

Bipaddle Pectoralis Major Myocutaneous Flap for oral cancer reconstruction: Operative technique, flap reliability and outcome, A single Institute experience.

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Abstract

Purpose: The Bipaddle pectoralis major myocutaneous flap (PMMF) is a commonly used flap in reconstructive head and neck surgery in advanced cases, but in literature, the flap is also associated with a high incidence of complications in addition to its large bulk. The purpose of the study is the evaluation of the flap reliability, operative technique and outcome in reconstructive head and neck cancer surgery.

Patients and methods:

The records of all patients treated with a bipaddle PMMF between 2012 and 2015 were systematically reviewed. Data of recipient localization, main indication, operative technique, postoperative complications and outcomes were analyzed. Major complications were evaluated if revision surgery was necessary and minor ones if conservative wound care alone was required.

Results: The male to female ratio was 4.6:1, with a mean age of 51 years (45-64). PMMF reconstruction was done in all patients of advanced squamous cell carcinoma of oral cavity. In 3 female patients (10.7%), minor flap related complications were seen, however recovered well with acceptable final outcome.

Conclusion: The Bipaddle PMMF is reliable for large defects in head and neck reconstructive surgery, particularly when a bulky flap is needed and the lesion is involving the outer skin. Placing the flap horizontally with inclusion of nipple and areola in most of the patients increased the reach and size of available flap.

Keywords: Full thickness cheek and oral defects, operative technique, Bipaddle pectoralis major myocutaneous flap (PMMF).

I. Introduction

Since the time of Aryan's description in 1979, the use of pectoralis major myocutaneous flap is rediscovered and has been used as the workhorse for head and neck reconstruction. Reconstruction of defect created after excision of advanced head and neck malignancies is still a challenge to reconstructive surgeons. These complex excisional defects often have extensive loss of mucosa, bone, soft tissue and skin. Ideal reconstruction should replace all these diseased structures to achieve acceptable aesthetic and functional results. Primary reconstruction of such defects with microsurgical techniques is now the protocol in almost all major cancer centers [1, 2]. But in view of the long operative time, specific and costly materials, the need for expertise and infrastructure and the large work volume in developing countries offering microsurgical reconstruction to all patients with such defects is not possible. Another factor limiting the use of free flaps is the necessity of good-quality recipient blood vessels for microvascular anastomosis [3]. Therefore using PMMC flap alone for lining as well as cover is also an established procedure now [4].

Complications from PMMF vary widely in the literature, where reported rates range from 13% to 63% [5], and several risk factors are described for complications and failures when this flap is employed. Some authors assert that, in skilled hands, free flaps result in fewer complications than do PMMFs [6, 7] there is a consensus that total flap necrosis is a rare complication when PMMFs are used, even when an inexperienced surgeon harvests the flap [8-12]. In addition, some of the complications associated with PMMF like mild skin flap necrosis can be managed by conservative approach with satisfactory results [12-15]. The disadvantages of pedicle flap can include a reduced neck mobility and the need to rotate the vascular pedicle of the flap 180° when using the skin paddle. Another disadvantage can be the thickness of the flap, which is determined by the amount of subcutaneous fat between the pectoralis muscle and the overlying skin paddle, leading to possible reduced swallowing or speech functions.

Objective

The objective of this study was to analyze our experience with Bipaddle PMMFs for head and neck reconstruction in advanced cases for the flap reliability, operative technique, complications and outcomes when this flap is employed.

II. Material And Method

Total 28 cases were studied that underwent radical composite resection and reconstructed using Bipaddle PMMFs between 2012 and 2015 at Cancer Research Institute, Swami Rama Himalayan University, Dehradun, India were systematically reviewed. The tumors were staged in accordance with the TNM criteria (AJCC)[38]. as stages I to IV. All Patients were eligible for the study if they had presented with advanced malignant tumors of the buccal mucosa involving the bone (mandible) and the skin of the face. Patients underwent immediate reconstruction using Bipaddle PMMFs. Data of recipient localization, main indication, and postoperative complications were analyzed. The complications were classified as flap-related complications if they were directly associated with the flap, the repaired area or the donor site. The flap-related complications were categorized as major complications or minor complications. Major complications were those that required reoperation in a surgical theater, or resulted in failure to attain the reconstruction goal. Minor complications were those that were treated successfully by means of conservative management with successful reconstruction. Conservative management included packing, small drainage, debridement and medication. When one complication gave rise to another, only the final complication was taken into consideration, in an attempt to represent the overall outcome from a succession of complications in an individual patient. For example, if dehiscence resulted in orocutaneous fistula, then the fistula was considered to be the complication. Among the cases that developed some kind of flap necrosis, we tried to identify possible technical causes that could be correlated with this. Unrelated complications were considered separately [15-25].

Flap design and operative technique:

The various surgical techniques used to harvest the PMMF was described in the literature [8,9,26,27] and the vascular pedicle was dissected under direct viewing. First, the clavicle, xiphoid, ipsilateral sternal border are identified, and then the size and location of the skin paddle being located at the inferior-medial border of the pectoralis major muscle are marked. The vascular axis is drawn on the skin of the chest. Second, the initial incision is made at the lateral part toward the anterior axillary line down to the pectoralis major muscle. The maximum amount of muscle should be harvested, because the larger the muscle volume, the safer the flap due to the increased number of myocutaneous perforators. Third, the inferior, medial and lateral incisions are made through the skin, subcutaneous fat and pectoralis fascia down to the chest wall. The superior incision is made down to the muscle fibres and the skin island is tightened to the muscle with absorbable sutures to protect the skin island during operative handling.

As the muscle is elevated inferiorly to superiorly, the pedicle should be identified by palpation and visualization on the deep surface of the muscle. The pectoralis major muscle derives its blood supply from the pectoral branch of the thoracoacromial artery and lateral thoracic artery. The thoracoacromial artery descends from its origin from the subclavian artery at the level of the midclavicular point in an inferomedial direction and anastomoses within the muscle with the direct branches of internal mammary and anterior intercostals branches of the internal mammary artery. The perforating branches to the skin paddle area used for head and neck reconstruction are located in 3 distinct places. First: along the medial edge of the muscle, direct musculocutaneous branches from the internal mammary artery. Second: 2–4 cm medial to the nipple, coming from the anterior intercostal branch of internal mammary artery. Third: fine branches reaching the skin by curving around the lateral border of the muscle. Because of the rich anastomotic network within the muscle, blood supply from thoracoacromial artery safely reaches the skin even after ligation of the branches of the internal mammary and lateral thoracic artery [26-28].

When the muscle fibres are cut along the sternal attachment, special attention should be taken not to cut the internal mammary perforators adjacent to the sternum that supply the deltopectoral flap. During the dissection the vascular bundle should always be seen in order to avoid injury to this bundle. After dissection the flap off the chest wall, a subcutaneous tunnel is formed under the skin between neck (preserving the perforators to the overlying deltopectoral flap) and the chest and the flap is passed underneath the skin bridge. In all of the cases, the supraclavicular route was used to transfer the flap to the defect. Magrim et al. use sterile liquid vaseline to lubricate the bulky flap and to raise the ipsilateral shoulder in order to facilitate passage and during the procedure, to instill a vasodilator substance (papaverine or lidocaine) over the flap pedicle [29]. The paddle was placed horizontally, including the nipple and areola, which extends from midline medially and crossing the lateral border of the muscle laterally increases the reach and size of available flap. Figure 1a&b showing Primary Lesion and Size of Bipaddle . Paddle for lining defect was placed around the nipple, that paddle was nourished by two sets of perforators (P2, P3). The paddle for the skin defect was placed on the medial edge of the muscle based on P1 perforators. The paddle was placed along the transverse axis, so that the reach of flap

was not compromised (Figure 2). If the nipple is prominent then it was excised and closed with a stitch and even spared in some patients. The technique was found to be anatomically sound, technically easy and reliable. Precautions that were taken included proper assessment of reach of the paddle, placing not more than one-third of the paddle outside the muscle and securing the skin paddle to the muscle to avoid shearing of perforators during flap raising. However, the disadvantages of bipaddle flap include loss of nipple and areola in most patients and technical difficulty in obese patients and females. Another pitfall, relates to the lateral pectoralis nerve division. It is observed that this nerve may lie parallel or oblique to the PMMF vascular pedicle. When running obliquely to the pedicle, the lateral thoracic nerve becomes taut after the flap is rotated through 180° and presses against the vascular pedicle, thus leading to PMMF vascular impairment. This phenomenon is seen in 30% of their cases and recommended that this nerve should be dissected and divided when the above situation is observed [30]. In regard to the possible arc of the rotation of the flap, soft tissue defects anterior to the retromolar region and inferior to the ear lobe and commissure of the lips can be reconstructed with relative ease [31]. Primary closure of the chest donor site was done inspite of large size of the skin paddle, due to the wide undermining of skin flaps. Most authors performed a primary closure but in some cases, different techniques have been described like buttons or Ventrofil®, a special tension- relief bridging device [32]. Closed suction drains are used to drain the donor site as well as the neck.

III. Results

Total 28 cases were studied. Among these, 25 (89.2%) were men. The age of patients ranged from 45 to 64 years (mean 52.3 years). All patients were reconstructed primarily by bipaddle pectoralis major myocutaneous (PMMC) flap. All the tumors were operable squamous cell carcinomas, mainly located in the oral cavity and cheek, and most of these were at an advanced stage of disease (stages III and IV) (Table 1).

Table1. Disease stage (n = 28)

| Disease stage | Number of cases | Percentage (%) |
|---------------|-----------------|----------------|
| IV | 21 | 75% |
| III | 7 | 25% |
| II | 0 | 0% |
| I | 0 | 0% |

All patients underwent composite resection (wide excision of the primary tumour with segmental/hemi/totalmandibulectomy and neck dissection in continuity). Neck dissections in all cases were modified type in twenty four and radical in four patients and sternocleidomastoid muscle was removed in all. This provides us a space to accommodate the PMMC flap muscle in neck. All patients received postoperative radiation therapy. The size of the paddle used for mucosal defect repair ranged from 4x4 to 8x7 cm and the size of the paddle used for skin cover ranged from 4x4 to 8x8 cm. The total flap size ranged from 9x4 to 15x7cm (Table 2). All patients achieved satisfactory cover. Besides partial or complete necrosis, other complications such as fistula formation, dehiscence, infection, and hematoma are described [23, 33]. The complication rate seems to be higher than in free flap reconstructions as, e.g., radial forearm flap [33]. Several reasons for complications have been described. McLean et al [22] reported complications mainly in patients after radiotherapy. A higher complication rate seems to be associated with the use of the flap as a salvage procedure and the presence of more than one risk factor by some for example if the patient is a heavy smoker and or the procedure is oral cavity reconstruction [17], while others reported no significantly higher complication rate associated with smoking, preoperative radiotherapy, or diabetes [21, 24].

Table 2.Particulars of the patients in present study.

| S.N. | Age | Sex | Complications | Paddle size(cm) | | | Hospital Stay (Days) |
|------|-----|-----|-----------------------|-----------------|-------|-------|----------------------|
| | | | | Lining | Cover | Total | |
| 1 | 56 | M | Nil | 6x6 | 7x6 | 13x6 | 12 |
| 2 | 63 | M | Nil | 7x7 | 6x6 | 13x6 | 10 |
| 3 | 48 | M | Nil | 6x8 | 6x6 | 14x6 | 8 |
| 4 | 50 | M | Salivary Collection | 6x5 | 6x5 | 12x5 | 14 |
| 5 | 47 | M | Nil | 7x7 | 6x7 | 14x7 | 9 |
| 6 | 45 | F | Partial Flap Necrosis | 5x5 | 6x5 | 11x5 | 35 |
| 7 | 55 | M | Nil | 7x7 | 8x8 | 15x7 | 10 |
| 8 | 59 | M | Nil | 7x6 | 5x6 | 12x6 | 9 |
| 9 | 50 | F | Partial Flap Necrosis | 6x8 | 7x6 | 15x6 | 20 |
| 10 | 64 | M | Nil | 5x6 | 4x4 | 10x5 | 8 |
| 11 | 46 | M | Orocuteaneous | 6x6 | 5x5 | 11x6 | 16 |

| | | | | | | | |
|----|----|---|------------------------|-----|-----|------|----|
| | | | fistula | | | | |
| 12 | 45 | M | Nil | 6x7 | 6x5 | 13x6 | 9 |
| 13 | 54 | M | Nil | 5x4 | 4x4 | 9x4 | 7 |
| 14 | 49 | M | Minor Wound Dehiscence | 8x7 | 7x7 | 15x7 | 14 |
| 15 | 46 | M | Nil | 7x5 | 6x5 | 13x5 | 8 |
| 16 | 51 | M | Nil | 6x6 | 5x5 | 11x6 | 9 |
| 17 | 58 | M | Nil | 4x4 | 6x7 | 11x5 | 12 |
| 18 | 47 | M | Nil | 7x6 | 6x6 | 13x6 | 10 |
| 19 | 54 | M | Nil | 5x6 | 6x6 | 11x6 | 8 |
| 20 | 62 | M | Nil | 5x5 | 6x5 | 11x5 | 7 |
| 21 | 46 | M | Salivary Collection | 6x6 | 7x6 | 13x6 | 16 |
| 22 | 56 | F | Nil | 7x7 | 8x8 | 15x7 | 9 |
| 23 | 48 | M | Nil | 5x4 | 4x4 | 9x4 | 10 |
| 24 | 52 | M | Partial Flap Necrosis | 8x6 | 7x6 | 15x6 | 19 |
| 25 | 59 | M | Nil | 6x8 | 6x6 | 14x6 | 7 |
| 26 | 60 | M | Nil | 4x4 | 6x7 | 11x5 | 9 |
| 27 | 49 | M | Nil | 6x7 | 6x6 | 12x7 | 8 |
| 28 | 47 | M | Partial Flap Necrosis | 7x7 | 8x8 | 15x7 | 15 |

Table 3. Flap-related major and minor complications (n = 28)

| Major complications | Number of cases | % |
|---|-----------------|--------|
| No | 23 | 82.14% |
| Yes | 5 | 17.85% |
| Partial flap loss + intraoral flap dehiscence | 4 | 14.28% |
| Orocutaneous fistula | 1 | 3.57% |

| Minor complications | Number of cases | % |
|----------------------|-----------------|--------|
| No | 25 | 89.28% |
| Yes | 3 | 10.71% |
| Neck skin dehiscence | 1 | 3.57% |
| Salivary collection | 2 | 7.14% |

Four patients had skin necrosis of outer flaps, one had wound infection with resultant orocutaneous fistula, two patients had salivary collection and one case had skin wound dehiscence (Table 3). For skin necrosis, one was reconstructed with local advancement flap and three covered with split skin graft. Orocutaneous fistula responded to local wound care. Minor wound dehiscence required debridement and resuturing, and both minor salivary collection between the two paddles of flap responded to repeated aspiration. Reconstruction time was approximately 3 h (range 2 to 4: 00 h). The mean duration of hospital stay was 12 days (range 7–35 days). All patients finally achieved acceptable functional and cosmetic results except one female patient (Figure 3a.). The intraoperative and the immediate postoperative course in all patients remained uneventful. Three patients received preoperative radiotherapy and all the other patients required postoperative radiation therapy. The postoperative radiotherapy was tolerated well. On follow up, the flaps proved to be robust as well. Fig. 3b and 4(a,b).

IV. Discussion

Easy reach of the flap upto retromolar region and cheek, good vascularity based on perforators, technical simplicity, coverage of the exposed vessels by muscle after neck dissection and the ability to provide bulk in the neck made it a popular option amongst oncoreconstructive surgeons. A good success rate for reconstruction purposes was observed using PMMFs (82.14%), and this rate compares favorably with several papers in the literature [8,17,21,24,34,35]. The present study did not observe any cases of total flap loss and rate of partial loss was acceptable, with good final outcome observed in four such cases.

These results are also comparable to those in the literature. In females the use of an inframammary incision is recommended for aesthetic reasons positioning the skin island just medially to the nipple, over the fourth, fifth and sixth intercostal spaces, is essential for encompassing the skin perforator vessels that arise from the intercostal branches of the internal thoracic artery. These cutaneous vessels are supplied by the pectoralis branch of the thoracoacromial artery, through open choke vessels, when the main blood flow through the internal thoracic artery is interrupted during PMMF elevation. Hence, a totally axial myocutaneous flap may be created respecting this anatomical condition. Below the seventh rib, the vascular supply for the skin comes from the cutaneous branches of the superior epigastric artery, [36] and therefore, when portions of skin beyond this limit are included in the flap, this creates an axial flap with a distal random portion, thereby increasing the risk

of partial loss. In females there is intervening extra fatty tissue in breasts as compared to males. In these two female patients, the skin island extended below the seventh rib and the skin paddle was small in one patient that probably did not encompass a sufficient number of skin perforator vessels, thus resulting in unstable blood circulation [37]. Almost fifty percent reduction in bulkiness of flap is reported within three months due to its atrophy after division of the motor nerves [19]. Proper flap design and operative technique should be implied for bipaddling in females and obese patients due to unreliability of skin paddle over the breast tissue and a very bulky flap. The bone replacement was not possible, in lateral and posterior mandibulectomies it was not always necessary to replace the bone since the soft tissue can provide acceptable aesthetics and prevent jaw deviation to some extent.

V. Conclusion

Since the risk factors for developing major complications and outcome failure may be anticipated, we are convinced that if the technical pitfalls listed throughout this study are given due attention and judicious clinical and nutritional support is provided for patients in a more critical condition, better results can be obtained. Bipaddle PMMF is a reliable and robust reconstructive option even in female patients.

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Figure legends:



Figure 1a - The primary lesion



Figure 1b- The flap size and design



Figure 2 Bipaddle reconstruction



Figure 3(a) Partial flap necrosis



Figure 3(b) Healthy flap post Radiation



Figure 4(a) Inner flap



Figure 4(b) Outer flap