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Supraclavicular artery island flap in the reconstruction of oral cavity cancer defects

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ABSTRACT

Background: Microvascular free flaps are the standard of care in the reconstruction of head and neck resection defects, however they need a significant surgical expertise and increase the operative time. Supraclavicular artery island flap (SCAIF) is a versatile fasciocutaneous flap that offers the advantage of both, a regional flap (easy to harvest) and a free flap (thin and pliable) in the head and neck reconstruction.
Methods: In this study we analysed the utility of this flap for the oral cavity cancer defect reconstruction done in 12 consecutive cases.
Results: There were 8 males and 4 females with a mean age of 54.75 years. The oral cavity subsites were as follows: buccal 3 (25%); tongue 3 (25%); lower alveolus 2 (16.66%); floor of mouth 1 (8.33%); gingivobuccal sulcus 2 (16.66%); retromolar trigone 01(8.33%).The excisional defect size ranged from 4×2 cm to 6×3 cm with a mean size of 5×3 cm. The mean harvest time was 45 minutes (range 35 min - 65 min). We had complete flap loss in 2 (16.66%) patients and partial flap loss in 1 (8.33%) patient. Donor site wound gape was noted in 2 (16.66%) patients. The hospital stay ranged from 7 days to 10 days in non-complicated cases. The mean follow up period was of 8.58 months.
Conclusions: SCAIF is versatile, easy to harvest, safe and reliable in selective cases of oral cavity cancers and a potential alternative regional flap in head and neck reconstruction.

Keywords: Supraclavicular artery island flap, Reconstruction, Oral cavity cancer

INTRODUCTION

Head and neck cancer resection lead to complex defects that are difficult to reconstruct. In addition to the anatomical defect, the functional loss, cosmetic disfigurement and the accompanying psychosocial effects can be devastating to the patient. Reconstructive surgery restores the anatomical defect with functional and aesthetic rehabilitation thereby improving the quality of life of the patient. The various reconstructive options range from simple primary closure, skin grafts, locoregional flaps, pedicled flaps to a more complex microvascular free flaps. The choice of these techniques depend on the type of defect, size of defect, the colour and texture of the donor area and the availability of surgical expertise. Although microvascular free flaps are the standard of care in the reconstruction of these complex composite resection defects, pectoralis major myocutaneous flap (PMMC) is still used in reconstruction of these complex defects. PMMC flap is rather a bulky flap that makes it difficult to inset it inside the defect and adds an extra soft tissue bulk in the neck.

In young females especially the presence of breast tissue within the flap and the donor site deformity makes it a less favoured choice in them. Microvascular free flap need a significant surgical expertise, they increase the operative time, increase the hospital stay and consequently the cost of the overall treatment.

Supraclavicular artery island flap (SCAIF) is a versatile fasciocutaneous flap that offers the advantage of both, a regional flap (easy to harvest) and a free flap (thin and pliable) in the head and neck reconstruction. The utility of SCAIF in the head and neck reconstruction is gaining popularity because of its versatile nature, thin and pliable donor skin and the ease of harvest. Its application has evolved over the time and at times even controversial regarding its vascularity and reliability. Mütter first described the use of medial-based random shoulder flaps in head and neck reconstruction.[1] Kirschbaum described the utility of the acromial or the "in charretera" flap, representing the ornamental shoulder patch worn on a military uniform.[2] The "in charretera" flap became known as the cervicohumeral flap as popularized by Mathes and Vasconez.[3] Lamberty described the supraclavicular artery flap, an axial flap taken from the shoulder and supraclavicular area.[4] He described the supraclavicular artery as a distinct branch of the transverse cervical artery in most cases and of the suprascapular artery in a smaller number.

Inspite the description of the flap and its anatomy, reports in literature disappeared until the late 1990s, when Pallua et al described the SCAIF for reconstruction of cervicomental scar contractures and provided a clear anatomic description of the blood supply to this flap. In their study, the supraclavicular artery branched off the transverse cervical artery in all cases.[5] The venous drainage came from paired venae commitantes that jointed the transverse cervical vein or the external jugular vein. The takeoff of the supraclavicular artery was located in the triangle created by the external jugular vein, the posterior border of the sternocleidomastoid muscle, and the clavicle. Chiu et al reported their initial experience with the SCAIF for reconstruction of oncologic defects of the head and neck, and their group have reported extensively on its reliability and versatility.[6]

In this study we analysed the utility of this flap for the oral cavity cancer defect reconstruction done in 12 consecutive cases.

METHODS

This prospective study was conducted at Shrimati Kashibai Navale Medical College and General Hospital, Narhe, Pune, from January 2017 to January 2018 following the approval of institutional review board. Twelve patients with biopsy proven squamous cell carcinoma of oral cavity who presented to the outpatient department of surgery were included in the study. All these patients underwent a standard metastatic workup that included a chest X-ray, ultrasonography of abdomen and contrast enhanced computed tomography of head and neck.

Patient's selection criteria

- Patients were deemed candidates for the SCAIF reconstruction if their defect was not expected to close primarily and was expected to require a regional flap or free-tissue transfer.
- The defect would not require a flap that was wider than 6 to 7 cm.
- The defect had to be located within 20 to 25 cm from the point in the supraclavicular fossa that was used as the fulcrum when rotating the SCAIF.
- Patients with a node negative neck detected on imaging.

We recorded demographic data, including age, sex, tobacco and alcohol use, prior treatment, tumour site and stage, and the adjuvant treatment received. Surgical information collected included the levels of neck dissection, defect location, flap size, and time to harvest the flap. In addition, success of flap reconstruction and complications were recorded. The study analysis was done by collecting data from the case records and entering into the proforma of the study. All these patients were followed up monthly to assess for recurrences and disease status. At the end of study, the entire data of these patients was analysed.

Surgical technique

All the patients were counselled preoperatively about the surgical procedure and a visible scar over the donor site area. For oncological safety it is important to ascertain that no enlarged nodes are present in the levels 4 and level 5. The procedure was performed under general anaesthesia with endotracheal intubation. The outline of the flap was centered over the deltoid-acromion prominence. The pedicle of supraclavicular artery flap lies deep in the supraclavicular and the posterior triangle (bounded anteriorly by the posterior border of sternocledomastoid muscle, posterior by the anterior border of trapezius muscle and inferiorly with the clavicle) deep to the belly of the omohyoid muscle and parallel to the clavicle. We did not use hand held Doppler for locating the pedicle in any of our cases. The flap outline was marked with two parallel lines; posterior line was 1 cm anterior to the trapezius muscle while the anterior line was 1 cm parallel to the anterior margin of the clavicle. These two lines were joined to include the deltoid-acromion prominence. The length of the pedicle was determined with the arc of rotation centred over the supraclavicular triangle. Flap was elevated from distal to proximal in subfascial plane by taking care to avoid damage to pedicle. The communicating perforators from the deltoid branch of the thoraco-acromial axis and posterior circumflex humeral artery are sacrificed. The

flap is raised at a subfascial level just superficial to deltoid muscle by sharp knife dissection (to reduce thermal damage). Special care is taken not to elevate the pedicle with its fatty adipose tissues from the floor of posterior triangle that contains the pedicle of the flap. The flap is then free to be transposed into the defect. The raised flap is observed for bleeding from the distal end to ensure intraoperative flap viability. The flap is tunnelled below the cervical incision and below the sternocleidomastoid muscle along an arc of 120-180 degrees rotation. The area of the pedicle that has to be buried under skin flaps is de-epithelized preserving the subcutaneous fat. The flap inset is done with a single layer suturing with 3-0 polygalactin (Vicryl). The donor site is closed after undermining the flaps and closed with non-absorbable 3-0 nylon (Ethilon) sutures. If primary closure was not possible then the defect was closed with split skin graft. In the postoperative period the flap was monitored for viability, temperature and haematoma formation.

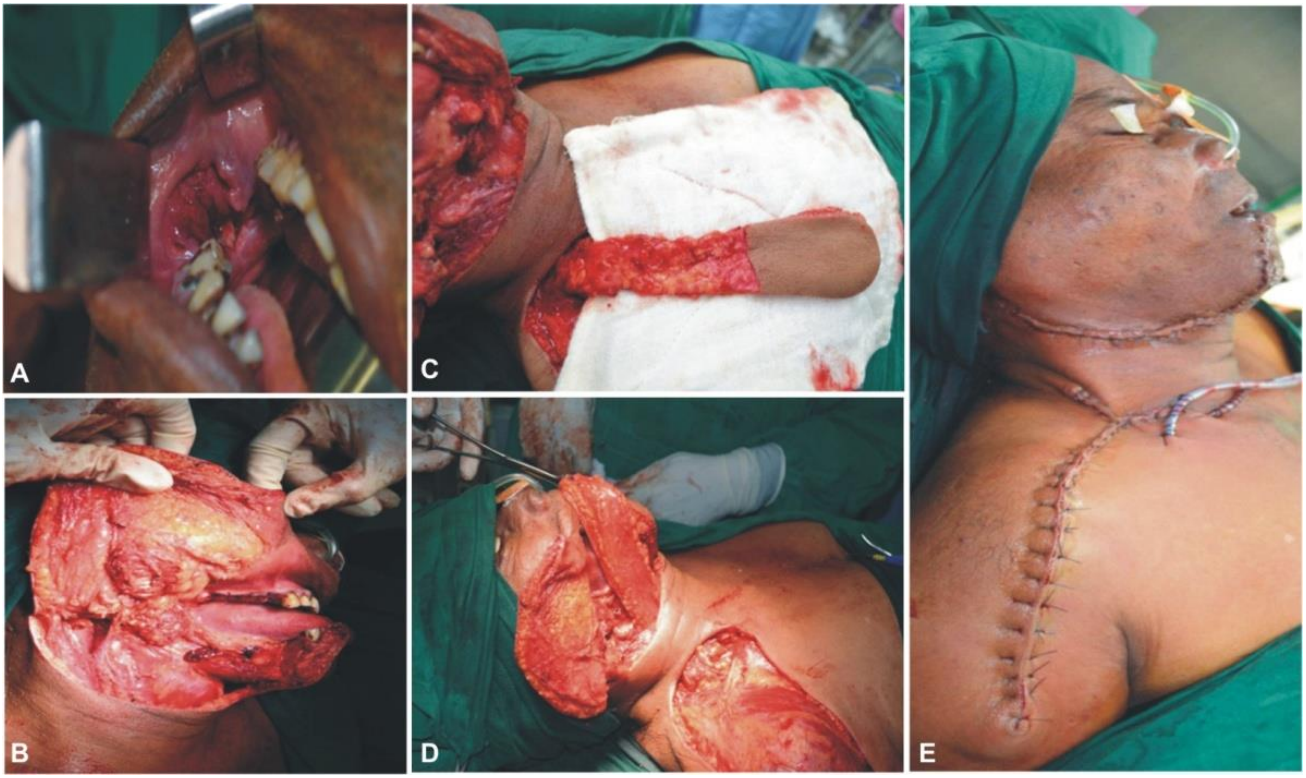

Figure 1: (A) Retromolar trigone growth; (B) wide local excision with posterior segmental mandibulectomy defect; (C) de-epithelised flap; (D) flap transposed beneath the sternocleidomastoid muscle into the defect; (E) donor area closed primarily.

Figure 2: (A) Retromolar trigone growth; (B) postoperative result after reconstruction at 6 month.

Representative case capsules

Case 1: Retromolar trigone defect

64 year old gentleman presented with a growth at the right retromolar trigone extending into the buccal mucosa. He underwent wide local excision with posterior segmental mandibulectomy. The resultant defect size was 4×3 cm that was reconstructed with right supraclavicular artery island flap (Figure 2).

Case 2: Segmental mandibulectomy defect

48 year old gentleman presented with a lesion over left lower alveolus. He underwent segmental mandibulectomy and the resultant defect size was 6×3 cm that was reconstructed with supraclavicular artery island flap.

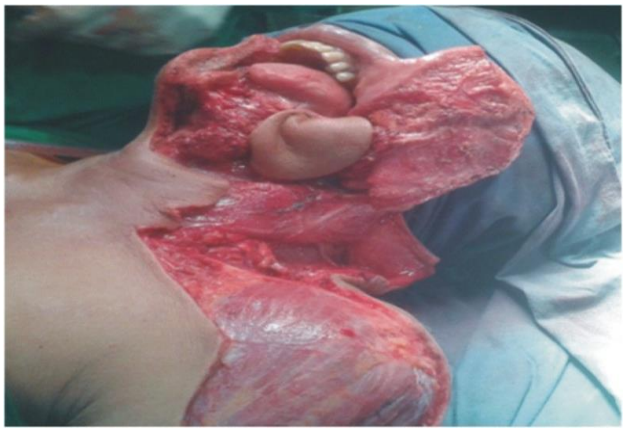

Figure 3: Segmental mandibulectomy defect showing flap inset.

Case 3: Hemiglossectomy defect

40 year old lady presented with an ulcero-proliferative lesion at the left lateral aspect of tongue. The floor of mouth was free and the lesion was away from the mandible. She underwent hemiglossectomy and the resultant 6×3 cm defect was reconstructed with supraclavicular artery island flap.

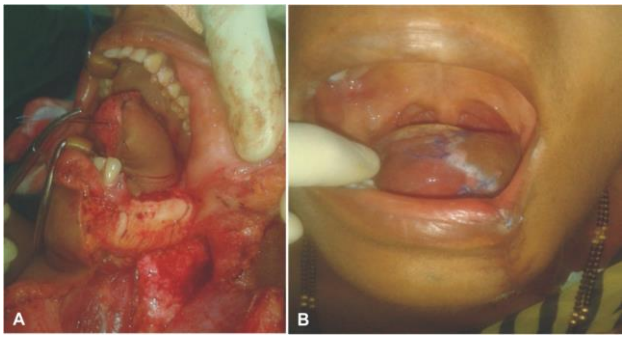

Figure 4: (A) Intraoperative view of hemiglossectomy defect reconstructed with SCAIF; (B) postoperative second week.

RESULTS

In our study 12 consecutive cases of oral cavity cancer underwent supraclavicular artery island flap reconstruction from January 2017 to January 2018.

Table 1: Patient and tumour characteristics and demographic data.

Age (years)	36-74; mean- 54.75	
Male:female	8:4	
Defect size (cm)	4×2 to 6×3; mean 5×3	
Oral cavity cancer subsites N (%)	Buccal mucosa	3 (25)
	Tongue	3 (25)
	Lower alveolus	2 (16.66)
	Floor of mouth	1 (8.33)
	Gingivo buccal sulcus	2 (16.66)
	Retromolar trigone	1 (8.33)
Type of neck dissection N (%)	Su praomohyoid neck dissection	8 (66.66)
	Extended supraomohyoid neck dissection	4 (33.33)
Type of mandibulectomy N (%)	Segmental mandibulectomy	4 (33.33)
	Posterior segmental mandibulectomy	2 (16.66)
	Marginal mandibulectomy	2 (16.66)
pTNM stage N (%)	pT2No	6 (50)
	pT2N1	2 (16.66)
	pT3No	2 (16.66)
	pT3N1	1 (8.33)
	pT4No	1 (8.33)
Complications N (%)	Complete flap loss	2 (16.66)
	Partial flap loss	1 (8.33)
	Donor site gape	2 (16.66)
Adjuvant treatment N (%)	Adjuvant treatment required	5 (41.66)
	No adjuvant treatment required	6 (50)
	Adjuvant treatment required but not taken	1 (8.33)
Follow up (in months)	4-16; mean- 8.58	

There were 8 males and 4 females. The age ranged from 36 years to 74 years with a mean age of 54.75 years. The oral cavity subsites were as follows: buccal 03 (25%); tongue 3 (25%); lower alveolus 2 (16.66%); floor of mouth 1 (8.33%); gingivobuccal sulcus 2 (16.66%); retromolar trigone 1 (8.33%).The excisional defect size ranged from 4×2 cm to 6×3 cm with a mean size of 5×3 cm. The mean harvest time was 45 minutes (range 35-65 min) and the time taken for flap de-epithelising was 15 minutes. In all our cases the donor site was closed

primarily. The hospital stay ranged from 7 days to 10 days in non-complicated cases. We had complete flap loss in 2 (16.66%) patients and epidermolysis and partial flap loss in 1 (8.33%) patient. Donor site wound gape was noted in 2 (16.66%) patients that were managed with dressings and secondary suturing. Eight patients (66.66%) underwent supraomohyoid neck dissection while 4 (33.33%) patients underwent extended supraomohyoid neck dissection. Segmental mandibulectomy was done in 4 (33.33%) patients, marginal mandibulectomy in 2 (16.66%) while posterior segmental mandibulectomy was done in 2 (16.66%) patients. The patients who had complete flap loss were managed with flap debridement and dressings. In these patients the oro-cutaneous fistula healed with secondary intention and it did not cause any major morbidity. These patients however had a long hospital stay and they were discharged on twentieth postoperative day after they resumed normal oral intake. On final histopathology report, 5 (41.66%) patients had pT2N0 disease; 02 (16.66%) patients had pT2N1 disease; 2 (16.66%) patients had pT3N0 disease; 1 (8.33%) patient had pT3N1 disease and 1 (8.33%) patient had pT4N0 disease. The margins were tumour free in all these excisions and the average lymph node retrieval was 17 nodes. Three patients (25%) had a node positive disease, however they did not have extracapsular extension. Out of these 12 patients, adjuvant treatment was given to 5 (41.66%) patients while 6 (50%) patients were kept on regular follow up because their tumour did not have high risk features. One patient (8.33%) was advised adjuvant treatment, however the patient defaulted the treatment due to financial reasons. The follow up period ranged from 4 months to 16 months with a mean follow up period of 8.58 months. During the follow up period the donor site scar showed minimal stretching in 4 (33.33%) patients and we did not have any local recurrences.

DISCUSSION

In our study all the cases were of the oral cavity carcinoma were reconstructed with SCAIF. These indications are similar to those of Alves et al, who reconstructed mostly oral cavity (40.4%) and cutaneous (51.1%) defects in 47 patients.[7] This flap can be utilised for variety of head and neck reconstruction as described by Chiu et al.[6] The mean defect size was 5×3 cm in our study. Pallua et al demonstrated successful flap harvest ranging from 4 to 12 cm in width and 20 to 30 cm in length and found that SCAIF is safe and reliable.[5] The mean flap harvest time was 45 minutes in our study that was similar to Chiu et al that was less than one hour. The time taken to de-epithelise the flap was 10 minutes and it is the most tedious part of the procedure because the flap is already mobilised and we have to be careful while de-epithelising the flap as we might accidently take the subcutaneous fat beneath the flap and jeopardize its vascularity. A study by Kotot et al reported 15 minutes time for de-epithelising the flap because their flap dimensions were more than our study patients.[8]

We had complete flap loss in 2 (16.66%) patients, epidermolysis and partial flap loss in 1 (8.33%) patient. In patients with complete flap loss oro-cutaneous fistula developed, that healed with secondary intention without the need of salvage flap. Similar study by Kotot et al [8] showed an oro-cutaneous fistula rate of 16% that was similar to our study. Studies using the SCAIF for reconstruction of head and neck oncologic defects had partial flap necrosis rates of 4.2% to 14.9% and complete flap necrosis rates of 0% to 5.6%. The rates of salivary fistula ranged from 6.4% to 16.7%.[6,7,9,10]

Fistula rates after radial free forearm flap have been reported to be 32% and pectoral major myocutaneous flap has been 13-63%.[11-13] Donor site wound gape was noted in 2 (16.66%) patients that were managed with dressings and secondary suturing. Chiu et al reported 2 cases of shoulder cellulitis and 1 shoulder wound dehiscence.[6] There was no functional morbidity of shoulder movements except that some patients experienced tension at the deltoid-acromian area. These patients had minor stretching of the scar. Donor site morbidity of PMMC flap includes loss of anterior axillary fold and distortion of breast form in females while morbidity of radial free forearm flap includes need of skin graft to close donor area and reduced strength of grip power. SCAIF has no major functional and cosmetic morbidity compared to PMMC and radial forearm free flap.

Limitations of our study

The major limitation of this study is the small number of case series (12 patients) and the fact that only oral cavity cancer cases were included in this study. This flap can be utilised for variety of head and neck reconstruction including non-malignant complex defects as well as the skull base defects. We began our study with a small number of early oral cavity cancers defects and with further experience we will encompass complex oropharyngeal resection defects as well. We could not identify the cause of total flap loss in our study so we have postulated that in some defects of the oral cavity, the complex folding needed to inset the flap in the defect may have lead to partial or total flap necrosis. Another limitation of our study is that we did not assess the patient's perception of the reconstructive surgery, especially with regard to cosmetic outcome for the cutaneous defects and the donor-site scar. Lastly the follow up period was small to assess for the local recurrences.

CONCLUSION

In our study we found that the SCAIF is versatile, easy to harvest, safe and reliable in selective cases of oral cavity cancers and head and neck reconstruction. The flap can be harvested in less than one hour in majority of cases. It provides a thin and pliable skin for oral mucosa lining and an excellent skin colour match for cervical and facial defects. The length of the flap is sufficient to reach

defects in oral and oropharyngeal reconstruction. Finally, donor-site morbidity is minimal. It therefore has a potential of becoming a alternative regional flap for head and neck oncologic reconstruction.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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