



CLINICAL STUDY OF VERSATILE FLAPS FOR RECONSTRUCTION OF 100 POST BITE RESECTION DEFECTS: PROCLIVITY TOWARDS PMMC FLAP

Oncology

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ABSTRACT

Introduction: In India head and neck cancer patients usually present in the advanced stage, requiring extensive resections with complicated reconstructions. The goal of reconstructive surgery is to provide functional ability, restoration of form and aesthetics. Various reconstructive techniques are local flaps, regional flaps and free vascularised flaps; each with its inherent advantages and shortcomings. Although microvascular technique is the standard of care, but its use is limited by availability of expertise and resources in developing world. The common alternative in these cases is the use of the pectoralis major myocutaneous flap (PMMC). Our article highlights the experiences and outcomes associated with PMMC flap and its availability in resource constrained facility. **Methods:** A retrospective analysis of 100 patients was conducted; diagnosed with oral squamous cell carcinoma and underwent complex resection from 2018 to 2021 in Department of Surgical oncology, Balco medical centre, Naya Raipur. A total of 58 patients underwent reconstruction with PMMC flap, rest with free microvascular flaps. All the patients were followed up for an average period of 1 year leading to the assessment and outcomes of PMMC flap. **Results:** A total of 100 patients were reviewed; of these, 83 (84.69%) were male, with median age of 36.14 (31-40 years) and rest were female (16.31%) with the median age of 33.33 (51-60 years). Every tumour was located in the oral cavity. PMMC flaps were used to cover both mucosal and skin defects. The overall complication rate involving partial flap necrosis was less in PMMC flaps in comparison to other reconstructive flaps. The results were in favour of PMMC flaps; decreased operative time, minimal cost and causation of additional donor site morbidity. **Conclusion:** PMMC flap can be a reliable and versatile option for advanced oral malignancies with an excellent reach to face, oral cavity and neck region especially in patients with poor status with any coexisting chronic illness. It can be considered as a valid alternative to free flap for repair of bony defects, especially in patients with low socioeconomic corridor like India.

KEYWORDS

PMMC flap, bite resection, reconstruction, carcinoma, oral cavity, free flaps

INTRODUCTION:

Oral cavity plays a pivotal role in an individual's life as it takes part during swallowing, speech, respiration and aesthetics. Malignancy of head and neck region is a threat that is increasing day by day because of tobacco, betel nut and alcohol abuse (1, 2). Cancer surgeries generally result in major defects that usually cannot be repaired by primary closure or mobilization of neighboring tissues, thus requiring surgical flaps for reconstruction. The employment of different flaps provides better esthetic and functional results, aiding the patients to recover and return to social life. There are many types of flaps available for reconstruction such as local, pedicle and microsurgical (3). Free flaps are nowadays considered as the standard choice of reconstruction.

But the utility of PMMC still exists in advanced disease patients with systemic co-morbidities and compromised vessel calibre which further prevents the use of free flaps. Before the introduction of free vascularized flaps, PMMC was the flap of utmost choice for reconstruction of head and neck defects (4).

The first description of PMMC flap by Ariyan in the 1970s has been the most commonly used one (5). First use of PMMC, described in 1947 was for cardiothoracic defects (6). The main reason for its usage is its simplicity, versatility, and proximity to the head and neck region (7-10). Its established uses include esophageal luminal augmentation, reconstruction of oropharyngeal defects, lateral mandibular defects, skull base and temporal bone defects, orbito-maxillary defects, and cutaneous defects (11). Due to its robust vascularity and easy learning curve for surgeons, it is still a workhorse at centres with limited resources and heavy patient load (6).

Complications from PMMC vary widely in literature, where reported rates range from 13% to 63% (12). However, in the past two decades, reconstruction with microsurgical free flaps has been broadly used. The free flaps can reconstruct larger head and neck tridimensional defects with significantly lower morbidity and complication rates to the donor and receptor sites and usually better functional and cosmetic

outcome compared with myocutaneous pedicled flaps. At present, it is considered the best option in major reconstructions (13).

However, their recommendation is limited by the need for professionals with extensive experience in microsurgery, specific and costly materials, healthy clinical conditions of the patient that allow them to tolerate generally longer surgical procedures. Another factor limiting the use of microsurgical flaps is the necessity of good-quality recipient blood vessels for anastomosis (14). Unfortunately, a specialized surgical team and costly instrumentation are required, and these are not available in many head and neck services. Therefore, the PMMC flap remains the mainstay reconstructive method in several centers worldwide (15).

Even at head and neck surgery services in which free flaps are used, the pectoralis major and other myocutaneous flaps can be performed in combination with free flaps to reconstruct larger defects, to protect important vessels at risk for complications, and to treat or prevent complications of wound breakdown (16). These data in literature reinforce the concept that myocutaneous flaps are a valuable tool in head and neck cancer surgery.

Henceforth, the objective of our study was to analyze a huge experience of one single institution with myocutaneous flaps in head and neck cancer reconstructions. Further we did the critical analysis of all flap-related complications and now we present our experience with PMMC flap.

PATIENTS:

We retrospectively analyzed patients who have undergone resective surgeries for head neck cancer and reconstructed with variant flaps. PMMC flap was analysed closely with its assessment, outcomes and complications. All patients were operated at Balco medical centre from 2018 to 2021. Every patient was subjected to routine investigations for general anesthesia. Informed consent was taken from patients for future necessity regarding scientific research. Out of 100 patients that

were operated; 20 patients' lost follow-up. Total 60 patients underwent PMMC reconstruction which were incorporated in the study. Data was analyzed with regard to clinical representation, tumor stage, size, primary site, nodal status, operative procedure and postoperative complication rates. Ipsilateral PMMC flap (Fig. 1) was harvested for reconstruction in 58 patients, whereas in 2 patients combination flaps were done. The other flaps included latissimus dorsi (LD) flap (Fig. 2), radial forearm flap (RAF) (Fig. 3), anteriolateral thigh (ALT) flap (Fig. 4) and free fibula flap (Fig. 5).



Fig. 1 – PMMC flap

Fig. 2 – LD flap

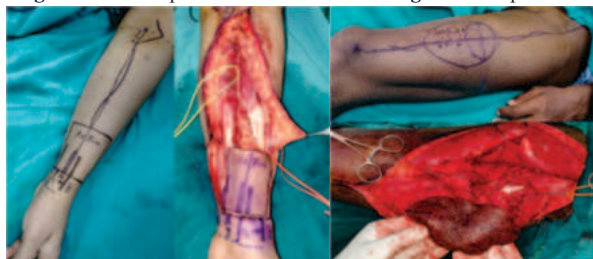


Fig. 3 – RAF flap

Fig. 4 – ALT flap

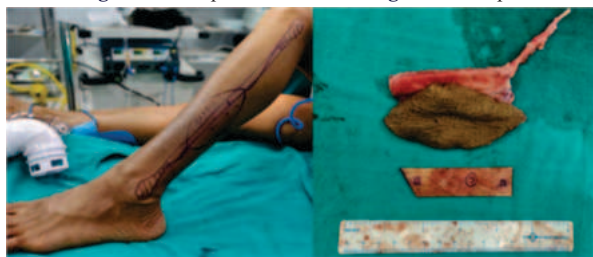


Fig. 5 – Free fibula flap

METHODS:

Technique Of Harvesting Flap

The technical details of the PMMC flap rotation were previously described by Azevedo in 1986, and some important steps were emphasized (17). Surface marking of vascular pedicle was made by drawing a line from the ipsilateral acromion to the xiphisternum and another line vertically from the midpoint of clavicle to intersect first line perpendicularly (Fig. 6). The skin paddle was designed so that it comes along course of pectoral or descending branch of thoracoacromial artery. During elevation care is taken not to undercut the skin paddle but rather to bevel it, so as to include as many perforators as possible. The skin paddle was sutured to the underlying pectoralis muscle to minimize the risk of shearing injury to myocutaneous perforators. The plane of dissection between pectoralis minor and major muscle with its vascular pedicle was found by dissecting the lateral border of pectoralis major muscle.



Fig. 6 – Marking of PMMC flap

Once in the plane, we could easily free the pectoralis major, with its

vascular pedicle from the pectoralis minor muscle. The pectoralis major muscle was divided lateral to the pedicle while keeping the pedicle in view, thereby freeing it from the humerus. A portion of clavicular fibers was divided to include only neurovascular pedicle and its adventitia, eliminating the supraclavicular hump. The flap was further passed into the neck through subcutaneous tunnel created superficial to the clavicle. The tunnel was made wide enough to permit easy delivery of the flap into the neck without compression. Suturing of the flap was done with 3-0 vicryl interrupted sutures; suction drains were placed. The donor site was always closed primarily which may require extensive mobilization of fasciocutaneous flaps.

One female patient with carcinoma of right buccal mucosa reconstructed with PMMC flap has been presented in this article (Fig. 7)

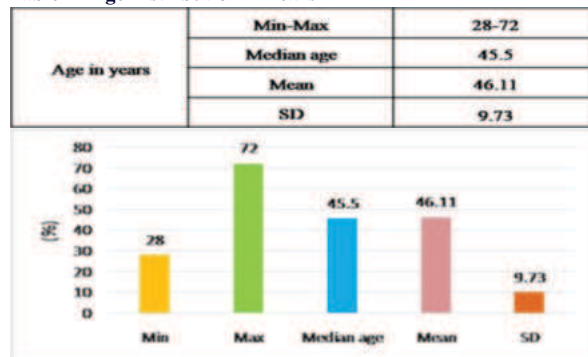


Fig. 7 – Carcinoma right buccal mucosa reconstructed with PMMC flap

RESULTS:

In our study we included a wide scale of age groups ranging from 28 years to 72 years, with mean age of 46.11 years and median age of 45.5 years (Table 1, Graph 1).

Table 1 – Age Distribution In Years

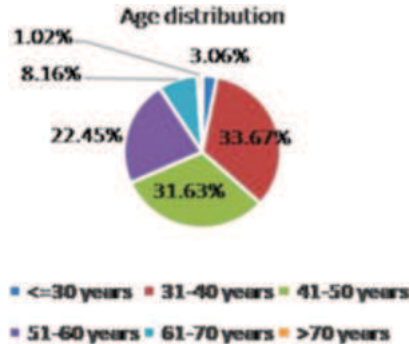


Graph 1 – Age distribution in years

100 patients were distributed amongst six age groups, maximum of patients belonged to the age group of 31 – 40 years (33.67%) (Table 2, Graph 2)

Table 2 – Age Groups Distribution In Years

Age distribution	N	%
<=30 years	3	3.06
31-40 years	33	33.67
41-50 years	31	31.63
51-60 years	22	22.45
61-70 years	8	8.16
>70 years	1	1.02
Total	98	100

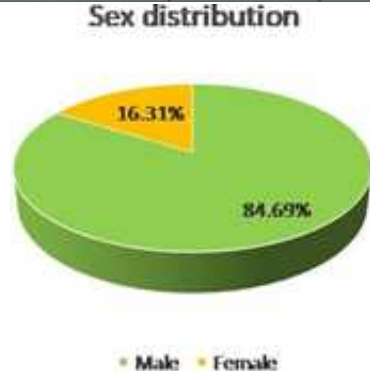


Graph 2 – Age groups distribution in years

Amongst 100 patients included in the study, 83 (84.69%) of them were males and 15 (16.31%) were females (Table 3, Graph 3).

Table 3 - Sex Distribution

Sex distribution	N	%
Male	83	84.69
Female	15	16.31
Total	98	100



Graph 3 – Sex distribution

Every patient involved in study suffered from squamous cell carcinoma (SCC) of various oral cavity sub-sites. Patients represented clinical stage IV disease, according to the 8th edition AJCC TNM staging, which mentions the involvement of skin accompanied with bony erosion (T4).

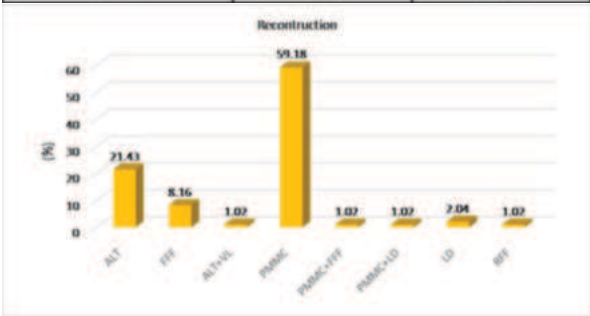
The reconstruction was planned by measurement of the sacrificed defect in both dimensions. Almost all donor sites were closed primarily especially in PMMC flaps.

Out of 100 patients, 58 ablative defects were reconstructed through PMMC flaps. In one patient PMMC with LD flap was used, whereas in another PMMC with Free fibula flap was done. *Microsurgical* fibula flaps were done in 8 patients, Anterolateral thigh flap in 22 patients, latissimus dorsi flap in 2 patients whereas radial artery forearm flap in

one patient (Table 4, Graph 4).

Table 4 – Reconstructive Flaps

Reconstruction	N	%
ALT	21	21.43
FFF	8	8.16
ALT+VL	1	1.02
PMMC	58	59.18
PMMC+FFF	1	1.02
PMMC+LD	1	1.02
LD	2	2.04
RFF	1	1.02



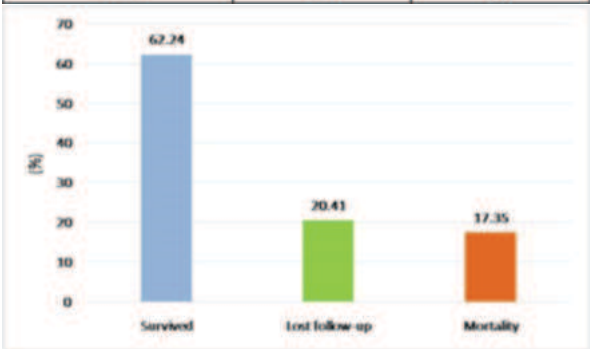
Graph 4 – Reconstructive flaps

Overall flap related complications were minimal in PMMC flap. No total flap necrosis occurred amongst 100 patients. Fibula flaps did showed more complications in comparison to other flaps.

In this study the viability of flap was based on the follow up of patients for 1 year atleast. Among 100 patients, we lost follow up of 20 patients. The survived patients count is 61 (62.24%) (Table 5, Graph 5).

Table 5 – Surgical Outcome

Outcome	N	%
Survived	61	62.24
Lost follow-up	20	20.41
Mortality	17	17.35
Total	98	100



Graph 5 – Surgical outcome

Most of them were those whose defects were reconstructed with PMMC flaps. 17 of them were under mortality due to recurrence or distant metastasis or any other co morbidity occurred during adjuvant therapies.

DISCUSSION:

Bite resections is that type of ablative defect which comprises of marginal mandibulectomy in combination with upper alveolectomy with skin involvement and adequate surgical margins depending upon the location of the tumour.

Pectoralis major myocutaneous flap is one of the most versatile flaps available and workhorse for reconstruction of head and neck defects.

This flap has now replaced other large regional cutaneous flaps because of its inherent properties.

This flap has been considered a remarkable step in the history of head and neck reconstruction since Ariyan's description in 1979 (1). The main advantages reported were its ease in technical aspects, the proximity of the head and neck region, and the possibility of obtaining a large amount of well vascularized tissue to cover skin and/or mucosal defects from the neck up to the mid-face. Furthermore, the low morbidity to the donor site and the execution as one-stage procedure has resulted in broad acceptance of this flap (5,7,8,10).

The pectoralis major flap can also be performed in association with free flaps, usually to offer a soft tissue component to a large reconstruction, to protect major vessels at risk for rupture, and to prevent possible complications of wounds with a high risk for breakdown. Also it can be used as a salvage procedure after the necrosis of micro-vascularized flaps and in cases where free flaps are contra indicated, such as a medical condition that makes the patient unable to tolerate a long surgical procedure or inadequate recipient vessels in the necks of patients who previously underwent high-dose radiotherapy. In present study, there were 2 patients who underwent salvage procedure after failure of free flaps; these findings suggested that PMMC flap forms an important tool in cases where use of vascularised flaps is not possible or in patients with vessels abnormalities, extremes of ages, patients with medical co-morbidities. Same results were reflected by Schneider et al (18) who stated PMMC flap was used as salvage procedure in 38% of their case series and another study done by Saito et al (19) stated that 75% of cases operated for PMMC flaps were only used as salvage procedure supporting our findings.

Also PMMC flap as stated above is final backup plan in cases of free flaps failure because it is more cost effective in patients with poor socio-economic status who are common in developing countries (4).

A reported disadvantage of the pectoralis major flap is related to the poor vascular supply to the distal skin paddle, which can cause partial dehiscence (mostly at the distal portion of the flap), fistulization, and infection, resulting in a prolonged hospital stay (16).

Regarding the technical aspects involved Azevedo (17) who emphasized that an island flap partially preserves the pectoralis major muscle, decreasing the functional impairment of the arm, and the flap transference to the head and neck region by a subclavicular tunnel increases the flap rotational arc. Kerawala et al (15) also confirmed the subclavicular route as a safe procedure. Moreover, the subclavicular passage increases its longitudinal extent in about 2 to 3 cm and also presents aesthetic advantages over the classical route. However, it should be noted that in obese patients and patients with bulky flaps, the flap passage through a subclavicular route will not be reliable.

Within the past 20 years, other series have reported overall complication rates ranging from 16% to 63% of cases, the incidence of partial and total necrosis from 4% to 29% and from 0% to 7%, respectively, and salivary fistulas from 5% to 29% (8,10). Our results showed mild complications like partial necrosis of flap, salivary fistula, and infection at the surgical site. Previous reports have described risk factors associated with the development of flap complications, such as age, sex, tumor subsite, previous radiotherapy, and comorbidities, but the results were not similar in all series (9).

In comparing free flaps, previously published series reported complication rates within the range of 14% to 39%, with reports of flap failure ranging from 2% to 6%, which showed a tendency toward lower complication rates with free flaps compared with most reported series of pectoralis major flaps (13). The results of our study reinforce the value of the pectoralis major flap in the reconstruction of head and neck defects and showed that this flap can be done with acceptable morbidity.

In this study, the difference in the complication rates between pectoralis major and other regional pedicled flaps was statistically significant. Other advantages over the other types of pedicled myofascial/ myocutaneous flaps include the versatility, the rotational arc, and the low morbidity to the donor site.

It is currently broadly accepted that the versatile free flaps with

microsurgical vascular anastomosis are the preferred methods for major defect reconstruction in patients who undergo head and neck cancer surgery (13). However, free flaps demand specialized surgical skills, special and costly instrumentation, and rigorous postoperative monitoring. These factors are not available in many head and neck centers (9,10), especially in developing countries. Also, the cost involved in this type of procedure has been debated in the world literature.

Tsue et al (20) reported a possible increase in cost, but better functional results and low complication rates with free flaps compared with pedicled myocutaneous flaps that could justify its use. Kroll et al (13) did not demonstrate an increase in the cost of free flaps compared with regional pedicled flaps. However, this topic is still at least controversial and a matter for further debate.

CONCLUSION:

Comparing the versatility, easy learning curve and consistent design of pedicle, PMMC flap is more favored flap with acceptable cosmetic and functional outcomes. Our experience has shown low flap related complications with zero total flap necrosis. We recommend free flap as a first choice when feasible and practical. But with limited resources and heavy patient load PMMC flap is still a workhorse flap for head and neck reconstruction.

FUNDING:

"This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. As this study was conducted in a busy hospital no funding was needed to conduct this study in specific. This is just an experience."

Conflicts Of Interest:

Competing Interests: The authors have no competing interests to declare that are relevant to the content of this article.

Ethical Approval:

Ethical approval was waived by the local Ethics Committee of Ayush University in view of the retrospective nature of the study and all the procedures being performed were part of the routine care. Hence no specific certification was granted by the committee.

CONSENT:

Consent to participate and publish: Informed consent was obtained from all individual participants included in the study and to publish the data in journals.

Authors Contribution:

All authors have made substantial contributions to the work reported in the manuscript. DC has given the concept, definition of intellectual content, helped in literature search, data acquisition and manuscript preparation. JS, HKN, DC and RR all were a part of both clinical and experimental aspect of study. PA has also contributed in manuscript preparations. RR has done all the editing and reviewing work of the manuscript. PA has done all the designing, data and statistical analysis of the study. All the authors have reviewed the text and checked for plagiarism. We give the rights to the corresponding author to make necessary changes as per the request of the journal, do the rest of the correspondence on our behalf and she will act as the guarantor for the manuscript on our behalf.

Acknowledgement:

We would like to thank all the nursing and operative staff for support and help during pre as well as post operative time of each patient. This study would not have been possible without this adjuvant critical assistance.

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