

Outcome of Coverage of Wound Around the Ankle & Distal third of Leg by Reverse Sural Flap

Dr. Asit Baran Dam^{1*}, Kazi Mohammad Hannanur Rahman², Md. Iftekharul Alam³, Md. Rashedul Islam⁴, Dr. Ripon Kumar Das⁵, Mohsin Hasan Samrat⁶, Dr. Md. Saiful Islam⁷

¹Associate Professor, Department of Orthopedic, National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh

²Assistant Professor, Department of Orthopaedic Surgery, National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh

³Assistant Professor, Department of Orthopaedic Surgery (Hand and Microsurgery), National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh

⁴Junior Consultant (Spine Surgery), Department of Orthopaedic Surgery, National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh

⁵Associate Professor, Department of Orthopedic, National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh

⁶Muhammad Hasnat, Assistant Registrar, Department of Orthopaedics, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh

⁷Assistant Professor, Orthopedic Surgery (Hand & Microsurgery), National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh

⁸Junior Consultant, Orthopaedics & Traumatology, National Institute of Traumatology & Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh

DOI: <https://doi.org/10.36347/sjams.2025.v13i02.036>

| Received: 14.01.2025 | Accepted: 19.02.2025 | Published: 24.02.2025

*Corresponding author: Dr. Asit Barman Dam

Associate Professor, Department of Orthopedic, National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh

Abstract

Original Research Article

Background: Distal 3rd of leg & ankle is characterized by tight skin and poor blood supply. Soft tissue loss in these areas provides a frequent challenge to reconstructive surgeons. Tendons and bones are frequently exposed because of the thinness of the subcutaneous tissue. The possible reconstructive options are skin grafts, local flaps, distant flaps and free flaps but their usage is limited and problematic. The present study has been designed to evaluate the outcome of coverage of these regions by reverse sural flap. **Material & Method:** This cross-sectional study was conducted at NITOR, Dhaka, from January 2017 to December 2018. Patients with soft tissue loss over distal 3rd of leg & around ankle without any PVD or uncontrolled DM were study population. Total 30 patients aging between 10 to 70 years were included in the study. All cases were evaluated by clinical features and functional outcome. Three to twelve months follow up was done. **Results:** The mean age was 33.13 ± 16.65 years with a male predominance (83%). 40% of the cases were smoker and it was identified as a risk factor of flap outcome. Only 2 (6.67%) had comorbidities which was DM and significantly associated with flap outcome. The mean flap size was 40.96 ± 14.19 cm². Higher flap size is significantly associated with lower flap survivability. The average injury to operation time was 8.97 ± 3.53 days. In 24 (80%) cases flap has survived completely. Marginal, partial, subtotal necrosis and complete flap loss has occurred in 3 (10%), 1 (3.33%), 1 (3.33%), and 1 (3.33%) case respectively. The complications were, wound infection (20%), hematoma (6.67%) and venous congestion (3.33%).

Keywords: Outcome, Wound, Leg, Reverse Sural Flap.

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INTRODUCTION

The distal 3rd of leg and around ankle is characterized by tight skin and poor blood supply. Soft tissue loss in these areas is challenging to reconstructive surgeons. Tendons, bone or hardware are frequently exposed because of the thinness of subcutaneous tissues.

Though the reconstructive options are limited, the reverse sural flap is one of the preferable options available for covering these areas.

Reconstruction of the lower leg and foot continues to be one of the most perplexing yet common

Citation: Asit Barman Dam, Kazi Mohammad Hannanur Rahman, Md. Iftekharul Alam, Md. Rashedul Islam, Dr. Ripon Kumar Das, Mohsin Hasan Samrat, Md. Saiful Islam. Outcome of Coverage of Wound Around the Ankle & Distal third of Leg by Reverse Sural Flap. Sch J App Med Sci, 2025 Feb 13(2): 507-512.

tasks. An unreliable lower limb subdermal plexus translates to notoriously poor wound healing using cutaneous flaps [1]. A durable flap with good skin texture, reliable vascularity, good arc of rotation, ease of dissection and minimum donor site morbidity is the most desired option for coverage of such defects [2].

There are many possible reconstructive options, including skin grafts, local flaps, distant flaps and free flaps but their usage is limited and problems exist in these regions. Skin grafts are not suitable to cover the exposed bone, tendon, malleoli, heel, and weight bearing areas [3].

Locoregional flaps for lower leg and ankle defects such as peroneal artery flap, anterior and posterior tibial artery flaps have the disadvantage of sacrificing a major artery in an already traumatized leg [4]. Supra-malleolar flap is another option but its reliability is questionable in case of vascular compromise [5]. Absence of peripheral pulses, diabetes, and peripheral vascular thromboses are contraindications to local flaps [6].

Free flap is currently the treatment of choice for large soft tissue defects of the distal extremity and it solves the problem of donor site morbidity in the immediate vicinity of the flap. It is however a technically demanding procedure for surgeons with less microsurgical experience. Furthermore in a few cases of trauma with damaged or 2 occluded major vessels, where a free flap may be potentially hazardous, the reverse sural artery flap can prove to be one of the few safe options for soft tissue coverage [7].

Cross leg flaps are poorly tolerated and do not bring in any additional vascularization. Their take on the area with poor local vascularity can be very uncertain [8].

The distally-based or “reverse” sural fasciocutaneous flap provides reliable coverage for the lower leg, and around ankle [9-12]. This is a robust flap which preserves the main vascular supply to the leg and has with a low failure rate. The flap was first introduced by Donski and Fogdestam in 1983 and a detailed anatomical description was provided by Masquelet in 1992 [13]. After the work of Masquelet *et al.*, the distally based sural fasciocutaneous flap has become a mainstay in the reconstruction of the lower leg [11]. Reverse sural flap is versatile in terms of movement and vascularity. Its arc of rotation is 180°, and provides adequate coverage of proximal and distal heel without kinking of the vascular pedicle.

The flap can be used to cover exposed vessels, bones, tendons, and internal fixation hardware. It has been shown to be more reliable and a better choice than the lateral supra-malleolar flap. Anterior and posterior tibial vessels occlusion and varicose leg veins are not considered an absolute contraindication to the use of a distally based sural flap [7, 14]. An occluded peroneal artery is however considered a contraindication [3].

The sural flap continues to evolve, with recent studies describing perforator and propeller - style modifications, as well as isolated adipo-fascial and sensate flaps [15-18]. Such modifications may extend the utility of this versatile and cost-effective reconstructive technique to the high-risk groups.

METHODOLOGY

This cross-sectional study was carried out in National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Sher-E-Bangla Nagar, Dhaka, Bangladesh, during January 2017 to December 2018. About 30 patients age between 10 to 70 years included who presented with Gustillo IIIB fracture of the distal third of the leg and around ankle and soft tissue loss with exposed bone in the distal third of the leg and around ankle without fracture and patient with extensive soft tissue loss with neurovascular injury, uncontrolled DM, peripheral vascular disease, malignant ulcer, post burn ulcer are excluded from the study. After taking consent and matching eligibility criteria, data were collected from patients on variables of interest using the predesigned structured questionnaire by interview, observation and clinical examination. Statistical analyses of the results were obtained by using window-based Microsoft Excel and Statistical Packages for Social Sciences (SPSS-24). P- value less than 0.05 is taken as test of significant.

RESULTS

Table I: Distribution of the patients according to age and sex (n=30)

Age (In years)	Frequency (%)
11-20	8(26.67)
21-30	10(33.33)
31-40	3(10.00)
41-50	3(10.00)
51-60	3(10.00)
>60	3(10.00)
Total	30 (100)
Sex	
Male	25(83)
Female	05(17)
Total	30(100)

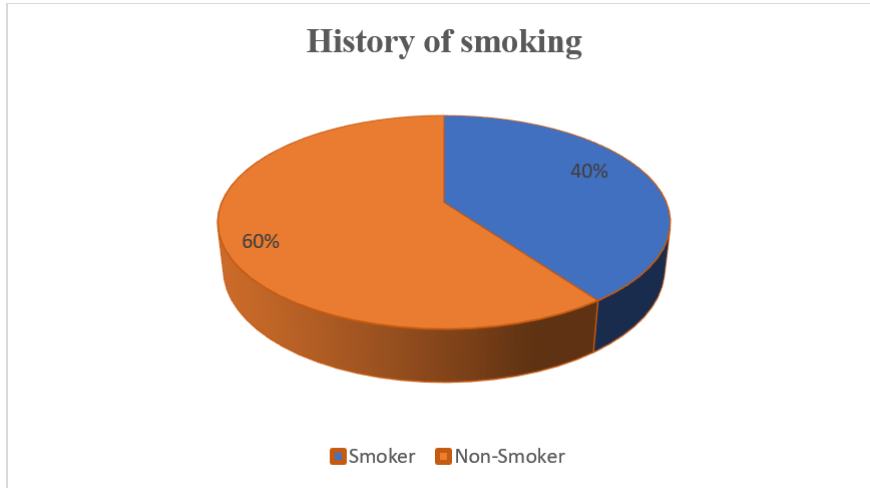


Figure I: Distribution of patients according to smoking (n=30)

Table II: Relative risk assessment of smoking and flap outcome. (n=30)

Exposure	Flap Outcome		Total
	Not Completely survived	Completely survived	
Smoker	4	8	12
Nonsmoker	2	16	18
Total	6	24	30

Table II: Flap was not completely survived in 4 (33.33%) cases among the smokers. But, flap was not completely survived only in 2 (11.11%) cases among the

non-smokers. The odds ratio was 4 suggesting that smoking is a risk factor of flap loss.

Table III: Assessment of significance between comorbidities and flap outcome. (n=30)

Comorbidities	Flap Outcome		Total
	Not Completely survived	Completely survived	
DM (Type II)	2	0	2
Nonsmoker	9	19	28
Total	11	19	30

Table III: In all cases of diabetic patient, the flaps were not completely survived. The p value was calculated by Fisher's exact t test and found <0.05 which was significant.

Figure II Among the cases, only 2 (6.67%) had comorbidities which was type II Diabetes Mellitus. The rest 28 (93.33%) were free from any other systemic diseases.

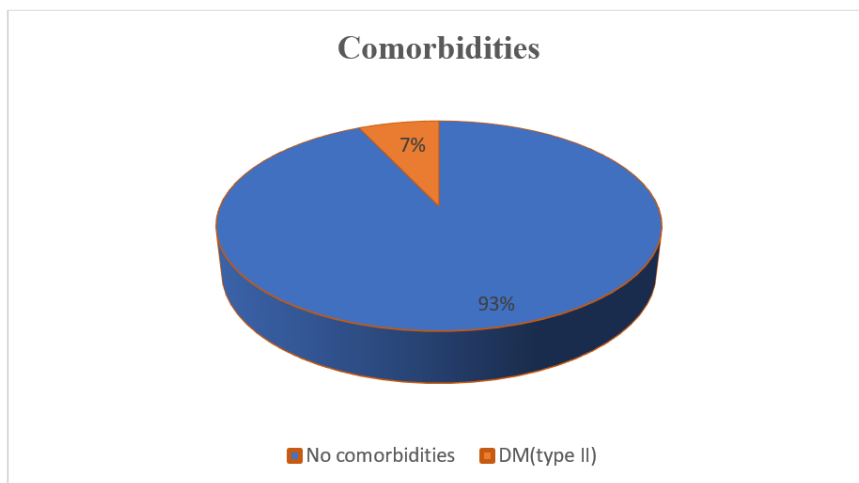


Figure II: Comorbidity of cases

Table IV: Distribution of the patients according to cause of injury and site of injury (n=30)

Variables	Frequency (%)
Site of Injury	
Distal third of leg	17(56.67)
Around ankle	12(40)
Over tendo-achillis	1(3.33)
Total	30(100)
Cause of Injury	
Motor vehicle accident	25(83.33)
Fall from height	3(10)
Toilet commode injury	1(3.33)
Machinery injury	1(3.33)
Total	30 (100)

Table IV Among the 30 cases, in 17 (56.67%) cases, the soft tissue loss was over the distal 3rd of leg. Twelve (40%) were around the ankle and the rest 1 (3.33%) was over the tendo -achillis and motor vehicle accident (MVA) accounted for 25 (83.33%) cases which

was the most common cause of injury. Other causes of injury were fall from height 3 (10%), toilet commode injury 1 (3.33%) and machinery injury 1 (3.33%) in descending order

Table V: Distribution of cases according to primary wound size and flap size (n=30)

Variables	Frequency (%)
Primary wound size	
<20 cm ²	8(26.67)
20-30 cm ²	14(46.67)
>30 cm ²	8(26.67)
Total	30(100)
Flap size	
<30 cm ²	6(20.00)
30-45 cm ²	16(53.33)
>45 cm ²	8(26.67)
Total	30(100)

Table V shows, Most of the primary wound size was in between 20 cm² to 30 cm² which was in 14

(46.67%) cases. In 6 (20%) cases, the flap size was <30 cm²

Table VI: Significance between flap size and flap outcome (n=30)

Flap wound size	Flap Outcome		Total
	Not Completely survived	Completely survived	
< 30 cm ²	1	5	2
30-45 cm ²	1	15	28
>45 cm ²	4	4	8
Total	6	24	30

Table VI The significance between flap size and flap outcome was calculated by extended chi square test with yate's correction. The calculated p value was <0.05.

The higher the flap size, the lower the chance of flap survivability.

Table VII: Distribution of cases according to flap outcome and complications with its management (n=30)

Variables	Frequency (%)	Frequency (%)
Flap outcome		
Completely survived	24(80.00)	
Marginal necrosis	3(10.00)	
Partial necrosis	1(3.33)	
Subtotal necrosis	1(3.33)	
Complete Flap Loss	1(3.33)	
Total	30(100)	

Variables	Frequency (%)	Frequency (%)
Complication and Management		
Wound Infection	Wound C/S& antibiotic accordingly	6(20.00)
Hematoma	Evacuation and reposition of flap	2(6.67)
Venous congestion	Foot elevation	1(3.33)
Total	30(100)	30(100)

DISCUSSION

Reconstruction of defects on the ankle, malleoli and lower 3rd of leg remains a demanding task for trauma surgeons. Trauma and other deforming process can involve soft tissue, underlying bone and ligamentous structures. In addition, the skin over this area is tight and has poor circulation. Study of the vascularity of the leg has revealed that there are linear areas of increased perfusion along the course of main arteries. This anatomic characteristic led to demonstration of perforators originating from each underlying artery and recognition of the potential for flap donor sites [19].

The present study has been undertaken in NITOR from January 2017 to December 2018 to evaluate one of the options in the management of soft tissue coverage of distal 3rd of leg and ankle. A total 30 patients satisfying the inclusion and exclusion criteria were selected for this study.

In this study, the highest number of patients 10 (33.33 %) were observed in the 3rd decade followed by 8 (26.67%) in the 2nd decade of life. Remaining 4th, 5th, 6th and 7th decade consists of 3 (10%) cases each. The mean age was (33.13±16.65) years with ranging from 11 to 69 years.

The most active decades of life who work outside are more susceptible to trauma requiring soft tissue coverage. This picture is clearly evident from the study age group. Study conducted by Rios-Luna, *et al.*, (2007), showed an average age was 38 which was similar to this study. But in the series of Ahmed, *et al.*, (2008) and Akhtar & Hameed, (2006) the average age was 59 and 47 respectively. The difference can be explained by that, in this series, patient with peripheral vascular disease and uncontrolled DM was excluded [20-22].

Male population in the study constituted 25 (83.33%) while the female made up the remaining 05 (16.67%) with a male female ratio of 5:1. Study conducted by Mileto, *et al.*, (2007) showed a male female ratio of 3:1 and Ajmal, *et al.*, (2009) observed a male predominance where male 21 (81%) & Female 5 (19%). In all the series, male representation is the majority because of more outdoor physical activity [23, 24].

Among the 30 cases, in 17 (56.67%) cases, the soft tissue loss was over the distal 3rd of leg. Twelve (40%) were around the ankle and the rest 1 (3.33%) was over the tendo-achilles. As the lesion in distal 3rd of leg

did not cover ankle joints, it did not affect ankle joint movement. In the series of Ahmed, *et al.*, (2008), The defect site included non-weight bearing heel in four (40%), tendo achilles in two (20%), distal tibia in two (20%), lateral malleolus in one (10%) and medial aspect of the midfoot in one patient (10%). These results are quite similar to the present study [21].

Most of the primary wound size was in between 20 cm² to 30 cm² which was in 14 (46.67%) cases. In 8 (26.67%) cases, it was <20 cm² and the rest 8 (26.67%) cases, the wound size were ≥30 cm². The mean wound size was 24.95±10.15 cm², ranging from 8.75 cm² to 54 cm². The flap dimension was taken according to the primary wound size. In every case, the flap size was about 10 cm² greater than wound size. The mean flap size was 40.96±14.19 cm², ranging from 18 cm² to 78.75 cm². In 6(20%) cases, the flap size was <30 cm². In most of the cases e.g. 16 (53.33%), the flap size was in between 30 cm² to 45 cm². In the series of Ajmal, *et al.*, (2009), the dimensions of the flap ranged from 6–12 cm in length and from 4–8 cm in width [23]. The mean length was 8.4 cm and mean width 5.7 cm with an average flap size of 47.88 cm. In their series, Rios-Luna, *et al.*, (2007) had taken an average flap size of 25 cm. The significance between flap size and flap outcome was calculated by extended chi square test with yate's correction. The calculated p value was <0.05 which was significant. The higher the flap size, the lower the chance of flap survivability [20].

Limitations of the study

The present study was conducted in a cross-sectional study with very short period due to time constraints and funding limitations. The small sample size was also a limitation of the present study.

CONCLUSION

The technique of the reverse sural flap in general is simple and safe. The operation can be done in a short time without interfering with the blood flow of the major vessels of the leg. The flaps reconstructions were performed in busy orthopedic institution under optimal environment and with adequate medical supplies. The reverse sural flap is an excellent option when the tissue loss involves the distal part of the leg and ankle. Its versatility and constant reliable vascularity made it superior to other flaps.

RECOMMENDATION

It can be recommended that Prospective study can be done, a long-term study with a large series and a larger follow up period can be done and multi-centric study may be done as it is more preferable.

ACKNOWLEDGEMENTS

The wide range of disciplines involved in a study defining the injury with infection pattern in open fracture tibia at a tertiary care hospital research means that editors need much assistance from referees in the evaluation of papers submitted for publication. I would also like to be grateful to my colleagues and family who supported me and offered deep insight into the study.

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