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Versatility of Medial Sural Artery Perforator Free Flap for Head and Neck Reconstruction: An Institutional Experience

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ABSTRACT

Background: The choice of flap in reconstruction post head and neck cancer ablation has been continuously modified with addition of novel free flaps. The medial sural artery perforator (MSAP) free flap is gaining traction among reconstructive surgeons because of reliable pedicle which is thin, of satisfactorily length and acceptable donor site morbidity. Through this study, we would like to present our institutional experience about clinical outcome of usage of MSAP free flap in head and neck reconstruction.

Material and method: 15 cases of head and neck defects were resurfaced with MSAP free flap depending on site and size of defect and also based on location of perforators for flap harvest.

Results: All flaps survived with no major post-operative complications. Skin grafting was required in two cases for donor site of flap while primary closure was achieved in rest of the cases.

Conclusion: MSAP perforator free flap can be effectively used to reconstruct small to medium-size defects of tongue, buccal mucosa and palatal defects. Donor site complications and long learning curve are the only disadvantages attributed to this flap.

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INTRODUCTION

As the bouquet of free flap options for resurfacing head and neck defects post resection increases, choosing the appropriate flap for reconstructing a particular subunit of the head and neck region may be challenging. Survival rates for these patients have improved with better surgical technique and adjuvant/ neo-adjuvant methodology. The most appropriate reconstructive options should largely focus on regaining both form and function.[1]

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The most commonly used free flaps for oral reconstruction are free Anterolateral Thigh (ALT) flap and free Radial Artery Forearm free flap (RAFFF). These time-tested flaps have been serving the purpose very well but are not without their drawbacks. The ALT flap is associated with the downside of its bulk, while the RAFFF has undoubtedly significant donor site morbidity and unacceptable cosmesis. MSAP flap can be the best alternative to these flaps as the donor site morbidity is quite low like ALT flap, and the flap thickness is as good as, if not better than the RAFFF.[2]

BACKGROUND

Head and neck malignancy mostly includes malignant tumors that most commonly arise from the moist squamous cell mucosa or from the lining of the head and neck region. They are characterized according to

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their primary site of origin which can be nasal cavity and paranasal sinuses, oral cavity, pharynx, larynx etc.[3,8] Post oncosurgical resection their resurfacing remains a challenge owing to their location, complex anatomy, limited working space and availability of trained reconstructive surgeon besides the responsibility to restore form and function which will be grossly acceptable to the patients.

MATERIAL AND METHODS

All adult patients of either gender, who were admitted to the department and underwent free MSAP flap coverage for their post oncosurgical defects, were included in the study. Children below 14 years of age and those patients who did not consent to participate in the study were excluded. All the surgeries were performed under aseptic precautions in the operating theatre under general anaesthesia. Postoperatively the flap was monitored for any colour or temperature change and capillary filling time. The primary outcome measured was flap survival and secondary outcome measures included colour match, contour match, donor site morbidity, and functional outcome.

Indications of MSAP Flap in our study

- Small sized soft tissue defects of head and neck region
- oncological resection

Contraindications

- Deep vein thrombosis
- Peripheral artery disease
- Previous history of trauma to popliteal region

INCLUSION CRITERIA

1. Operated cases of oral squamous cell carcinoma in the study period having histopathology report available.
2. Age between 18–75 years

EXCLUSION CRITERIA

1. Patient with recurrent disease
2. Patient underwent NACT
3. Patient with other than oral cavity malignancy
4. Patient underwent surgery outside hospital

SURGICAL PROCEDURE

Marking of the flap was performed in a supine position. A line from the midpoint of the popliteal crease to the tip of the medial malleolus was drawn (figure 1). The potential perforators were localized with an 8 MHz handheld Doppler following this line from proximal to distal mostly at 8–12 cm. The preliminary flap design was based on the dopplered perforators and was further tailored intraoperatively using a defect template for drawing of the skin Island. After general anesthesia, and perioperative antibiotic single shot, the patient was placed in supine position with the hip and knee flexed at a 90-degree angle. With the aid of a tourniquet (without exsanguination) and magnification loupes, the planned flap was first incised medially. Flap elevation can be done supra - or sub-fascially. We prefer the subfascial approach because of easier flap and pedicle dissection. Dissection proceeded sub-fascially from medial to lateral until all potential perforators were identified. If a longer pedicle was needed, the flap was tailored so that the perforator entry - point was located at the margin of the skin paddle. Frequently, either one branch or an entire segment of the small saphenous vein was included in the flap as safety measure, as a potential additional venous outflow, if the perforator veins proved to be insufficient, or if the main pedicle vein was either not usable or irreparable injured during anastomosis. The perforator/perforators were dissected through the medial gastrocnemius muscle in a retrograde fashion towards the main vascular pedicle by longitudinally splitting the muscle fibers to "unroof" the perforator vessels. In this way, flap harvesting could be performed with minimal damage to the gastrocnemius muscle, thus avoiding potential postoperative muscle weakness. During dissection, multiple muscle branches were either coagulated or clipped meticulously, thus avoiding potential injury of the perforators or bleeding and consecutive hematoma formation after tourniquet release. Motor nerve branches of the tibial nerve running alongside the pedicle, during dissection were carefully prepared and preserved. After the flap and its main pedicle were completely raised, the tourniquet was released and a thorough evaluation of flap perfusion was performed. To reduce the overall ischemic time, the flap was only clamped when the

receptor vessels were properly prepared. All the vessel anastomoses were hand–sewn with separate stitches using 9–0 Nylon.

AIMS AND OBJECTIVES

To study the versatility and usefulness of Medial sural artery perforator (MSAP) free flap - a novel, yet challenging and versatile free flap for post-oncological defect reconstruction (a case series of 15 cases).

DURATION OF STUDY

The study was conducted for a period of April 2023 to March 2024 with follow up period of 6 months.

MATERIAL AND METHOD

All adult patients of either gender, who were admitted to the department and underwent free MSAP flap coverage for their surgical defects, were included in the study. Children below 14-years of age and those patients who did not consent to participate in the study were excluded.

All the surgeries were performed under aseptic precautions in the operating theatre under general anaesthesia. Postoperatively the flap was monitored for any colour or temperature change and capillary filling time. The primary outcome measure was flap survival and secondary outcome measures included colour match, contour match, donor site morbidity, and functional outcome (in terms of complete wound closure without any of distortion of adjacent facial structures.

CASE

A 40-year-old gentleman, diagnosed with carcinoma tongue T3N1M0 (figure 2) underwent near total glossectomy (figures 3 and 4) underwent reconstruction with free MSAP cover (figures 5 to 7). The flap survived with no donor site complications (figures 8 and 9). On subsequent follow up every 2 weeks till 6 months, patient was evaluated on parameters of flap mobility, swallowing, and speech comprehensibility.

RESULT ANALYSIS

A total of 15 patients were included in the study who underwent head neck oncological resection. Three out of 15, i.e., 20% were females while rest other were males.



Figure 1. Preoperative markings of MSAP flap axis and perforators with hand held doppler.



Figure 2. Preoperative photo of carcinoma tongue.



Figure 3. Excised specimen of tongue malignancy.



Figure 4. Defect created post excision of tongue malignancy.

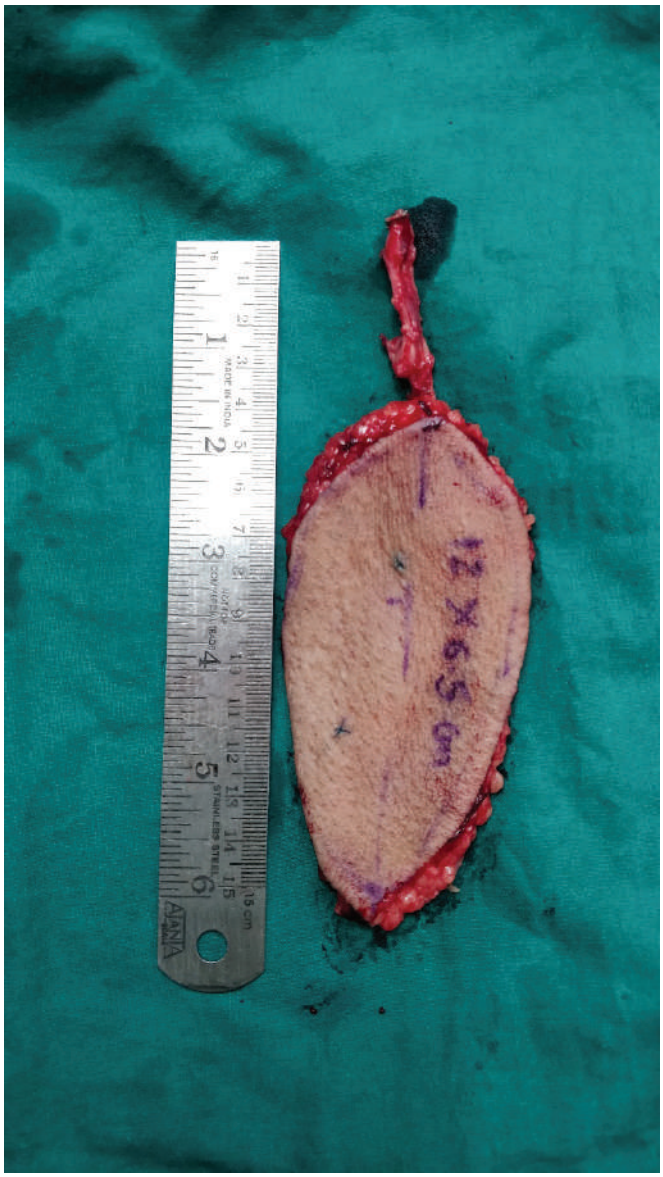


Figure 5. Anterior view of harvested free MSAP flap.



Figure 6. Posterior view of harvested free MSAP flap.

Also, 20% were tongue defects while 13% had maxillary defects. Three patients required donor site management with split skin graft because those defects were full thickness requiring outer skin and inner lining reconstruction. Rest 80% donor defects were managed with primary closure. Mean pedicle length was found to be 10.9 cm while average distance of perforator located from mid - point of popliteal crease was found to be 12.3 cm. Immediate post-operative complications were hardly any barring marginal necrosis in one of the flap which was managed conservatively. All flaps survived well and on follow up of 3months post their radiotherapy session, no complications were seen either.

LITERATURE REVIEW

In search of reliable free flap donor sites, Taylor and Daniel described in 1975 a "popliteal island flap" supplied by musculocutaneous branches of the medial and lateral sural vessels. In 1996, Montegut and Allen presented, based on their anatomical studies of the calf, the sural artery perforator flap, primarily as a local alternative to the gastrocnemius flap. In 2001, Hallock and Cavadas et al published a more extensive study about the mapping of the sural artery perforators, where also a series of six successful clinical cases of the medial sural artery perforator (MSAP) flaps,[4] including five free flaps



Figure 7. Post operative photograph of insetted flap after 5 days.



Figure 8. Immediate photograph of flap donor site closure.



Figure 9. Follow-up of flap donor site after 3 months.

and one pedicled flap for ipsilateral lower - leg and foot reconstruction were included. Since then, other manifold studies assessed the anatomical basis of the MSAPs. This flap has gained substantial popularity and has become one of the primary free flap choices for reconstruction of small - to – medium-size post-resectional soft tissue defects in the head and neck region. Considering the actual detailed knowledge of the calf perforator anatomy, and possessing adequate microsurgical expertise, this flap can be safely raised and transferred, especially in thin patients, presenting with small - to - moderate size soft tissue defects, where thin pliable skin is needed to achieve optimal postoperative aesthetic and functional results with minimum donor site morbidity.[5-7]

CONCLUSION

The MSAP flap has been shown to work well for hemi to near total glossectomy defects, besides buccal mucosa and maxilla defects. The advantages are its thin and pliable skin, good vascular pedicle length, less operating time, low blood loss and hairless flap with minimal donor site morbidity. An acceptable outcome and restoration can be expected with the use of such flaps for the defects mentioned above. The disadvantage on other side is long operative learning curve due to inconsistent location of perforators, tedious intramuscular dissection.[9,10] The usage of Doppler, CT angiography or magnetic resonance angiography could provide some idea of perforator location thus facilitating harvest of the flap.

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