PECTORALIS MAJOR MYOCUTANEOUS FLAP

Description of the Pectoralis major flap has to be credited to Ariyan[9] in 1979, when he demonstrated on fresh cadaver dissection, the consistency of a large axial vessel branching off the thoraco-acromial artery that coursing on its undersurface, vascularized the muscle. Since then it has been widely accepted as the option of choice to cover defects on the head and neck, anterior chest and shoulder[10]. It has also been employed as a compound flap[59] able to bring bone (either rib or sternum), attached to the muscle[48,107].

Though this flap can be elevated in all patients, special attention has to be paid to female patients, in order to avoid severe breast distortions. Aside from general aspects such as local irradiation and general diseases or personal habits, particular attention has to be paid to those patients with marked chest asymmetry, because the possibility of Poland syndrome (congenital absence of the pectoralis major muscle).

Muscle description

The Pectoralis major is a broad, flat, fan-shaped muscle covering the upper chest. It originates from the medial half of the clavicle and the anterior half of the sternum, with several minor insertions to the first seven ribs. It inserts into the lateral lip of the bicipital groove of the humerus. Its nerve supply comes from the medial and lateral pectoral nerves (direct branches from the lateral and medial cords of the brachial plexus). These nerves enter the muscle with its major vascular pedicle. Blood supply comes from a single dominant pedicle, the pectoral branch of the *thoraco-acromial artery* and from several minor perforator branches from the internal mammary artery. This muscle is an adductor and medial rotator of the arm, and some degree of disability will occur if the muscle is transferred as a flap.

Indications

Pectoralis major flap based on either of its dominant pedicles (branches from the *thoraco-acromial artery* or several minor intercostal branches from the *internal mammary artery* have been used to treat defects in quite different regional anatomic areas in the past. Nowadays, fasciocutaneous and perforator flaps, either pedicled or free, have limited its use as routine procedure. Though it can reach different areas and add high vascularized mass to a defect, it usually results in a flap that is too thick.

However, given that it is, actually, a versatile flap, it can be use for:

- Oropharyngeal defects.
- Mandibular reconstruction.
- Cheek defects.
- Shoulder girdle.
- Anterior chest (cutaneous-sternal defects).

Vascularization

As previously said, this flap has two pedicles. The main one comes from branches of the *thoraco-acromial artery*, arising from the *subclavian artery*.

Thoraco-acromial branch pedicle: The thoraco-acromial artery is a short anterior branch arising from the second part of the axillary artery deep into the Minor pectoralis muscle and gives four branches: the pectoral, acromial, clavicular and deltoid. The pectoral branch overlaps the Pectoralis minor muscle and gives a small branch for it and a larger one that courses down medially to supply the Pectoralis major. Their terminal muscular perforator branches also supply the breast. Initially, the pectoral branch courses downwards somewhat vertically to adopt an oblique-medial course following the axis marked by a line from the acromion-clavicle point to the xiphoid. This is the pedicle for a superiorly based Pectoralis major flap.

Segmental intercostal arteries: From the Internal mammary artery, intercostal arteries branched off at each of the intercostal spaces to vascularize the integument of the anterior chest.

The most important are the 2nd, 3rd and 4th branches, but all intercostal vessels, on their way to the subcutaneous tissue and breast, give branches that vascularize the medial aspect of Pectoralis major muscle and these can be used as a pedicle for a medially based Pectoralis major muscle flap.

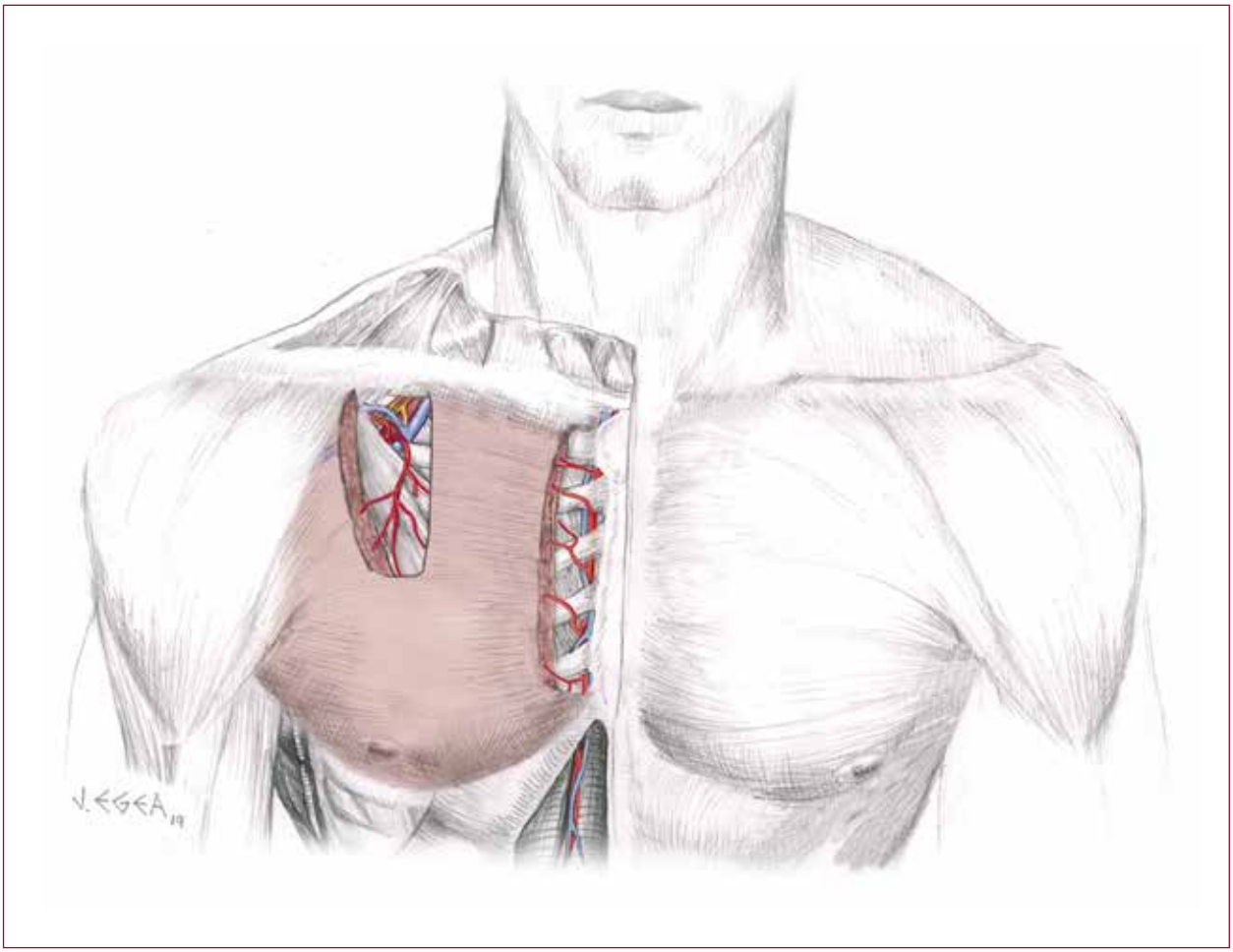

Figure 5.28. Pectoralis Major Vascularization. The thoraco-acromial vessels arising from the second part of the axillary artery and the segmental intercostal arteries branching off from the internal mammary artery.

Markings

Outlining of the flap will depend on its use as an island rotation flap superiorly based, superiorly based medial advancement flap or reverse flap.

Island superiorly based flap: As in every flap, the pivot point has to be established first to calculate the length of the pedicle, how the flap will rotate and how the skin paddle over the muscle (if needed) has to be designed. The thoraco-acromial artery (and vein) emerges at a right angle from beneath the middle third of the clavicle coursing downwards first and later following the previously mentioned shoulder tip-xiphoid axis. If a cutaneous paddle is needed it is designed accordingly to this axis over the muscle.

Superiorly based medial advancement flap. This usually refers to a muscular flap that is mobilized by an advancement-sliding transposition over the sternal region with no cutaneous paddle. Only the muscle boundaries are marked out as well as the entrance point of the main pedicle. Medial incision is determined by the already completed medial thoracotomy incision or by the wound border in case of thoracotomy dehiscence. Every muscular insertion at the clavicle, rib and humeral groove has to be detached to allow an acceptable range of medial displacement. This is the preferred option to treat medial defects over the sternum no wider than 10-12 cm. However, muscles should be skin grafted. For very large medial defects, the superiorly based muscular flap will allow a better

transposition and coverage. In the case of large defects, a bilateral medial advancement is required. As for all infected injuries that need debridement, vacuum therapy has to be considered before any muscular flap is used.

Reverse muscular flap. In this case, the muscular flap is supplied exclusively from the intercostal perforator arteries. The muscle belly has to be completely released from its clavicular, humeral and costal insertions. The Reverse muscular flap is rarely used as it leaves a bulky mass at the level of the hinge, while the lateral aspect of the muscle, which is to be transposed, is the less vascularized portion of the Pectoralis major.

Elevation

The most versatile and reliable procedure is the rotation-transposition based on the main thoraco-acromial pectoral branch as a muscular flap, myocutaneous flap or osteomyocutaneous flap (which is the one exposed here).

Figure 5.29. Outlining of the muscle (in blue) and one of the possible skin paddles. Dotted lines indicate the incision needed to gain access to the muscle and superior main pedicle.

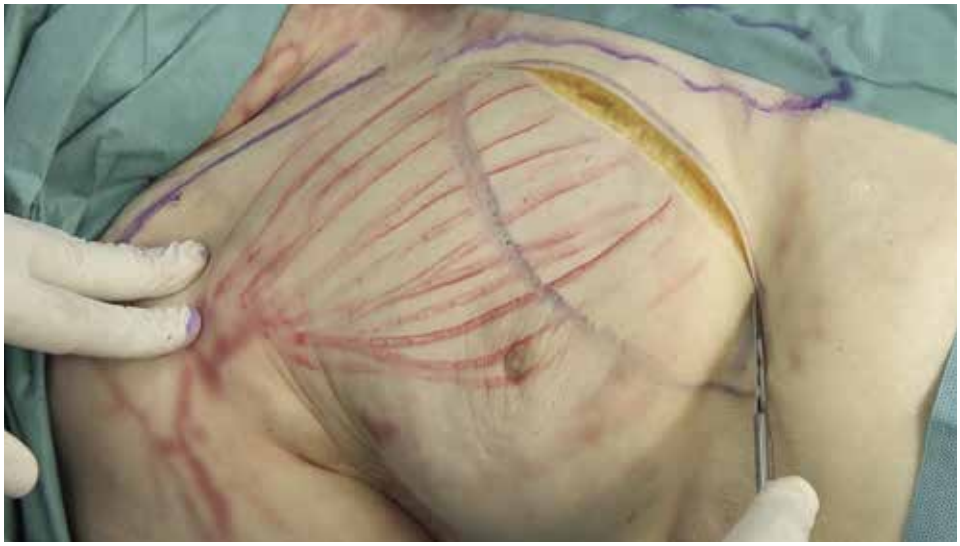

Figure 5.30. Distal incision is done deep to the fascia, and the same is done on the proximal border of the skin paddle.

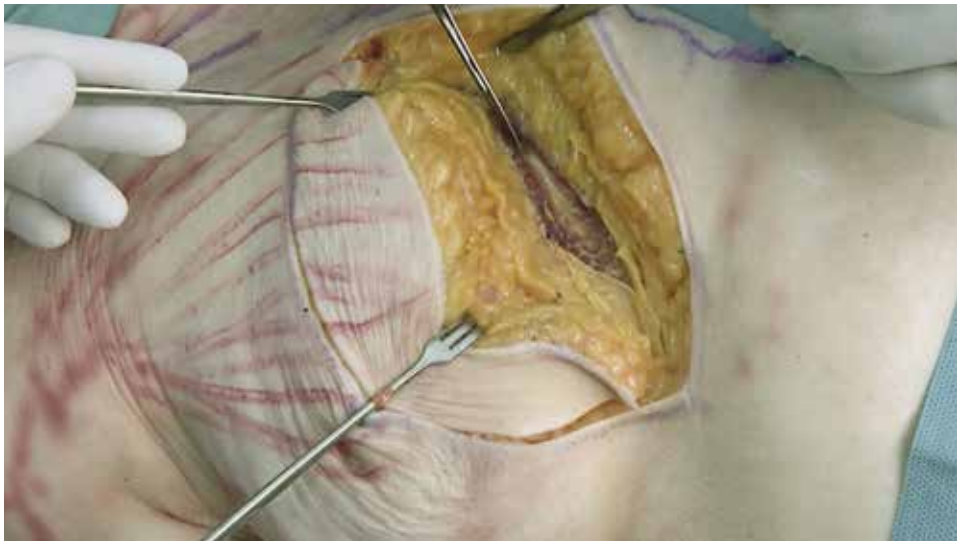

Figure 5.31. Incision is continued deep into the muscle until rib cartilages close to the sternum are exposed. Muscle is detached until a clear submuscular plane is reached.

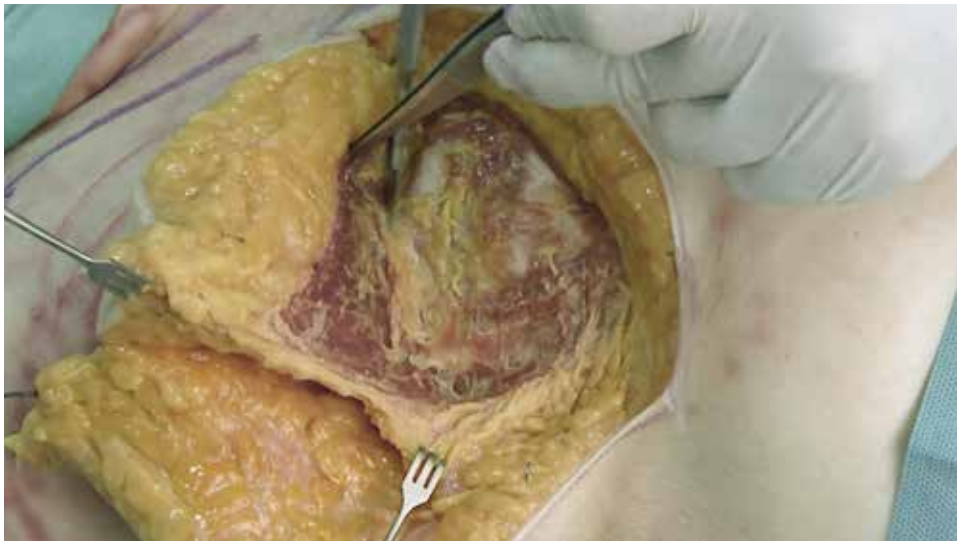

Figure 5.32. Pectoralis major insertions to the sternum and ribs are divided and the muscle released from distal to proximal. Every intercostal vessel is divided and ligated.

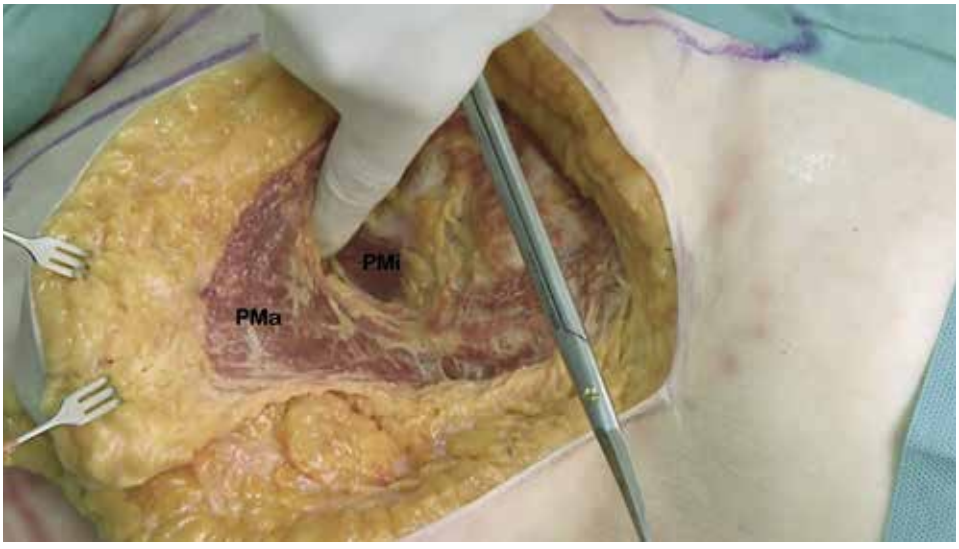

Figure 5.33. When a loose plane is reached, as it is over the pectoralis minor muscle (PMi), blunt dissection is preferred. The plane is rather avascular and no perforators are found. At this stage elevation is easily done. Pectoralis Major (PMa).

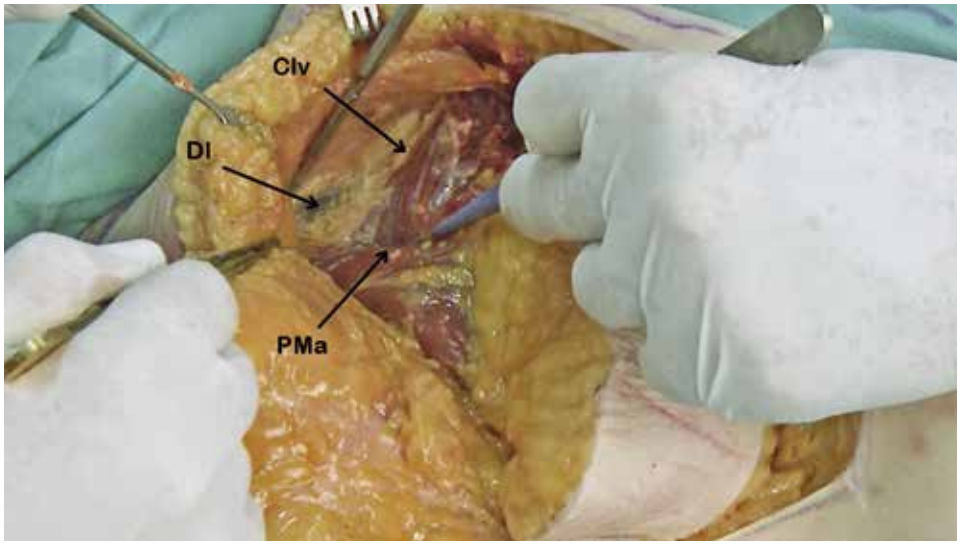

Figure 5.34. Pectoralis major muscle (PMa) is undermined proximally respecting its fascia until the clavicle (Clv) is reached. Deltoid muscle (Dl) medial clavicular insertion can be seen in the upper-left corner.

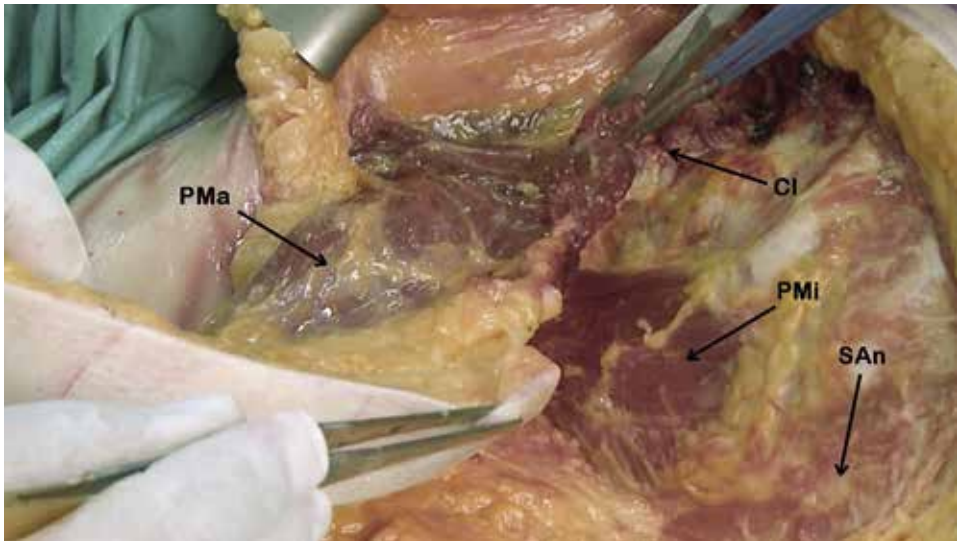

Figure 5.35. The muscle (PMa) is easily divided from its insertion at the clavicle (Cl), though great care has to be taken at the clavicular medial third where the pedicle emerges. Pectoralis minor (PMi) and Serratus Anterior (San) are seen.

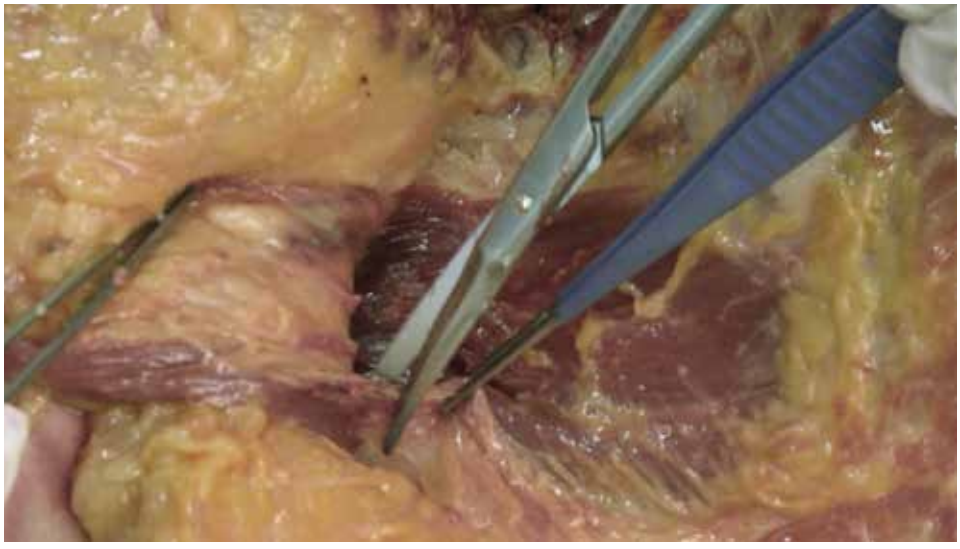

Figure 5.36. The Pectoralis major flap is elevated, respecting its fascia, from the Pectoralis minor. The motor nerve that invariably goes to the pectoralis major muscle traversing the pectoralis minor is divided, as are some of the vessels coming from the axillary artery.

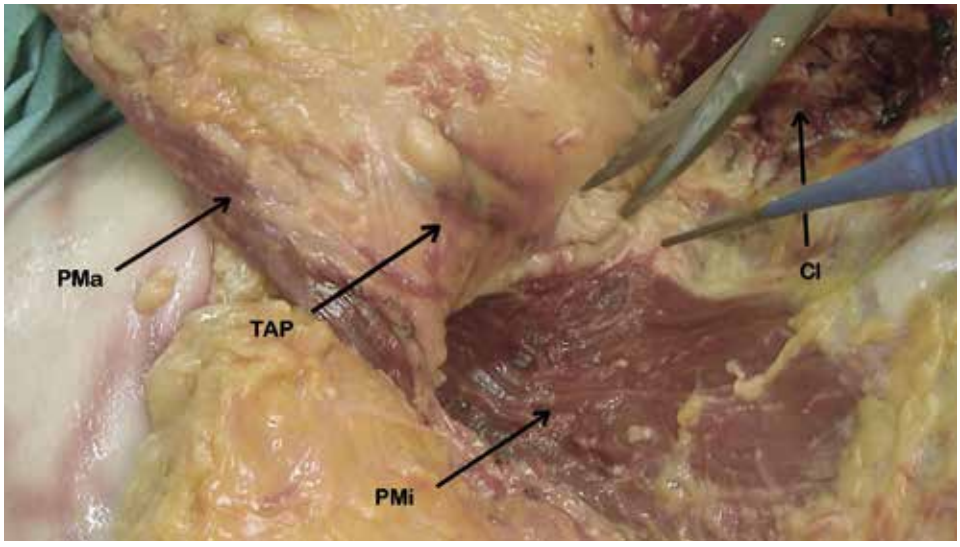

Figure 5.37. At the middle third of the clavicle, between its lower border and the upper boundary of the pectoralis minor, the main pedicle arises. Carefully, with blunt scissors, the pedicle is isolated from the loose areolar tissue.

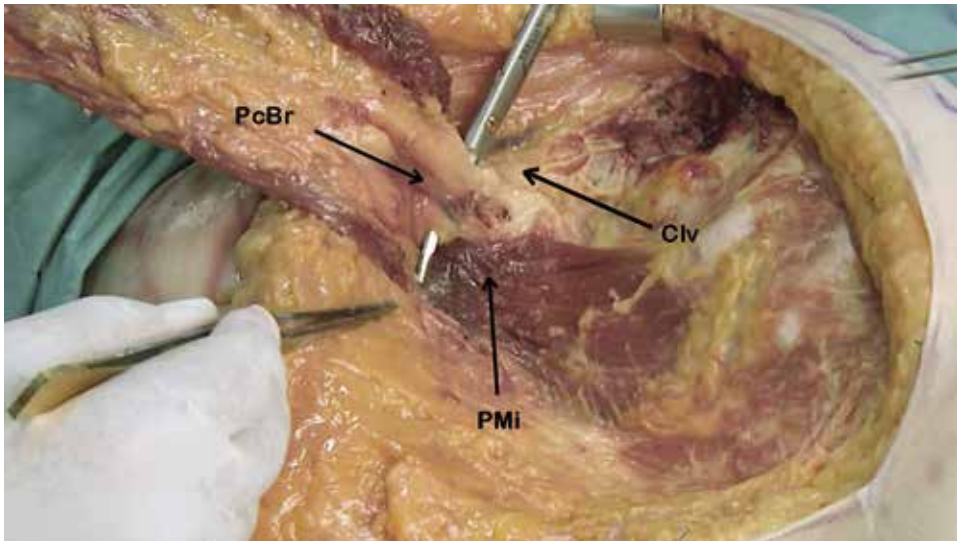

Figure 5.38. Blunt and careful dissection enables the localization and isolation of the pectoral branch from the thoraco-acromial artery (PcBr), which emerges between the clavicle (Clv) and the Pectoralis minor (PMi).

Figure 5.39. With the pedicle completely isolated the Pectoralis major muscle can then be safety released from its middle clavicle insertion.

Figure 5.40. Independent as to whether that Pectoralis major muscle has been released completely or not from all its clavicle insertion, it has to be completely liberated from the humeral insertion.

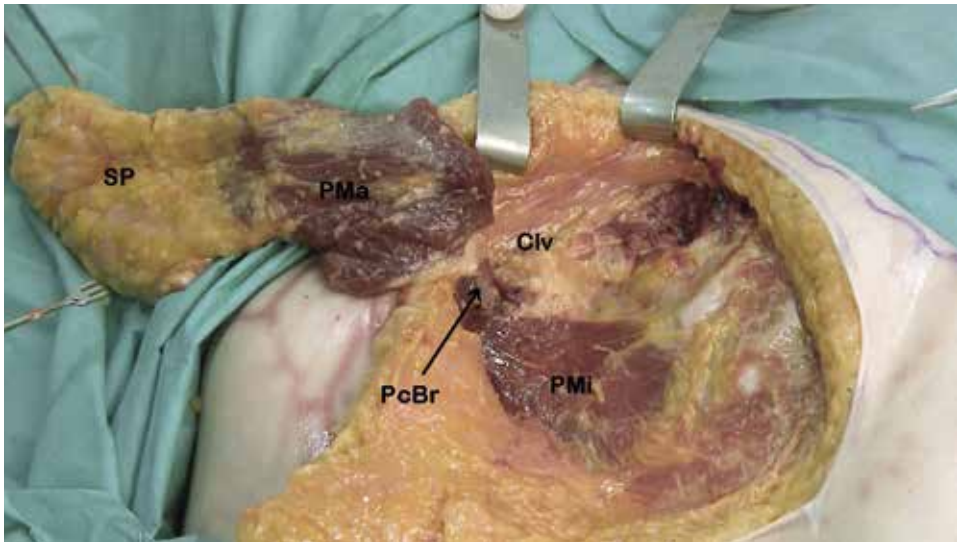

Figure 5.41. Completely free form all its attachments, the superiorly based myocutaneous Pectoralis major flap (PMa) and its skin paddle (SP) can easily reach the cheek, neck, ipsilateral back and a large area of the opposite chest. Clavicle (Clv), Pectoralis minor (PMi).