

## Thoracoacromial Vessel Based Pectoralis Major Myocutaneous Flap in Oral and Maxillofacial Soft Tissue Defect Reconstruction□

\*Quazi Billur Rahman, Rajan Karmakar, Shaymal Kumar□

*Dr. Quazi Billur Rahman, Dr. Rajan Karmakar, Dr. Shaymal Kumar  
Department of Oral and Maxillofacial Surgery  
Bangabandhu Sheikh Mujib Medical University Dhaka*

\* Corresponding Author

### ABSTRACT

Pedicled flaps play an important role in cancer treatment centers, particularly in developing and emerging countries. Although different flaps can be used for facial reconstruction but Pectoralis major myocutaneous flap is still considered the workhorse for maxillofacial reconstruction because of simple procedure and high success rate, while other flaps of facial region ranging from pedicled to free flaps require greater surgical skills along with unpredictable results. The aim of this study is to find outcomes of Pectoralis major myocutaneous flap in reconstruction of middle and lower facial regions. Main outcome measures are vitality of the Pectoralis major myocutaneous flap, donor site morbidity and recipient and donor site complications.

This study was carried out on 36 patients in BSMMU and Health & Hope Hospital in Dhaka from 1<sup>st</sup> April 2005 to 30<sup>th</sup> June 2011 who require soft tissue reconstruction of defects of middle and lower facial regions. The age and sex of the patients and size of defect were analyzed. Vitality of Pectoralis major myocutaneous flap, donor site morbidity and donor and recipient site complications were studied. In this study, male female ratio was 13:5; mean age 50 the success rate of was 100%. All of the flaps were vital but 13.8% of the flaps had partial loss of flap.

Pectoralis major myocutaneous flap is a versatile flap as it can not only provide skin and mucosal cover simultaneously, but also provide adequate muscle bulk for through and through defects. It doesn't cause any hindrance in mandibular movements.

**Keywords:** Maxillofacial Reconstruction, Pectoralis major muscle, Myocutaneous flap, Axial pattern flap, Complication.

### Introduction

Reconstruction in the head and neck region continues to be a surgical challenge, as it requires restoration of both form and function. Through and through, extensive intra- and extra-oral high volume defects are mainly created after resection and excision of tumors. Reconstructing major ablative defects in the head and neck remains a challenge for surgeons as it requires both restoration of form and function. Soft tissue defects mostly demand both skin cover and oral lining<sup>1</sup>. The radical resection required for local-regional control of head and neck malignancies has the capacity to disfigure and limit the patient's quality of life<sup>2</sup>. Post-traumatic (i.e. road traffic accidents,

firearm, and war injuries) and post-infective defects also require soft tissue reconstruction. The central tenets of post-ablative head and neck reconstruction are the restoration of adequate function, form and esthetics, which maintain or improve quality of life. Regional flaps revolutionized reconstructive surgery in the 1970 s and 1980 s, the introduction of microvascular surgery in the last two decades has caused a philosophical shift in contemporary head and neck reconstruction<sup>3</sup>. Reconstructive options for soft tissue defects after cancer extirpation depend on several factors. The two most important factors are the location and

extent of the defect; however, several other factors, such as the condition of the patient, the disease prognosis, and the capability of the surgeon, must also be taken into consideration. Although the use of free flaps has become state-of-the-art for reconstruction of oral and maxillofacial defects. However, the need of expert microvascular surgeon with long learning curve, this technique is not without hazards, as it has a longer operative period with greater blood loss, increased length of hospital stay, the high cost of such surgery, and increased morbidity when performed in high-risk patients may not be justified in patients with advanced disease and poor prognosis, or poor performance status. In such cases, simpler reconstruction using pectoralis major myocutaneous flap may be used, providing a good possibility of restoring function, including masticatory function and improving appearance, thereby improving quality of life<sup>5</sup>. Described by Ariyan in 1979<sup>6,7</sup> the pectoralis major myocutaneous (PMMC) flap has been used to reconstruct oncologic head and neck defects after either primary extirpation or surgical salvage following radiation failure. The simple anatomy of the pectoralis major flap, ease of harvest, proximity of the flap to the head and neck and consistency of vascular pedicle make this flap an ideal source of vascularized tissue in reconstructing oral and maxillofacial defects. It can provide both mucosal lining and skin cover with double skin paddles<sup>8</sup> and gives bulk and pliability to the soft tissues<sup>9</sup>. The Pectoralis major myocutaneous flap is an axial pattern flap. The pedicle of the flap is based on thoracoacromial artery, which is a branch of axillary artery<sup>10</sup>. It is type V muscle flap according to Mathes and Neahai classification<sup>11</sup>.

The purpose of this study was to evaluate the outcomes of this myocutaneous flaps in term of survival (failure of flap), Recipient and donor site complications (wound infection, haematoma, seroma, dribbling of saliva, marginal necrosis/ partial flap failure, sinus fistula formation, and neck contractures.), Donor site morbidity, primary closure, chest expansion and shoulder movements.

## Patients and Methods

This study was carried out in the department of Oral & Maxillofacial Surgery of BSMMU & Health & Hope Hospital in Dhaka. 36 patients were included in this study from 1st April 2005 to 30th June 2011. The sampling method was purposive. The inclusion criteria were TNM (UCC, 1987) stage II-IV extirpation, reconstruction with skin and soft-tissue defect, or a defect involving the middle & lower third of face. All these patients needed extensive soft tissue reconstruction for high volume and composite defects of face below the level of inferior orbital margin and zygomatic arch after trauma, infection and oncologic resection. Patients with shallow defects and with distant metastasis were not included. After taking complete history, general physical and systemic examination was done. Preoperative assessment included the site, stage of the disease. An open biopsy from the tumor was undertaken for all cases. The stage of the disease and probable defect after resection was evaluated by clinical examination and radiological (OPG, CT or MRI) examination. A routine chest x-ray, and abdominal ultrasound were carried out for assessment of distant metastasis. Preoperative medical assessment included routine complete blood picture, bleeding and coagulation profile, liver and kidney functions, ECG. The indications for the flap use and the flap design to fit the defect were planned preoperatively. Consent for the operation was taken. Photographs were taken preoperatively, intraoperatively and postoperatively. Chests of the patients were examined for any injury, scar and contracture at the donor site along with fractures of rib cage. Color Doppler was sent in specific cases to evaluate patency of vascular pedicle and chest X-ray to see the deformities of chest cage. Pre-operatively probable the soft tissue defects were measured and marked on the pectoral region of the patients in sitting or in supine positions. Resectional surgery with selective neck dissection was done in all patients according to surgical oncologic principle. The operative technique used was essentially the same as originally described by Ariyan<sup>6</sup> with a modification of the incision as described by Schuller<sup>12</sup> to preserve the deltopectoral flap

area. Following resectional procedure the defect was measured. The skin paddle of appropriate size enough to reach the defect without tension was marked over the chest wall. Its length from the clavicle was measured along the axis of the vessel (i.e along the line joining the acromion to the xiphoid process). The skin incision was taken from the anterior axillary fold to meet the marked skin island superolaterally.

The paddle incision was also taken in continuity with the skin incision. The skin paddle was sutured down to the underlying muscle with silk sutures to prevent shearing movement between the skin and the muscle. The pectoralis major muscle was then elevated from the chest wall to visualize the flap vessel running on its undersurface. The flap pedicle was fashioned by cutting the muscle on either side of the vessel and elevating it till the clavicle. After achieving haemostasis on the cut muscle on the flap side by catgut ligatures, the flap was flipped over the clavicle, tunneled through the neck and inserted into the defect with 3-0 silk was sutured in layers to cover defect. The skin paddle size ranged from 6cm x 4 cm to 9 x 6 cm.. Haemostasis was achieved with a continuous catgut suture on the cut pectoralis major and the donor site was closed primarily with a drain. The flap sutures were removed on the 8th-10th post-operative day. Post-operatively the patients were kept in postoperative unit for first 24 hours after which they were shifted to the ward. Post-operatively, blood pressure of patients was maintained slightly at higher level to achieve good perfusion of the flap. Head ends of patients were elevated and steroids were prescribed to avoid oedema and venous congestion of the flap. Hemoglobin percentage in blood was checked. Patients were discharged from the ward after 10th post operative day or when all the drains and sutures were removed. Postoperatively, patients were evaluated for vitality of the flap (i.e. flap color, temperature, marginal necrosis, epidermolysis, and bleeding on pin pricking) along with other complication like suture dehiscence, infection, sinus or fistula formation and neck contracture. Donor site morbidity was measured in terms of shoulder and arm movements and chest expansion.

The vitality of flap was monitored primarily with the help of clinical evaluation and above said parameters. Specific sensors like temperature probe, oxygen pressure probe and Doppler probe and more formal tests like I/V vital dyes and nuclear medicine studies are not used in this study. The same variables which were noted upon discharge (one week post operatively) were again measured at one the months follow up periods. Follow-up of patients also involved a thorough clinical examination aided by radiological assessment for the local recurrence, complications and distant metastasis.

## Result

There were 26 (73%) males and 10 (27%) females with a mean of age 50 years, and a range of 26-67 years. The pathology of the disease included squamous cell carcinoma in the majority of cases (88.8%). The rest of the cases were mucoepidermoid carcinoma (5.5%), Adenoid cystic carcinoma (5.5%). Reconstructions were completed after ablation of cancer in 36 patients with carcinoma of the oral cavities (cheek involving skin 14, floor of the mouth 16 and chin including lip 6); Out of these 36 patients 4 were stage 2, 20 stage 3, and 12 cases were stage 4 who presented with fungating mass. Primary reconstructive procedures were carried out in all the patient. Twelve patients (33.33%) had been affected by complications such as wound dehiscence (8.3%), infection (8.3%), hematoma (5.5%), seroma (5.5%), partial flap failure (13.8%), total flap failure (0.0%), orocutaneous fistula (5.5%), dribbling of saliva (8.3%) and donor site healing problems (25%). All the minor complications were treated conservatively with no resulting functional morbidity. Most complications were minor and did not require a second salvage procedure. Our results are shown in tables I, VI.

## Loss of flaps

In first week after surgery 5 (13.8%) patient had partial loss of flaps and total flap loss was not found in any patient, Out of 5 patients with partial flap loss, 5% of partial flap loss was seen in 2 patients, 10% of partial flap loss was found in one patient and 15% of partial flap loss was seen in only one patient.

Table- I: Distribution of cases by loss of flap

| Loss of flaps | After 1 Week    |      | After 1 Month   |      | After 3 Month   |     |
|---------------|-----------------|------|-----------------|------|-----------------|-----|
|               | No. of patients | %    | No. of patients | %    | No. of patients | %   |
| No loss       | 30              | 83.3 | 34              | 94.4 | 36              | 100 |
| Total loss    | 0               | 0.0  | 0               | 0.0  | 0               | 0.0 |
| Partial loss  | 5               | 13.8 | 2               | 5.5  | 0               | 0.0 |
| Total         | 36              | 100  | 36              | 100  | 36              | 100 |

Donor site morbidity was also minimal as we did the primary closure in all patients. Chest expansion and shoulder movements were less than normal in 18 patients (50%) in 1 week post operatively. 18 patients acquired normal chest movement and shoulder movements in the subsequent follow up visit. Neck contracture was found in 2 patients (5.5%).

Table II: Site of the disease

| Site of the disease  | No. and % of Patients |
|----------------------|-----------------------|
| Cheek skin involving | 14(38.8%)             |
| Floor of the mouth   | 16(44.4%)             |
| Chin including lip   | 6(16.6%)              |

Table III: Stage of the disease

| Stage of the disease | No. and % of patients |
|----------------------|-----------------------|
| Stage 1              | 0                     |
| Stage 2              | 4 (11.1%)             |
| Stage 3              | 20 (55.5%)            |
| Stage 4              | 12 (33.3%)            |

Table IV: Pathology of the disease

| Pathology                | No. and % of the patients |
|--------------------------|---------------------------|
| Squamous cell carcinoma  | 32 (88.8%)                |
| Mucoepidermoid carcinoma | 2 (5.5%)                  |
| Adenoid cystic carcinoma | 2(5.5%)                   |

Table V: Type of Reconstruction

| Type of Reconstruction | No. (%)   |
|------------------------|-----------|
| Primary Reconstruction | 36(100%)  |
| Cheek                  | 14(38.8%) |
| Floor of the mouth     | 16(44.4%) |
| Chin & Lip             | 6(16.6%)  |

Table: VI Post operative complications

| Postoperative complications | No. and % |
|-----------------------------|-----------|
| Partial flap loss           | 5(13.8%)  |
| Wound infection             | 3(8.3%)   |
| Dehiscence                  | 2(5.5%)   |
| Dribbling of saliva         | 3(8.3%)   |
| Orocutaneous Fistula /Sinus | 2(5.5%)   |
| Total flap failure          | 0(0.0%)   |
| Neck contracture            | 02(5.5%)  |
| Hematoma                    | 01(2.7%)  |
| Postoperative Complications | No. and % |
| Donor Site                  |           |
| Wound Infection             | 2 (5.5%)  |
| Seroma                      | 2 (5.5%)  |
| Wound dehiscence            | 3 (8.3%)  |
| Hematoma                    | 2(5.5%)   |

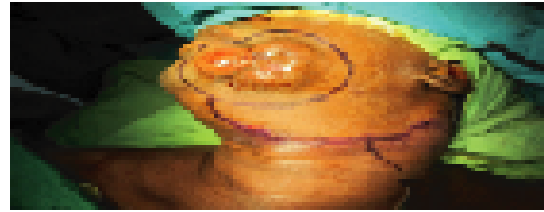


Fig-1: SCC of cheek



Fig-2: Defect After Surgical Excision



Fig-3: Flap Transposed to Defect



Fig-4: Closure of defect



Fig-5: Donor site closure



Fig-6: Flap Status after 15 days after surgery

## Discussion

Reconstruction of facial defects is very tedious job requiring high skill and technique. We used pectoralis major myocutaneous flap with single skin paddle in 36 patients for through and through defects to provide skin and mucosal cover at the same time. Within 1st week postoperatively, there is decreased blood flow in the flap due to oedema, congestion and gravitational forces. The mild hypoxic status of flap causes neovascularization and the vessels re-orientate along the long axis of flap. During and 1 week after reconstruction, circulation becomes well established between the wound bed and flap. Within 3rd to 4th weeks after surgery a flap achieves most of its final blood circulation.

We determined the vitality of flap by many variables like color, temperature, capillary refill, bleeding on pin pricking, marginal necrosis, epidermolysis and loss of flap. In our study, 70% of the patients had normal flap color and temperature and 30% had pale flaps in the initial post operative days, both of these parameters improved with each progressive day. No flap was found cyanosed. The susceptibility of the skin paddle and margins to undergo necrosis depend upon the musculoskeletal perforating vessels. The skin paddle was stitched with the underlying pectoralis muscle and all flaps were treated very gently to avoid excessive mobility of the skin paddle and subsequent damage of the perforating vessels to skin. All the flaps bleed on pin pricking.

Pectoralis major flap has such a strong and consistent vascular pedicle, it rarely undergoes into total failure unless some major event (pressure, stretch and damage to the pedicle) happens to occur pre operatively or post operatively. Partial loss of flap was found mostly in obese and female patients where thick subcutaneous fatty tissue and fine musculo-cutaneous vascular perforators made the skin paddle more susceptible to ischemia. Total flap failure is not seen in any case. Only 5 (13.8%) out of 36 patients had partial loss of flap and the skin paddle was lost up to 15%. Acosta<sup>13</sup> in 2002 and Cheema<sup>14</sup> in 2003 studied on the same

lines and he reported 6% total loss of flap and 20% of partial loss of flap.

The beauty of the pectoralis major myocutaneous flap is that a very big skin paddle, overlying whole of the muscle can be elevated. The skin paddle can be extended as far down as the rectus abdominal sheath. Infra-mammary and parasternal skin paddle were mostly used in this study. The infra-mammary skin paddle was considered esthetically more pleasant in female patients as it affected the breast contour minimally. Despite the fact that scars at the donor site were hidden in clothing, vertical incisions were avoided and horizontal incisions were preferred for esthetic reasons. Tunneling in the chest was undertaken for more esthetics; moreover the vertical incisions also damage the subsequent use of the deltopectoral flap. We did primary closure in all patients. In all of the patients, we had preserved the anterior axillary fold for esthetics. The expansion of the chest and shoulder movements were mainly affected in 18 patients (50%) in 1st week after pectoralis major flap elevation because the stretch on the chest wall and pain due to dissection caused reduction in chest expansion. Good analgesics and physiotherapy were found beneficial in this regard. After 1 month, 10 patients (27.7%), and after 3 months 8 patients (22.2%) had acquired normal chest expansion and shoulder movements due to loosening of tissues with passage of time. Suture dehiscence was dependent upon the vascular integrity of skin margins, bulkiness of the flap, presence of infections, residual tumor at the margins, condition of the tissue bed and tension on sutures. Suture dehiscence was found more in patients with marginal necrosis. Three patients (8.3%) had suture dehiscence. Adequate antibiotic cover was given to all of the patients and infection rate was almost negligible 8.3%. In our study, we had 2 patients (5.5%) with sinus/ fistula at 1st week after surgery and was noted especially in through and through defects. This complication was treated by resuturing or by simple conservative approaches. Our results show a less incidence of complications (33.3%) with other series: Shah<sup>15</sup> et al found

complication in 63%, Ijsselstein 16 et al 53 %, Kroll<sup>17</sup> et al 63% and Liu 18 et al in 35%. In the published reports by Shah<sup>15</sup> et al and Kroll<sup>17</sup> et al, total flap necrosis occurred extremely seldom (3% and 2.4% respectively vs. no flap loss in this series). That is of great importance as total flap necrosis is the only complication that requires another flap and in fact another surgical procedure. Partial skin flap necrosis was 13.8%. Its incidence in this series was less than in series of Shah<sup>15</sup> et al who reported 29% of partial flap necrosis and Mehta<sup>19</sup> et al with 25% of partial flap necrosis. Fistula and dehiscence incidence were not so frequent as in the above mentioned papers. Ferri and Bacchi 20 in 1999 reported to have fistula formation in 14 out of 85 patients.

Neck contracture was present in 2 patients (5.5%), which can be hid ed easily under clothing. This webbing of neck due to contracture was acceptable in patients with radical neck dissection as this contracture simulates the excised sternocleidomastoid muscle. Incidence of donor site complication was 25% in this series which is more to previously published data. Biller<sup>21</sup> et al reported 7%, Baek<sup>22</sup> et al 5% and Ossoff<sup>23</sup> et al 8% of donor site complications..

## Conclusion

Pectoralis major myocutaneous flap is a versatile flap and very useful reconstructive option for the defects of facial region as it can not only provide skin and mucosal cover simultaneously, but also provide adequate muscle bulk for through and through defects. It doesn't cause any hindrance in mandibular movements, even when used over mandibular reconstruction plate, which makes it different from other flaps used in this region. Its arc of rotation limits its use only for the defects below zygomatic arch and inferior orbital rim. Donor site is closed mostly by primary closure, with minimum morbidity. Although free-tissue transfer has emerged as a safe, reliable means of soft tissue and bony reconstruction in the head and neck region, but due to constraint resource and

expertise in free flaps, country like Bangladesh pectoralis major flap should still be considered as a source of vascularized soft tissue where lots of patients presented with stage III & stage IV. It is fast, reliable, provides safe repair and is indicated especially where bulk is needed. It continues to be one of the most universal flaps in head and neck reconstruction.

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