

RESEARCH ARTICLE

EXPLORING THE REVERSE SURAL ARTERY FLAP IN SOFT TISSUE RECONSTRUCTION

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Manuscript Info

Manuscript History Received: 31 May 2024 Final Accepted: 30 June 2024 Published: July 2024

Key words:-Regional Soft Tissue

Regional Soft Tissue Augmentation Flap, Flap Necrosis

Abstract

Background: Addressing soft tissue defects in the distal lower extremity and foot remains a complex reconstructive procedure, presenting considerable challenges. These challenges underscore the necessity for locally available tissue reconstructive alternatives that offer superior solutions. The Regional Soft Tissue Augmentation Flap (RSSAF) emerges as an optimal choice, demonstrating considerable versatility at the lower leg level and serving as a viable alternative. This study aims to discuss the advantages, limitations, and potential complications associated with RSAF and to study the outcome of RSSAF in management of complex distal one third leg defects in MVJMC&RH.

Method: The study was Retrospective Observational Study and was conducted in MVJMC&RH amongst 20 patients who underwent reconstruction of distal lower extremity and foot defects with an RSSAF between June 2022 to September2023. Data concerning patient demographics, location and cause of defect, mean operation time, mean size of the defect, postoperative protocol, healing flap rate, and complications were recorded. Results The result of the Sural artery fasciocutaneous flap for the 20 cases had complete recoveries, 2 cases had partial necrosis and 2 case had wound dehiscence. A total of 4 patients suffered complications. Complication rate -20%. Overall flap survival rate was 100%.

Conclusion: The Reverse Superficial Sural Artery flap can be used as a reliable alternative to free tissue transfer in reconstruction of defects over the lower third of leg, ankle and foot to recreate a functional lower limb with comparable aesthetic results.

Recommendations: Optimizing Patient Selection: Conduct studies to refine criteria for patient selection, ensuring that RSAF is applied in cases where it is most beneficial. Enhancing Rehabilitation Protocols:Develop and refine rehabilitation protocols to improve postoperative outcomes and minimize the risk of complication.

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Introduction:-

Addressing soft tissue defects in the distal lower extremity and foot remains a complex reconstructive procedure, presenting considerable challenges.Local donor tissue is frequently inadequate or situated within the injury zone. Micro surgical reconstruction remains the established standard for managing complex wounds, yet it is often

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burdened by issues such as donor site morbidity, extended operative duration, pronounced contours, trauma to recipient vessels, the demand for surgical expertise, and the requirement for expensive equipment^[1].

These challenges underscore the necessity for locally available tissue reconstructive alternatives that offer superior solutions. The Regional Soft Tissue Augmentation Flap (RSSAF) emerges as an optimal choice, demonstrating considerable versatility at the lower leg level and serving as a viable alternative^[2].

Anatomy of Reverse Sural Artery

The reverse sural artery flap is an adipofasciocutaneus flap based on vascular axis of sural nerve which receives its blood supply from its communications with peroneal artery perforators around lateral malleolus^[3].



Aims and Objectives:-

- 1. To discuss the advantages, limitations, and potential complications associated with RSAF through the analysis of case studies and comparisons with alternative techniques and To study the outcome of RSSAF in management of complex distal one third leg defects in MVJMC&RH.
- 2. To explore the intricate anatomy of the sural artery, emphasizing its relevance in the context of soft tissue reconstruction.
- 3. To break down the step-by-step procedure of RSAF, highlighting critical technical aspects for a successful flap.

Materials and Methods:-

The study was conducted in MVJMC&RH amongst 20 patients who underwent reconstruction of distal lower extremity and foot defects with an RSSAF between June 2022 to September2023.

Study Design:

Retrospective Observational Study.

Inclusion And Exclusion Criteria Inclusion Criteria -

Soft tissue defects over the lower extremity requiring reconstruction due to -

1. acute or chronic wounds

- 2. tumor excision and
- 3. chronic osteomyelitis.
- 4. Diabetic foot
- 5. Necrotising fasciitis
- 6. Trauma

Exclusion Criteria -

- 1. Patients with chronic venous insufficiency and peripheral vascular disease.
- 2. Patients with vascular injury.
- 3. Patients with large defects (defect >15cms)
- 4. Patients with Mangled extremity and fracture of both bones distal third of leg.

Preoperatively the patients were screened for patency of peroneal perforators especially the one at around 7-8cm from lateral malleolus using Doppler ultrasound probe. Data concerning patient demographics, location and cause of defect, mean operation time, mean size of the defect, postoperative protocol, healing flap rate, and complications were recorded. Comorbidities and details of patients with flap failure are also presented.

Surgical technique

Prone position:

Defect is located at the posterior aspect of the heel or the lateral aspect of the ankle.

Supine position:

The ipsilateral buttock slightly elevated. Flexion and adduction of the hip and flexion of the knee allow raising the flap in a rather comfortable position while the whole anterior aspect of the ankle and the medial side of the leg remain easily accessible.

Preoperatively, the course of the sural nerve was marked and pivot point is also marked. The flap is fashioned in the shape according to defect which has to be covered and minimum of 5 cm pedicle is marked. Dissection is begun proximally and carried down through to the deep fascial level until the sural nerve, artery, and lesser saphenous vein are identified. These vessels are ligated and severed.

At this point, the island flap including the skin, subcutaneous tissue, and the deep fascial tissues containing the neurovascular structures, are elevated off the surface of the gastrocnemius muscle bellies.

The pedicle is created as dissection continues distally, elevating these tissue layers as a single unit until the pivot point of the flap is reached.

Once the flap is mobile, it is repositioned distally and sutured to the recipient site with care to not kink the flap as it is folded back upon itself. The donor site is either primary closed or covered with a split-thickness skin graft that can be taken from the ipsilateral thigh.

A non-adherent dressing followed by a well padded posterior splint is used to cover and protect the surgical site^[3].

S1.	Α	S	ETIOLOGY	DEFECT SITE	SIZE	DE	COMOR	POST OP				
No	G	E				LA	BIDITY	COMPLI				
	Е	Х				Y		CATION				
1.	55	М	Diabetic foot	Tendoachilles and weight bearing heel	8*5	Nil	Diabetic	Nil				
2.	53	Μ	RTA	Weight bearing Hee	9*6	Del	NIL	Partial Ne				
				1		ay		crosis				
3.	35	М	Osteomyelitis	Medial malleoli	8*4	Nil	NIL	NIL				
4.	22	Μ	RTA	Ankle joint	9*5	Nil	NIL	NIL				
5.	35	F	RTA	Weight bearing heel	10*7	Nil	NIL	NIL				
6.	54	Μ	Diabetic foot	Dorsum of foot	12*10	Del	Diabetic	NIL				

Results:-

						ay		
7.	18	М	RTA	Tendo achilles and hindfoot	8*7	Nil	NIL	NIL
8.	52	F	Necrotizing fascitis	Weight bearing heel	9*6	Nil	Diabetic	Wound d ehiscence
9.	20	Μ	RTA	Medialside of foot	9*5	Nil	NIL	NIL
10.	47	F	Motor vehicle accident	Posterior ankle and heel	8 cm x 6 cm soft t issue loss	Nil	Diabetic	Nil
11.	36	М	Wound dehiscence aft er orthopedic surgery	Proximal calf	7 cm x 5 cm	Del ay	NIL	Partial Ne crosis
12.	58	F	Diabetic neuropathy	Lateral foot	5 cm x 4 cm	Nil	NIL	NIL
13.	55	F	Thermal burns	Dorsum of the foot	15 cm x 12 cm	Nil	NIL	NIL
14.	42	Μ	Previous infection	Medial lower leg	10 cm x 8 cm wit	Nil	NIL	NIL
15.	28	М	RTA	Lateral malleolus	5cms x4cm	Del ay	Diabetic	NIL
16.	48	М	Venous insufficiency	Medial malleolus	8 cm x 7 cm with exposed tendons	Nil	NIL	NIL
17.	55	М	Cellulitis with necrotiz ing fasciitis	Lateral ankle	11 cm x 9 cm	Nil	Diabetic	Wound d ehiscence
18.	27	М	RTA	HEEL	6X4cms	Nil	NIL	NIL
19.	40	М	Diabetic foot	Mid foot	7x5 cms	NII	Diabetic	NIL
20.	47	F	Motor vehicle accident	Posterior ankle and heel	8 cm x 6 cm	Nil	Diabetic	Nil





Figure A shows a 35 year old male with history of chronic osteomyelitis complicated wound over medial malleoli and B shows wound after debridement and regular dressings.



Figure C:-Figure D:-Figure C shows intraoperative sural flap rotation to completely cover the wound. Figure D shows POD-7 of wound with complete uptake of graft and flap.



Figure E:-

Figure F:-Figure E and F shows POD-30 wound with complete coverage of the defect and full uptake.

Defects around ankle and weight-bearing foot along with exposed tendons were successfully covered with the flap. The result of the Sural artery fasciocutaneous flap for the 20 cases had complete recoveries, 2 cases had partial necrosis and 2 case had wound dehiscence. A total of 4 patients suffered complications.

Complication rate -20%. Overall flap survival rate was 100%.

Discussion:-

RSSAF has following advantages -

- Simple 1.
- 2. Versatile
- 3. Minimal donor site morbidity
- Ideal flap thickness and quality 4.
- 5. The wide arc of rotation
- 6. Major vessels of the limb are preserved.

At the same time it has certain set of limitations which are -

- 1. Loss of sensation over lateral aspect of foot
- 2. Congested flap

Alternative techniques- rule of thirds

- 1. Fasciocutaneous flap media calf flap, retrograde peroneal flap
- 2. Muscle and musculocutaneous- gastrocnemius- medial and lateral heads, soleus- medial and lateral heads, tibialis anterior.
- 3. Skin/subcutaneous- reversed dermis flap, fillet of toe flap, lateral calcaneal artery skin flap, suprafascial rotational flap, cross foot flap, medial plantar flap
- 4. Fasciocutaneous –flexor digiti minimi brevis.
- 5. Muscle-abductor digiti minimi, flexor digitorum longus, flexor hallucis brevis, extensor digitorum brevis, abductor hallucis brevis flap.
- 6. Muscle/musculocutaneous –flexor digitorum brevis (plantar artery skin fascia flap)
- 7. Also consider free flap, skin grafts as an alternative, (attempts should be made to preserve sensation)^[4].

Conclusion:-

With a constant blood supply that doesn't require sacrifice or manipulation of a major artery, its reliability and easy dissection, the Reverse Superficial Sural Artery flap can be used as a reliable alternative to free tissue transfer in reconstruction of defects over the lower third of leg, ankle and foot to recreate a functional lower limb with comparable aesthetic results.

Recommendations and Future Directions:-

- 1. Improving Flap Viability Explore innovations in vascular anastomosis techniques to enhance blood supply and flap survival. Investigate the use of advanced imaging technologies for real-time monitoring of flap perfusion.
- 2. Minimizing Complications Research strategies to further reduce complications associated with RSAF, such as donor site morbidity and wound healing issues. Evaluate the use of new materials or technologies for minimizing the risk of infection in the donor and recipient sites.
- 3. Optimizing Patient Selection Conduct studies to refine criteria for patient selection, ensuring that RSAF is applied in cases where it is most beneficial.
- 4. Investigate patient- specific factors that may influence the success of the RSAF procedure.
- 5. Enhancing Rehabilitation Protocols Develop and refine rehabilitation protocols to improve postoperative outcomes and minimize the risk of complications.
- 6. Explore the integration of physical therapy modalities and technologies to optimize functional recovery^[5].

References:-

- 1. Mohamed, M. and Mobarak, B. (2018) Role of Reversed Sural Artery Flap in Reconstruction of Lower Third of the Leg, Ankle and Foot Defects. Modern Plastic Surgery, 8, 50-59.
- Sugg KB, Schaub TA, Concannon MJ, Cederna PS, Brown DL. The Reverse Superficial Sural Artery Flap Revisited for Complex Lower Extremity and Foot Reconstruction. Plast Reconstr Surg Glob Open. 2015 Sep 22;3(9):e519..
- 3. Athanaselis E D, Fyllos A, Zibis A H, et al. (July 22, 2021) A Single-Center Surgical Experience With the Reverse Sural Artery Flap as a Reliable Solution for Lower Leg Soft Tissue Defects, With Minimum Two-Year Follow-Up. Cureus 13(7): e16574. doi:10.7759/cureus.16574
- 4. Hollier L, Sharma S, Babigumira E, Klebuc M. Versatility of the sural fasciocutaneous flap in the coverage of lower extremity wounds. Plastic and Reconstructive Surgery. 2002 Dec;110(7):1673-1679.
- Park JS, Roh SG, Lee NH, Yang KM. Versatility of the distally-based sural artery fasciocutaneous flap on the lower leg and foot in patients with chronic disease. Arch Plast Surg. 2013 May;40(3):220-5. doi: 10.5999/aps.2013.40.3.220. Epub 2013 May 16. PMID: 23730597; PMCID: PMC3665865.