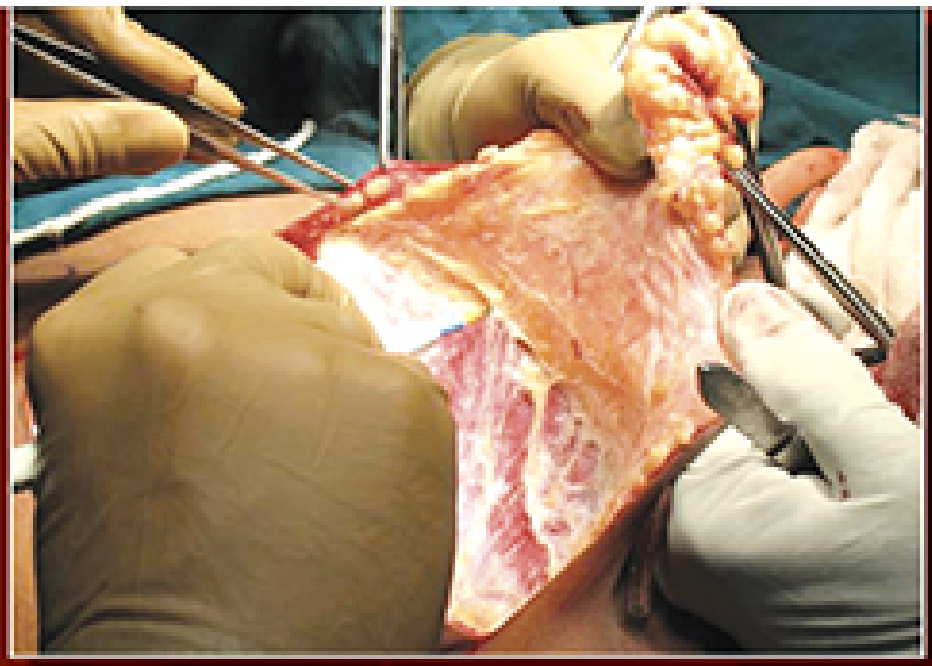
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Pectoralis Major Myocutaneous Flap in Head and Neck Reconstruction

A Color Atlas



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JAYPEE

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1 Historical Perspective

History is a kind of introduction to more interesting people than we can possibly meet in our restricted lives; let us not neglect the opportunity.

—Dexter Perkins

Plastic surgery probably had its organized beginnings as especially in World War I. Many of the early Physicians involved in the development of plastic surgery as especially were, like Sir Harold Gillies, an Otolaryngologist.[4]

Correct grammatical usage demands that these flaps be called *myodermal*, combining the Greek based word, or *musculocutaneous,* combining two Latin based words. The term myocutaneous being shorter and more popular, will be used here.

800 BC: *Susruta* (India) is commonly credited with being the first to utilize the tissue flaps, having used forehead flaps to reconstruct the amputated noses. He described miniflaps, flaps from cheek to repair nose and some to repair earlobes. He described the use of horse hair sutures.[4]

1952: Conley (US) described laterally based skin flaps to cover carotid artery. He described laterally based chest flaps supplied by lateral thoracic and thoracoacromial arteries and superiorly based chest flaps supplied by intercostal branches of the internal mammary arteries. He did not include muscle with the flap.[4]

1966: Milton (England) reported data that challenged the concept of length-to-width ratio as a determinant in skin flap survival. He said that for a flap to survive to any reasonable length, an arterial supply must be included that will provide an arterial perfusion pressure to the tip of the flap.[4]

1968: Heuston and McConchie (Australia) noted that by including underlying skeletal muscle in a large skin flap, there was greater assurance of an adequate blood supply. However, they did not use the term *myocutaneous*.[4]

1972: McGregor and Morgan (Scotland) enhanced the understanding of flap physiology by distinguishing the difference between axial pattern flaps with a built in arteriovenous system and random pattern flaps which lack such a system. This advanced the concept of primary reconstruction, bringing it closer to single stage.[5]

1976: McCraw, Dibbell and Caraway (US) published a refinement of concept of independent territories. They first used the word *myocutaneous* to refer to compound muscle skin flap. The age of myocutaneous flaps has arrived or better stated myocutaneous flaps had come of age and were now being called by their rightful name.[4]

1977: Ariyan and Krizek (US) reported the use of pectoralis major myocutaneous flaps at Cine Clinics at American College of Surgeons' Meeting.

Since then, Ariyan, McCraw, Biller and many other otolaryngologists, head and neck surgeons and plastic surgeons have reported their results with the use of these flaps.[4]

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2 Various Uses of Pectoralis Major Myocutaneous Flap

- Loss of major portion of buccal mucosa and lateral mandible may be well-tolerated without reconstruction, but unopposed masticatory pull can result in pain and dysphagia.[6] It is not aesthetically acceptable also. Pectoralis major flap can restore the mandible couture but will not permit dental restoration.
- It can be used for restoration of tongue bulk when total glossectomy or base of tongue resection is performed.[6]
- Resection of the floor of mouth may leave a defect, affecting the portion of tongue, the floor of mouth, the mandible and the cervical lymph nodes. An ideal flap for reconstruction of this wound is pectoralis major myocutaneous flap.[7]
- The pectoralis major myocutaneous flap can be used for reconstruction of the entire hypopharynx , portion of cervical esophagus after total laryngopharynectomy as well as cervical esophagus in some patients. This flap is tubed in these cases, forming the anterior and lateral walls.[8]
- It can be used as a salvage procedure after the necrosis of microvascularized flaps and in cases in which a contraindication to free flaps exists, such as a medical condition that makes the patient unable to tolerate a long surgical procedure or inadequate recipient vessels in the necks of patients who previously underwent high-dose radiotherapy.

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3 Advantages, Disadvantages and Limitations

ADVANTAGES

- This flap offers one-stage reconstruction, requiring no delay[13]
- The patient's position need not be changed intraoperatively[6]
- It has got sturdy and easily identifiable vascular pedicle
- This flap provides a large cutaneous island that can be used for defects involving two epithelial surfaces
- The muscular part covers neck structures protecting the carotid artery, especially in patients who have undergone the radiation therapy
- The donor site can be closed primarily without a skin graft[13]
- Because of their generally long vascular pedicles, they may be brought from relatively distant non-irradiated area into the head and neck
- In cases requiring the protection of vital vascular structures from infection, salivary secretions or skin flap breakdown, the pectoralis major myocutaneous flap should be considered
- Large segmental vessel ensures excellent perfusion pressures to all parts of the flap, thus ensuring survival
- This is technically an easy procedure[13] and no specialized surgical team and costly instrumentation are required, and these are not available in many head and neck services
- Short hospital stay and minimum postoperative complications.

DISADVANTAGES AND LIMITATIONS

- The flap can conceal recurrences, making follow-up in the neck area more complicated
- The flap can lead to distortion of symmetry at donor site.[13] In women, the flap might include breast tissue, which may lead to breast asymmetry. Moreover, it is practically little difficult to harvest this flap due to bulky breast mass
- In males, hirsute chest skin is placed intraorally. So, hairs in oral cavity are little problematic to the patient and he has to learn how to manage them[6]
- This flap causes loss of pectoralis muscle function in arm adduction and/or rotation and impaired shoulder function[13]
- In patients who are overweight, the flap is bulky, which leads to postoperative contour deformities even harvesting the flap also poses little difficulty
- Usual lack of function of flap (e.g. a flap brought into floor of mouth and/or tongue will not itself move with deglutition), dysphagia and pooling of food may result
- Compromise of viability of flap by radiotherapy[8]
- At times, this flap can also be bulky[13] and can be a problem, when utilized for cervical esophagus and/or hyopharynx.[8]

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4 Surgical Anatomy

The pectoralis major is the large fan-shaped muscle of the upper anterior chest wall. It arises from the medial half of the clavicle, the sternum and upper seven costal cartilages and insert into the crest of the greater tubercle of humerus.[8]

The blood supply of the skin flaps has been described by McGregor and Reed (1970) as being axial or random.[9] Actually, a combination of both types may exist in a number of skin flaps, for example, the pectoralis major myocutaneous flap (Ariyan, 1979).[1,10]

The blood supply is widely reported to be the pectoral branch of thoracoacromial artery arising from the second portion of the axillary artery,[6] but also the pectoral branches of lateral thoracic artery[11] (Figs 1 and 2). The reconstructive surgeons may take advantage of this double blood supply. The intercostals and perforating branches of internal mammary artery also supply pectoralis major but, in severing the medial edge of pectoralis major flap, the contribution is lost.

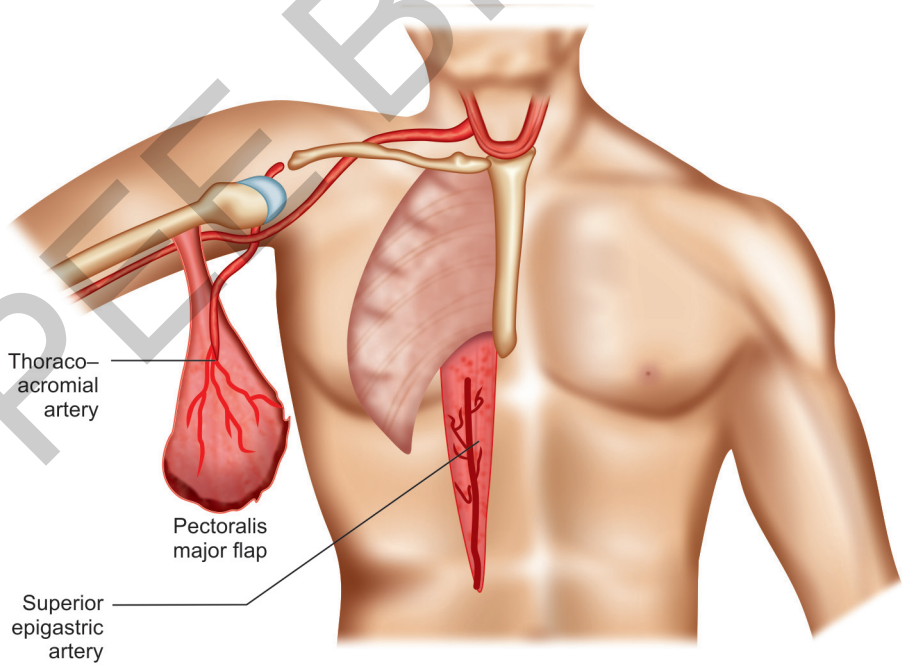


Fig. 1: Thoracoacromial artery on the dorsal surface of pectoralis major muscle

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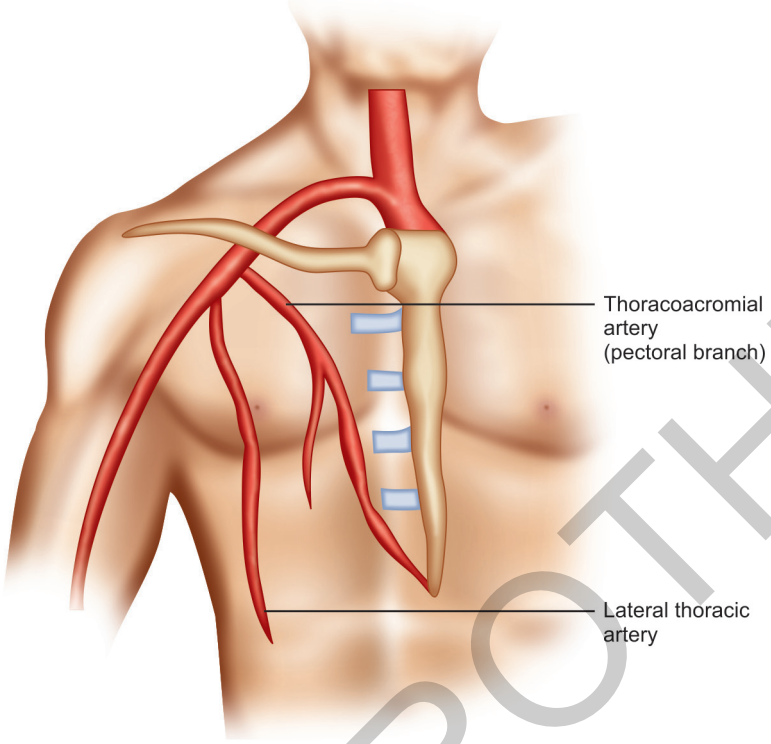


Fig. 2: Thoracoacromial artery: Main artery of pectoralis major myocutaneous flap (Course)

LANDMARKS

1. Identify the clavicle
2. Ipsilateral sternal border
3. Xiphoid
4. Humeral insertion of the pectoralis muscle (Fig. 3).

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Fig. 3: Surface marking and skin paddle of pectoralis major myocutaneous flap

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Skin Paddle

- Size and location of skin paddle depends on reconstructive requirements. Standard skin paddle is located at the inferomedial border of the pectoralis major muscle that is inserting on the lateral border of the sternum and the second-to-sixth costal cartilage (Fig. 4)
- Practically skin overlying any portion of the pectoralis major muscle may be utilized
- Larger the paddle harvested, higher the likelihood that skin will survive the transfer due to the increased number of myocutaneous perforators
- If a small skin flap is extended beyond the inferior muscle edge, then it may exhibit an absence of myocutaneous perforators. However, the myofascial flap is raised without a skin paddle.

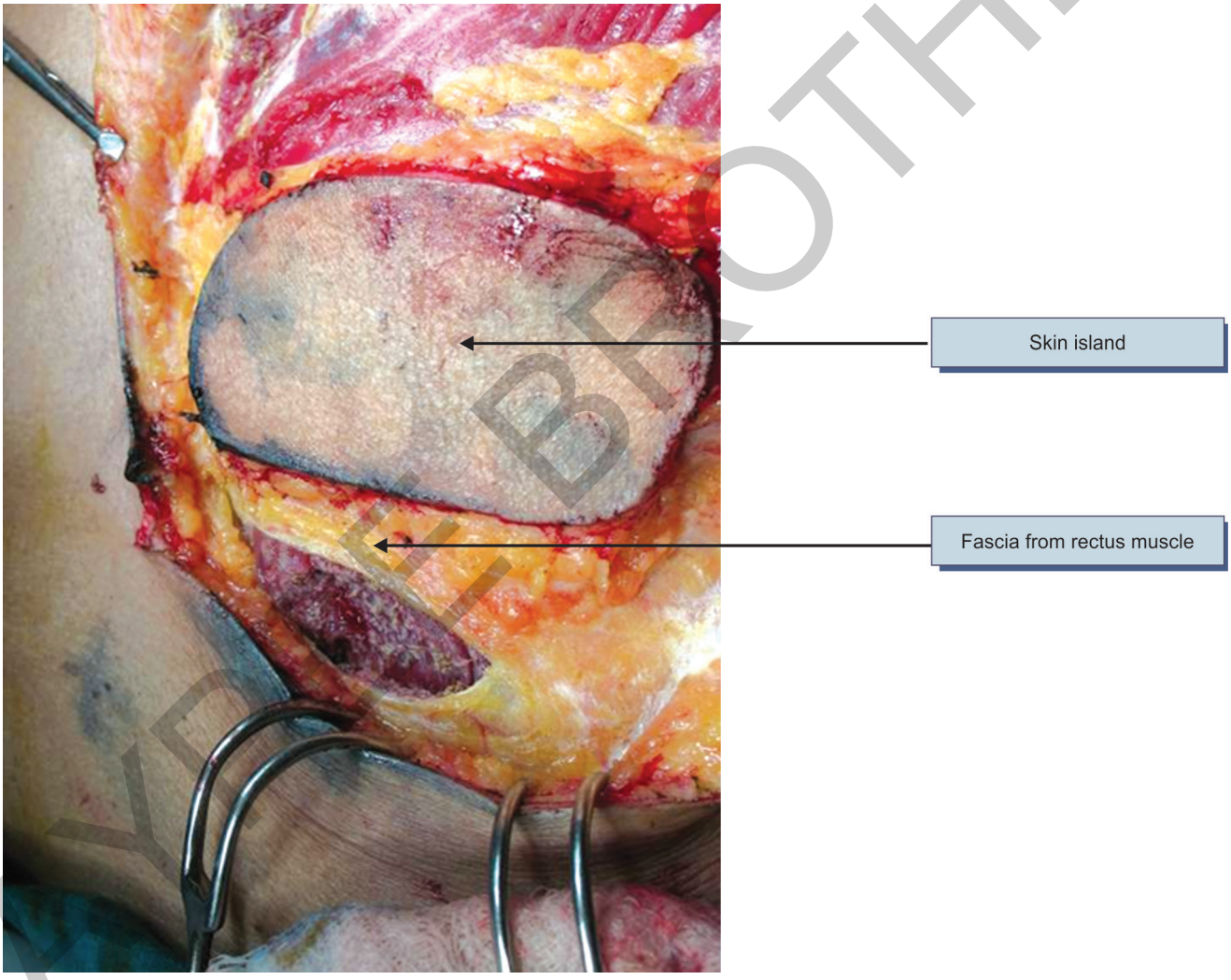


Fig. 4: Skin paddle with muscle

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Blood Supply

- Pectoral branch of the thoracoacromial artery (primary blood supply) (Fig. 5).
- Sacrifice of the lateral thoracic artery (secondary blood supply) is usually required to gain necessary length (Fig. 2).
- The supreme thoracic artery also supplies the pectoralis major, but is usually divided when the flap is raised.

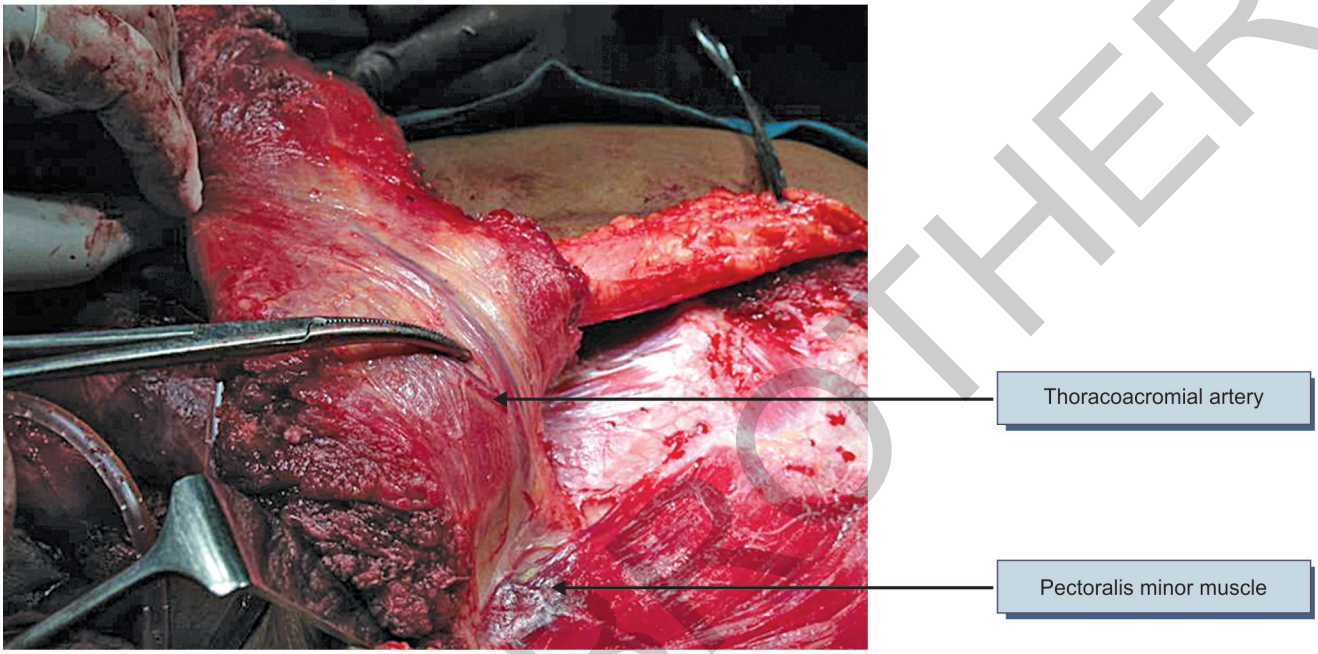


Fig. 5: Pectoral branch of the thoracoacromial artery

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5 Physiological Principles

The basic physiology upon which, the survival of all flaps depends, is the concept that a flap must have vascular channels supplying and draining all its parts. This had been known for many years, yet it has been only within past 15 years that this has been understood and applied. Our understanding of this principle will continue to grow.

The blood supply to the ideal myocutaneous flap comes from large, named, longitudinally-oriented segmental vessels, coursing below the muscles and the perforating vessels, which enters the muscle supplying it and communicates with cutaneous vessels, which derive its supply from both the perforators and segmental vessels.[9]

Muscles such as pectoralis major, latissimus dorsi, and trapezius, with a named arterial supply and closely applied overlying skin, confer well to the principle and function as true myocutaneous flaps.

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6 Consent Inclusions

Before planning the reconstruction using pectoralis major myocutaneous flaps, it is very essential to properly explain this procedure, the benefits and the risk associated with this to the patient. Written consent is an absolute must before attempting this. Following are some points which the authors are always including in consent:

1. The surgery will require a skin incision on the chest wall that will result in a skin scar.
2. Absence of the muscle will affect the chest wall contour to a minor degree.
3. The flap used will decrease the strength of the shoulder and upper arm and may affect the patient's ability to work and recreate.
4. The reconstruction has a risk of partial or complete failure that would require additional surgery and/or wound care.
5. There is a risk of wound infection, hematoma, and/or hemo/pneumothorax.

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7 Preoperative Preparation

PREPARATION

- Standard preparation, Betadine painting (neck, chest and shoulder)
- *Drape:*
  - Head drape
  - Towels covering chest from beyond the contralateral sternal border, below xiphoid, ipsilateral arm, and midaxillary line

DRAINS AND DRESSINGS (SHOULD BE KEPT READY)

- *Vacuum suction drain (10 mm):* Separate for the neck and the chest
- Antibiotic ointment to suture lines

SPECIAL CONSIDERATIONS

- Sometimes skin graft may be necessary

ANESTHESIA CONSIDERATIONS

- General anesthesia
- *Tube position:* As per primary resection
- *Positioning:* Supine
- *Estimated blood loss:* 150 cc.

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8 Pectoralis Major Flap Steps

SINGLE PADDLE ISLAND FLAP

1. The length and width of pectoralis major myocutaneous flap as well as length of pedicle are determined by the site, size and shape of surgical defect. Ariyan states that this flap can reach orbit and at times the forehead (Fig. 1).[1,10]

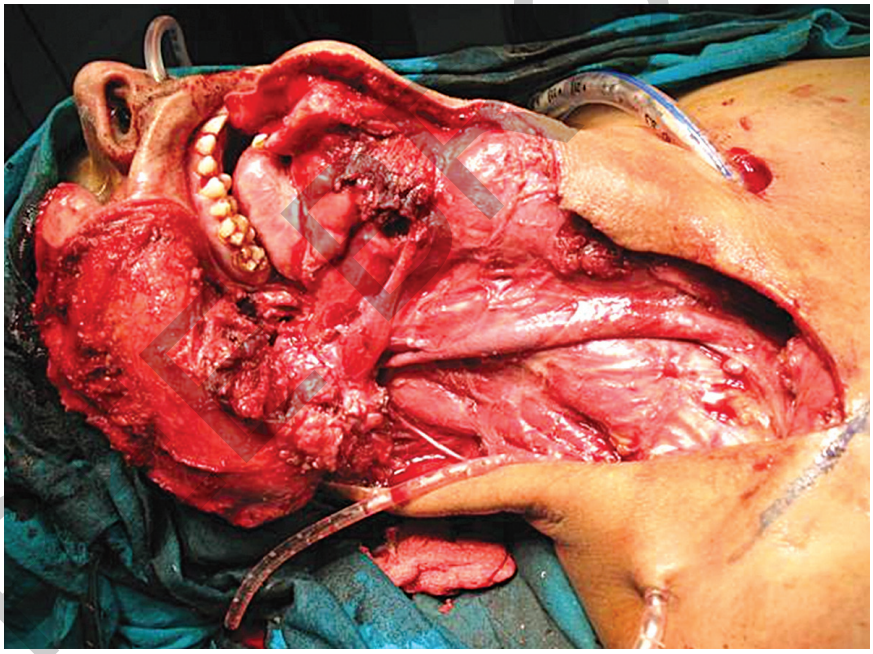


Fig. 1: A combined oromandibular resection right side, where right half of mandible, buccal mucosa, part of floor of mouth along with all the tissues around has been removed

So, we now know the site, let us see how to measure the size and give shape to the flap.

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2. The size and shape can be estimated by measuring the defect with the help of limpe's cloth.

In this case, superioly the flap will be stitched in upper gingivolabial sulcus, inferiorly to the tongue tissue, the deepest point (posteriorly) is retromolar region and anteriorly to the part of lower lip. So, putting a limpe's cloth over the blood-stained area makes an outline of the flap and gives an idea what should be the size and shape of the flap.

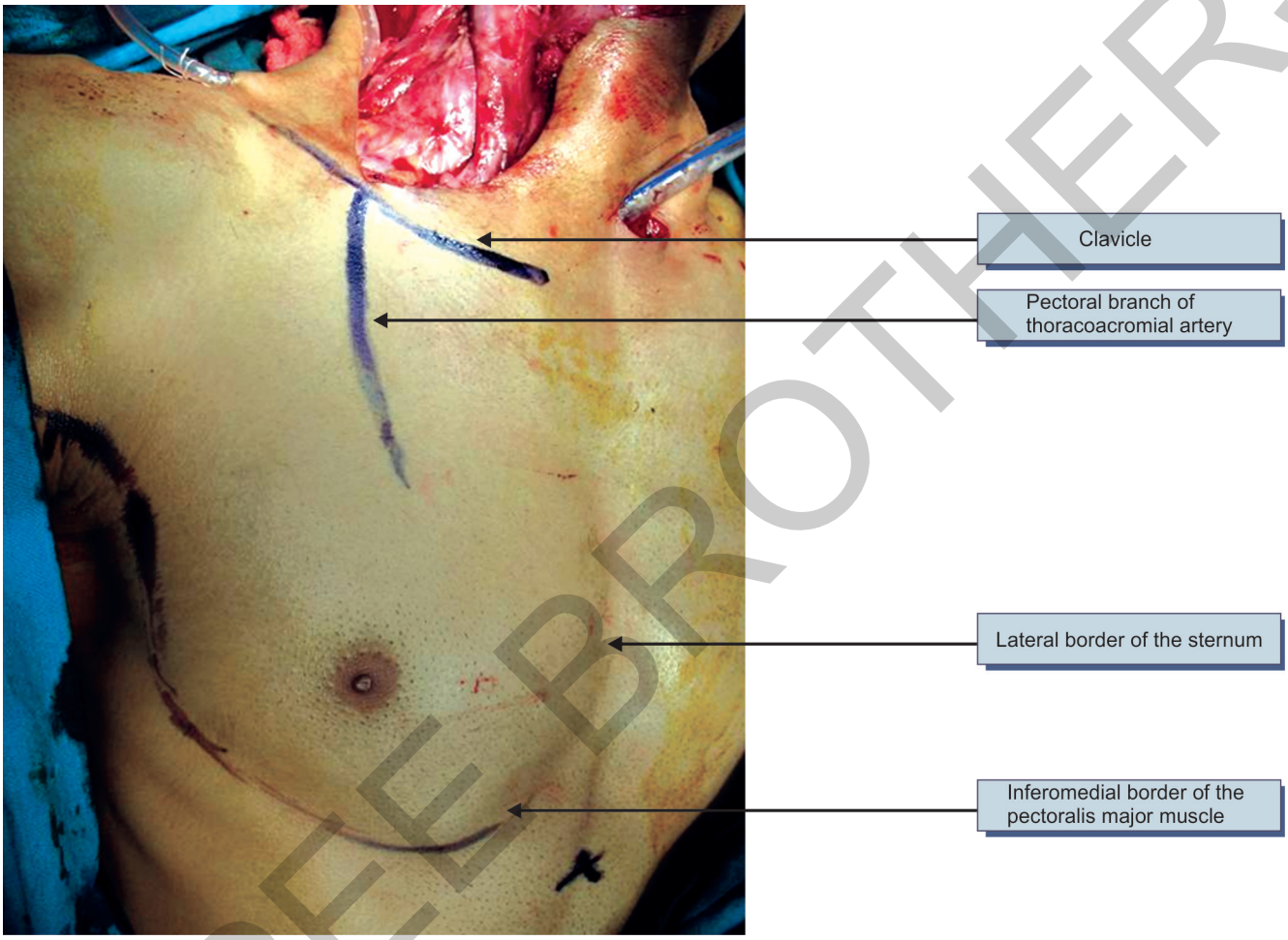


Fig. 2: Surface marking

As mentioned earlier that the standard skin paddle is located at the inferomedial border of the pectoralis major muscle that is inserting on the lateral border of the sternum and the second-to-sixth costal cartilage. So, the skin island, which is usually transferred, is placed below and medial to nipple, about the level of 6th rib[11] (Fig. 2).

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Salient Features

- Provides information for those who work in the field of head and neck reconstruction
- Describes the general principles and techniques in clear language
- Contains most of the basic principles and facts about pectoralis major myocutaneous flap
- Depicts numerous color plates explaining various designs of pectoralis major myocutaneous (PMMC).

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