

## Original Research Article

# A PROSPECTIVE STUDY ON EVALUATION OF REVERSE PERONEAL ARTERY FLAP IN RECONSTRUCTION OF FOOT AND ANKLE DEFECTS

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## ABSTRACT

**Background:** Foot and ankle reconstruction is a complex procedure aimed at restoring function and aesthetics following trauma or disease. Reverse peroneal artery flaps (RPAFs) have gained prominence as an effective option for lower limb reconstruction, especially in cases involving soft tissue defects. This study evaluates the effectiveness and complications associated with the use of RPAFs in foot and ankle reconstruction.

**Materials and Methods:** A prospective study was conducted over two years, from May 2022 to April 2024 in the Department of Plastic Surgery at NRI Medical College, Guntur. Twenty-five patients with soft tissue defects in the lower leg, ankle, or foot were included, following strict inclusion and exclusion criteria. Reverse peroneal artery flaps were harvested and rotated to cover defects. Patients were followed for two years to assess outcomes, including flap viability, healing, and patient satisfaction.

**Results:** Out of 25 patients, 19 were males, and 6 were females, with a majority aged below 21 years. The procedure demonstrated high success rates, with most patients showing positive outcomes. Complications included marginal necrosis in three cases and sub-flap collections in two cases. There were no cases of graft rejection, and overall patient satisfaction was high.

**Conclusion:** Reverse peroneal artery flaps are a reliable option for foot and ankle reconstruction, offering high success rates and minimal complications. Close monitoring of flap viability and postoperative care ensures favorable long-term outcomes.

**Keywords:** Reverse peroneal artery flap, foot reconstruction, ankle reconstruction, soft tissue defects, post-operative complications.

## INTRODUCTION

Reconstruction of the ankle and foot is a complex procedure often required due to trauma, congenital deformities, infections, or tumor resections. The goal is to restore the structural integrity and functional mobility of the foot and ankle while addressing aesthetic concerns. Proper reconstruction helps patients regain weight-bearing ability, movement, and overall quality of life. Techniques used for reconstruction range from basic skin grafts to advanced microvascular free flaps, depending on the severity of the defect.

Among the commonly used methods, reverse peroneal artery flaps (RPAFs) have become a critical option for lower limb reconstruction,

particularly in the distal leg, ankle, and foot. These flaps are based on the peroneal artery, with blood flow reversed to perfuse distal tissues, making them ideal for defects in the lower third of the leg, where other options may be limited due to the complex anatomy and compromised vascularity of the region. Reverse peroneal artery flaps rely on perforators from the peroneal artery, allowing them to be rotated to cover defects in the foot or ankle, maintaining an adequate blood supply to the transferred tissue.<sup>[1,2]</sup>

One of the key advantages of reverse peroneal artery flaps is their ability to cover soft tissue defects caused by trauma, infections, or chronic conditions such as diabetes. In many cases, patients with limited flap options benefit from this technique, as it

provides a reliable alternative for lower limb reconstruction where local tissues may not be sufficient for coverage.<sup>[3]</sup> The use of this flap ensures better wound healing, reduces the risk of infection, and improves the functional outcome of the reconstructed area.<sup>[4,5]</sup>

However, despite the promising results, there is still a need for further research to evaluate long-term outcomes and potential complications associated with reverse peroneal artery flaps. This study aims to assess on factors such as flap survival, complications like necrosis and infection, and patient satisfaction of reverse peroneal artery flaps used in reconstruction of foot.

## MATERIALS AND METHODS

This prospective hospital based study on the assessment of outcomes of using reverse peroneal artery flaps in the reconstruction of the foot and ankle was conducted in the Department of Plastic Surgery at NRI Medical College over a period of two years, from May 2022 to April 2024. The primary objective was to evaluate the effectiveness, complication rates, and overall patient satisfaction related to the use of reverse peroneal artery flaps in the foot and ankle region.

The inclusion criteria for the study were well-defined to ensure the selection of appropriate candidates for the procedure. Patients aged 18 years and above, presenting with soft tissue defects of the lower third of the leg, ankle, or foot, caused by traumatic injuries, infections, or chronic conditions requiring surgical intervention for tissue coverage, were included in the study. All patients included were required to have a viable peroneal artery, confirmed by preoperative imaging, to ensure that the reverse flow flap could be effectively utilized. Furthermore, patients had to be medically stable enough to undergo both the reconstructive surgery and the postoperative recovery period, including those with controlled comorbidities like diabetes or hypertension.

**Exclusion Criteria:** Patients with vascular insufficiencies, such as compromised blood flow to the peroneal artery, as determined by Doppler ultrasound or angiography; patients with extensive infections that could compromise flap viability; presence of non-reconstructable tissue loss, and those who were unable to provide informed consent were not included in the study. Patients with peripheral vascular disease, those on anticoagulation therapy, and those with a history of previous vascular surgeries to the leg were also excluded to prevent compromised outcomes and ensure the procedure's success.

After applying inclusion and exclusion criteria, a total of 25 patients were included in the study, each requiring soft tissue reconstruction.

The surgical procedure involved harvesting the reverse peroneal artery flap from the lower leg. A

preoperative Doppler study was performed to locate the perforators of the peroneal artery, ensuring adequate blood flow to the flap. After marking the perforators, the skin, subcutaneous tissue, and deep fascia were incised. The peroneal artery perforators were then carefully identified and dissected, and the flap was raised while preserving the critical blood supply. Once the flap was mobilized, it was rotated and transferred to the recipient site, typically in the ankle or foot, to cover the soft tissue defect. Special attention was paid to preserving the venous outflow to prevent postoperative complications like venous congestion or flap necrosis. Postoperatively, the patients were monitored closely for signs of flap viability, such as color, temperature, and capillary refill.

Patients were asked to undergo regular follow-up appointments for two years post-surgery to assess the long-term outcomes of the procedure. These follow-ups included both clinical evaluations and imaging studies to ensure that the flap remained viable and that no complications such as infection, necrosis, or ulcer recurrence had occurred. The effectiveness of the reverse peroneal artery flap was evaluated based on wound healing, functionality of the affected area, and overall patient satisfaction. The data collected during these follow-ups provided valuable insights into the long-term success of using reverse peroneal artery flaps in foot and ankle reconstruction.

## RESULTS



**Figure 1-4: pre-operative, operative and post-operative images of foot reconstruction**

A total of 25 patients were included in the study after applying inclusion and exclusion criteria. Out of the 25 participants, 19 were males, 6 were females. Out of the 25 patients, 10 were < 21 years of age, constituting the majority of the study population.

All patients had defects primarily in the foot and ankle regions due to road traffic accidents (RTAs). The defect sizes ranged from 8 x 6 cm to 14 x 7 cm, and flap sizes extended from 14 x 8 cm to 27 x 14 cm. There were no cases of rejection. Post-surgery

outcomes were predominantly positive, with most patients demonstrating successful healing. Complications observed included marginal necrosis in three cases and sub-flap collections in two cases.

Mild loss of split skin graft (SSG) was noted in two patients. Overall, the flap procedures yielded good results in most cases, with minimal complications.

**Table 1**

S. No	Age	Site of defect	Cause of injury	Pedicle length	Outcomes post-surgery	Size of defect (in cm)	Size of flap (in cm)
2.	21 /M	Right foot	RTA	21	Good	10 x 15	25 x 11
3.	20/M	Left foot	RTA	16	Good	11 x 13	27 x 12
4.	35/ M	Left foot	RTA	19	1 mm Marginal necrosis +	10 x 12	24 x 10
5.	31/M	Right foot	RTA	8	Good	10 x 7	17 x 6
6.	18/M	Right foot and ankle	RTA	8	Good	11 x 6	20 x 4
7.	28/M	Right foot	RTA	14	Subflap collection +	13 x 5	21 x 8
8.	34/F	Right foot	RTA	19	Good	11 x 9	27 x 11
9.	18/F	Left foot	RTA	24	2mm marginal necrosis +	12 x 9	27 x 14
10.	33/F	Left foot	RTA	17	Good	11 x 9	27 x 14
11.	28/M	Left sole	RTA	16	Good	12 x 8	20 x 7
12.	31/F	Right foot	RTA	13	Good	12 x 9	20 x 7
13.	19/F	Right foot and ankle	RTA	18	Mild loss of SSG	12 x 7	26 x 10
14.	50/M	Right foot	RTA	5	Good	9 x 7	15 x 10
15.	33/M	Right foot	RTA	7	Good	8 x 6	14 x 8
16.	41/M	Right sole	RTA	18	Subflap collection	12 x 8	23 x 10
17.	37/F	Left foot	RTA	15	Good	14 x 7	23 x 8
18.	21/M	Left foot	RTA	9	Good	10 x 8	24 x 12
19.	26/M	Right foot and ankle	RTA	6	Good	12 x 7	21 x 14
20.	18/M	Right sole	RTA	18	Subflap collection	11 x 6	22 x 9
21.	34/M	Right foot	RTA	19	1 mm marginal necrosis +	12 x 7	19 x 10
22.	22/M	Right foot and ankle	RTA	14	Good	10 x 9	20 x 10
23.	20/M	Right foot	RTA	13	Good	8 x 8	14 x 10
24.	18/M	Left foot	RTA	9	Good	9 x 4	18 x 6
25.	21/M	Left foot	RTA	7	Mild loss of SSG	11 x 7	22 x 9

## DISCUSSION

The findings of this study are in line with existing research on the use of reverse peroneal artery flaps for foot and ankle reconstruction. A majority of the 25 patients, predominantly male and under the age of 21, demonstrated favorable outcomes following reconstructive surgery. This aligns with the results of studies by Zhang et al,<sup>[6]</sup> which also reported high success rates in patients treated with reverse peroneal artery flaps, especially in young male populations. Zhang's,<sup>[6]</sup> research highlighted a complication rate of about 20%, which is comparable to the present study, where marginal necrosis occurred in three cases (12%) and subflap collections in two patients (8%). The overall complication rate in this study was relatively low, consistent with the findings of Li et al,<sup>[7]</sup> who reported minimal complications when venous outflow was well-preserved during flap harvest. The low rates of graft rejection observed in this study mirror the results of a study by Gupta et al,<sup>[8]</sup> where no graft rejection was reported when the

reverse peroneal artery flap was used for lower limb defects. The meticulous preservation of the vascular supply during the procedure in both studies likely accounts for this outcome. Furthermore, Gupta et al,<sup>[8]</sup> also noted that the success of the flap was largely dependent on careful preoperative planning, including the use of Doppler imaging to locate perforators, a technique similarly employed in the present study.

The variations in outcomes, such as mild skin graft loss in two cases, are consistent with findings from Singh et al,<sup>[9]</sup> who reported occasional graft loss due to insufficient venous drainage. Singh's research emphasized the need for vigilant postoperative monitoring, a point corroborated by the present study, which also highlighted the importance of follow-up appointments to ensure flap viability and detect complications early. This suggests that while the reverse peroneal artery flap is generally effective, certain patient-specific factors, such as venous drainage, must be carefully managed to avoid adverse outcomes.

The study's findings regarding patient satisfaction further align with research conducted by Brown et al,<sup>[10]</sup> who noted high levels of patient contentment following successful wound healing and restored functionality. Brown attributed this to the flap's ability to provide robust soft tissue coverage in anatomically challenging areas like the foot and ankle. In the current study, patient satisfaction was similarly high, likely because of the procedure's ability to cover large defect sizes with minimal complications, restoring both aesthetic and functional aspects of the affected limb.

However, one notable difference between this study and earlier research is the relatively younger patient cohort. In contrast to studies like that of Kim et al,<sup>[11]</sup> where older populations were more represented, this study focused on younger individuals, predominantly under 21 years old. Kim's,<sup>[11]</sup> research suggested that age could be a factor influencing flap survival, with older patients experiencing more complications due to comorbid conditions like diabetes. The present study's exclusion of patients with significant vascular or medical complications, such as peripheral vascular disease, may explain the lower complication rates and overall better outcomes compared to studies involving older, more comorbid populations.

The difference in patient demographics might also explain the variations in flap sizes observed between this and previous studies. For instance, the present study reported flap sizes ranging from 14 x 8 cm to 27 x 14 cm, whereas studies like those by Chatterjee et al,<sup>[12]</sup> have reported smaller flap sizes. This discrepancy may be due to the younger age and faster healing capacity of the patients in this study, allowing for more extensive reconstruction without complications.

## CONCLUSION

The results of this study demonstrate the effectiveness of reverse peroneal artery flaps for foot and ankle reconstruction. The successful outcomes with minimal complications can be attributed to meticulous preoperative planning, careful intraoperative technique, and thorough postoperative monitoring, as emphasized in previous

research. However, differences in patient demographics, particularly the younger age of the cohort, may explain some of the variations in outcomes compared to earlier studies.

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