



## Evaluation Of The Subclavicular Route For The Pectoralis Major Flap In Oral And Maxillofacial Reconstruction-Our 15 Years Experience

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### ABSTRACT

**Introduction:** The pectoralis major flap (PMF) is an important reconstructive tool for defects in the head and neck region but excessive bulk and a limited arc of rotation can be problematic. These problems can be addressed by passing the pedicle deep to the clavicle but some authors feel that this modification may compromise the vitality of the flap. In the current article, these problems have been addressed by using a modified method.

**Materials and Methods:** During the past 15 years (2000 to 2014) 182 head and neck cancer patients were treated for primary reconstruction following tumor ablation. PMF was modified by passing the pedicle deeply to the clavicle. Following flap harvest, the pedicle was passed in the subclavicular plane for reconstruction.

**Results:** It was possible to increase the average length of PMF to 2.5-3.5cm compared to the supraclavicular route by using this modification. Minor complications were observed in 9 of 182 cases (5%): Partial flap necrosis occurred in 6 cases and fistula formation was observed in 3 cases.

**Conclusion:** The subclavicular route increases the length and arc of rotation without compromising vascular supply to a higher degree compared to the conventional supraclavicular route. Furthermore, this concept decreases the bulk of the flap pedicle which is functionally and cosmetically favourable.

**Keywords:** Pectoralis major flap; Subclavicular route; Head and neck reconstruction; Pedicle flap.

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## Introduction

**A**riyan [1] and Baek [2] first described the pectoralis major musculocutaneous flap (PMF) for head and neck reconstruction in 1979. This allowed the head and neck surgeons to reliably reconstruct head and neck defects in a single stage and proved more reliable than earlier techniques such as the deltopectoral flap. It quickly became the workhorse of head and neck reconstruction. Although today the PMF plays a secondary role because of the popularity of microvascular free tissue transfer, the PMF continues to play an important role in head and neck surgery [3]. This flap is used most often when a patient is considered too debilitated to tolerate free tissue transplantation or when recipient vessels are not available. It is best used to reconstruct defects requiring tissue bulk, such as composite posterior mandible defect or total glossectomy. It is useful for reconstruction of oropharynx, oral cavity, lateral skull base, periauricular, cervical esophageal, and hypopharyngeal defects [4]. The PMF also plays an extremely important role in providing external coverage, alone or in conjunction with free tissue transfer to the oral cavity (Figure 1). Although the flap has been shown to reach above the zygoma in some patients, it is reliable only for coverage of the neck and lower face. The pectoralis muscle flap is occasionally used to bolster primary mucosal repair or to close a small intraoral defect [3].

Despite its versatility, this flap has several drawbacks. The flap bulk is often excessive. At best it produces a significant bulge as the flap passes over the clavicle. At worst, and especially in cases in which radical neck dissection has not been performed, skin coverage of the flap pedicle may only be achieved by the additional use of a split skin graft. In Ariyan's [1] original description, the muscle was exteriorized and subsequently removed after a delay to allow neovascularization. The arc of rotation can restrict the ability of the PMF to reconstruct defects approaching the zygomatico-temporal region. Many have suggested effectively lengthening the pedicle by either removing a section of clavicle [6,7] or passing the muscle pedicle deep to it [8,9,10]. Although this latter technique may improve the arc of rotation and allow the reconstruction of progressively more cephalad defects, some authors have expressed concern regarding the potential for vascular compression to occur underneath the clavicle. This study presents our five-year experience with modifications of the PMF and emphasizes important clinical points that play key roles in increasing the rate of success.

## Materials and Methods

One hundred and eighty two patients (141 males, 41 females, aged between 45 and 85 years) underwent modified PMF technique of reconstructive surgery at our department from 2000 to 2014. From the histological standpoint, 112 patients had squamous cell carcinoma, 21 had basal cell carcinoma, 14 had osteogenic sarcoma, 12 had rhabdomyosarcoma, 8 malignant melanoma and 15 had salivary gland malignant tumor (10 had mucoepidermoid carcinoma and 5 had adenoid cystic carcinoma) (Table 1). All patients underwent radical resection of the neoplastic lesion, confirmed by histological examination of several sections to ascertain whether the lateral and deep resection margins were clear. We did neck dissection (modified or radical) in indicated cases.

### Surgical Technique

#### Flap Design

Once the surgical defect is defined, an appropriately matched skin paddle is designed. To minimize the donor site defect in women; the paddle may be placed medially along the sternum with an extension into the inframammary fold. This design is less reliable, and some surgeons prefer to avoid the use of the musculocutaneous flap in women. With the pivot point at the midpoint of the clavicle, the arc of rotation is examined to ensure that the distal end of the flap will reach the upper edge of the defect. Using the supraclavicular route has limitations of length and arc of rotation of the flap.

The vascularity of the skin paddle is optimized by including the skin overlying the vascular axis of the flap. For intraoral defects, a muscle flap can be used for lining. The muscle may be covered by skin graft or allowed to resurface. The approximate location of the pectoral branch of the thoracoacromial artery is located by drawing a line from the acromion to the xyphoid. A vertical line is drawn from the midpoint of the clavicle and should intersect the xyphosternal angle. The pectoral branch of the thoracoacromial artery follows this line and continues medially [4] (Figure 2).

#### Flap Dissection

The edges of the paddle are incised, beveling outward, until the muscle is reached. The adjacent skin is elevated off the muscle in all directions to better define the anatomy and to mobilize the chest skin for primary closure. The lateral edge of the pectoralis major muscle is identified, and the plane between the major and

minor muscles is developed. The pectoralis major is divided distally and medially, with care taken to control the parasternal perforators. The muscle is elevated in a cephalad direction, and the vascular pedicle is identified on its deep surface. With the pedicle in view, the muscle is divided laterally. An attempt is made to preserve the lateral border of the muscle in situ for aesthetics. Ideally, the muscle portion of the flap is narrowed dramatically as the dissection proceeds to decrease the bulk of the flap.

The pedicle dissection is facilitated by an incision from the superior corner of the skin paddle to the mid-clavicular region or, alternatively, by an incision parallel to the clavicle. As the clavicle is approached, the flap can be developed as an island flap, attached only by its vascular pedicle. It may be helpful to leave some adventitial tissue intact around the pedicle to help prevent traction injury when the flap is transplanted. We also debulk the anterior part of the flap in pivot point before passage of the flap under the clavicle. Then clavicular periosteum is incised and elevated carefully in its length of the ventral part allowing the pedicle to pass under the bone. At first step the flap is rotated into position supraclavicular and mark the distal point. Then we elevate the shoulder of the

same side while we place traction via two long silk threads that we have passed from flap distal margins, to facilitate passing the flap (Figure 3). The flap is rotated into position and inset into the mouth. The distal point is marked and distance to previous marked point was measured. It is advisable to suspend the flap from a non-mobile structure to lessen the tension on the suture line and to offset the unavoidable downward pull on the flap. In oral cavity reconstruction, the pectoralis donor site is generally small enough to be closed primarily over drains. Otherwise, a split-thickness skin graft is applied to the chest wall.

### Follow up

All patients were followed up from 2ys to 5 yrs. so as to evaluate not only complications induced by the reconstruction but particularly for local recurrence or distant metastasis.

## Results

The supraclavicular route permitted more cephalad length reconstructed with greater ease with measurements suggesting a 2- to 3-cm increased arc of rotation. Total flap necrosis was not seen in any of our patients. Six flaps had partial necrosis in peripheries on the

third postoperative day which required debridement and split thickness skin grafting. Fistula formation occurred in 3 patients in the second week postoperatively which were resolved by debridement, reclosure and appropriate antibiotic coverage. Donor area was repaired primarily in all patients. Donor site complications were not seen in any patients. In no instance did damage occur to either the underlying subclavian vessels or pleura. All flaps survived completely and all provide a good cover and contour (Table 2). Mean hospital stay was 10 days (between 8 and 15 days). All of the patients were visited monthly in our outpatient clinic and were followed till at least 24 months after surgery. Local recurrence was seen in 32 patients and 14 of our patients died because of distant metastases during 24 months follow up period.



*Figure 1.* The pectoralis major flap can play an important role in providing external coverage, to the oral cavity.



*Figure 2.* The approximate location of the pectoral branch of the thoracoacromial artery.

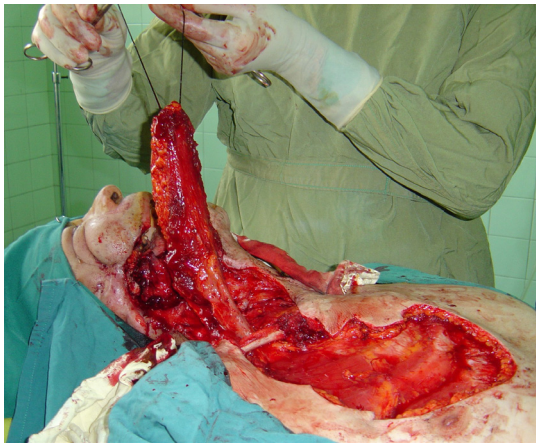


Figure 3. The pectoralis major flap after passing down the clavicle.



Figure 4. This concept decreases the bulk of the pectoralis major flap pedicle (The same patient in Figure 1).



Figure 5. This concept create favorable result from functional and cosmetic stand point of view (The same patient in Figure 1 and 4).

## Discussion

Straightforward design, ease of dissection, and relative reliability are advantages of the PMF. The flap can be dissected with the patient supine, and microsurgical expertise is not required. The muscular portion of the flap is large enough to cover and protect the carotid artery in those patients undergoing radical neck dissection. Although excess bulk can be a disadvantage, the pectoralis major flap is specifically selected when bulk is beneficial, such as after subtotal or total glossectomy. Although the muscle portion of the pectoralis flap is reliable, the skin paddle is not. Other disadvantages include a limited arc of rotation and bulkiness, which can be resolved by using a subclavicular route instead of supraclavicular one.

This concept decreases the bulk of the pectoralis major flap pedicle which is functionally and cosmetically is more favorable (Figure 4 and Figure 5). It also increases the length (2.5cm-3.5cm) and arc of rotation available for reconstruction without compromising vascular supply to a higher degree than with the conventional supraclavicular route [11]. In our patients we saved only a thin bulk of muscle in front of vascular bundle. We debulk the anterior part of the flap (3cm x 3cm) in pivot point for preventing compression of the feeding bundle of the flap with muscle bulk when passing under the clavicle. The important problem of this technique in women is bulk of the breast. We solve this problem by transferring it without skin paddle and elevate the flap without the skin paddle. We then used skin grafts for covering its surface. Periosteal incision of the lower border of the clavicle and dissection of the total length of the ventral part of the bone (with special attention to anatomic shape of the clavicle) is another point that should be given attention. This provides a safe route under the clavicle for passage of the pectoralis major flap. Elevation of the shoulder on the ipsilateral side will create much more space under the clavicle to help pass the flap underneath it. Silk threads help us to broaden the flap instead of crumple it and this will facilitate passage of flap under the clavicle. The other interesting point in this technique is rotation of subclavian artery and vein around their axis. Rotation of flap can be facilitated with total rotation of the vascular bundle.

Table 1. The reported histopathologic diagnosis of patients.

Diagnosis	No. of patients (%) (n=32)
Squamous cell carcinoma	112 (61.5)
Basal cell carcinoma	21 (11.5)
Osteogenic sarcoma	14 (7.6)
Rhabdomyosarcoma	12 (6.5)
Malignant melanoma	8 (4.3)
Mucoepidermoid carcinoma	10 (5.4)
Adenoid cystic carcinoma	5 (2.7)

Table 2. Summary of complications.

Complication	No. of patients (%) (n=32)
Total flap necrosis	0 (0)
Partial necrosis in peripheries	6 (3.2)
Fistula formation	3 (1.6)
Donor site complications	0 (0)
Damage to the underlying subclavian vessels	0 (0)
Damage to the underlying pleura	0 (0)
Local recurrence	32 (17.5)

## Conclusion

The subclavicular route increases the length and arc of rotation without compromising vascular supply to a higher degree compared to the conventional supraclavicular route. Furthermore, this concept decreases the bulk of the flap pedicle which is functionally and cosmetically favorable.

## Conflict of Interest

There is no conflict of interest to declare.

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