OPEN ACCESS

ORIGINAL ARTICLE

From Free Flaps to Pectoralis Major Flaps: A Workhorse in Limited Resources

Aamna Sanober[1], Shahzad Shaikh[1], Pir Naveed Ahmed Ahsan Qureshi[2], Samra Irshad[2], Sana Maria[1], Zaheer Qasmi[2]

[1]Department of Plastic Surgery, Liaquat University of Medical & Health Sciences (LUMHS), Jamshoro; [2]Department of Plastic Surgery Liaquat University Hospital, Hyderabad.

ABSTRACT

Objective: To assess the functional and aesthetic outcomes of using pectoralis major flaps in patients with head and neck region soft tissue defects after oral squamous cell carcinoma tumors in a resource-limited setting.

Methodology: This prospective study was conducted on patients who received repair of post-ablative defects at the plastic surgery unit of Liaquat University of Medical and Health Sciences and Bilawal Medical College, Jamshoro, between October 2022 and March 2023. All patients admitted to the plastic surgery unit during the study period for reconstruction of post-ablative defects using subsequent PMMC flap repair for head and neck region soft tissue defects after oral squamous cell carcinoma that were surgically treated and aged between 20 and 70 years. All major and minor PMMC flap-related and flap-unrelated complications were assessed.

Results: Among 78 patients, 63 (80.7%) were male and 15 (19.3%) were female, with a mean age of 34.10 ±12.10 years (range: 24-70 years). The Buccal mucosa was the most common location for oral cavity cancer, whereas the base of the tongue and floor of the mouth were used for reconstruction. Infections and wound dehiscence were the most common consequences, and the reconstruction site was statistically significant ($p<0.05$).

Conclusion: Despite encountering a few minor complications both associated and isolated to the PMMC flap, the survival rate of the flap remains high, while the occurrence of complete flap necrosis is extremely rare.

Keywords: Buccal Mucosa, Hematoma, Oral Squamous Cell Carcinoma, Pectoralis Muscles, Reconstructive Surgery, Wound infection

Authors' Contribution:
[1,2]Conception; Literature research; manuscript design and drafting; [3,4]Critical analysis and manuscript review; [5,6]Data analysis; Manuscript Editing.

Correspondence:
Shehzad Shaikh
Email: drshahzad83@hotmail.com

Article info:
Received: March 01, 2024
Accepted: October 20, 2024

Cite this article. Sanober A, Shaikh S, Qureshi PNA, Irshad S, Maria S, Qasmi Z From Free Flaps to Pectoralis Major Flaps: A Workhorse in Limited Resources. J Islamabad Med Dental Coll. 2024; 13(4). 610-616. *DOI: https://doi.org/10.35787/jimdc.v13i4.1163*

Funding Source: Nil
Conflict of interest: Nil

Introduction

Deficits in soft tissues occur when certain portions of soft tissues are either damaged or absent. The presence of cosmetic imperfections following extensive repairs of oro-facial diseases might impact the patient's overall welfare.[1] Head and neck issues often occur as a consequence of the removal of head and neck tumors or due to physical injury to the region. Unlike other parts of the body, this condition causes both cosmetic and functional impairments, significantly affecting the patient's quality of life. The reconstruction in this region is crucial for preserving functionality and maintaining self-deception.[2]

Reconstructive surgery typically employs two types of flaps: microvascular free flaps and regional pedicle flaps. With the widespread availability of information, enhanced clinical accessibility, and the expertise of maxillofacial surgeons in emerging nations, the free flap procedure has become a favored and highly regarded surgical technique.

However, substantial resources and training are necessary for such free flaps.[3]

The Pectoralis Major Flaps (PMF) is a reliable and versatile approach for treating complex problems in head and neck reconstruction caused by trauma, cancer surgery, or birth defects.[4] In the following three decades, these PMFs are employed as a workhorse flap for repairing head and neck-related deformities. Currently, microvascular free flap repair is considered the standard because it produces excellent outcomes in terms of both functioning and aesthetics.[5] These PMF designs are applicable in a range of operations, including cases when the patient's condition is compromised, when free flaps are unsuccessful, or when utilized in conjunction with free flaps to augment soft tissue. Performing reconstruction using free flaps in a nonindustrial nation is challenging due to the high cost, lengthy time requirements, lack of infrastructure, and shortage of skilled personnel.[6,7] Various studies have indicated a wide range of successes and problems related to the PMF. This design also experiences the same difficulties that are typically observed in other reconstruction procedures, however, the frequency of these issues is not consistent. Moreover, in resource-limited settings such a technique is frequently used and is workhorse in such settings. Therefore, an exhaustive examination of the multifaceted factors influencing the incidence of complications and the outcome in PMF treatments assumes critical importance as surgeons' endeavor to refine their abilities and improve outcomes. Keeping in view, the objective of this study was to assess the functional as well as aesthetic outcomes of using PMF in patients with head and neck region soft tissue defects after oral squamous cell carcinoma tumors in a resource-limited setting.

Methodology

This prospective study was carried out between October 2022 to March 2023 on patients who underwent reconstruction of post-ablative defects at the plastic surgery unit of Liaquat University of Medical and Health Sciences and Bilawal Medical College, Jamshoro. All patients operated on for head and neck region soft tissue defects after oral squamous cell carcinoma that were surgically treated belonging to either gender and aged between 20 and 70 years were admitted during the study period in the plastic surgery unit for reconstruction of post-ablative defects using subsequent PMMF repair were included in the study. Those who didn't undergo head and neck surgery for cancer and didn't fulfill the inclusion criteria were excluded from the study.

Information related to complication risk factors includes gender, age, preoperative albumin levels of 3.8 g/dL, a history of oncological treatment (surgery, radiation, or chemotherapy), the reconstruction sites, systemic health conditions (diabetes mellitus, hypertension, and cardiovascular diseases), blood transfusion was recorded on a pre-designed and tested checklist.

For harvesting the pectoralis major myocutaneous flap, the standard technique was applied under general anesthesia. Initially, two lines were drawn to represent the vascular pedicle's surface: one from the ipsilateral acromion to the xiphisternum, and the other vertically from the clavicle's midpoint to the intersection of the first line. Following that, the skin paddle was formed and imprinted in a caudal-medial direction along the pectoral wall, extending to the nipple, while avoiding the area. The elliptical skin paddle is positioned across the pectoralis major muscle, which runs parallel to the pectoral branch of the thoracoacromial artery, by mirroring the defect. The distance between the flap recipient site and the inferior clavicle should be equal to or larger than the distance between the top of the skin pedicle and the inferior clavicle. After cutting the skin around the paddle, the dissection is performed on the surface of the pectoralis major muscle. The skin paddle was

beveled rather than undercut during flap elevation to accommodate as many myocutaneous perforators as possible.

The skin paddle was stitched to the underlying pectoralis muscle to prevent the likelihood of myocutaneous perforators being severed. Slicing the lateral edge of the pectoralis major muscle revealed the plane of dissection linking the pectoralis minor and pectoralis major muscles, as well as their vascular pedicle. Once in the plane, we had little trouble releasing the pectoralis minor muscle from the pectoralis major, which has a vascular pedicle. It was separated from the humerus by dividing the pectoralis major muscle lateral to the pedicle while maintaining the pedicle visible. The supraclavicular hump was removed when a section of the muscle's clavicular fibers was split to make room for the neurovascular pedicle and its adventitia alone. Now, a subcutaneous tunnel was made just below the collarbone, via which the flap was inserted into the neck. The tunnel's width allowed for the flap to be delivered into the neck with ease and without being compressed. Using 3-0 Vicryl interrupted sutures, the flap was finally sutured. The wounds were bandaged in layers, and suction drains were inserted into the neck and chest. Because the donor site was always mostly closed, significant fasciocutaneous flap mobilization was necessary.

Follow-up of all patients was carried out in the outpatient department every three months by a trained outpatient nurse. Any morbidity related to the donor site 6-12 months following surgery was assessed and reported. The concluded result of the reconstruction (reconstruction outcome) as well as the existence and severity of complications were evaluated. The viability of the flap and the degree of function restoration were assessed for each patient. To assess the outcomes of treatment, flap-related issues were analyzed throughout the hospital stay, defined as the length of time it took patients to be discharged following the surgery. All major and minor PMMC flap-related and flap-unrelated glitches were evaluated. To accomplish this, the flap-related shortcomings were categorized into serious complications and needing surgery while minor complications can be managed conservatively (including packing, small drainage, debridement, and medication). In the case, of patients with more than complication the final one was picked.

For the statistical analysis, SPSS ver. 23.0 (SPSS Inc., Chicago, IL, USA) was utilized. Quantitative and qualitative characteristics are used to present the data. The variables were computed using chi-square and Fisher's exact probability tests. $P<0.05$ was used as the significance level.

Results

A total of 78 patients were included, with a mean age of 34.10 ±12.10 years (ranging from 24-70 years), of which 63 (80.7%) were males and 15 (19.3%) were females. The mean length of time required to harvest the flap and move it toward the defect was around 135 minutes (range 90-185 minutes). The largest circumferential defect repaired was 12 cm. The range of the average hospital stay was 10–40 days, with a mean of patients who experienced complications remained longer than those who had a smooth recovery. With a mean follow-up of two years, all patients were monitored for long-term problems such as stenosis, ranging from six months to five years.

Table I: Distribution of tumor sites among study participants (n=78)

Tumor site	n	%
Buccal Mucosa	38	48.7
Lower lip	4	5.1
The base and lateral border of the tongue	12	15.4
Gingiva-Retromolar trigone	10	12.8
Gingivo-buccal sulcus	14	18.0

Table II: Reconstruction site, prior oncological therapy, and blood transfusion (n=78)		
	N	%
Reconstructed site		
Base of tongue + floor of the mouth	32	41.1
Retromolar area + oropharynx	15	19.2
Buccal	14	18.0
Cervical and facial skin	17	21.7
Oncological treatment History		
Yes	19	24.4
No	59	75.6
Blood transfusion		
Yes	17	21.8
No	61	78.2

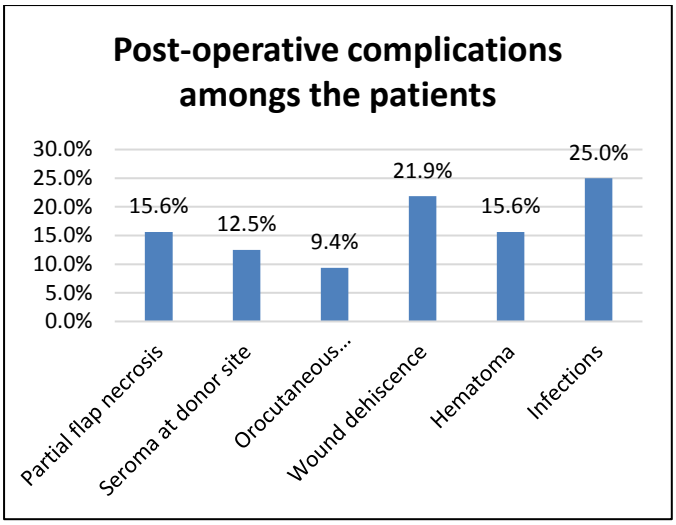

Figure 1: Post-operative complications

Table III: Factors related to the postoperative complications			
Study Variables	**Complication**		**p-value**
	Yes (32)	**No (46)**	
Age			
• ≤ 45 years	10	20	0.27
• > 45 years	22	26	
Gender			
• Male	27	36	0.50
• Female	05	10	
Reconstructed area			
• Base of tongue + floor of the mouth	18	14	**0.04***
• Retromolar area + oropharynx	02	13	
• Buccal	06	08	
• Cervical and facial skin	06	11	
Oncological treatment History			
• Yes	09	10	0.51
• No	23	36	
Blood transfusion			
• Yes	08	09	0.56
• No	24	37	

The Buccal mucosa was identified as the most prevalent site for oral cavity cancer among the individuals. The lower lip is the least frequent location for oral malignancies mentioned in Table I. The distribution of patients in terms of reconstructed area, prior oncological therapy, and requirement for blood transfusions is presented in Table II. An incidence of complications was documented in 32(41.0%) patients, whereas 46(59.0%) patients remained asymptomatic. The most frequently reported complications included infections, wound dehiscence, partial flap loss, and hematoma mentioned in Figure I. The demographic and other factors related to the postoperative complications are mentioned in Table III. There is a statistically significant difference ($p<0.05$) in the reconstructed site for the development of postoperative complications. (Table III)

Discussion

The reconstructive procedure depends on the defect's location, tissue type, functional and cosmetic effects, other health concerns, and resource availability. Microvascular repair requires intense supervision and re-exploration and is not always feasible, especially in developing countries.[8] PMF is regarded as a dependable choice for

providing coverage to head and neck areas. Since it is often used to correct cosmetic defects following tumor operations, this flap design has been lauded for its reliability in various studies.[4,9] The present study is designed to assess the complications and the resulting functional and aesthetic outcomes of using PMMF in patients with head and neck region soft tissue defects after oral squamous cell carcinoma tumors. In our study majority, 63 (80.7%) of the participants were male compared to their counterparts while most patients were > 45 years older. The mean length of time required to harvest the flap and move it toward the defect was around 135 minutes (range 90-185 minutes). The largest circumferential defect repaired was 12 cm. The most common site of cancer was at the Buccal mucosa while the base of the tongue and floor of the mouth were the commonly reconstructed site in our patients. These findings are consistent with Konduru et al., Lyu X et al., and Chen et al. who reported a similar distribution of gender, age, duration, and size of flap used for reconstruction.[3,6,10]

The examination of the data of our study demonstrated the diverse uses of PMC flaps for a wide range of abnormalities in the head and neck area. An advantage of the PMC flap is that it allows for the removal of a large skin paddle that covers the whole muscle, with the skin paddle extending down to the rectus abdominal sheath. In 60 selected patients, Pradhan et al. assess the indications, technique, reliability, complications, and aesthetic and functional outcomes of PMC flap head and neck reconstruction.[4] Jha et al. also reported that the flap has been utilized in the oral cavity, oropharynx, hypopharynx, neck, and face reconstructions in their study.[11]They reported that despite the widespread application and dependability of free flaps in head and neck reconstruction, they concluded that PMC is a viable alternative in situations where microsurgery facilities are scarce or as a salvage procedure following the failure of free flaps.[7,11] Muscle flaps are an effective option for parietal reconstruction. Muscular selection relies on defect location and severity.[12]

Extending the area of skin beyond the 7th rib raises the likelihood of experiencing partial loss. Similarly, we discovered that problems were predominantly observed in flaps extending beyond the 6th rib. Sen et al. indicated that placing the skin island slightly towards the center of the nipple, specifically covering the fourth, fifth, and sixth spaces between the ribs, effectively included the skin perforators originating from the internal thoracic artery.[13]

When characteristics such as age, sex, tumor location, site of reconstruction, prior radiation, and other factors were compared with reconstruction outcomes, the literature revealed contradictory results.[13,14] In a study conducted by Sen et al., it was shown that flap necrosis was associated with factors such as being female, being over the age of 70, being obese, having pre-operative albumin levels that were less than 4.0 mg/dL, reconstructing the oral cavity, and having systemic disorders.[13] The present study demonstrated that post-operative complications are correlated with site reconstruction only.

The outcomes we observed are similar to the findings reported in the existing body of research. The primary benefit of the PMC flap is its ability to enhance survival. Despite its extensive use in head and neck reconstruction for the past four decades with favorable outcomes, PMF has several limitations. Flap success is not guaranteed to be 100%, even in the hands of a skilled microvascular surgeon. Free flaps generally adhere to the all-or-none principle in the majority of cases.[2,11]

However, the possibility of postoperative problems should not be disregarded, even though the procedure for harvesting the flap is straightforward.[15] In our study, we observed a total complication rate of 41%. The complication that occurred most frequently was infections followed by

wound dehiscence, occurring in 25% and 21.9% of cases respectively. No additional surgical procedures were necessary, and the wound healed by secondary healing. Anehosur et. al. reported that complications were reported in 49% of their patient with wound dehiscence reported as the most prevalent complication.[15] Moreover, Gupta et al. also reported that infection was the dominant complication among the participants.[16] On the other hand, Oktaherniza et al. reported partial or complete necrosis as a postoperative complication in their case report.[17] Some authors reported an incidence of skin necrosis between 7% and 27%.[16,18,19] Partial flap necrosis was prevalent in 15% of our patients. Total flap necrosis and significant flap loss were not observed in our study, potentially attributable to the proficient management of soft tissues. There may be various limitations to this study because it was conducted within a single health institution without a comparator group, and the findings may not be generalizable.

Conclusion

Based on the findings the study concludes that the PMMC flap reconstruction is flexible and cost-effective with a high success rate. Despite encountering a few minor complications both associated and isolated to the PMMC flap, the survival rate of the flap remains high, while the occurrence of complete flap necrosis is extremely rare as observed over the 2-year follow-up period.

References

1. Trainotti S, Hoffmann TK, Rotter N, Greve J, Veit JA, Schuler P, et al. Pectoralis Major Muscle Free Flap: Anatomical Studies on Pedicle Length and Vessel Diameter. Ear, Nose & Throat Journal. 2019;98(7):431-4. https://doi.org/10.1177/0145561319840821
2. Hakeem AH, Javaid H, Iftikhar N, Javaid U. Bi-Paddle Pectoralis Major Myo-Cutaneous Flap: A Step by Step Approach. Journal of Otolaryngology Research & Reports. 2023;2(1):1–3. https://doi.org/10.47363/JOLRR/2023(2)108
3. Konduru V, Tirkey AJ, Samy K, Devarakonda KK, Janakiraman R. The folded, bipaddled pectoralis major myocutaneous flap for complex oral cavity defects: Undiminished relevance in the era of free flaps. JPRAS open. 2021;27:108-18. https://doi.org/10.1016/j.jpra.2020.11.007
4. Pradhan P, Samal S, Preetam C, Samal DK, Parida PK. Pectoralis Major Myocutaneous Flap Reconstruction for the Mandibular Defects in Advanced Oral Cavity Malignancies: A Retrospective Study of 30 Cases. Indian journal of otolaryngology and head and neck surgery: official publication of the Association of Otolaryngologists of India. 2018;70(3):415-20. https://doi.org/10.1007/s12070-018-1429-x
5. Khachatryan A, Tevosyan A, Novoselskiy D, Arakelyan G, Yushkevich A, Nazarian DN. Microsurgery Manual for Medical Students and Residents: Springer; 2021. available at: https://books.google.com.pk/books/about/Microsurgery_Manual_for_Medical_Students.html?id=JzsxEAAAQBAJ&redir_esc=y
6. Lyu X, Liu S, Zheng L, Huang M, Zhang J, Zhang J. A Modified Design of the Pectoralis Major Myocutaneous Flap for Reconstruction of Head and Neck Defect. The Journal of craniofacial surgery. 2021;32(5):1762-4. https://doi.org/10.1097/SCS.0000000000007287
7. Pradhan P, Preetam C, Sarkar S, Samal DK, Parida PK. Combined use of pectoralis major myocutaneous flap and deltopectoral flap for the reconstruction of advanced oral cancers: our experience in 29 cases. Journal of Maxillofacial and Oral Surgery. 2020:1-8. https://doi.org/10.1007/s12663-020-01464-2
8. Abrar Y, Muntaha ST, Khan K, Hameed U. Successful Use of Deltopectoral Flap in Reconstruction of Defect Caused by Squamous Cell Carcinoma. Journal of the College of Physicians and Surgeons--Pakistan : JCPSP. 2018;28(6):S125-s7. https://doi.org/10.29271/jcpsp.2018.06.S125
9. Khalid FA, Saleem M, Yousaf MA, Mujahid AM, Shahzad I, Tarar MN. Oropharyngeal, Hypopharyngeal and Cervical Esophageal Reconstruction: An Experience of Pedicle Flaps. Journal of the College of Physicians and Surgeons--Pakistan: JCPSP. 2019;29(2):168-72. https://doi.org/10.29271/jcpsp.2019.02.168
10. Chen WL, Zhang DM, Huang ZQ, Wang Y, Zhou B, Wang YY. Comparison of outcomes with extensive segmental pectoralis major myocutaneous flap via the anterior axillary line and the conventional

technique in oral and oropharyngeal cancer. Head & neck. 2018;40(2):349-54. https://doi.org/10.1002/hed.24959
11. Jha RK, Jami S, Tiwari RVC, Purohit J, Vipindas AP, Ibrahim M, et al. The Effectiveness of the Bilobed Pectoralis Major Myocutaneous Flap at a Tertiary Care Hospital: A Retrospective Analytical Study. Journal of pharmacy & bioallied sciences. 2021;13(Suppl 2):S1291-s4. https://doi.org/10.4103/jpbs.jpbs_111_21
12. Ayed AB, Hentati A, Abid W, Ghorbel I, Nouri K. Interest of Myocutaneous Plasty after Extended Sternal Resection. Pulmonary & Respiratory Medicine. 2020;8(1):1–3. https://doi.org/10.4172/2161-105X.1000447
13. Sen S, Gajagowni JG, Pandey JK, Dasgupta P, Sahni A, Gupta S, et al. Effectiveness of pectoralis major myocutaneous flap in the surgical management of oral cancer: A retrospective study. Journal of stomatology, oral and maxillofacial surgery. 2019;120(1):21-7. https://doi.org/10.1016/j.jormas.2018.08.003
14. Lakhera KK, Shenoy AM, Chavan P, Siddappa K. PMMC Patch Pharyngoplasty Reconstruction After Laryngectomy: Our Experience at a Regional Cancer Institute. Indian journal of otolaryngology and head and neck surgery: official publication of the Association of Otolaryngologists of India. 2015;67(2):170-2. https://doi.org/10.1007/s12070-015-0833-8
15. Anehosur V, Dikhit PS, Nagraj N, Jayade B, Kumar N. PMMC flap revisited and its clinical outcome in 150 patients. Journal of Maxillofacial and Oral Surgery. 2020;19:26-31. https://doi.org/10.1007/s12663-019-01228-7
16. Gupta R, Choudhury CR, Gupta S. A clinicopathological study of cheek carcinoma and different types of reconstructive procedure for its treatment in a tertiary care center in India. International Surgery Journal. 2018;5(12):3969-75. https://doi.org/10.18203/2349-2902.isj20185028
17. Oktahermoniza O, Oktavenra A, Khambri D. Pectoralis major myocutaneous flap for head and neck reconstruction: a case report. Bali Medical Journal. 2021;10(1):164-6. https://doi.org/10.15562/bmj.v10i1.2112
18. Tripathi M, Parshad S, Karwasra RK, Singh V. Pectoralis major myocutaneous flap in head and neck reconstruction: An experience in 100 consecutive cases. National journal of maxillofacial surgery. 2015;6(1):37. https://doi.org/10.4103/0975-5950.168225
19. Huang J-W, Wu N-Y, Lin Y-Y. Using a pedicle pectoralis major musculocutaneous flap in head and neck reconstruction after modified radical mastectomy: A case report. Medicine. 2017;96(15). https://doi.org/10.1097/MD.0000000000006313