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Original article

Reliability of the pectoralis major myocutaneous flap in reconstructive oral cancer surgery in developing countries: Our experience

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ARTICLE INFO

Article history:

Received 18 December 2015

Accepted 28 February 2016

Available online 4 May 2016

Keywords:

Mouth neoplasms

Myocutaneous flap

Pectoralis muscles

Postoperative complications

Reconstructive surgical procedure

ABSTRACT

Background: Although free flaps are nowadays considered 'Gold standard' of head and neck reconstruction, pectoralis major myocutaneous (PMMC) flap is still popular among many reconstructive cancer surgeons in developing countries for its many advantages and also due to lack of resources for free flaps in most of the centers, large number of cancer patients with poor nutritional status and economic condition. However, many studies have reported high complication rate in PMMC flap. So, the purpose of our study was to evaluate the reliability of PMMC flap.

Methods: Within a span of 2 years, 20 reconstructions were done with PMMC flaps in patients with oral cancer and they were followed for a period of 1 year. Documentation was done for patient demographics, site of lesion, duration for reconstruction, occurrence of complications, etc.

Result: Among 17 males and 3 female patients, complications developed in 4 males and all female patients (total 7 patients, overall 35%). Flap-related complications were – one major (5%) and six minor (30%), which were comprised of three orocutaneous fistula (15%), three partial flap loss (15%), two marginal necrosis (10%), and one donor site necrosis (5%). Total necrosis was nil in our study. All the complications were managed conservatively except the patient with major complication which required intervention. Final cosmetic and functional outcome was acceptable in majority of patients.

Conclusion: PMMC flap is still 'workhorse' of reconstruction in head neck cancer patients in developing countries and can be used effectively with acceptable morbidity.

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<http://dx.doi.org/10.1016/j.mjafi.2016.02.013>

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Introduction

Oral cancer is a scourge that cuts across all the socio-economic strata of society affecting increasingly large numbers of patients worldwide. The widespread use of tobacco and associated products in the lowest socioeconomic groups, illiteracy, poverty, and consequential poor oral hygiene awareness contribute to high prevalence and late reporting of oro-pharyngeal cancer. Early detection and multidisciplinary therapy remains the most effective weapon against oral cancer. However, many patients report in advanced stages of the disease and one of the barriers to their optimum treatment remains economic factors. Surgery is still considered mainstay therapy along with or without adjuvant chemotherapy and/or radiotherapy.

Reconstruction of post-oncosurgical defects in the head and neck region presents a challenge due to the complex anatomy and functional demands of this region. Nowadays, microvascular free flaps are considered the gold standard for reconstruction, whereas pedicled flaps are commonly utilized as a salvage procedure.¹ The limitations, however, of microvascular reconstruction techniques lie in the fact that the expertise and facilities for this specialized surgery are not available at all centers; procedure is costly; and operating time is greatly increased which entails higher anesthetic risk for critically ill patients.²

In contrast, pectoralis major myocutaneous (PMMC) flap is still considered as the 'work horse of pedicled flaps' for head-neck reconstruction, since its description by Ariyan in 1979³ and it still remains popular in developing countries around the globe.⁴ The advantages of this flap are excellent vascularity, proximity to head and neck region, simplicity of harvesting, and consequent to their bulk have the main benefit of covering vital structures of neck, unlike free flaps or other regional flaps.⁵

Literature, however, has reported various complication following PMMC flap reconstruction such as partial necrosis, dehiscence, or fistula formation.^{6,7} A study was undertaken, therefore, to evaluate the reliability of this flap, in the reconstruction of oral cancer patients and to evaluate the complications arising thereof.

Materials and method

The study was conducted in the Department of Oral and Maxillofacial Surgery of a dental college following institutional ethical clearance.

Initially all patients with histopathologically confirmed oral carcinoma reporting to the Maxillofacial Surgery OPD were evaluated for suitability as per laid-down criteria. They were evaluated on the basis of history, clinical, radiological, histopathological findings, and routine blood examination prior to treatment planning. The staging was done according to TNM classification (UICC 2002 criteria).

The inclusion criteria were: patients diagnosed with resectable oral carcinoma confirmed histopathologically; willingness to be a part of the study; cases where post-excisional defect would need reconstruction with PMMC flap.

Patients who were not included in the study were those presenting with compromised medical condition; distant metastasis (confirmed with chest radiograph and abdominal ultrasound); and invasion to critical region such as skull base.

Among 32 initially shortlisted patients, 2 patients were excluded due to sudden deterioration in their medical condition and 3 patients presented with inoperable lesions with an h/o recurrence and were sent for palliative care with chemotherapy and radiotherapy. In some cases, surgical reconstruction was done exclusively by forehead flaps or deltopectoral flaps (7 patients) and hence they were excluded from the final study. After the exclusion of twelve patients, remaining 20 patients were finally included in our study. Informed written consent was taken prior to the study.

The same team of surgeons performed both ablative and reconstructive surgeries using standard operating procedures.

Surgical technique

All the patients underwent wide (2 cm) excision of the lesion with segmental mandibulectomy (either due to close proximity to the mandible/lesion involving mandible) along with modified radical neck dissection/radical neck dissection (depending on N status) in continuity. Bony reconstruction was not undertaken for the continuity defect. Only PMMC flap was utilized for reconstruction of complex defect after ablative surgery.

Surgical technique of PMMC flap reconstruction

Marking

The vascular axis of pectoral branch of thoracoacromial artery was drawn on the chest wall as a line that descends perpendicularly from the middle of the clavicle and then bends and follows an imaginary line from acromion toward xiphisternum (Fig. 1B). The size, shape, and location of the skin paddle were determined by the size, shape of the surgical defect, and its distance from the point of pivot (midclavicular point) of the flap. First, a piece of roller gauze was used to measure the distance from midclavicular point up to the most distal portion of the surgical defect (Fig. 1A), and then distal tip of the skin paddle was marked at the same distance from point of pivot along vascular axis. Finally, a skin island was drawn according to size and shape of the surgical defect.

Flap elevation

Initial incision was made from lateral edge of designed skin paddle toward the anterior axillary line. The superior skin flap incision was made only up to the muscle fibers of the pectoralis major muscle. The inferior, medial, and lateral incisions were made through the muscle and fascia of the pectoralis major muscle and down to the chest wall. The skin paddle was temporarily secured to the muscle with few sutures to decrease any shearing injury to the perforators. The PMMC muscle was divided medial and lateral to the vessels with either electrocautery or scissors all the way up to the clavicle avoiding injury to the vessel which was identified by visualization and palpation on the deep surface of the muscle at about mid clavicular point. Division of muscle medially and laterally permitted further elevation and greater arc of

Fig. 1 – Reconstruction with PMMC flap: (A) post-excisional cervicofacial defect, (B) marking over chest: cutaneous paddle located on vascular axis, (C) flap inset on recipient bed, (D) completed suturing of donor site and neck flaps.

rotation. Flap was passed to the recipient site through a skin tunnel prepared above the clavicle.

Flap inseting

Due care was taken in handling the skin paddle to avoid shearing injury and the flap was fixed into place by first suturing the muscle to surrounding soft tissue at recipient site. The anchoring sutures were then removed one at a time and the skin was sutured to the mucosal defect (Fig. 1C). The neck incision was closed over the muscle and vascular pedicle. The chest skin was mobilized extensively and closed primarily in all cases. Separate closed suction drains were utilized for neck and chest. Naso-gastric tubes were inserted in all patients for feeding (Fig. 1D).

All the specimens were sent for histopathological restaging following surgery. All patients were postoperatively referred to Department of Radiotherapy for consideration of adjuvant radiation.

Total duration of the surgery, size of the cutaneous paddle, number of units of blood transfusion, postoperative complications, and total days of hospital stay were documented. The criteria of Pinto et al.⁴ and Chepeha et al.⁷ were followed for documentation of complications. The complications at recipient and donor sites, directly related to the PMMC flap were categorized as 'flap-related complications' and other complications not directly related to the PMMC reconstruction were regarded as 'other complication'. The flap-related complications which required active surgical intervention or failed to achieve the goal of surgery were grouped as *Major complications* and those which were managed by conservative approach were categorized as *Minor complications*. If one complication

resulted in another, only the final complication was recorded, so as to highlight the final outcome among the complications in a patient. For example, if a case with dehiscence resulted in orocutaneous fistula, then the "fistula" was considered to be the complication. The exclusion to this rule was that where an ischemic complication was observed, i.e. partial necrosis, then both this ischemic event and the final resultant complication were recorded.

All cases were regularly followed up postoperatively for 1 year and closely reviewed for recurrence.

Results

Within a span of 2 years, 20 reconstructions (Table 1) were done in 17 males and 3 female patients, with an age range of 21–64 years (median 46.5). Age-wise distribution of the patient is presented in Fig. 2. Majority of the sites of lesion involved buccal mucosa (40%), followed by alveolus (30%) (Fig. 3). All the patients presented with higher primary T-status, 13 patients were in T4, and 7 patients had T3 stage. Most of them (70%) had tried alternative therapy for years and three patients (15%) received chemotherapy in other centers before reporting to us. Squamous cell carcinomas of various grades were diagnosed in all cases except one female patient, who presented with ameloblastic carcinoma of mandible.

Average time taken for harvesting and insertion of flap into recipient bed was approximately 1 h (65.75 ± 8.47 min) and flap size ranged from 8 cm × 4.5 cm to 12 cm × 7 cm. Postoperative blood transfusion was required in 70% of the patients (range 0–3 units). The average length of hospitalization was 2

Table 1 – Patient demographics.

Patients characteristics	N (%)
Sex	
Male	17 (85%)
Female	3 (15%)
Age	
Median (range), years	46.5 (21–64)
Stage	
III: T3N0-4; T3N1-3	7 (35%)
IV: T4N0-4; T4 N2 _a -6; T4 N2 _b -2; T4 N2 _c -1	13 (65%)
Diagnosis	
Squamous cell carcinoma	19 (95%)
Ameloblastic carcinoma of mandible	1 (5%)
Previous treatment	
Chemotherapy	3 (15%)
Alternative medicine (homeopathy/naturopathy)	14 (70%)
None	3 (15%)
H/o tobacco ± betel nut use	
Yes	18 (90%)
No	2 (10%)

weeks (median: 12 days; range: 10–23 days). Patients with complications had to stay for an average of 20 days and those without complications stayed an average of 10 days. Nutrition of the patient was maintained with blended liquid diet, fed through Ryle's tube, every 2–3 h till the day of discharge.

All documented complications are presented in Table 2. Overall, seven patients (35%) developed some kind of complications. One patient (5%) developed major complication (Fig. 4), which needed surgical intervention under local anesthesia (LA) and six patients (30%) developed minor complications, which were managed conservatively by regular dressing change, irrigation of site of reconstruction, etc. In one patient (Fig. 5), minor complications developed both at donor and recipient sites, which were recorded independently. The patient with major complication developed ischemic necrosis of the neck flap over posterior triangle (Fig. 4c) and it was recorded as other complication.

All of the three female patients (15%) developed partial flap loss due to ischemic necrosis of cutaneous portion and one of them also developed an oro-cutaneous fistula. In our study, total flap loss was nil. Majority of our patients received postoperative radiotherapy, but none of them developed any complication related to healing at the site of neck. Final cosmetic and functional outcome was acceptable in all cases (as per limitations of PMMC flap reconstruction without any

Age distribution (n=20)**Fig. 2 – Age distribution of the patients.** **Distribution of sites of lesion (n=20)****Fig. 3 – Distribution of sites of lesion.**

bony reconstruction), except one female patient (21 years), whose cosmetic outcome at the donor region was less than satisfactory. Training flange was provided to all the patients for preventing deviation of mandible. All cases were referred to the Department of Maxillofacial Prosthodontics for evaluation and prosthodontic rehabilitation.

Within an extended follow-up period of 1 year, three cases (15%) demonstrated mucosilation clinically and in two cases (10%) partial return of sensibility was found. Two patients (10%) with tongue and floor of mouth cancer developed recurrences after 6 months and 8 months of surgery and were referred for palliative therapy.

Table 2 – Complications: flap-related (major/minor) and other complication.

Major complications	N (%)	Minor complications	n	Other complications	n
No	19 (95%)	No	14 (70%)	No	19 (95%)
Yes	1 (5%)	Yes	6 (30%)	Yes	1 (5%)
Oro-cutaneous fistula	1 (5%)	Oro-cutaneous fistula	1 (5%)	Neck skin necrosis	1 (5%)
		Partial flap loss + orocutaneous fistula	1 (5%)		
		Partial flap loss	2 (10%)		
		Marginal necrosis ± infection at recipient site	2 (10%)		
		Donor site necrosis	1 (5%)		

Fig. 4 – Major complication: (A) recipient site on 7th postoperative day: orocutaneous fistula as a result of dehiscence, (B) recipient site after 3 months: excellent healing, (C) other complication: 14th postoperative day, necrosis of cervical skin flap over posterior triangle, (D) result after 3 months: with only conservative management.

Fig. 5 – Minor complication: (A) recipient site on 10th postoperative day: marginal necrosis with infection, (B) recipient area after 1 year: excellent result with clinical mucosilation of cutaneous island, (C) donor site on 10th postoperative day: necrosis of skin flap, (D) donor site after 1 year.

Table 3 – Reported complication in PMMC flap.

Authors	Year of publication	No. of patients/flaps	Flap related complications					
			Overall complication	Partial necrosis	Fistula	Total necrosis	Wound infection	Dehiscence
Aničin et al. ¹⁰	2015	39 patients 40 flaps	20.5%	7.6%	–	–	–	
Chen et al. ¹¹	2015	107 patients	5.6%	4.7%		0.9%		
Bussu et al. ¹²	2014	274 patients	4.7%	2.9%		0.7%		
Jena et al. ¹³	2014	140 patients	21.4%	10%	4.28%	1.4%	7.85%	
Ribeiro Salles Vanni et al. ¹⁴	2012	17 patients	52.9%	11.76%	29.4%	–	–	23.5%
Saito et al. ⁸	2012	12 patients	50%	33%	33%	–	8.33%	
Kruse et al. ¹⁵	2011	20 patients	35%	10%		10%		
Pinto et al. ⁴	2010	58 patients	43.1%	12%	15.5%	–		10.3%
El-Marakby et al. ⁶	2006	25 patients 26 flaps	60%	12%	48%	8%	20%	
Vartanian et al. ⁹	2004	371 patients	36.1%	9.7%	11.8%	2.4%	8.3%	2.8%

Discussion

In the developed countries, with the advent of increased knowledge, clinical skills and availability of better infrastructure, free flap reconstruction remains the gold standard and the first choice of reconstruction of the head and neck surgeon. PMMC flaps, however, are kept reserved for salvage procedure in case of failure of free flaps, compromised patient status, or if planned as soft tissue filler in combination with free flaps.^{8,9}

However, in developing countries, due to lack of necessary training and exposure to the free flap surgical procedure; inadequate armamentarium; higher patient load; and economic realities, such reconstructions though desirable are not always possible. Hence, PMMC flaps are still being used in most of the cancer centers with great success for complex cervico-facial defects due to its many advantages.^{5,9} Saito et al. state that the most important benefit of PMMC flap is survival. Total microvascular flap loss may be seen even in the hands of skilled surgeons, but total PMMC flap failure is very rare even under inexperienced hands, due to its dependable vascularity and its shorter procedural learning curve.⁸

The drawbacks of PMMC flap are its higher complication rates; large bulk which contraindicates its use for reconstruction in superficial defects and less than satisfactory functional and esthetic result as compared to free flaps.⁶ In addition, there may be resultant malocclusion due to the weight of the flap. A review of relevant literature^{4,6,8–15} (Table 3) shows that the overall complication rates vary from low (4.7%) to very high (60%); however, total necrosis of PMMC flap is low in most of the studies. Several studies on PMMC flap have also correlated higher complication with age, sex, site of reconstruction, previous therapy, etc. Liu et al.,¹⁶ El-Marakby et al.,⁶ Pinto et al.,⁴ and Ribeiro Salles Vanni et al.¹⁴ have described the risk factors for flap-related complications as, advanced age, female patients, reconstruction of oral or hypo-pharyngeal defects, history of previous irradiation, salvage procedure, lower margin of skin island over chest, presence of co-morbidities, reconstruction in heavy tobacco users, etc. Leite et al.⁵ correlated risk of fistula formation to be associated with Hb level <13 g/dl, serum albumin <3.4 g/dl, and hypopharynx reconstruction. Wang et al.¹⁷ demonstrated recipient site

infection to be associated with lower margin of skin island, concurrent tracheostomy, diabetes mellitus, mandibular plate reconstruction, and perioperative blood transfusion.

In our study, all patients belonged to poor socio-economic group and all reported with advanced stages of oral malignancy. PMMC flap was used for reconstruction of post-surgical defect following ablative surgery, without bony reconstruction of continuity defect. Eighteen patients (90%) had history of high tobacco use for many years, which posed a risk factor for flap-related complications; however, the incidence of total necrosis was nil among 20 PMMC flaps. Overall, seven flaps (35%) suffered some sort of complications and among those, major complications were present in one patient (5%), who required minor procedures under LA. Partial necrosis was detected in all three female patients and final outcome at the donor site was less than satisfactory in one young patient among them. Our findings corroborate the published data regarding flap complications. Kroll et al.¹⁸ described increased flap-related complication in female patients due to intervening fatty tissue and Asamura et al.¹⁹ described disfigurement of breast as the reason for dissatisfaction among female patients. On the contrary, in the study of Jena et al.,¹³ on female patients, overall complication rate was 21%, which is not different from other reported studies.

Despite having a group with high tobacco use (90%) in our study, there were minimal complications, all of which could be managed conservatively or with minimal intervention.

Conclusion

The results of our study amply demonstrate that the PMMC flap still remains the 'workhorse' of reconstruction in head and neck cancer patients. It is advocated to be used in developing countries, such as ours, and can be used effectively with acceptable morbidity and with good results, especially at peripheral centers with limited facilities. The overall complication rates are well within acceptable range and most can be managed conservatively. However, caution and patient counseling are recommended for reconstruction in young females, as complications might be more; cosmetic outcome at donor site might be less than satisfactory and may need

revision plastic surgery. Even in this era of free flap dominance, reconstruction using PMMC flaps are here to stay and all budding surgeons would be advised to master the technique and add it to their repertoire.

Conflicts of interest

The authors have none to declare.

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