



The Medial Sural Artery Perforator Flap

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Abstract

An ideal free tissue transfer flap after a major ablative head and neck cancer surgery is one that creates low donor site morbidity and allows for the greatest return of function. The Medial Sural Artery Perforator Flap (MSAPF) is a novel free tissue flap that is very thin and has low donor site morbidity. Below is a retrospective review of four MSAPF utilized by the senior author and an anatomical and instructive article.

Keywords: Perforator flap; Free tissue transfer; Reconstruction

Introduction

Free tissue transfer has become a standard procedure after a major ablative head and neck cancer surgery. For soft tissue reconstruction, the Anterolateral Thigh (ALT) free flap and Radial Forearm Free Flap (RFFF) are the most frequently used. While the anterolateral free flap has low donor site morbidity, the flap can be rather bulky for intraoral reconstruction of partial glossectomy defects and floor of mouth defects [1]. Conversely, while the radial forearm free flap is less bulky, there is considerable donor site morbidity including risk of sensory disturbance, scar, exposed tendon, and a second donor site for split-thickness skin graft harvest [2].

An alternative for soft tissue reconstruction is the Medial Sural Artery Perforator Flap (MSAPF). It is an attractive alternative as it combines the low donor site morbidity of the ALT flap while maintaining the thin pliable skin quality of a RFFF with long vascular pedicle. The MSAPF was first described by Cavadas et al. [3] in 2001. It has been recently reported in European oral surgery literature for oral defect reconstruction [4]. However, this novel technique is rarely used in head and neck surgery literature in the United States. The anatomy, preoperative planning and flap design, harvest techniques are reviewed below.

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Methods

This was a retrospective study of four patients at a single institution with whom a MSAPF was used by the senior author for head and neck reconstruction.

Anatomy/Surgical technique

The medial sural artery arises from the popliteal artery in the popliteal fossa and courses through the gastrocnemius muscle fibers. There are variable numbers of musculocutaneous perforators from the medial sural artery to the skin overlying the muscle. The average number of perforators is about two [5].

A line is drawn from the mid-popliteal fossa to the medial malleolus. A hand-held Doppler is utilized to identify skin perforators along the marked-line. An incision is first made laterally and skin carefully elevated off the gastrocnemius muscle in a subfascial plane. Care must be taken near the areas of the perforator during the elevation to avoid injury to these small perforators. Once identified, intramuscular dissection of the perforator is performed and the overlying muscle is divided with a fine bipolar cautery or harmonic scalpel. Dissection along the intramuscular perforator is carried from inferiorly to superiorly up to the popliteal fossa where the sural artery and venae comitantes take-off from the sural vessels. Next, the posterior anterior or medial incision made in the skin paddle and the skin paddle is raised. A chimeric flap can be raised with 2 skin paddles depending on the number of perforators to the skin. Typically, the incision can be closed primarily, but for larger skin paddles and depending on the skin laxity on the posterior aspect of the lower limb a skin graft can be placed over the muscle or external tissue expander device [6-10].

Results

From January 2017 to March 2018, four MSAPF were employed for reconstructing various

Table 1: Description of patients, indication for MSAPF, size of the skin paddle, and means of donor site closure.

Patient sex and age	Indication for flap	Skin paddle size	Donor site closure
63 male	Reconstruction for defect after mastoidectomy and total parotid	5 cm x 4 cm	Primarily
74 male	Reconstruction of floor of mouth after development of ankyloglossia from previous oncologic resection	Not recorded	Primarily
62 male	Reconstruction of vallecula, base of tongue, posterior pharynx	8 cm x 15 cm	External tissue expander
26 female	Reconstruction of hemiglossectomy and floor of mouth	Dual paddle, 5 cm x 8 cm and 3 cm x 5 cm	Primarily

**Figure 1:** Dual paddled MSAPF after dissection.**Figure 2:** Dual paddled MSAPF measuring 5 cm x 8 cm and 3 cm x 5 cm.

defects. Each patient had different use of the MSAPF, demonstrating the versatility of the flap. Three were males and one was female. Please refer to Table 1 for indications of flaps, skin paddle size, and the means by which the donor site was closed. Interestingly, a MSAPF was used to reconstruct a defect after hemiglossectomy for T2N0M0 squamous cell carcinoma of the tongue. The flap was dual paddled with one 5 cm x 8 cm paddle and one 3 cm x 5 cm paddle (Figures 1A, 1B). The larger paddle was used to reconstruct the hemiglossectomy defect, while the smaller paddle was used to reconstruct the floor of mouth defect (Figure 1-3). The donor site was closed primarily. The median age at the time of surgery was 56 years (range 26 years to 74 years). Three of the four patients were closed primarily. The fourth, given the size of the defect, was closed using external tissue expander. This continuous external tissue expander allows for delayed closure of the wound. There were no flap related complications.

Discussion

This study explored the versatility and effectiveness of the MSAPF. The flap was utilized for intraoral applications as well as external skin coverage with excellent success. Advantages of using

**Figure 3:** Dual paddled MSAPF after inset in floor of mouth and lateral tongue.

the medial sural artery perforator flap include the thin, pliable skin paddle, long pedicle, and ability to harvest 2 skin paddles on different perforators. The disadvantages of the flap are that it is perforator based flap requiring careful assessment of the perforator and meticulous intramuscular dissection of the small caliber artery and venae comitantes. The vessels usually get larger in the popliteal fossa but there is patient-to-patient variability in the size of the vessels.

The learning curve for this flap is not difficult for surgeons familiar with perforator flaps. The most important aspect is locating the perforator and positioning the patient in such a way to allow the surgeon to dissect the perforator. In some cases depending on the patient's size it may be helpful for the surgeon to stand on the same or contralateral side of the donor site. In our experience, bipolar or advanced harmonic technology devices can help keep bleeding to a minimum during the intramuscular pedicle dissection.

This is a fairly new flap for head and neck reconstruction, and there are not many studies on this flap. One of the few studies by Kao et al. [2] compared the use of MSAPF with the RFFF for head and neck reconstructions in 47 patients. There was no significant difference in time to harvest the flap, hospital stay, or recipient site complications. The sural flap group had better subjective functional and cosmetic outcomes. The lack of functional swallowing from the third patient is likely secondary to the very large defect after ablation. None of the aforementioned patients complained of their scar or difficulty with ambulation. The MSAPF advantages include ability to have a two-teamed approach, low donor site morbidity, long perforating vessels, and ability to raise a large skin paddle, versatility within the head and neck, and decreased bulk, as compared to the ALT flap.

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