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Case Series

Submandibular gland flap in reconstruction of head and neck cancer defects

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ABSTRACT

Management of head and neck cancer defects has been challenging owing to the complexity of the created defects. Various local and regional flaps to free flaps have been described in the reconstruction of cancer defects, each of them having it's own merits and limitations, therefore none of them appears as an ideal one. A Submandibular gland flap (SMGF) technique has emerged as a versatile flap having advantages of a regional and a free flap. In this study, eleven patients (four tongue, six buccal mucosa defects and one retromolar trigone defect) underwent reconstruction of oral cavity cancer defects with SMGF. The outcomes of the SMGF were evaluated in terms of the ease of harvest, functional outcome, and postoperative complications. The mean defect size and the flap dimensions were 4.4×3.9 cm and 3.6×3.3 cm respectively. One patient suffered wound infection resulting in partial flap necrosis with wound dehiscence. In the follow-up period one patient developed contra nodal recurrence and another patient developed a second primary on the contralateral base of the tongue. This study showed that SMGF is an excellent flap for the reconstruction of oral cavity cancer defects because of its reliability, versatility and its relative ease of application.

Keywords: Submandibular gland, Reconstruction, Head and neck defects, Squamous cell carcinoma, Submandibular gland flap

INTRODUCTION

Submandibular swelling is a common presentation in Head and neck surgery clinics but SMG tumor is quite rare comprising less than 2% of head and neck cancer and SMG malignancies are even rarer.[1,2] Because of low risk of metastasis to the gland from the primary oral cavity tumors, the reconstruction of defects with SMG flap remains a safe and viable option for reconstruction.[3] Management of head and neck cancer defects has been challenging owing to the complexity of created defects. In head and neck cancers various local and regional flaps to free flaps have been described for reconstruction.[4] Submandibular gland flap (SMGF) is a pedicled flap based on the facial artery, harvested with relative ease utilizing the same incision as for the neck dissection.[5] Reports have shown that salivary gland flap is effective in repair of medium sized defects of head and neck because of its simplicity, effectiveness and without any additional morbidity.[6] The SMG flap is also effective for volume restoration in hemi-glossectomy and reconstruction of almost whole of the buccal mucosal defect.[7]

Most conventional reconstructive regional and free flaps tend to be time-consuming in being harvested, requiring additional scar leading to increased morbidity. Hence, there has been a need for a new reconstruction method to improve the reliability and versatility of reconstructive surgery.[8] The SMGF is a versatile flap, which overcomes disadvantages of both regional flap and a free flap; the

SMGF is an excellent reconstructive method and is successfully used for the reconstruction of oropharyngeal malignancies, oral cavity defects and head and neck cancer defects.[9-11] SMGF flap has also been reported to be effective for the reconstruction of oral cutaneous fistula's.[12] SMGF is therefore considered having a potential application in reconstructing medium head and neck defects. Considering this, the study was conducted to determine the effectiveness and the outcomes of using SMGF among head and neck malignancies. Eleven patients with primary head and neck squamous cell carcinoma underwent excision and reconstructive surgery with SMGF during the period February 2018 to February 2019. Tumors of oral cavity <T3, N0 neck, expected survival over 1 year, without cerebrovascular disease and comorbidities were the inclusion criteria for this study. The patients with N+ neck, systemic metastasis, prior neck surgery or radiotherapy, ECOG performance status >1 were excluded from the study. The patients were followed up to 11 months with a mean of 7.27±3.93 months. Demographic profile, intraoperative details, postoperative outcomes and follow-up of the flap patients were recorded (table). The hospital ethical committee review board approved the study and written informed consent was obtained from all the patients.

The procedure was carried out under general anesthesia; patient intubated and positioned supine with neck extension face rotated to the opposite side. The primary tumor was resected with 1 cm margin beyond the indurated margin, oriented with markings; negative margins were confirmed by frozen-section. Ipsilateral SND (I-III) was performed in buccal mucosa tumors and SND (I-IV) in tumors of lateral border of the tongue. A horizontal skin incision through the subcutaneous tissue and platysma was given 2 fingerbreadths below the chin extending to the angle of the mandible, preserving marginal mandibular nerve hitched in the upper flap. The submandibular gland with its protected capsule was dissected cranially and caudally freeing the anterior border from the digastric muscle. Facial artery was identified, proximal ends of the facial artery and anterior facial vein served as pedicles, the distal ends of facial artery and vein were ligated at the level of the lower border of mandible. The SMG was released after severing the Wharton's duct, was transposed intraorally through an incision in the mylohyoid muscle and sutured to the oral defect. Utilizing the same incision subplatysmal flap was raised inferiorly and ipsilateral selective neck dissection was performed. The neck wound was closed in layers after hemostasis and drain was inserted and secured. The drain was removed after 48 hours, maintaining collection below 30 ml, and sutured removed on 7th day.

CASE SERIES

Case 1

A 55-year-old woman developed an ulcerative lesion involving nearly the whole of left buccal mucosa, 1.5 cm away from oral commissure. The lesion reached up to the upper and lower gingivobuccal sulcus. The patient underwent wide excision of a buccal lesion + marginal mandibulectomy + upper alveolectomy with ipsilateral SND dissection (I-III). After resection of the lesion, a defect sized 5x3.5 cm was reconstructed with left-sided preserved pedicled SMGF, passed through a tunnel created in the floor of the mouth and sutured onto the defect. The harvesting time for the flap was 30 minutes. The Ib node sent for frozen section confirmed the absence of metastasis. The postoperative course was uneventful with a normal range of mouth opening and swallowing. Patient was disease free at 9 months' follow-up. The details shown in Figure 1.

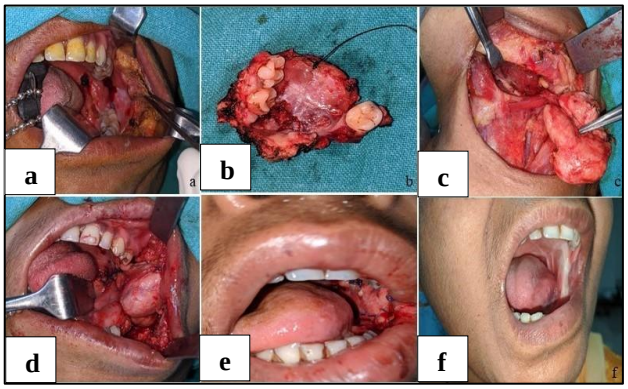

Figure 1: (a) ulcerative lesion involving left buccal mucosa and upper and lower gingivobuccal sulcus (b) wide local excision of lesion+marginal mandibulectomy and upper alveolectomy (c) submandibular gland flap raised (d) submandibular gland flap sutured to the defect (e) postoperative results after 2 weeks (f) postoperative results after 3 months.

Case 2

A 48-year old female presented with ulcero-proliferative lesion of lateral border of the left tongue, approximately 4×3 cm in size not crossing the midline with sparing of the tip. A left hemiglossectomy with ipsilateral SND (I-IV) was performed and the resulting defect reconstructed with SMGF. Following reconstruction function of the tongue recovered well without any negative impact on swallowing and phonation. The contour of the tongue appeared pleasing with well-mucosalized surface postoperatively (Figure 2). There was no recurrence at the primary site during the follow-up period, but a second primary developed on the contralateral base of tongue at 11 months.

Case 3

A 59-year old man had a small ulcerative lesion sized 3.1×3 cm, located on posterior right buccal mucosa falling short of retromolar trigone (RMT) region. Wide local excision of the lesion including 1 cm safety margin beyond

the induration was performed along with right SND (I-III). The defect was reconstructed with SMGF. Buccal mucosal defect reconstruction postoperatively looked satisfactory without restrictive mouth opening (Figure 3). The postoperative period remained uneventful. Table 2 shows the demographic and clinical characteristics of all the three study cases.

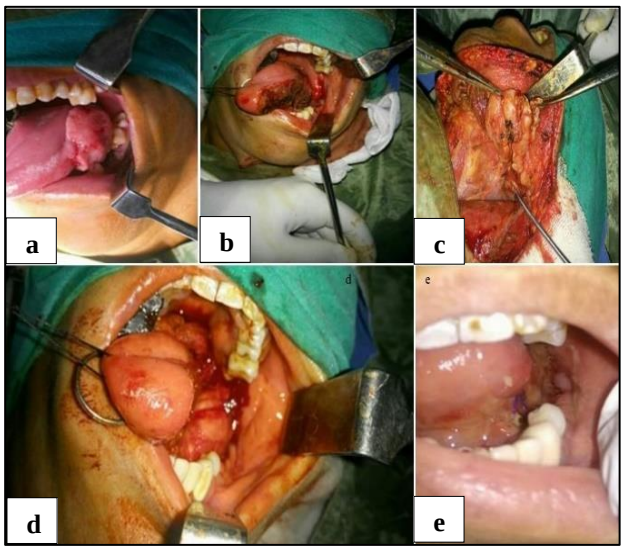

Figure 2: (a) Ulcero-proliferative lesion on the lateral border of tongue (b) excision of the tumor with 1 cm clearance beyond indurated margins (c) submandibular gland flap being raised (d) submandibular gland flap being raised sutured into the tongue defect (e) postoperative results after 3 weeks.

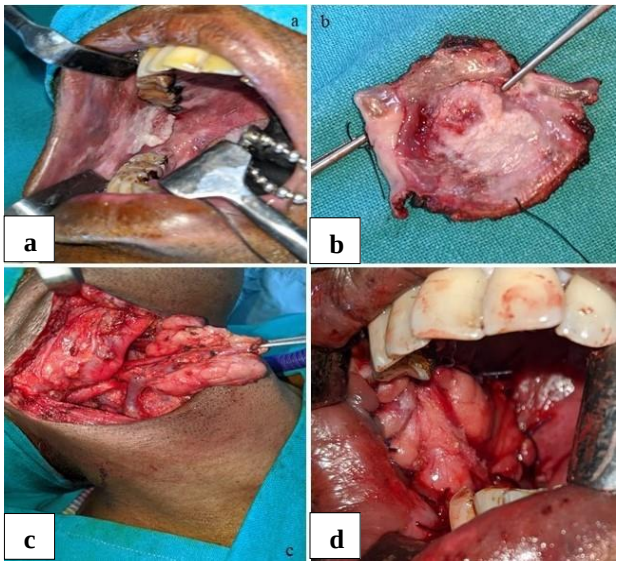

Figure 3: (a) Ulcerative lesion of right posterior buccal mucosa extending up to RMT (b) excised lesion including 1 cm beyond the indurated margins (c) submandibular gland flap raised after level I-III dissection (d) submandibular gland flap sutured to the defect.

RESULT

Oral cavity primaries were operated in eleven patients: four patients (36%) with tongue defects, posterior buccal mucosa defect in six patients (55%) and one (9.09%) RMT defect. Selective neck dissection (I-III) was performed in six patients and five underwent I-IV. The demographic and clinical parameters detail of site, clinical stage and type of surgery, pathological type of the tumor and followed-up information were recorded (Table 1). 55% were males vs. females (45%) with the mean age of 60.36±5.70. Amongst them smoking (55%), alcohol consumption (45%) and chewing pan masala (27.27%) were found. There were 3 (27.27%) patients with diabetes and 2 (18.18%) were hypertension. All patients had untreated primary T2 of the oral cavity with N0 neck.

Patients with tumors of lateral tongue involving the periosteum of mandible underwent marginal mandibulectomy (27.27%) and two (18.9%) had upper alveolectomy. The mean surgical defect size was 4.4×3.9 cm (range 3×2.5-4.5×4.2 cm) and the mean of total flap dimensions was 3.63×3.3×1.6 cm (range 3×3.3 - 4×3.8 cm). The size of SMGF is comparatively smaller than the size of the defect because SMG being a globular 3D structure, size increases by flattening when sutured to the defect. The mean flap pedicle length was 2.95 cm and the flap harvest time was less than 30 minutes since the operative field of the harvest was same as that for neck dissection. The donor sites in all the patients were closed primarily.

Patients were followed up for a mean 7.27±3.93 months, none died with the disease progression or systemic complications. Barium swallow and functional endoscopic evaluation of swallowing by video-fluoroscopy assessed functional outcome of posterior tongue reconstruction showed satisfactory improvement in swallowing. Minor flap complications such as seroma, wound infection and partial or complete loss were not encountered except in one patient who had mild wound dehiscence due to poor diabetic control which healed subsequently by secondary intention. The mean hospital stay of the patients was 3-4 days, the maximum being of 7 days in a patient of large buccal mucosa lesion defect who suffered partial flap loss, managed conservatively. Among the patients, six (55%) of them received postoperative radiation and one (9.09%) received chemotherapy. There was no flap related complications encountered which delayed starting adjuvant radiotherapy therapy. Recurrence of tumor at the flap site, or nodal recurrence within a year of follow-up was not observed, however in 2 patients (19%) one patient of carcinoma tongue (T2N0M0) developed a contralateral level II node within 8 months of completion of the treatment while another one developed a second primary on the contralateral base of the tongue at 11 months. All the patients survived surgery with 100% postoperative satisfactory success rate, with a reasonable good outcome after a 11 months of follow-up.

Table 1: Demographic and clinical characteristics of the patients.

Clinical characteristics		N (%)
Male		6 (55)
Female		5 (45)
Age		60.36±5.70
Smoking	Yes	6 (55)
	No	5 (45)
Pan masala	Yes	3 (27.27)
	No	8 (72.73)
Alcohol	Yes	5 (45)
	No	6 (55)
Diabetic complications	Yes	3 (27.27)
	No	8 (72.73)
Hypertension	Yes	2 (18.18)
	No	9 (81.82)
Previous surgery/radiotherapy		0
Primary site		Oral cavity
Sub site	Buccal mucosa	6 (54.55)
	Tongue	4 (36.36)
	Retro molar trigone	1 (9.09)
Composite stage		II
Primary surgery		
Wide excision + marginal mandibulectomy		3 (27.27)
Hemiglossectomy		3 (27.27)
Wide excision + marginal mandibulectomy + upper alveolectomy		1 (9.09)
Wide excision + upper alveolectomy		1 (9.09)
Wide excision		2 (18.19)
Partial glossectomy		1 (9.09)
Reconstruction		Submandibular gland flap
Ipsilateral neck		
SND (I-III)		6 (55)
SND (I-IV)		5 (45)
Side of flap		
Right		5 (45)
Left		6 (55)
Size of the defect (mean)		4.4×3.9 cm
Size of the flap (mean)		3.6×3.3×1.6 cm
Pedicle length (cm)		
2.8		4 (36.36)
3.0		5 (45.46)
3.1		1 (9.09)
3.2		1 (9.09)
Donor site closure		Primary
Systemic/flap/donor complication		None
Postoperative		
Radiotherapy		6 (55)
Chemotherapy		1 (9.09)
None		4 (35.91)
Follow-up		7.27±3.93
On the last follow-up		
Mild oral stiffness		1 (9.09)
Second primary opposite buccal mucosa		1 (9.09)
NED		9 (81.82)

Continued.

Clinical characteristics	N (%)
Recurrence	
Contralateral level II lymphatic metastases	1 (9.09)
Second primary in contralateral base of tongue	1 (9.09)
None	9 (81.82)
Survived	11 (100)

Data are reported as the number of subjects with percent in parentheses. Age and follow-up are represented in mean±SD. SND-side neck dissection, NED- no evidence of diseases

Table 2: Detailed information of the two cases described as case studies.

Case No	Gender	Age	Sub-site	Size of defect (cm)	Primary surgery	Size of the flap (cm)	Pedicle length (cm)	Follow-up (months)	Last follow-up information
1	F	55	Buccal mucosa + UBGS + LGBS	5×3.5	Wide Excision + Marginal Mandibulectomy + Upper Alveolectomy + Neck Dissection (I-III)	3.8×3.2	3.2	9	NED
2	F	48	Tongue	4×3	Hemiglossectomy + neck dissection (I-IV)	4×3	3.1	11	Second primary opposite buccal mucosa
3	M	59	Buccal mucosa	3.1×3.3	Wide excision + neck dissection (I-III)	3.2×3	3	9	NED

NED-No evidence of disease, UBGS- Upper gingivobuccal sulcus LGBS - Lower gingivobuccal sulcus

Table 3: Analysis of literature concerned on using various flaps successfully in the reconstruction of various defects.

References	No. of patients	Pathology	Flap used	Tumor Location	Harvesting time/ follow-up (minutes/months)
Mashrah et al[6]	20	SCC	SGMF	Oral cavity	-/26
Zhang et al[10]	8		SGMF	Tongue	-/28
Giordano et al[17]	28	SCC	Supraclavicular artery island flap	Oropharynx	55-60/-
Ramirez et al[18]	14	Oral SCC	Submental artery island flap	Oral cavity	-/12
Koktot et al[19]	45	SCC	Supraclavicular artery island flap	Oral cavity, oropharynx, laryngopharynx	60/31
Sittitrai et al [20]	35	SCC	Submental island flap	Oral cavity	-/48
Guha et al[21]	23	SCC	Facial artery perforator-based flaps	Facial defects	-/20
Current study	11	SCC	SGMF	Head and neck defects	30/12

SCC- Squamous cell carcinoma, SGMF- submandibular gland flap, BCC- basal cell carcinoma, VC-verrucous carcinoma

DISCUSSION

Reconstruction of the defects following ablation of head and neck malignant tumors with complete clearance of the tumor remains challenging. The size, location, and function of the defective site are the key determining factors in choosing the most appropriate reconstruction modality. Ideally flap for reconstruction should be reliable, functional and cosmetically acceptable, of sufficient size with minimal donor site morbidity and should match the recipient site in terms of color, texture, and thickness.[13]

Various techniques, including skin grafts, local or regional flaps, and free vascularized tissue transfers, can be used in the reconstruction of the defects in the head and neck to restore function and cosmesis.[14] However, each of these methods has their own limitations because of the lack of color and texture match, and with the chance of re-contracture leading to dissatisfaction.[15] At the other end of the spectrum, free flaps are excellent option for reconstruction but require micro vascular skills and instrumentation, have longer operative time resulting in donor site morbidity.

In 1999, Mozolewski et al introduced the SMG pedicled flap based on facial artery for reconstruction of the oral cavity defects tumor resection.[16,5,11] With existing distant flaps like pectoralis major myocutaneous flap (PMMC), regional pedicled flaps such as supraclavicular artery island flap, submental artery island flap submandibular gland flap, showed a renaissance of reliable outcomes comparable to the free flaps. Although supraclavicular artery island flap (SAIF) is also an effective reconstructing option but requires additional incision with longer harvesting time and morbidity. Table 3 shows the variable flaps used successfully in the reconstruction of head and neck defects in various studies.

In recent years, the SMGF has been increasingly used in the reconstruction of head and neck defects. The SMGF is an axial patterned flap based on the facial artery.[22] In our study, SMGF has been used for the reconstruction of head and neck defects after excision. The most common defects reconstructed in our study were the oral malignancy of buccal mucosa (54.55%), since it accounts for 10% of all oral cancers and had been reported as the fourth common site in a Korean study.[23] Studies have suggested that history of smoking, alcohol and diabetics may contribute to the early flap related complications; however, in this study, we encountered complication of partial flap necrosis in one case that too because of poorly controlled diabetes.[24,25] Mean harvesting time for raising the flap was less than 30 minutes since it was performed as a part of neck dissection compared to the supraclavicular artery island flap (45 minutes) in oral cavity carcinoma.[26] For oral cavity defect reconstruction we recommend passing the flap pedicle through the floor of the mouth to prevent tension and shearing of the pedicle. All the patients were followed up for a minimum of 7 months and 10 cases showed successful flap uptake (91.01%), which is well in accordance with several studies on the following-up period.[26,27] The distal necrosis or wound dehiscence of the flap occurred only in one patient of buccal mucosa defects involving the RMT region with history of diabetes, alcohol consumption, and smoking, which had been well noticed in the other studies.[28,29] Although the vascularity of the flap may be affected by prior radiation, in our study one patient (9.09%) had wound dehiscence and wound gap in early postoperative periods, which responded well to conservative therapy and healed spontaneously.

The donor site morbidity of SMGF in our study was nil, which is an advantage utilizing the incision for neck dissection, compared with the other local flaps in reconstructions.[30] Use of the SMGF for moderate-sized defects may eliminate the need for a distant flap for head and neck reconstruction, which had been reported previously.[11] Furthermore, the use of SMGF for the tongue (lateral border) and buccal mucosa defect not only improves the total area being reconstructed, because of its proximity to the defect as it eliminates the tension on the suture line while attempting to cover intraoral defects.

Most of the reconstructive studies on head and neck defects show a high risk of nodal recurrence ipsilateral or contralateral, in large primaries.[31,32] Similar to this, in our study we had one (9.09%) patient developing recurrence of contralateral node in previous N0 neck, another one (9.09%) developed a second primary in the contralateral base of tongue region during follow-up period which could be due to the aggressiveness of the disease and not related to selective neck dissection. This study has to be interpreted within the context of limitations, in relation to oncological safety of preservation of the submandibular gland. Studies have shown that metastasis to SMG is rare and does not lead to tumor recurrence or metastases for the preservation of non-invaded submandibular glands.[33]

This study focuses on the outcome of SMGF in the reconstruction of the defects after head and neck surgery and the oncological safety of this flap, which requires a long follow-up of the patients, was not studied. Besides, we failed to assess the patient's perception of the reconstructive surgery, especially about the cosmetic outcome for the cutaneous defects and the donor-site scar. The limited number of subjects and short follow-up may affect the validity of the results.

CONCLUSION

Our preliminary experience shows that the SMGF is an excellent alternative in the reconstruction of head and neck medium sized defects because of its reliability, lesser morbidity, relative ease of utilizing same neck dissection incision compared to other regional flaps. The vascular pedicle and SMG capsule should be skeletonized meticulously to prevent incomplete removal of the lymph nodes during the neck dissection.

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