



TECHNICAL MODIFICATIONS IN ENHANCING THE SAFETY OF THE REVERSE SURAL FLAP – A BRIEF REVIEW

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ABSTRACT Reverse sural flap has emerged as the work horse flap for reconstruction of soft tissue defects around the distal leg, ankle and composite heel defects. Since its inception, it has undergone various technical modifications to enhance its safety. These technical modifications were described at different periods of time and therefore they are yet to be described in a single article. In this article, we have elaborated on every technical modifications and their effective application in clinical practice.

KEYWORDS : Reverse Sural Flap; Fasciocutaneous Flap; Distal Leg Defect; Ankle and Foot Defect

INTRODUCTION

The Reverse Sural Flap has emerged as one of the most widely flaps in the soft tissue reconstruction of the distal leg, ankle and foot defects. In this era of microsurgery, though free tissue transfer is the first preferred option for both simple and composite defects, the Reverse Sural Flap is the best alternative in the event of free tissue failure or when there is a lack of micro surgical expertise. This flap was first described by Donski and Fogdestram¹ and later underwent several modifications in its design², composition and application.³⁻¹⁵ Prominent among the modifications were use of this flap from the opposite leg,⁵ elevation of this flap as a pure fascial flap,⁶ extension of the skin paddle up to the popliteal crease,⁷ harvesting the flap with a wider fascial pedicle,⁸ elevation of the flap without the sural nerve,⁹ Neurotised sural flap,¹⁰ use of the lesser saphenous vein for supercharging at the recipient site,^{3,13} Delaying the flap for staged reconstruction,⁴ including a part of the gastrocnemius muscle in the skin paddle¹¹ and very recent modification of the flap as a myofascio cutaneous flap by incorporating the peroneus brevis muscle.¹²

Conventionally, the marking for the flap is done by drawing a line from a point midway between the lateral malleolus and tendo achilles distally and midpoint of the popliteal crease proximally. Though anatomical variations may be present rarely, under normal circumstances, the distal point corresponds to the presence of the source vessel of this flap and the proximal point corresponds with the point where the lesser saphenous vein pierces the deep fascia and the line joining the two points corresponds with the course of the sural nerve and the lesser saphenous vein in the subcutaneous plane. The elevation of the flap stops at a distance of 5cm proximal to the lateral malleolus along the above mentioned line protecting the last peroneal perforator which may add as an additional vascular source to the flap. The flap elevation starts from the junction of the proximal and mid leg with the inclusion of the sural nerve and lesser saphenous vein and can be raised as fasciocutaneous flap in its entirety or fasciocutaneous skin island with a fascial pedicle or as a purely fascial flap. Depending up on the type of flap raised, the donor site can be closed primarily or with split skin graft. Loss of sensation along the lateral border of foot is a common but acceptable side effect of this flap.

In this study, a comprehensive review of the reverse sural flap modifications is presented which were found effective during clinical application.

The Technical Modifications

During Flap Marking

A vertical line of 5 cms is marked upwards from the midpoint of the proximal flap margin. After making incision on the proximal flap margin, incision made on this vertical line gives two flaps which are sutured back on their bases giving more working space proximal to the flap.



This working space helps in identifying and securing additional length of short saphenous vein, sural nerve and adipofascia beyond the proximal skin margin of the flap. The additional length of short saphenous vein can be used for venous supercharging^{3,13} at the recipient site or for intermittent bleeding if there is venous congestion. By identifying the lesser saphenous vein and sural nerve further proximal to the skin paddle,⁸ any anatomical variations in their course could be recognized and the axis of the skin paddle can be adjusted accordingly so that they both lie in the center of the skin paddle before making the two lateral and inferior skin incisions. Additional perforators are included at the base of the flap whenever possible.



This additional perforator can be included on either side of the flap base [Lateral or medial] and the angle of rotation of the flap can be decided based on bleeding from the flap margins after raising the flap.¹⁴

During Flap Raising

The flap is raised under tourniquet control and during flap elevation, an additional length [2 – 5 cm] of the short saphenous vein and sural nerve from the proximal aspect.^{3,8,13} Adipofascial fascia [1 cm] is included around the flap in the medial, lateral and proximal aspect so as to increase venous plexuses draining the skin paddle.⁸ The adipofascial pedicle is elevated wider [5 to 9 cm] than the conventional width of 2 to 4 cms.



During Flap Insetting

After flap elevation, the tourniquet is released and the bleeding points were cauterized and was followed by mobilization of the flap in to the defect. During mobilization of the flap in to the defect, it is important that the angle of rotation of the flap pedicle does not compromise on the flap vascularity.⁸ This depends on two factors. The location of the defect and the location of the additional perforator. It is safer to rotate the flap on either directions to 180° from the donor to the recipient site and observe for the bleeding pattern in the flap. Any kinking or compression might decrease the bleeding from the flap margins and henceforth the angle of rotation can be altered.



Avoidance of flap tunneling⁸ and application of far and few sutures¹⁵ at the recipient site also avoids compression of the flap pedicle and vascular compromise. In this series, no part of the flap was tunneled. The skin bridge between the flap donor and recipient sites was always opened and the adipofascial pedicle of the flap was directed through and was covered with split skin graft.



CONCLUSION

To conclude, increasing the venous plexus drainage of the reverse sural flap 1] By including the sural nerve and the lesser saphenous vein along the entire length of the flap in its mid axis, 2] By increasing the width of the adipofascial pedicle and avoiding the occlusion of venous drainage of the flap, 3] By careful selection of the angle of rotation of the pedicle, 4] By avoidance of tunneling, 5] Application of far and few sutures to the flap will enhance the safety of the reverse sural flap without flap delay or super charging.

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