

PECTORALIS MAJOR MYOCUTANEOUS FLAP: THE WORKHORSE FLAP IN HEAD AND NECK RECONSTRUCTIONS

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Abstract:

Ablative surgeries in the head and neck requiring reconstruction are mostly challenging due to the complicated three dimensional nature of defects in this region. Such defects can have drastic consequences on aesthetics as well as function which in turn may result in a substantial toll on patient's standard of life. Pectoralis major myocutaneous flap (PMMF) has widely been employed in the form of the workhorse flap in the reconstructive surgery of head and neck region over next few decades since it was first introduced by Ariyan in 1979. PMMF has become one of the most regularly used regional flaps, greatly enhancing the protection as well as functional results for head & neck reconstructive surgery. The distinctive benefit for PMMF exists in the sense that it is dependable, simple to obtain, could be elevated within relatively shorter period of time, offers lesser morbidity of the donor area, provides optimal bulk, can also be coupled with various flaps like free flap, and employed in head and neck area for the single-stage reconstructive surgery of internal mucosa/external dermis defects. In this article we will discuss various aspects of the pectoralis major myocutaneous flap (PMMF) like indications, relevant anatomy, flap design, operative technique, and pitfalls.

Key words: Pectoralis major myocutaneous flap, vascular pedicle, regional flap, reconstruction

Introduction

It has always been a surgical challenge to perform reconstruction as structure; function and esthetics have to be restored. Ablative surgeries in the head and neck requiring reconstruction are mostly challenging due to the complicated three dimensional nature of defects in this region.¹ In addition, the recent intensive chemotherapy and radiotherapy protocols, warrants the necessity for bringing an oxygenated flap having adequate vascular supply to reconstruct the defect.² Over a period of time, reconstruction in the area of the head and neck has progressed with better expertise and techniques. In due course various pedicle regional flaps have been proposed, such as PMMC flap, forehead flap, deltopectoral flap. Currently free tissue transfer is being practiced in many centers and hence given first preference for reconstructive surgeries of head & neck. However certain specific requirements like specialized techniques, expertise, microsurgical equipment, limits the ability to carry out such a free tissue transfer to only highly specialized centers. Stephen Ariyan initially presented the pectoralis major myocutaneous flap in 1979.³ Since then various regional flaps have gradually emerged namely latissimus dorsi, platysma, sternomastoid, trapezius. Despite this PMMF has continued to prove its worthiness over the years and therefore till date recognized as the workhorse flap in head and neck reconstruction with some amount of acceptable morbidity.⁴ The main advantages of this flap includes its reliability, vascularity and good viability, ease of harvest, comparatively shorter operating time, protection of carotid artery and acceptable cosmetic appearance in cases where bulk of tissue is required. In addition, this flap could be coupled with various other flaps like free flap, also it can be easily used in irradiated areas, and lastly even a large cutaneous island of donor site is closed primarily.

In this article we will discuss various aspects of the pectoralis major myocutaneous flap (PMMF) like indications, relevant anatomy, flap design, operative technique, and pitfalls.

Indications:

Oropharynx: Resection of the lateral floor of the mouth, alveolar ridge, posterior half of the tongue, and piriform sinus requires sufficient skin and bulk for reconstruction. This can be achieved with a pectoralis major musculocutaneous flap in one stage. The bulk provided by this flap appears to be sufficient to avoid aspirations, either by directing fluids past the airway or by diverting fluids to the contralateral normal piriform sinus, as a result of fullness on the operated side.⁵

Orbital Exenteration: The pectoralis major musculocutaneous flap is particularly useful for reconstruction in this area because it provides bulk and well-vascularized tissue to fill the cavity, seals any cerebrospinal fluid leak, and offers greater bacterial invasion defense.⁵

Temporal Bone Resection: The pectoralis major musculocutaneous flap is ideal for these reconstructions because it provides sufficient bulk and soft tissue coverage of duramater and seal it against CSF leaks and it offers a rich vascular supply to permit uncomplicated healing even with bacterial contamination of wounds.^{5,6}

Mandibular Reconstruction: Extended pectoralis major flap may be used for reconstruction of segmental resections of the mandible, it does not appear to be suitable for reconstruction of the entire mandible.^{5.}

Anatomical Considerations:

Pectoralis major muscle: The clavicular head originates from the anterior surface of the medial half of the clavicle. The sternocostal head originates from the anterior surface of the sternum; the superior six costal cartilages and from the aponeurosis of the abdominal external oblique muscle. These muscle fibers converge to form a flat tendon which inserts on the humerus.⁸ (Fig-1)

Deeper relations of pectoralis major: Deeper to pectoralis major lies its vascular pedicle. Besides that we also find the pectoralis minor muscle, the costal cartilages, and towards the inferior aspect we have the costal attachments of the abdominal external oblique muscle.^{8,9} (Fig-2)

Blood supply for PMMF: Although the thoracoacromial artery had been previously described in the literature as running along the undersurface of the pectoralis minor muscle, fresh cadaver dissections confirmed the consistent presence of this vessel along the undersurface of the pectoralis major muscle, with a branch from this vessel to the pectoralis minor. Nevertheless, the dominant blood supply is the thoracoacromial artery, branching off from the subclavian artery. The thoracoacromial artery is accompanied along its course by its corresponding vein.^{8,9,10} (Fig-3)

Nerve supply: The innervation to the pectoralis major is provided by the lateral pectoral nerve which is present inferiorly from the clavicle and in close relation to the pectoral branch of thoracoacromial artery. The pectoralis major also receives 2-3 branches from medial pectoral nerve which transverses through pectoralis minor muscle. While raising the flap these innervations are usually divided which causes the denervated muscle to lose bulk over time. This may be either advantageous or disadvantageous, in view of desired functional and esthetic outcomes.⁵

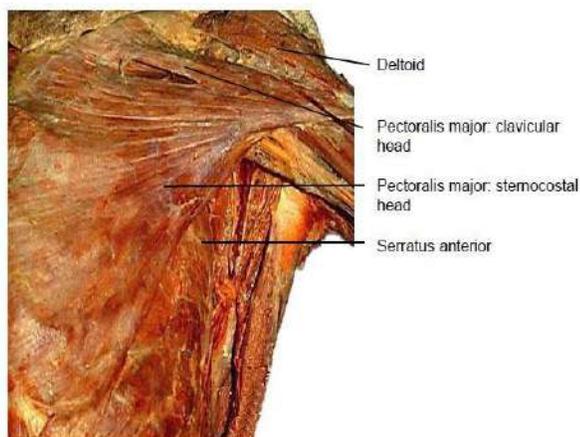


Figure 1: Superficial dissection

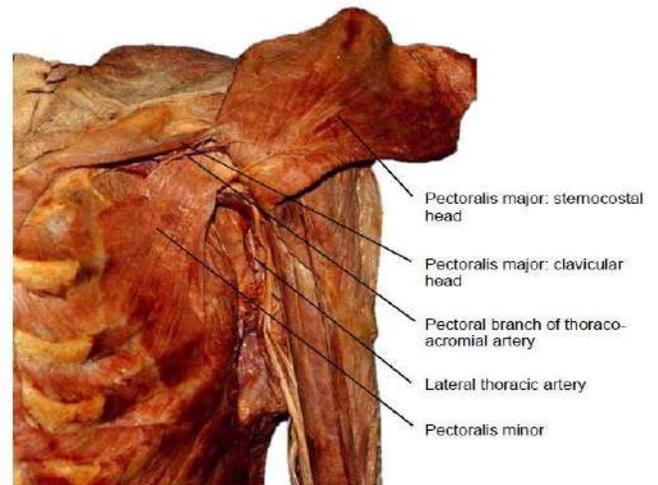


Figure 2: Pectoralis Major Deep Relation

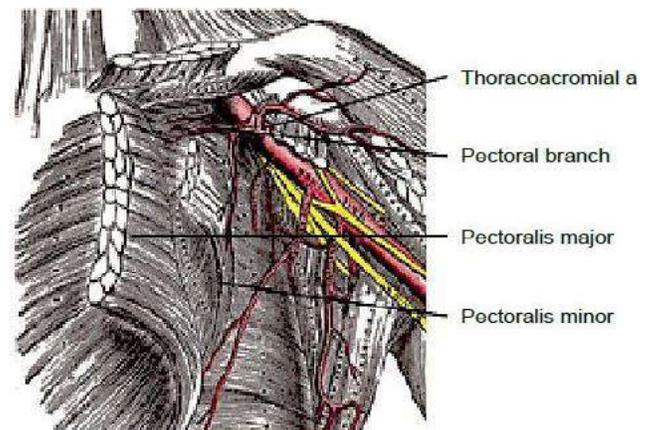


Figure 3: Blood supply for PMMF

Flap design: Depending upon the type of surgical defect to be reconstructed the flap can be raised as muscular/musculocutaneous, with or without 4th and 5th ribs.

Surface marking of vascular pedicle: Vascular pedicle is determined by drawing a line from the shoulder to the xiphisternum and another line vertically from the midpoint of the clavicle to intersect the 1st line. (Fig-4a, b)



Figure 4 a: Surface marking for the vascular pedicle

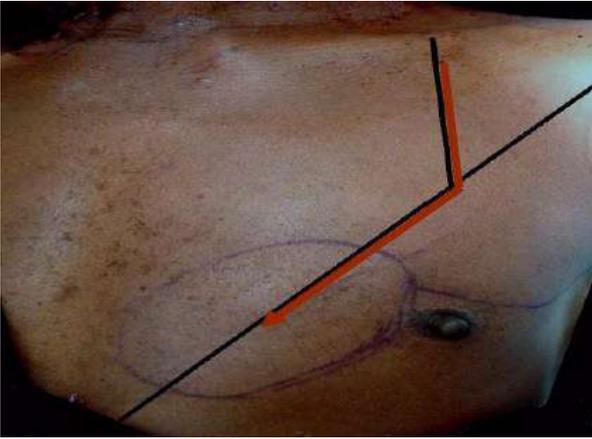


Figure 4b: Surface marking for the vascular pedicle

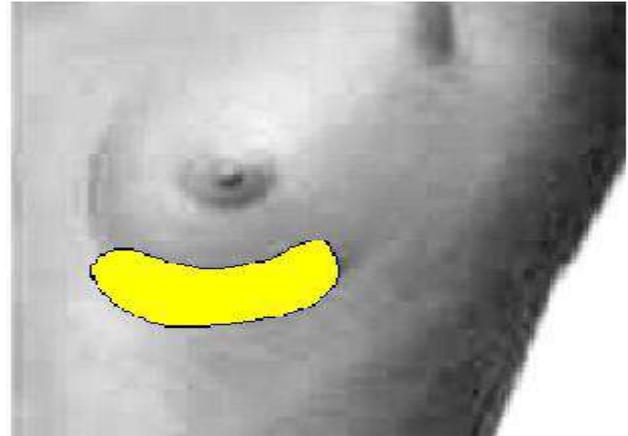


Figure-6: Inframammary skin paddle

Skin paddle: Designing of skin paddle is done such that it lies over pectoralis major along with pectoral branch of thoracoacromial artery coursing beneath (Fig- 5). To ensure an adequate length of the pedicle, the distance from the inferior margin of clavicle to top of skin paddle should be equal or greater than the distance from inferior margin of the clavicle to recipient site. In case of women skin paddle should be designed in the inframammary crease including dermis from either side of the crease, which would help in avoiding excess bulk by excluding the breast tissue, and at the same time would not interfere majorly with esthetics at the donor site (Fig- 6). In some case where there is requirement of additional pedicle length, the flap may be designed even more inferiorly up to 2.5cm at costal margin, however in such cases the flap turns into a random pattern flap with precarious blood supply. In order to include maximum myocutaneous perforators in the skin paddle, the dissection at the edges should be beveled radially and care should be taken to avoid undercutting the paddle.



Figure-5: Dissection of the skin paddle

Exposing pectoralis major: Incision is made which extends laterally from the periphery of skin paddle towards anterior axillary fold that also demarcates the lateral boundary of pectoralis major. Skin and tissue is then separated from the pectoralis major and widely elevated in the region above the skin paddle, going superiorly up till the clavicle. (Fig- 7)

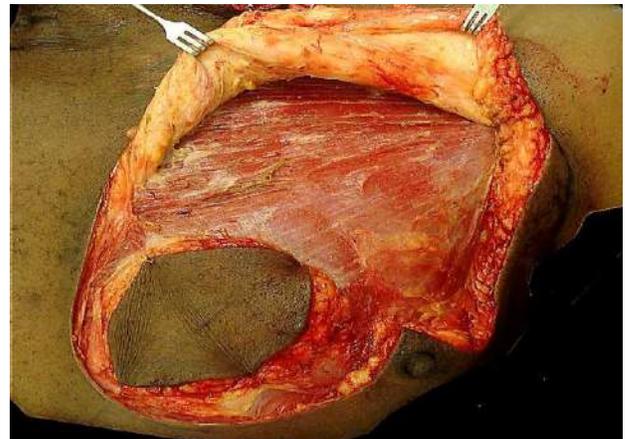


Figure-7: Pectoralis major muscle exposure

Elevating the flap: Incision of pectoralis major is carried out with the help of an electrocautery medial and inferior to skin paddle to dissect it from underlying rib and the intercostal muscle. Care should be exercised to not dissect the muscle in the region superior to skin paddle as it may lead to transection of the vascular pedicle. Following this the pectoralis major is further freed with cautery along the sternum. The perforator vessels get transected and cauterized during the process. To distinguish and reach the dissection plane in between pectoralis major and pectoralis minor dissection is done on the later margin of the pectoralis major till the intermuscular plane is identified. Pectoralis major muscle along with its vascular pedicle is raised by stripping towards the clavicle (Fig- 8).

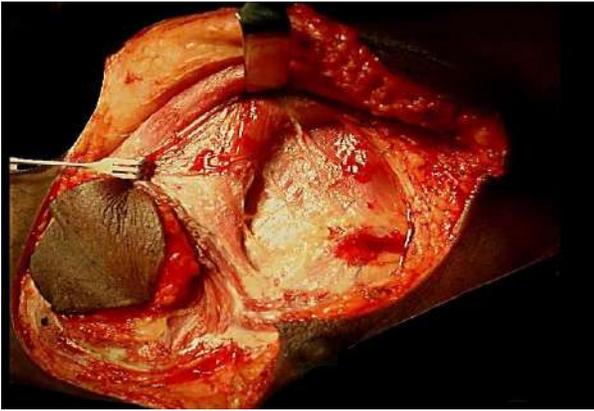


Figure-8: Elevating pectoralis major

Now the pectoral branch of thoracoacromial artery is clearly visible on deep surface of pectoralis major coursing within the fascia (Fig- 9). This pedicle is maintained in sight and saved from any sort of injury. Few structures are transected like lateral thoracic artery, and also medial pectoral nerve branches which pass through pectoralis minor to supply deeper surface of PMMF. Muscle fibers of the pectoralis major is then dissected laterally to the pedicle to free it from humerus, at the same time without disturbing the structural integrity of the vascular pedicle.

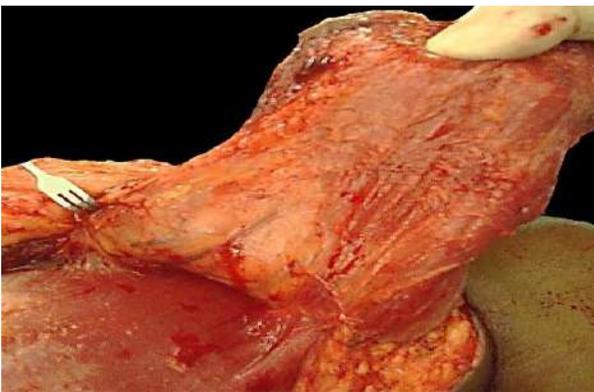


Figure-9: Vascular pedicle

Skin tunnel: A wider subcutaneous passage is made over the clavicle through which the PMMF is usually passed upwards towards the head and neck (Fig- 10). The width of this passage should be enough to allow convenient repositioning of PMMF avoiding strangulation of the main vascular pedicle as well as protecting the musculocutaneous perforators from shearing forces. For gaining additional space subdermal connective tissue fibers in the region of the skin tunnel can be divided using an upturned scalpel. Care should be taken to avoid any sort of twisting of the flap after passing the tunnel.



Figure-10: PMMF passing over clavicle

Closure of donor site defect: A closed suction drain is placed and donor site is closed using primary closure. To enhance the ease of primary closure the surrounding skin can be undermined to some extent. Sometimes a split skin graft may be required.

Pitfalls: PMMF has some of its own disadvantages which includes resultant thoracic wall deformity, more than desired bulk in some circumstances, incidences of complications at donor site, functional neck and shoulder impairment, partial necrosis of the skin paddle, and less that optimum recipient site functional outcome.¹¹⁻¹⁵

Conclusion: The value of the PMMF still remains irreplaceable, despite the fact that recent focus in tissue reconstruction has transitioned towards microvascular free-tissue flaps. PMMF offer an easier, faster, reliable option for reconstruction in post-ablative head and neck surgery. It is still considered as workhorse flap in developing countries with limited resources, while it can play the role of a salvage flap in countries with more advanced centers for microvascular free tissue transfer.

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