



Original Research Article

Clinical outcome and oncological safety of submental flap for reconstruction in head and neck cancer patients

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ABSTRACT

Background: Submental flap is an axial pattern, myo-cutaneous flap based on submental artery (branch of facial artery). We have used this novel flap for reconstruction of the intra-oral, as well of the lower and mid face defects created after resection of certain intra-oral malignancies.

Materials and Methods: This study included 15 patients and done over a period of 3 years. Cases were operated by a team of surgical oncologists using the same technique and under 2.5 x magnifications (loupe). Any nodes in the region were carefully dissected and sent for frozen section for intra-operative verification of presence or absence of microscopic tumor deposits. Evaluation had been done based on the clinical and pathological staging, nodal status as well as the patient outcome.

Results: Out of the 15 patients who underwent reconstruction with submental flap, one patient developed total flap loss, whereas one patient had partial flap necrosis. The remaining 13 patients showed decent clinical outcome and the flap uptake was good. In the follow up period of 2 years, two patients developed regional recurrence (none in the flap donor or recipient sites) and 2 developed distant metastasis.

Conclusion: Submental flap is an excellent flap for reconstruction of small to medium size defects for intra-oral as well as lower and mid face. It is useful in medically compromised conditions, old age or low socio-economic status of the patient as these factors preclude the use of a free flap. It is oncologically safe for reconstruction and in the absence of clinical or radiological evidence of nodal disease in sub-mental region and may be considered for reconstruction in N0 as well as N1 patients.

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1. Introduction

Oral cavity cancers are the sixth most common cancer worldwide and in India it is the second most cancer in males after lung carcinoma and comprises 30% of all head and neck cancers.¹ Most tumors of the oral cavity are squamous cell carcinomas (SCC), but other histological types such as minor salivary gland carcinomas, tumors arising from gingiva, lymphomas and melanomas may occur rarely. Presence of lymph node metastases is the most significant prognostic factor of adverse outcome in head and neck SCC.²

Surgery is the backbone for primary management of oral cavity cancers as radiotherapy and chemotherapy has reserved for adjuvant treatment in patients with high risk for loco-regional recurrence. Surgical excision of oral carcinoma usually creates a three dimensional defect. The reconstruction of such defect is a challenging task as it generates a significant impact on the quality of life in these patients.³ Split thickness skin graft, loco-regional rotation or pedicle flap and free flap have been used for reconstruction of oral cavity defects. Free flaps such as the radial forearm or antero-lateral thigh (ALT) flaps have become the first choice in the last two decades and are currently used with great success in the reconstruction of extensive intra-oral defects.⁴ If part of the mandible has

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been sacrificed then free fibular osseo-myocutaneous flap is very useful.

In the last few years, the submental island flap has proven to be a reliable reconstructive option in head and neck surgery. Moreover, the operative time and hospital stay are shorter than using the radial forearm free flap.⁵

We present this study in patients of oral cavity cancer and after resection, its reconstruction with submental flap. We have also highlighted the patient selection, intra-operative considerations, technique of flap harvesting, post-operative complications and final outcome.

2. Materials and Methods

This study was carried out in 15 patients with SCC of oral cavity in a specialized cancer institute over a period of around 3 years. Cancer patients of various sub-sites of oral cavity like lateral tongue 9(60%) (Figure 1), buccal mucosa 3(20%), cheek 2(13.3%) and lower lip 1(6.7%), who were presented in the OPD of surgical oncology dept. were included in the study. All cases of clinically palpable lymph nodes in the neck were excluded from the study. Patients underwent an appropriate workup and had a comprehensive treatment plan discussed and decided in institutional tumor board. We offered resection of the tumor with neck dissection, reconstruction of resultant defect at primary site with submental artery flap or alternative flap for patients who would have nodal metastasis on frozen section.

All patients were operated by the same team of surgical oncologists under loupe magnification of X 2.5. After resection of primary tumor an island was designed on the skin of submental area according to the size of the defect (Figure 2). The upper line was made 1.5 cm below the mandible at the midline and 2.5 cm below the angle of the mandible on either side. This line was drawn in such a way that it should meet the incision line of neck dissection. We performed neck dissection first and sent all the lymph nodes (with submental lymph nodes separately) for frozen section. For oncological safety, in patients with any positive submental lymph node and two or more than two positive lymph nodes from rest of the group, we abandoned this flap and alternate flap was used. Thus, patients who had all negative submental lymph nodes and only one lymph node positive in rest of the group were continue with this flap and included in the study.

During neck dissection we preserved both facial artery and vein on ipsilateral side. The arterial tributaries to the submandibular gland were clipped as close as possible to the gland and preserving the submental vessels. In case of bilateral neck dissection, the vessel was harvested on the lesser involved side of the neck. Flap dissection started from the contralateral side of the pedicle, in the subplatysmal plane then coming to the ipsilateral side. The anterior belly of the digastric muscle was always taken with flap on ipsilateral side (Figure 3). It had cut from

its common tendon and elevated with the skin flap and then its mandibular insertion was sectioned. Then flap was rotated towards the oral cavity by passing it medially to the mandible if the defect involved the floor of the mouth or lateral tongue and laterally for the defect in the cheek or buccal mucosa. Lastly the flap had inset (Figure 4), sutured in place and donor site defect and neck incision closed primarily in layers after putting the neck drains.



Fig. 1: Carcinoma left lateral tongue



Fig. 2: Design of Island of flap on submental skin

3. Results

Out of 15 patients, 11 were male and 4 were female. All our 15 patients underwent one stage surgery with wide local resection of lesion with modified radical neck dissection. Intra operatively submental lymph nodes were sent for frozen section and if submental lymph nodes were positive, then reconstruction with an alternative flap was



Fig. 3: Flap harvested with pedicle



Fig. 4: Flap in setting



Fig. 5: Hair growth on flap in a male patient

done. Primary sites involved lateral tongue in 9 patients, buccal mucosa in 3 patients, cheek in 2 patients and lower lip in one patient. We did unilateral neck dissection in all patient except one case of carcinoma lip who underwent bilateral neck dissection. Average length of flap was 7.6 cm and average width was 4.7 cm. We did orthograde flap reconstruction in all patient except two, in these we used retrograde flap. Post operatively, 2 patients developed seroma relieved on conservative treatment, one developed hematoma and required opening of wound and drainage in the operating room. Two patients developed venous congestion, of which one was recovered by multiple prick of flap to relieve the congestion, while the other developed partial flap loss and required multiple dressings, re-freshening and resuturing after 10 days. One patient had complete flap loss and required reconstruction with another flap after 2 weeks (Table 1). Remaining 13 patients showed good clinical outcome with complete flap uptake. On post-operative histological analysis, 14 had squamous cell carcinoma and one patient of cheek lesion had basal cell carcinoma. Out of 15 patients, 7 patients (6 male and one female) received post-operative adjuvant radiotherapy, as they had advanced lesion. Hair growth in the flap persisted in male patients (Figure 5), who did not receive adjuvant radiotherapy and was managed by laser therapy or epilation. With a follow up of two years, one patient developed trismus and showed improvement after mouth opening exercises and physiotherapy, two developed regional recurrences but none in the region of donor or recipient site and two patients developed metastatic disease (Table 2).

Table 1: Overall complications

	Complications	Number of Patients
1.	Seroma	2
2.	Haematoma	1
3.	Venous congestion	2
4.	Partial flap loss	1
5.	Complete flap loss	1
6.	Trismus	1
	Total	8

Table 2: Oncological outcome after two years of follow-up

	Outcome	Number of Patients (%)
1.	Loco-regional recurrence	2 (13.3)
2.	Metastatic Disease	2 (13.3)
3.	Alive and disease free	11 (73.3)
	Total	15

4. Discussion

Martin et al first described the submental island flap in 1993 for reconstruction of soft-tissue in head and neck.⁶ It is based on the submental artery, a constant branch of the

facial artery (itself is a branch of the external carotid artery). Submental artery has five main branches along its course toward the midline and anastomoses with the branches of contralateral artery in 92% of cases.⁷ It is located medial to the inferior border of mandible⁸ and represents the main blood supply of the floor of the mouth in 60% of cases.⁹

Submental artery flap can be classified according to blood supply as pedicle flap, free flap or perforator flap (rarely used now) and according to the composition of the flap paddle, as myocutaneous or osteo-cutaneous flap (not used nowadays).¹⁰ The submental flap can be pedicled inferiorly, ortho-grade variant, which depends upon the integrity of facial artery, or superiorly, reverse flow variant, which relies on anastomosis between internal and external carotid arteries via angular artery.¹¹ Orthograde variant has a limited mobility but it can be used in the reconstruction of the tongue, the floor of mouth skin of lower face and buccal mucosa, whereas the retrograde variant has better mobility and can be used for oropharynx, skin of midface, posterior tongue and alveolar ridge of maxilla. We did orthograde variant flap in all our patient except two patients, who required retrograde flap as both were cases of carcinoma tongue and the defects were going posteriorly, required extra length of pedicle.

Inclusion of ipsilateral anterior belly of the digastric muscle in the submental artery flap island has been controversial. Magden et al.¹² and Faltalous and Yetman¹³ found that the main submental artery courses under the anterior belly of the digastric muscle in most of the specimens and there is also a superficial branch that runs above the digastric muscle. Indeed, flap survival has not been affected by omitting the muscle.¹⁴ But we had included the anterior belly of the digastric muscle in the flap in all our patients. Inclusion of this muscle definitely had improved its blood supply and flap viability in our case series, and we recommend that inclusion of anterior belly of digastric muscle should be done in this type of flap reconstruction. Sometimes, a strip of the mylohyoid muscle can be included in the flap to protect the perforating vessels and increase its venous drainage but since it compromised some length of the pedicle, we did not perform this procedure in any case of our study.

Chow et al. reported partial loss of two out of 10 flaps.¹⁵ Merten et al. reported loss of one flap in 11 non-irradiated patients.¹⁶ The authors mentioned they avoided this flap if the neck had been previously irradiated. However, in the experience of Taghinia, and his colleagues pre-operative radiotherapy was the most consistent finding in those who suffered flap loss.¹⁷ In one study, no flap loss occurred in the two patients who had received pre-operative radiotherapy.¹⁸ So data from different studies are conflicting regarding pre-operative radiation in case selection. In our study, one patient had complete loss and one had partial loss of flap but we did not include any patient who had

received pre-operative radiotherapy to the neck and we do not recommend this flap in these patients. Our seven patients received adjuvant radiation therapy but none had any scar breakdown problems.

There has been some concern in the literature that submental flap can potentially compromise the oncological principals after resection of aggressive oropharyngeal cancers. Three cancer recurrences were noted that were more likely related to the aggressive nature of the tumor not due to the oncologic violation by the flap. In one series, there were 4 nodal recurrences in their early cases, however no single recurrence had developed after they started completing the neck dissection before harvesting the flap. After resection of primary tumor, we performed neck dissection first in all cases and sent all lymph nodes (including submental nodes separately) for intra operative frozen section. If submental lymph nodes were positive on intra operative frozen then we abandoned this flap and reconstruction was done with an alternative flap, which was already planned pre-operatively. Other reports correlate well with our findings and support to the oncologic safety of this flap.^{19,20} This flap should be avoided in those patients with clinically advanced nodal disease in the neck (> N1).

Use of pectoralis major myocutaneous flap, is another classic surgical option, characterized by technical simplicity and robust blood supply.²¹ The disadvantages of this flaps are bulky volume and a higher rate of complications especially in female patients.²²

Nowadays, free flaps such as radial artery forearm flap, anterolateral thigh flap or free fibular osseo-myocutaneous flap (if part of the mandible has sacrificed) have become first choice in the last two decades and are still currently used with great success in reconstructing extensive intra-oral defects.^{23,24} Free flaps are usually not recommended in old age and patients with co-morbid conditions like ischemic heart disease, diabetes mellitus, hypertension and with a high ASA risk score. Also longer operating time, need for trained and dedicated plastic surgical team and consequently increased hospital stay, higher costs and post-operative complications make it difficult to use this technique to manage in poor patients.^{5,25}

Among all these flaps, the submental artery flap has some potential advantages. It is an ideal flap for soft-tissue reconstruction in head and neck as it can be easily raised and it is a thin, pliable and versatile flap in its design similar to the radial artery forearm free flap. It also presents an excellent colour match for the head and neck region.²⁶

As the flap being in the hair bearing area, causes inconvenience for intraoral reconstructions in some individuals especially in male patients. This problem has been managed using different techniques, such as laser ablation, mechanical epilation and electrolysis.²⁷ In our study, hair growth in the flap persisted in male patients after a variable time (who did not received

adjuvant radiotherapy), it was managed by laser therapy or epilation. A de-epithelialised variant of the submental flap was introduced to solve this problem in intra-oral, oropharyngeal and laryngeal reconstruction in male patients.²⁸

5. Conclusion

Submental flap is a good alternative for reconstruction of intra-oral as well as small to medium defects of the lower and mid face. It has advantages of good color match, texture, thin and pliable tissue, concealed scar below the mandible and absence of a secondary donor site scar and morbidity. It is especially useful in patients who are medically compromised, belonging to old age or low socio-economic status as these circumstances preclude the use of a free flap. Its shortcomings are limited reach and hair growth in male patients, for which frequent epilation is required.

It is oncologically safe for reconstruction in head and neck cancer patients. In the absence of clinical or radiological evidence of nodal disease in submental region, it may be considered for reconstruction in N0 as well as N1 patients.

6. Source of Funding

None.

7. Conflict of Interest

None.

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