artery flap in 02 patients and defect over anterior tibial region was managed with reverse sural artery flap in 01 patient [16].

Flap dimensions

In this study, we harvested flaps with width ranging from 5 cm to 10 cm with a mean width of 8.05 cm and length ranging from 15 cm to 20 cm with mean length of 16.35 cm. Our results are comparable with a study conducted by BelalA Al Mobarak et al, who studied the role of reverse sural artery flap in reconstruction of lower third of leg, ankle and foot defects. In their study, the flap dimensions were similar with length ranging from 10 cm to 20 cm with mean length of 15 cm and width ranging from 05 to 10 cm with mean width of 7.5 cm [17].

It is uncertain as to how large a flap can be elevated successfully. In this study, largest flap dimensions were 10 x 20 cm for a lower third leg defect. Also, 06 patients in this study underwent flap delay as the distal margin was extending in the upper third of leg during planning in reverse.

In a study conducted by Shuhei Torii et al, largest flap size of island RSA was 10 (width) x 13 (length) cm [12].
In a study conducted by M Darweesh et al [18], the flap size varied from 3 x 4 cm to 20 x 8 cm. The size of the flap varied from 3 x 3 cm to 9 x 12 cm in a study conducted by Jorge Reis et al [11]. In a study conducted by Fu-Chan Wei et al [19], the size of the flap varied from 6 x 8 cm to 14 x 8 cm. In a study conducted by Mustafa Yilmaz et al, the largest flap which was used measured 15 (length) x 12 (width) cm [15].
In a study conducted by Paulo Roberto da Costa et al, the largest pedicle was 21 cm [14].
In a study conducted by Marco Fraccalvieri et al, the defect size was from 4 x 2 cm to 11 x 10 cm [16].

Ayyappan and Chadha reported that sural flaps with an area of 338 cm^2 and the superior margin extending to the distal side of the popliteal crease could be safely removed. They named this flap as the super sural neurofasciocutaneous flap [20].
In this study, we had 02 flaps that almost reached the popliteal crease which were used to cover defects over the heel and dorsum of foot. Both these flaps behaved well with minimal complications.

Flap harvest

In this study, we have included the short saphenous vein, the sural nerve and the deep fascia in all 20 cases.
In a study conducted by Jeffrey Scott Isenberg et al, inclusion of the deep fascia and the sural nerve greatly increased the flap perfusion and reduced the operative time [21]. Attempt at mobilizing the flap without the sural nerve is not advised, as it can lead to less perfused flap and can also make the dissection tedious.
According to Carlos Pinho et al, raising the flap without the sural nerve is too risky for the vascular supply of the flap and is not necessary [11].
In the study conducted by Jorge Reis et al [11], during a follow up of one year after flap harvest, there was no patient with significant alteration in foot sensation which is the same observation in this study.

Delay procedure

In this study, 06 patients underwent prior delay procedure, out of which 04 patients underwent primary delay and 02 patients underwent secondary delay. We observed that, prior delay procedure increased the vascularity of the flap and prevented complications in large dimensional flaps which extended in the proximal third of the leg.

Akyurek et al in his study demonstrated that the flap vascularity was increased with delay procedure [22]. Kneser et al managed to safely harvest flaps of up to 19 x 12 cm with delay procedure [23]. Parrett et al recommended the delay procedure in patients with obesity, smoking, peripheral vascular disease and advanced age in which the flap complications are more likely [24]. Tosun et al also suggested that flap vascularity would be achieved by implementing delay procedure [25].

In this study, 06 patients had flap dimensions extending in the proximal third of the leg with a maximum random portion of 10 x 10 cm. Wei et al summarized the risk factors in sural flap application based on their study of 179 cases. As per the authors, the upper edge of the flap located in the proximal 1/9 of the cruris, the transverse ratio of the flap length of 5:1 or above and the width of 8 cm or above are significant risk

factors [26]. Al-Qattan claimed that the flap could be raised safely 2 to 3 cm below the popliteal crease by including a muscle tissue [27].
In this study, we had 06 flaps which were in the ratio of 5:1, out of which 02 flaps were supercharged that almost reached the popliteal crease and were used to cover the defects over the heel and dorsum of foot and had minimal complications.

Duration of surgery
The average time for flap harvest in our study was 1 to 1.5 hours and total time of surgery was between 2.5 to 3 hours, which is comparable to study conducted by BelalA Al Mobarak et al [17]. In their study, the duration of surgery ranged from 2 to 3 hours and flap harvest between 1 to 1.5 hours.

Donor site management
In this study, donor site was grafted in all of the 20 cases and primary closure was not attempted as the smallest flap width was 05 cm.
In a study conducted by Jorge Reis et al [11], it has been observed that the donor site defect can be closed directly when the flap is less than 4 cm wide. In a study conducted by Marco Fraccalvieri et al [16], the donor site defect was closed directly in 4 patients in whom the maximum width of donor site was 3 cm to 4 cm and by split skin grafting in remaining 14 patients.
According to RL Huisinga et al [13], donor defect of up to 6 cm can be closed directly, otherwise a split skin graft is used.
In a study conducted by Seng Feng Jeng et al, the donor sites were closed directly in 15 patients and in 5 patients, the donor sites were resurfaced by skin grafting [28].
In a study conducted by Mustafa Yilmaz et al, primary closure of donor sites was done in 10 cases and skin grafting was done in 7 cases [15].

Complications
In this study, the major complications observed were complete flap necrosis (01 case/ 05%) and flap donor site graft loss (03 cases/ 15%). In a study conducted by Marcelo Figueiredo Almeida et al [14], total necrosis was seen in 03 (4.2%) cases. In a study conducted by RL Huisinga et al [13], 01 out of 14 patients had complete flap failure (7.1%). In a study conducted by N Rajacic et al [18], 01 out of 21 patients had complete flap failure (4.7%).

In this study, donor site graft loss was seen in 03 cases, which occurred in patients with electric burns. Donor site breakdown could possibly be due to poor blood supply of donor site in electric burns cases. In a study conducted by Antonio Costa Ferreira et al [11], donor site breakdown was observed in 01 case. Marco Fraccalvieri et al [16] observed delayed recovery over the grafted donor site in 03 patients. Seng Feng Jeng et al [28] observed donor site skin graft loss in 01 case.
We also observed minor complications such as venous congestion (04 cases) which shows incremental improvement. Also observed was flap distal marginal necrosis (04 cases), which was managed by proper positioning, serial debridement and flap reinset.

In a study conducted by Marcelo Figueiredo Almeida et al [14], partial flap necrosis was observed in 15 (22.1%) cases, venous congestion in 17 (23.9%) cases. Five cases of partial flap necrosis were observed in a study conducted by Antonio Costa Ferreira et al [11].
Morimasa Hasegawa et al conducted a study of 21 patients, in which most of the flaps showed slight venous congestion which normalized in few days. In the same study, distal tip necrosis was mentioned in 01 patient [12].
RL Huisinga et al conducted a study of 14 flap cases, 12 survived completely and 02 flaps showed partial necrosis. In the same study venous congestion was seen in 01 case which was successfully treated with leeches [13].
Seng Feng Jeng et al conducted a study in which 01 flap developed distal marginal necrosis which was managed by skin grafting. One patient developed post-operative infection, which was managed by oral antibiotics [28].
Fu-Chan Wei et al [19] conducted at study in which 07 flaps out of 08 cases survived completely and 01 patient developed distal necrosis which was managed by debridement and surgical revision.
In a study conducted by M Darweesh et al, 02 out of 21 patients had distal flap necrosis not extending to fascia [18].
Careful positioning in post-operative period is important in preventing flap necrosis to avoid pressure over the flap or the pedicle.

V. ILLUSTRATIVE CASES

Figure 9 – Post traumatic compound defect over the heel.

Figure 10 – Preoperative markings of reverse sural artery flap for compound defect over heel.

Figure 11 – Inset given over the heel and split thickness skin graft spread over the donor site.

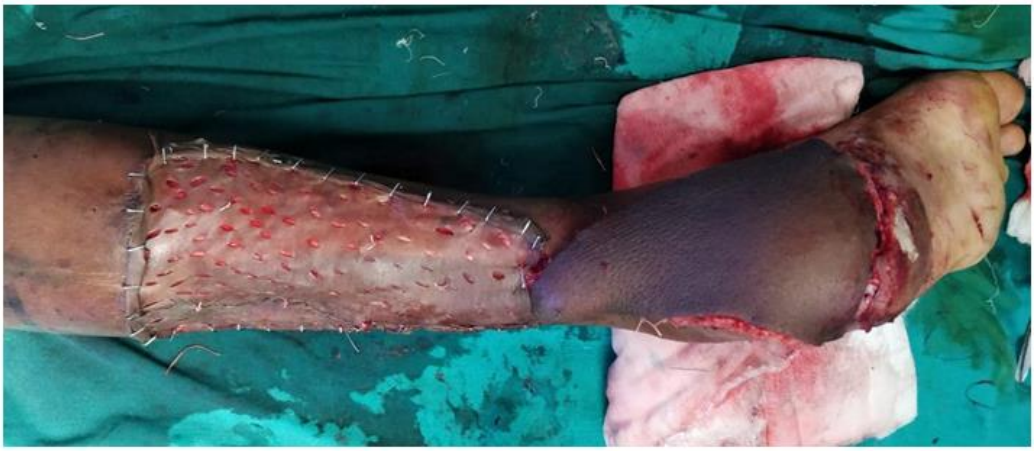


Figure 12 – Compound defect present over the lower third – middle third junction of leg.

Figure 13 – Compound defect showing the exposed bone over the lower third of leg.

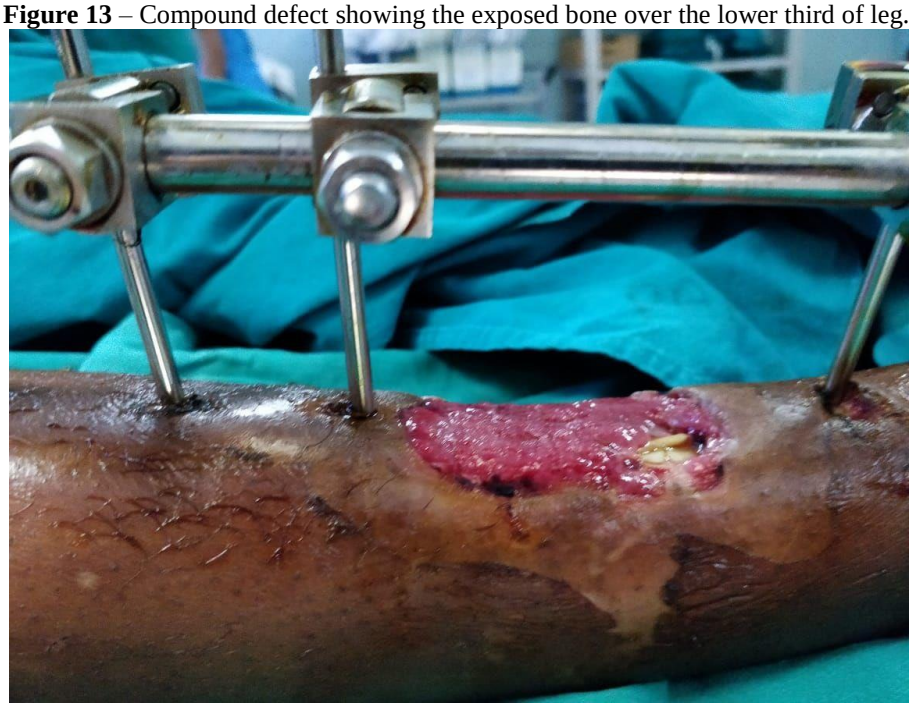


Figure 14 – Flap inset given for compound defect over lower third – middle third junction of leg.

Figure 15 – Compound defect over the lower third of leg with exposed tibia.

Figure 16 – Flap inset given for defect and split thickness skin graft over donor site.

Figure 17 – Prior delay done for flap dimensions extending up to the popliteal crease for a defect over the foot extending up to the metatarsophalangeal joint of little toe.

Figure 18 – Sural nerve is identified in a case of prior delay.

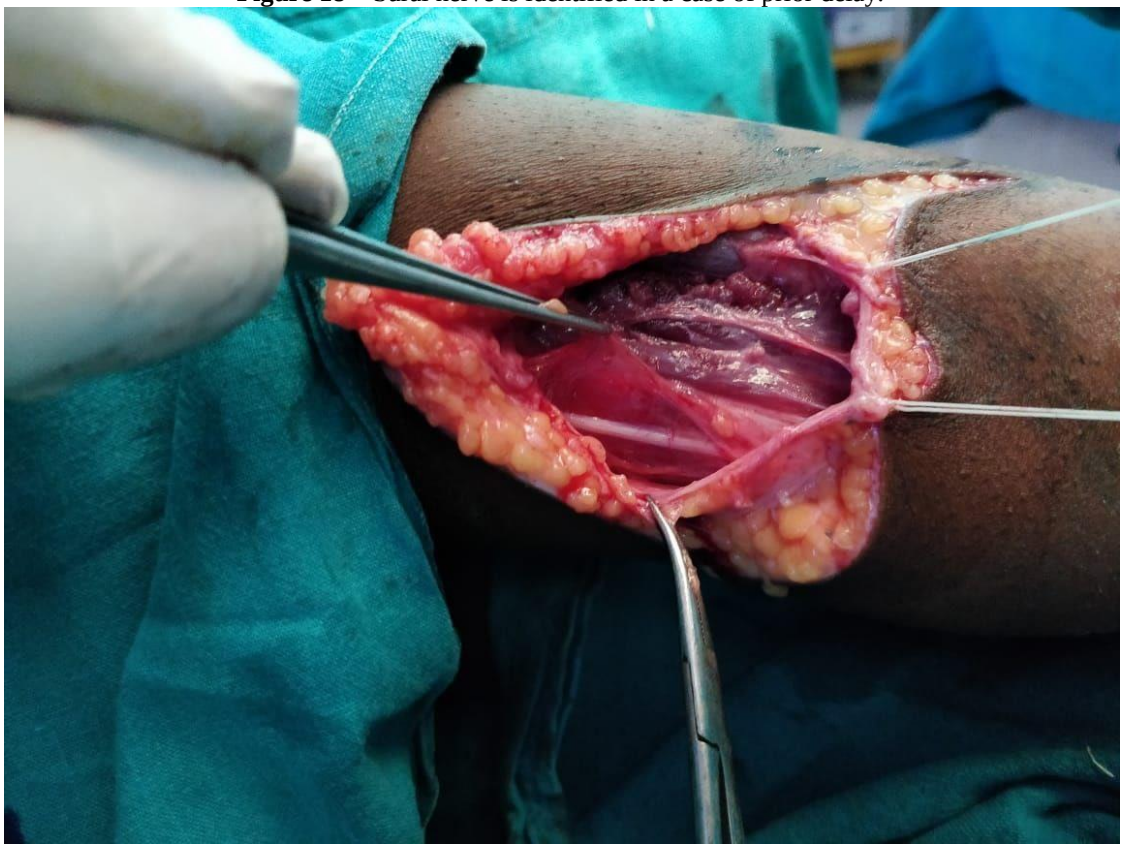


Figure 19 – Flap inset given for compound defect over foot with prior delay.

VI. Conclusion

Distally based reverse sural artery flap is a reliable flap for grade II-b compound defects in lower third of leg and foot.

The advantage of this flap is that it is easy and fast to execute with reliable blood supply and without any injury to major arteries.

The reverse sural artery flap has the widest arc of rotation as compared to other flaps in the region of lower leg.

The reverse sural artery flap can cover defects extending up to the heel.

Complications such has marginal ischaemia and partial necrosis may occur in some cases, but can be prevented by a wider flap base and proper post-operative positioning. In some cases, minimal surgical debridement may also be needed.

Patient compliance is very important in the post-operative period. Patient should be explained regarding procedure, post-operative positioning and the staged nature of the procedure.

The portion of flap extending in the upper third of leg behave as random portion and has higher chances of marginal necrosis. In such cases, prior delay of the flap may have an added advantage, in improving the survival of flap. In this study, we had 07 flaps in which the flap dimension extended beyond the safe limit in the upper third of the leg, out of which 02 flaps extended almost up to the popliteal crease. These flaps were used for defects over the heel and dorsum of foot. These flaps survived well with minimal complications and without any flap loss.

Flap dissection for sural artery flap is not very difficult and the advantages of this flap outweigh its complications.

Though, some authors have advocated to raise the sural artery flap without the sural nerve. We do not recommend the same. We included the sural nerve in all our flaps and it is observed that the vascular structures being in close proximity to the nerve leads to tedious dissection and flap necrosis. We advocate the inclusion of deep fascia and the sural nerve while raising the flap which helps in preventing complications.

In lower third leg and heel defects, usually free flap is the go to option. But in tertiary care hospitals where infrastructure and resources are limited, reverse sural artery flap can not only be opted as a replacement for free tissue transfer and can be a flap of first line of management.

References

[1]. Jainath R, Manjunath P, Ramesha KT, Shankarappa M, Segu S, Biradar A. Study of various modifications of reverse sural artery flap. Journal of Evolution of Medical and Dental Sciences 2013; Vol. 2, Issue 44, November 04; Page: 8540-8546.

[2]. Wee JT. Reconstruction of the lower leg and foot with the reverse-pedicled anterior tibial flap: preliminary report of a new fasciocutaneous flap.Br J Plast Surg. 1986 Jul;39(3):327-37. PMID: 3730678.

[3]. Liu K, Li Z, Lin Y, et al. The reverse-flow posterior tibial artery island flap: anatomic study and 72 clinical cases. PlastReconstr Surg. 1990 Aug;86(2):312-6; discussion 317-8.PMID: 2367580.

[4]. Yoshimura M, Imura S, Shimamura K, et al.Peroneal flap for reconstruction in the extremity: preliminary report.PlastReconstr Surg. 1984 Sep;74(3):402-9.PMID: 6382371.

[5]. DonskiPK ,Fogdestam I. Distally based fasciocutaneous flap from the sural region. A preliminary report.Scand J PlastReconstr Surg. 1983;17(3):191-6. PMID: 6673085.

[6]. Le HuecJC ,Calteux N , Chauveaux D , et al. [The distally based sural fascio-cutaneous flap. A new technic for the coverage of loss of substance of the lower leg].J Chir (Paris). 1987 Apr;124(4):276-80. PMID: 3584290.

[7]. MasqueletAC ,Romana MC , Wolf G. Skin island flaps supplied by the vascular axis of the sensitive superficial nerves: anatomic study and clinical experience in the leg. PlastReconstr Surg. 1992 Jun;89(6):1115-21. PMID: 1584872.

[8]. Hasegawa M , Torii S , Katoh H , Esaki S. The distally based superficial sural artery flap. PlastReconstr Surg. 1994 Apr;93(5):1012-20.PMID: 8134458.

[9]. Donski PK, Fogdestam I. Distally based fasciocutaneous flap from the sural region. A preliminary report. Scand J PlastReconstr Surg. 1983;17(3):191-6.PMID: 6673085.

[10]. Masquelet AC, Romana MC, Wolf G. Skin island flaps supplied by the vascular axis of the sensitive superficial nerves: anatomic study and clinical experience in the leg. PlastReconstr Surg. 1992 Jun;89(6):1115-21. PMID: 1584872.

[11]. Costa-Ferreira A, Reis J, Pinho C, Martins A, Amarante J. The distally based island superficial sural artery flap: clinical experience with 36 flaps.AnnPlast Surg. 2001 Mar;46(3):308-13. PMID: 11293525.

[12]. Hasegawa M, Torii S, Katoh H, Esaki S. The distally based superficial sural artery flap.PlastReconstr Surg. 1994 Apr;93(5):1012-20. PMID: 8134458.

[13]. Huisinga RL, Houpt P, Dijkstra R, Storm van Leeuwen JB. The distally based sural artery flap. Ann Plast Surg. 1998 Jul;41(1):58-65. PMID: 9678470.

[14]. Almeida MF, da Costa PR, Okawa RY. Reverse-flow island sural flap.PlastReconstr Surg. 2002 Feb;109(2):583-91. PMID: 11818840.

[15]. Yilmaz M, Karatas O, Barutcu A. The distally based superficial sural artery island flap: clinical experiences and modifications. PlastReconstr Surg. 1998 Dec;102(7):2358-67.PMID: 9858170.

[16]. Fraccalvieri M, Verna G, Dolcet M, Fava R, Rivarossa A, et al. The distally based superficial sural flap: our experience in reconstructing the lower leg and foot. Ann Plast Surg. 2000 Aug;45(2):132-9. PMID: 10949339.

[17]. Mohamed MEM, Al Mobarak BA. Role of Reversed Sural Artery Flap in Reconstruction of Lower Third of the Leg, Ankle and Foot Defects. Modern Plastic Surgery. 2018 July; 8 (3):50-59. doi: 10.4236/mps.2018.83007.

[18]. Rajacic N, Darweesh M, Jayakrishnan K, et al. The distally based superficial sural flap for reconstruction of the lower leg and foot. Br J Plast Surg. 1996 Sep;49(6):383-9.PMID: 8881785.

[19]. Jeng SF, Wei FC, Kuo YR. Salvage of the distal foot using the distally based sural island flap.AnnPlast Surg. 1999 Nov;43(5):499-505. PMID: 10560865.

[20]. Ayyappan T, Chadha A. Super sural neurofasciocutaneous flaps in acute traumatic heel reconstructions. PlastReconstr Surg. 2002 Jun;109(7):2307-13. PMID: 12045555.
[21]. Isenberg JS. The reversal sural artery neurocutaneous island flap in composite lower extremity wound reconstruction. J Foot Ankle Surg. Jan-Feb 2000;39(1):44-8.PMID: 10658950.
[22]. Akyürek M, Safak T, Sönmez E, Ozkan O, Keçik A. A new flap design: neural-island flap. PlastReconstr Surg. 2004 Nov;114(6):1467-77. PMID: 15509934.
[23]. Kneser U, Bach AD, Polykandriotis E, Kopp J, Horch RE. Delayed reverse sural flap for staged reconstruction of the foot and lower leg. PlastReconstr Surg. 2005 Dec;116(7):1910-7. PMID: 16327603.
[24]. Parrett BM, Pribaz JJ, Matros E, et al. Risk analysis for the reverse sural fasciocutaneous flap in distal leg reconstruction.PlastReconstr Surg. 2009 May;123(5):1499-1504. PMID: 19407622.
[25]. Tosun Z, Ozkan A, Karaçor Z, Savaci N. Delaying the reverse sural flap provides predictable results for complicated wounds in diabetic foot. Ann Plast Surg. 2005 Aug;55(2):169-73. PMID: 16034248.
[26]. Wei JW, Dong ZG, Ni JD, et al. Influence of flap factors on partial necrosis of reverse sural artery flap: a study of 179 consecutive flaps. J Trauma Acute Care Surg. 2012 Mar;72(3):744-50. PMID: 22491564.
[27]. Al-Qattan MM. The reverse sural fasciomusculocutaneous "mega-high" flap: a study of 20 consecutive flaps for lower-limb reconstruction. Ann Plast Surg. 2007 May;58(5):513-6. PMID: 17452835.
[28]. Jeng SF, Wei FC. Distally based sural island flap for foot and ankle reconstruction. PlastReconstr Surg. 1997 Mar;99(3):744-50.PMID: 9047194.

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Approval for this study was granted by the Institutional Ethics Committee of Dr. KNR University of Health Sciences, Warangal, Telangana (Rc No. IEC/GMC/2021/01/12).

Consent to participate
Informed consent was obtained from all individual participants included in the study.

Consent to publish
The authors affirm that human research participants provided informed consent for publication of the images.

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