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Original Research Article

The power flap: streamlining the PMMC for consistent surgical outcomes

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ABSTRACT

Background: The gold standard for reconstructive surgery is free flap reconstruction. Nevertheless, in developing nations, the high volume of cases, along with infrastructural and resource limitations, has led to the continued use of pectoralis major musculocutaneous flap (PMMC). This article seeks to share our experiences with the harvesting of PMMC flap and the associated outcomes.
Methods: A total of 45 patients were retrospectively assessed for reconstruction over a period of 5 years (January 2019 to February 2024). Of these, 30 patients underwent reconstruction using the PMMC flap following a stream lined protocol. The outcomes of the reconstruction, categorized as either successful or unsuccessful, along with any complications that arose, were thoroughly evaluated. Data was analyzed using SPSS version 26.0.and presented a numbers and percentages.
Results: The largest proportion of patients fell within the 41–60 age range, accounting for 63.33%. The buccal mucosa was identified as the most frequent location for primary lesions, affecting 21 patients (70.00%). Among the 30 patients who received PMMC flap reconstruction following a standardized technique making it a streamlined protocol, there were no instances of complete flap loss, resulting in a success rate of 100%. However, one case did report necrosis of the breast mound where standardization was not considered.
Conclusions: Based on our experience, PMMC flap remains a practical choice for reconstruction, particularly in settings with limited resources. Present approach was standardized by clearly defining the steps of the flap elevation by making it thin and less bulky, increasing its reach, minimizing the donor site morbidities and reducing the donor site deformities. With this stream lined protocol even a junior most plastic surgeon can perform the surgery confidently without facing significant complexity.

Keywords: Head and neck reconstruction, Nipple-areola complex, Necrosis, Pectoralis major musculocutaneous flap

INTRODUCTION

The reconstruction of intricate head and neck defects following cancer removal continues to pose significant challenges for plastic surgeons. Microsurgical techniques are expensive and need highly specialized training, many centers that treat head and neck malignancies do not offer free flaps, which are thought to be the "gold standard" for this type of reconstructive therapy.[1] Numerous musculocutaneous flaps have been created to provide specific benefits for immediate reconstruction in individuals with head and neck cancer.[2] The introduction of the PMMC by Ariyan has enhanced the options available for head and neck reconstructions. The PMMC offers several advantages, including a larger size, ease of implementation, minimal donor-site complications, its proximity to the head and neck area and the ability to perform one-stage reconstruction for extensive defects.[3] The cutaneous paddle can be utilized to restore the oral mucosa, the skin or both. Studies have documented the complications associated with PMMC transfers. On the event of large flaps and flaps taken from females with

enormous breasts because of the thin fat pedicle, the blood supply is insufficient to reach the distal region. Also, bulky flaps cause pressure over the pedicle especially at the clavicle leading to loss of muscle flap.[4]

The current study focusses on streamlining and clearly defining various steps in elevation of PMMC and also involving the nipple-areola complex (NAC) into the flap in large flaps which will improve the outcomes. This approach was successfully implemented in the head and neck reconstruction of 15 consecutive patients.

METHODS

Study design

Ethical approval was obtained from the institutional review board for this retrospective, observational study and the study adhered to the Declaration of Helsinki guidelines.

Study site

The current study is a single-centre, hospital-based investigation conducted for 5 years, in the Department of Plastic surgery, Yashoda Super Speciality Hospital, Somajiguda which is accredited by the NABH and NABL.

Study sample

In this study, we examined a cohort of 45 patients who underwent reconstruction of the resulting defect using a pectoralis major musculocutaneous flap in a routine standardized manner of which 30 patients were treated adhering to the stream lined protocol. The data was analyzed using percentages.

Inclusion criteria

It comprised patients with complete clinical records, between 20 years to 80 years of age, both male and females and with a minimum follow-up of 12 months.

Exclusion criteria

Patients with incomplete data, with less than 20 years and above 80 years of age, both male and females and with no follow-up were excluded from the study.

Technique

Once the patient is handed over to the plastic surgeon, the defect is marked and the flap is planned in reverse. Marking of the flap is done over the chest wall taking maximum number of perforators into the flap which is between NAC and sternal margin. Incision is done on the lateral border of the pectoralis muscle on the anterior axillary fold close to axilla. The initial length of the incision is 5-7 cm and is deepened to visualize the lateral border of pectoralis major muscle. Now the muscle is dissected and the surgeon enters into the plane below the pectoralis major and minor (Figure 1).

The incision is extended now in a curvilinear fashion taking around the nipple areolar complex till the marked skin flap and deepened to the muscle. In female patients, the incision is marked superiorly along the anterior axillary fold and is while going down it is turned posterior laterally along the lateral border of the breast and turned medially along the inframammary crease to reach the skin paddle. After the initial incision and visualization of the pedicle the incision is extended and the whole breast is elevated so as to avoid a big scar across the breast. Now the superior skin flap over the pectoralis muscle is elevated over the muscle till the clavicular margin. Care is taken while elevation so as to preserve the 2nd intercostal perforators by skirting the flap elevation medially just above the skin paddle and perforator zone towards the neurovascular bundle. Once the superior skin flap is elevated, the pectoralis muscle along with overlying skin paddle is elevated from the chest wall. The vascular pedicle is marked the muscle is elevated and cut medially from insertion (Figure 2).

Care should be taken to preserve or avoid the intercostal perforators especially 2nd and 3rd by incising the muscle close to the vascular pedicle and skin paddle with a muscle cuff of approximately 2.5 to 3 cm medially to the pedicle. The muscle should be incised superiorly till the clavicle by preserving the described cuff. Laterally the pectoralis muscle should be cut similarly, keeping at least 2.5-3 cm of muscle laterally with the vascular pedicle till the clavicle. Care should be taken while elevating the superior skin flap not to enter in a plane between clavicular head and sternal head inadvertently lest vascular pedicle can be damaged. The flap is tunneled supra clavicularly to the defect and inset (Figure 3).

Preservation of the 2nd intercostal perforator preserves the blood supply to the donor skin flaps and minimizes the donor site problems. In females the incision can be taken around the breast so that the breast mound can be preserved as much as possible and an incision is avoided across the breast and the blood supply is ensured by preserving the 2nd intercostal perforators, which are a major blood supply to breast. This principle is also used extensively in superomedial pedicle technique of breast reduction surgeries.

There were no incidences of flap necrosis or partial flap losses in flaps elevated by the standardized approach mentioned above. Whereas one case of breast mound necrosis was encountered in approaches where no standardization was followed and while elevation inadvertent damage to the 2nd intercostal supply occurred. Since the flap is elevated on thin muscle pedicle along the entire length and bulk of the flap is reduced causing less discomfort and swelling postoperatively in the clavicular region, neck and also

lengthening the flap thus increasing the reach of flap and decreasing the tension of the flap thus preventing the occurrence of contractive band later on.

Statistical analysis

Data was performed using SPSS version 26.0.and presented a numbers and percentages.

RESULTS

Table 1 indicates that the average age of the patients was 47.25 years, with the majority in the 41–60 years age range. Among the 45 cases analyzed, males (62.22%) outnumber females (37.78%). The buccal mucosa emerged as the predominant site for primary malignancies among the participants (71.12%), followed by retromolar trigone (8.88%), cheek (6.66%), tongue (6.66%), lower alveolus (4.44%).

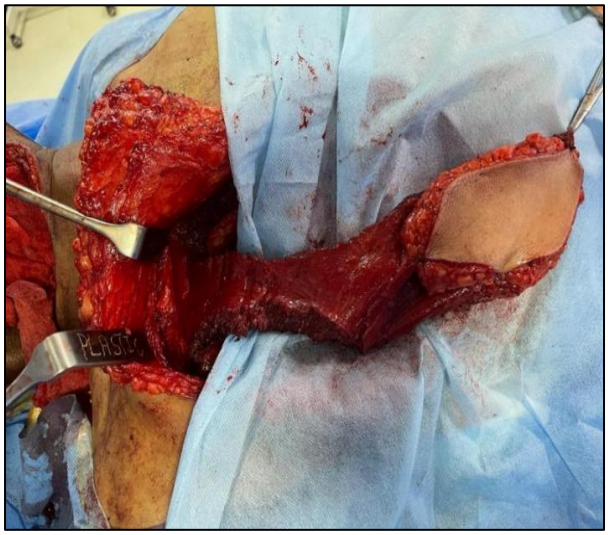

Figure 1: Plane below the pectoralis major and minor.

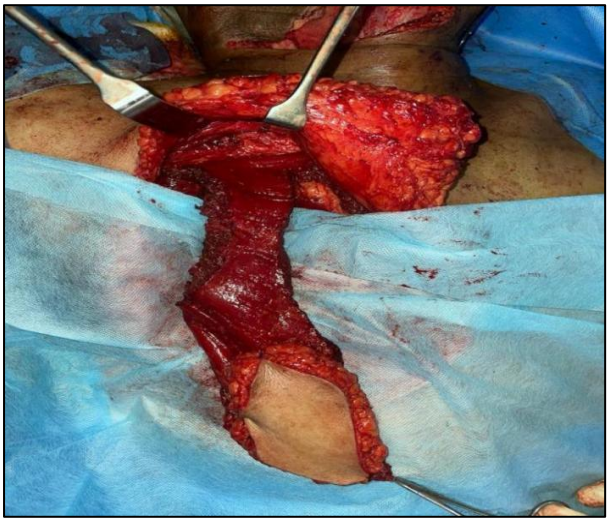

Figure 2: Vascular pedicle marked, muscle elevated and cut medially from insertion.

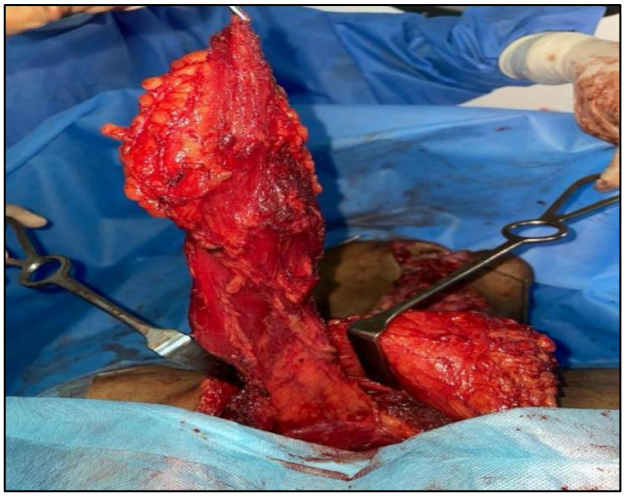

Figure 3: Flap is tunnelled supra clavicularly to the defect and insert.

Additionally, there were no recorded instances of flap necrosis or partial flap loss in the observed flaps; however, one case of breast mound necrosis was noted (2.22%). One case of skin flap necrosis due to thin fat pedicle in female. Out of 45 cases analyzed 15 cases underwent routine standardized technique with no stream lined protocol as we mentioned whereas remaining 30 patients adhered to the stream lined protocol which resulted in 100% success rate.

Table 1: Distribution of patients based on age, gender, site of primary lesion and complications.

Gender distribution	No. of cases (n=45)	%
Male	28	62.22
Female	17	37.78
Age wise distribution (in years)		
20-40	11	30.00
41-60	29	63.33
61-80	4	6.67
Percentage distribution of site of primary lesion		
Buccal mucosa	32	71.12
Retromolar trigone	4	8.88
Cheek	3	6.66
Tongue	3	6.66
Lower alveolus	2	4.44
Right squamous cell carcinoma	1	2.22
Complications		
Total flap loss	0	0.00
Breast mound necrosis	1	2.22
Outcome		
Standardized technique with no stream lined protocol	15	33.33
Standardized technique with stream lined protocol	30	66.66
Success rate	30	100

DISCUSSION

The pectoralis major musculocutaneous (PMMC) flap is a fundamental technique for reconstructing the head and neck. Flap failure in this area can lead to severe complications, significantly increasing morbidity and mortality rates. Incorporating the nipple-areola complex into the skin paddle enhances blood flow to the skin island of the PMMC flap.[5] Especially in large flaps we have standardized the approach by clearly defining the steps so that even the junior most plastic surgeons can operate without hesitation and with better outcomes. In our study a modified approach utilizing the pectoralis major musculocutaneous flap with the nipple-areola complex was successfully implemented in patients undergoing head and neck reconstructions, with no instances of partial or total necrosis of the skin island.

Despite recent progress in microsurgical techniques, local and regional flaps remain viable options for reconstructing complex defects in the head and neck. Among these, the pectoralis major musculocutaneous flap (PMMC) stands out as the most dependable and adaptable choice, often regarded as the primary option for patients affected by cancer-related disfigurement or those with significant medical complications.[6] The pectoralis major musculocutaneous flap offers numerous benefits. Its skin paddle can be utilized to reconstruct the mucosa, the skin or both, while the combination of muscle, skin and fat provides the necessary volume to restore the contours of the cheek.[7] In our case analysis, we employed PMMCs across a broad range of defects, affecting nearly all mucosal areas as well as various regions of the face and neck. This wide array of applications highlights the adaptability of PMMCs, a point also noted by other researchers.[8] We recorded a perfect success rate of 100% for reconstruction using PMMCs (30 out of 30 cases), which aligns positively with findings reported in several studies.[9] Authors did not encounter any instances of complete flap loss and the rate of partial loss, showing positive outcomes in all cases except in one case breast mound necrosis was observed. These findings align well with those reported in the literature.[10]

The vascular supply of the nipple-areola complex has been extensively documented in various clinical and anatomical studies conducted on female subjects.[11] Castelli et al, characterized the female breast as a modified sweat gland, noting that the blood supply to the nipple-areola complex is comparable to that of the male breast.[12] Considering the insights gained from these studies on the female breast and recognizing the similarities in the vascular structure of the nipple-areola complex in the females included in our research, the incision is planned to begin superiorly along the anterior axillary fold. As it descends, the incision curves posterior laterally along the lateral edge of the breast and then turns medially along the inframammary crease to connect with the skin paddle.

Previous research corroborates our initial findings regarding the modified technique that incorporates the NAC within the skin island of the PMMC in large flaps.[13] In our cohort, we observed no instances of total, partial or marginal necrosis of the skin island. While the sample size was limited, this positive outcome may be attributed to the inclusion of the nipple-areola complex in the skin island, which optimizes the capture of perforator vessels and enhances blood perfusion to the skin island.

CONCLUSION

In conclusion, this revised surgical method mainly addresses both functional and aesthetic issues by preserving vital perforators and maintaining cosmetic boundaries as well as increase in the length and reach of the flap.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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