

How to Cite:

Setiawan, I. G. B., & Pramegia, D. K. N. S. (2022). Flap selections in the reconstruction of tongue squamous cell carcinoma following glossectomy: A report of case series. *International Journal of Health Sciences*, 6(S6), 10204–10214.
<https://doi.org/10.53730/ijhs.v6nS6.12660>

Flap selections in the reconstruction of tongue squamous cell carcinoma following glossectomy: A report of case series

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Abstract---Tongue SCC comprises 20% of all SCC involving oral cavity which increase in incidence worldwide. Glossectomy either sub-total or total is the mainstay of treatment for tongue SCC to achieve cure with optimum functionality. Various surgical might be used based on tumor burden. Reconstruction method for defect following the surgeries has always been challenging with variable options of flaps and variable outcomes. These case series reporting 4 cases of tongue SCC treated with glossectomy, neck dissection and standard therapy. Approaches used were lateral mandibulotomy, lower cheek and visor flap approach. Each treated with different reconstructive technique following the surgery. Case 1 was reconstructed with pectoralis major flap, case 2 with latissimus dorsi flap, case 3 with sternocleidomastoid flap and case 4 with supraclavicular island flap. Despite the well-known benefits and disadvantages for every above-mentioned method for defect closure, all these flaps in our reports gave satisfactory result in tongue mobility including articulation and swallowing, as well as the local aspect such as flap survival, wound healing, and no involvement of significant post-operative complication. In conclusion, anatomical, functional and aesthetical outcomes after glossectomy using different type of flaps are generally comparable. Pre-operative considerations including tumor size, area of resection and surgeon preference may lead to certain kind of reconstruction method to be promoted.

Keywords---squamous cell carcinoma, tongue SCC, glossectomy.

Introduction

Oral cancer is malignant condition involving oral cavity including the area of buccal mucosa, tongue, floor of mouth, alveolus, upper and lower lip, palates vestibule and gingiva. It is known as 8th most common cancer in the world that tends to be more often in males compared to females. Asian countries have the highest incidence among all. Most common sites were tongue (25.4%, labial or buccal mucosa (21.7%), gingiva (14%), palate (9.9%) and alveolar mucosa (7.9%). Risk factors such as older age (40-49 years), alcohol consumption and tobacco have been well-studied, while association to other factors like viruses, syphilis, candida, nutrition and dental hygiene are still controversial. Usually, oral cavity cancers are squamous cell carcinomas (more than 90%), followed by lymphoma and mucoepidermoid carcinoma (Rivera, 2015).

The tongue is the predilection site for oral cancer due to carcinogens in the oral cavity mixing with saliva have the tendency to pool at the bottom of the mouth. These areas were covered only by thin and non-keratinized mucosa. As a consequence, they provide less protection against the carcinogen. Despite advances in diagnosis and management of oral cancer in recent decades, the long term prognosis of patients with advanced-stage SCCA of the tongue is generally poor, with 5-year survival rates around 50% (Ettinger, Ganry and Fernandes, 2019). Treatment has always been challenging because not only functional outcomes need to be prioritized, but aesthetic implication that may affect psychological condition of the patients need to be put in concern. Resection and reconstruction is the standard therapy for tongue cancer (Scully and Bagan, 2009).

Surgical interventions range from simple wide local excision and primary closure in small tumors to composite resections of the tongue/floor of mouth/mandible which involve neck dissections in advanced tumors with the need for locoregional flaps or microvascular free flap reconstruction. Although free flaps are the mainstay of reconstructive options, locoregional pedicled flaps are a viable alternative when free flap reconstruction is contraindicated, not available, or has failed. These include the submental island flap, supraclavicular island flap, latissimus dorsi pedicled flap, the pectoralis major myocutaneous flap and sternocleidomastoid flap (Sturgis, Wei and Spitz, 2004). When compared to free flaps, these have the advantage of shorter operative times, decreased donor site morbidity, do not need any microvascular expertise, easy to harvest, cost much less and good reliability. Pectoralis major (PM) flaps are widely used for reconstruction of extensive oral cancer defects. It is fast, reliable and provides safe repair and is indicated, especially where tissue bulk is needed. It has excellent viability and reliability of the flap due to its rich blood supply. Large skin defects can be easily covered, along with primary closure of the donor site (McLean, Carlson and Losken, 2010).

Latissimus dorsi being the largest muscle of the body by surface area incorporates a large skin paddle which can easily be tunneled into the neck

through a small trans-axillary window in a plane between the pectoralis major and pectoralis minor muscles. The skin paddle (SP)-LD flap enables a two-team approach with simultaneous resection and reconstruction without the need for repositioning the patient. The operation time is shorter and the postoperative requirements are less complex than in microvascular surgery. Sternocleidomastoid (SCM) flap based on study from 2015 is a reliable and convenient flap that serves as an adequate alternative to free flaps in the reconstruction of small-to-medium defects of the oral cavity, as well as neck defects following extensive resections (Chen and Chang, 2015) . With a technical modification in which preservation of superior thyroid arteriovenous system and portion of external jugular vein in harvesting the flap were done, SCM is counted as applicable in wide range of applications. Supraclavicular island flap also proven to be a good option for oral cancer reconstruction. Even though it is not extensively used, it can be an alternative to free-tissue transfer in which it is easy to harvest and versatile despite of its limitation for length as a rotational flap in some complex oral cavity defects (Pallua and Von Heimburg, 2005; Chiu, Liu and Friedlander, 2009; Pinto *et al.*, 2010).

Case

These case series reporting 4 cases of patients underwent glossectomy procedure with followed by reconstruction using 4 different kind of flaps for defect closure in Sanglah General Hospital, Denpasar, Bali..

Case 1

A 71-year-old female was referred with chief complain of solid mass in the lateral aspect of the tongue since 8 months, 2x1.5cm in size, no pain nor bleeding. Mass was found to be slowly enlarging within long period of time. Previous incisional biopsy was done in other hospital and concluded as squamous cell carcinoma of the tongue. Bimanual palpation was done and mass found to be operable (T2N1M0). Hemiglossectomy with mandibulotomy approach along with right radical neck dissection was done. The defect was then closed using Latissimus Dorsi Flap as seen below (Figure I).



Figure 1. Case 1: A 71-year-old female with solid mass in the lateral aspect of the tongue

Access to larger tumors of the tongue, particularly those closer to the base of the tongue where the mandible is not involved, requires wider exposure for resection. mandibulotomy or mandibular osteotomy is an excellent mandible-sparing surgical approach designed to gain access to the oral cavity or oropharynx for resection of primary tumors otherwise not accessible through the open mouth or by the lower cheek flap approach. The anterior edge of the muscle palpated and a marking for incision was made from the axilla to as distally as possible (towards the insertion along the iliac crest). Dissection was completed when the anterior border perfectly presented. Skin paddle over the muscle was detected and sutured to the muscle fascia to prevent shearing of the skin from the muscle during the remainder of the flap elevation or muscle transfer. The flap was then elevated. All branches of thoracodorsal pedicle up to the axillary vessels were ligated in order to prevent kinking of the pedicle when rotation of the flap made during its movement to the neck area. A tunnel in the neck was created in subplatysmal plane with avoidance to injure external jugular vein. When it reaches the clavicle, axillary tunnel was made. The flap was then transferred to the neck or oral region. Donor site was closed primarily and a drain was inserted to observe bleeding. Mandibula was reconstructed with plate and screw. Prophylactic antibiotic therapy was given. Postoperatively, no limitations of head movements was found. Shoulder motion was limited to 90 degrees of abduction and extension for almost 3 weeks. No complication such as arterial injury, fistula, significant hematoma, seroma, flap necrosis or wound healing problems observed

Case 2

A 69-year-old female was referred with a chief complain of solid mass located in the base of tongue since 5 months, 5x4cm in size, mobile, with no clear margin and is painful. MRI of the head with contrast showed solid mass with unclear and irregular margins on the right side of the body root of the tongue with a necrotic component and internal bleeding infiltrating the sublingual space, right mylohyoid M, right hypoglossus M, Genioglossus with malignant lymphadenopathy

in the right submandibular region suggesting a malignant mass according to AJCC T3N2aMx staging with atypical, multiple subcentimeter lymph nodes at right submental, left submandibular, and upper jugular levels bilaterally. Patient have had previous biopsy and result showed squamous cell carcinoma of the tongue (T3N3M0). Hemiglossectomy, mandibulotomy, right radical neck dissection and reconstruction with pectoralis major myocutaneous flap was done. Figure below shows lower cheek flap approach with modified schobinger incision in which a midline lip-splitting incision was done continued laterally into the neck. This approach suitable for the tumor burden in this patient since it provides excellent exposure of oral cavity except those of the upper gum and hard palate. Mandible was divided and incision made in the floor of the mouth.



Figure 2. Case 2. A 69-year-old female with solid mass located in the base of tongue

Case 3

A 66-year-old male referred with chief complaint of solid mass in the right side of the tongue since the last 3 months, 1x1cm in size, enlarging and painful. Single ipsilateral lymph node, 1 cm in diameter was found (staging T1N1M0). Previous biopsy result was positive for squamous cell carcinoma of the tongue. Hemiglossectomy through lower cheek flap with modified schobinger approach and radical neck dissection was done. Reconstruction with supraclavicular island flap was conducted. This approach provided excellent exposure. Elevation of the flap started from the distal to medial direction. An incision is made at the distal tip of the flap and deepened to the fascia overlying the deltoid muscle. A subfascial dissection is elevated in a medial approach towards the mid-third of the clavicle. Deltoid perforators were divided with cautery. Completion of the skin incision is performed circumferentially along the skin island with care not to extend the incision deeper than the subcutaneous tissue that will harm the vascular pedicle. Dissection was continued in a medial direction in a combination of blunt and bipolar dissection. As the dissection proceeds medially and posteriorly, the small dorsal scapular artery identified and limited the arc of rotation, so it was ligated and divided. Flap was then elevated and brought to the desired tongue area as seen on Figure 4. Prophylactic antibiotic therapy was given. Post-operative complication such as flap ischemia and loss, dehiscence or

wound healing problem of the donor site were not observed. The relatively thin flap with lack of hair in this area were beneficial.



Figure 3. Case 3. A 66-year-old male with solid mass in the right side of the tongue

Case 4

A 66-year-old male was referred with the chief complaint of solid mass in the right side of the tongue, 3x2 cm in size since the last 3 years which was painful and enlarging. Multiple ipsilateral lymph nodes was found (staging T2N2M0). It was biopsy-proven as squamous cell carcinoma of the tongue since 1 year ago. Visor flap approach was indicated due to the size of the tumors located at the base of tongue to allow wide exposure without splitting the mandible or lip. Hemiglossectomy with bilateral supraomohyoid neck dissection (SOND) were done. Reconstruction method used was sternocleidomastoid (SCM) flap. For the flap harvest, firstly the SCM should be palpated and visualized. Marking was made and skin paddle outlined to center it over the belly of the muscle. Arc of rotation was determined then low-neck apron or visor incision as shown in Figure 3 was made from behind the sternocleidomastoid muscle extending inferiorly along the neck crease, transverse the neck on the other side. Skin incised down through the platysma. Subplatysmal flap was then raised to the inferior border of the mandible to expose the SCM along the neck from the origin to the superior part of the skin paddle and avoided compromises to the skin paddle. Skin paddle was sutured to the fascia of SCM to avoid shearing of the skin flap. Muscle dissection was done inferiorly to identify the insertion, then in superior fashion towards the middle part where identification and ligation of superior thyroid artery was done. Division of this artery allowed better arch of flap rotation to reach superior defect without producing any tension. Continued with the

dissection towards the upper third part of the muscle where occipital vessels and spinal accessory muscle should be kept safe. Submandibular drain was left in place. Donor site was closed primarily. No early nor late post-operative complication such as hematoma, skin paddle loss, necrosis, shoulder instability or limited shoulder movement observed.



Figure 4. Case 4 A 66-year-old male with solid mass in the right side of the tongue

Discussions

Oral cavity malignancy, excluding non-melanoma skin cancer, is the most common carcinoma of the head and neck. 90% of these neoplasms are squamous cell carcinoma (SCCA), with minor salivary gland malignancies and other rare tumors comprising the rest. The field of head and neck reconstructive surgery is a dynamic one. Advances made in the last decade are mostly secondary to expanded use of microvascular free flaps (Rivera, 2015; Ettinger, Ganry and Fernandes, 2019). Choice of reconstruction actually depends on factors such as site of the defect, type of tissue required, functional and cosmetic implications of the defect, associated co-morbidity and availability of resources. Microvascular reconstruction is not feasible at all centres, especially in developing countries and has its share of disadvantages like the need for vigorous monitoring and re-exploration (Scully and Bagan, 2009).

Indonesia is a developing country in which most of the patients presenting to the hospital at advance stages, usually malnourished and economically poor. A pedicled myocutaneous flap constitutes the major mode of reconstruction in these patients. In 1979, Stephen Ariyan popularized the pectoralis major myocutaneous (PMMC) flap as a virtual workhorse in head and neck reconstruction. It is simple to harvest, resilient, easily accessible and versatile in its applicability. The

superiority of a well-conceived microvascular flap is unmatched, however high failure rates are seen when performed on high-risk patients with advanced disease and poor performance status. Besides this, the long learning curve and cost constraints isolate free flap reconstruction mostly to specialized centres (Sturgis, Wei and Spitz, 2004).

One prospective study by Sen et al in 29 patients with PM flap for oral cancer management found that PM flap use is beneficial since the very big skin paddle overlying whole of the PM muscle with the skin paddle extension as far down as the rectus abdominal sheath can be taken and complications were mostly seen amongst the flaps with extent beyond the 6th rib. Total necrosis flap is rare and partial loss of the flap can be managed conservatively. The potential risk factors identified for flap necrosis were found to be female sex (28.6% vs 9%), presence of co morbidities (3 out of 4 patients, $P = 0.0001$) and infection (4/4 patients, $P = 0.0001$). It was mostly identified on the 3rd and 4th post-operative with overall failure rate as final outcome was seen in 2 patients, 1 with uncontrolled diabetics and had involvement of mentum and floor of mouth with both patients had previously received neoadjuvant chemotherapy. In our reports however, the one case using PM flap as reconstruction method presented with no comorbidities and had no history of infection. Despite the old age, there was no flap problems or necrosis have been observed despite (McLean, Carlson and Losken, 2010). A study by Chen et al in 2015 offer a modification of the PMMC flap technique to preserve the lateral thoracic vessels without limiting the rotation arc of the flap, due to the use of the subclavian route to avoid compromising distal skin flap (Chen and Chang, 2015). This modified technique was found to be simpler and safer than those that divide the pectoralis minor muscle, or section and anastomose the lateral thoracic vessel.

This technique may later lead to further studies for better outcome (Pinto *et al.*, 2010). Based on previous researches, other flap selection that is latissimus dorsi (LD) flaps, were able to perform in cancer resections with curative intention in morbid patients with advanced locoregional head and neck tumors.. The flap could be harvested in all cases simultaneously with the resection, thus shortening surgical time. There were no problems with the vascularity of the flap observed on the design. And although one can argue that an operation with microvascular reconstruction is not necessarily longer, these patients were evaluated to have an elevated risk for thromboembolic complications and would not have tolerated possible reoperations. Moreover, the defects after tumour resection were estimated to be very difficult to reconstruct with other local or pedicled flaps. The pedicled latissimus dorsi flap has been proven to be a useful flap in head and neck reconstructions with reliable results (Pallua and Von Heimburg, 2005; Chiu, Liu and Friedlander, 2009).

In our case, the patient treated with LD flap had satisfactory result with no known significant complication. The LD muscle part is large, pliable, and often thin. The subcutaneous in this patient was also thin and the skin island could be positioned as needed in the reconstruction. Care was taken postoperatively to avoid external compression to the area of the pedicle. Donor-site morbidity of the latissimus dorsi musculocutaneous flap harvest was well tolerated and aesthetically acceptable as the donor site can be closed primarily. Studies on

shoulder function have also shown that the recovery of strength and motion is acceptable after the use of the latissimus dorsi muscle, as seen in our patient (Bhata, Aryal and Khanal, 2013)

Supraclavicular flap in reconstruction following resection of oral cancer. This study involved 25 patients in which complex surgeries were done in 10 patients (6 patients underwent hemimandibulectomy and 4 patients underwent marginal mandibulectomy). Supraclavicular flap concluded as a good option in reconstruction of oral because it is easy to raise, reliable, less bulky and has minimal donor site morbidity and short operating time. Preservation of external jugular vein was said to be very important for flap survival while preservation of supraclavicular nerves can lead to donor site morbidity like dysaesthesia. This flap was best suited in patients with T₂ or T₃ oral cancers particularly when they have co-morbidities which may not allow long operating time as in our case. In other group it may lead to several complications such as flap necrosis, infection at the flap site, wound dehiscence and pain at the donor site (Chen *et al.*, 2012)

The osteomyocutaneous flap was used for one patient, the myocutaneous perforator flap was used for one patient, and the myocutaneous flaps were used for the remaining 18 patients. Post-operatively, no skin-paddle loss occurred, although one patient experienced marginal skin loss in the tongue border because of venous congestion. One case exhibited partial SCM muscle necrosis from tissue over-grasping, although the skin paddle healed effectively without complication, and one case had clavicle bone fracture 2 days postoperation, but healed effectively following close reduction with a figure-of-8 harness. Four patients exhibited hematoma accumulations that were resolved with open drainage. Despite the previously known association to high complication rates of Sternocleidomastoid (SCM) flap has that likely due to part to the variable nature of its blood supply, our report found that SCM can be a good selection of reconstruction technique even in complex defect or surgery. So despite the previously known association to high complication rates of Sternocleidomastoid (SCM) flap has that likely due to part to the variable nature of its blood supply, one study by Chen et al on 2015 concluded that SCM flap was a versatile option for patients where prolonged free flap surgery is inappropriate (Chen and Chang, 2015)

Conclusion

Reconstruction of oral defects following cancer surgery is a challenge to the head and neck surgeon as the function has to be restored as far as possible and the outcome of reconstruction should be of good aesthetic appearance. Microvascular free tissue transfer is an ideal choice of reconstructive method but requires two team approach, expertise, longer operating time and may not be feasible in some centres. Therefore, the use of pedicle flaps in the reconstruction after complex surgeries which were described earlier can be an option.

Acknowledgments

All patient and all author.

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