DELTOID ISLAND FLAP

The Deltoid flap was initially described by Franklin in 1984[27] as a free fasciocutaneous flap, based on the *posterior deltoid subcutaneous artery.*

As the deltoid muscle is not an expandable one, it should never be entirely included in a myocutaneous flap. However, as full muscle flap, it has been successfully used in upper arm amputations[60]. As a flap it can be used if only one part of it is mobilized (either anterior or posterior), as long as vascularization and innervation is preserved for the muscle that has been left in place[56].

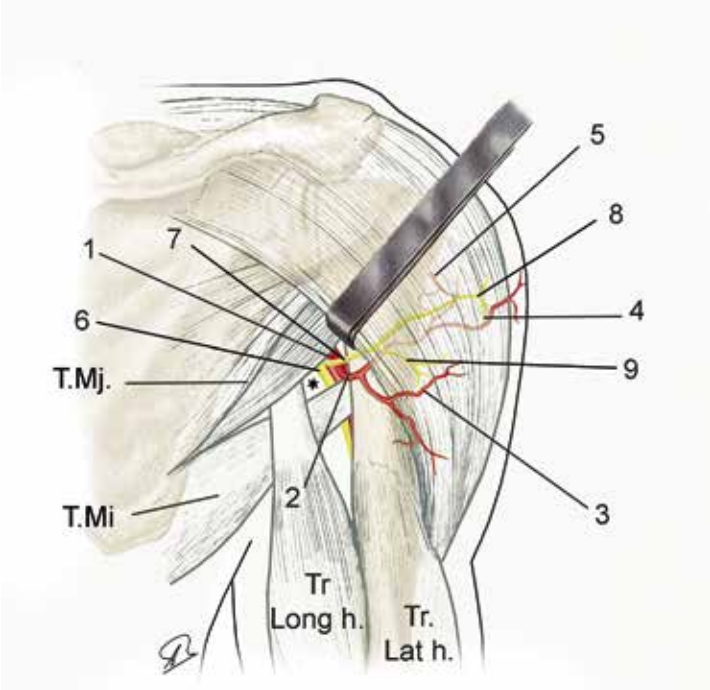
Indications

It will depend on how this flap is elevated, as it can be used as a split myocutaneous pedicled flap, a fasciocutaneous perforator pedicled flap or a free perforator flap. As a myocutaneous flap, and due to its very important function as arm abductor, it has been used for upper arm amputations[60]. Or, by splitting the muscle into two parts, and using exclusively only one of them, it can be used to treat local deep defects (radionecrotic ulcers)[56], or as an orthopaedic procedure for rotator cuff tears of the elbow[2,21]. As a fasciocutaneous perforator flap it can be used to cover neighbouring defects around the acromion and either anterior, or posterior axillary folds. As a free flap it has been used to repair a great variety of defects; from the lower extremity to the penis[34, 57, 65]. The flap is highly reliable as its pedicle is, but the unsightly donor site scar, which is prone to becoming hypertrophic or the highly visible defect when donor site is repaired by skin grafting, are all factors that prevent this flap from being a first option.

Vascularization and anatomy

The Deltoid muscle has two origins; the posterior part on the acromial process and the anterior part on the clavicle. It inserts at the deltoid tuberosity at the mid humerus. Two branches from the axillary nerve innervate the muscle; the anterior branch supplies the anterior part of the muscle, while the posterior branch supplies the posterior part[56].

The Deltoid muscle is vascularized by three main vessels, the *Posterior circumflex humeral artery* (PCHA), Anterior circumflex humeral artery (ACHA) and terminal branches (deltoid branches) of the *Acromiothoracic artery.* A Deltoid flap is based on a constant perforator branch, the *Posterior subcutaneous deltoid artery.* This is a well-known artery described by Manchot[47] that branches off from the PCHA. This artery surrounds the neck of the humerus and emerges through the quadrangular space delimitated by the Teres Major superiorly, Teres minor inferiorly, Long head of the Triceps Brachii medially and lateral head of the Triceps brachii laterally. It supplies the shoulder joint, Teres major and Teres minor, the long and lateral head of the Triceps, Deltoid muscle and the posterior-lateral aspect of the skin over the shoulder (see 6.9). PCHA anastomoses with the ACHA and the acromial and deltoid branches of the thoraco-acromial system. The Deltoid flap, as a perforator flap, can also be supplied by perforator vessels from the PCHA.



1 Axillary artery
2 Posterior circumflex humeral artery
3 Posterior subcutaneous deltoid artery
4 Cutaneous perforator from the posterior circumflex humeral artery
5 Anterior circumflex humeral artery anastomoses
6 Radial nerve
7 Axillary nerve
8 Anterior branch axillary nerve
9 Posterior branch axillary nerve.

T.Mj.: Teres Major muscle.
T.Mi: Teres minor muscle.
Tr. Long h.: Triceps long head.
Tr. Lat. H.: Triceps muscle Lateral head.
*: Quadrangular space

Figure 6.9. Deltoid muscle and deltoid perforator flap vascularization.

Markings

To localize the area where the nourishing vessels of the flap may emerge *(Posterior subcutaneous deltoid artery* or perforator branch from the *Posterior circumflex humeral artery),* a point (Ec) is marked out over the medial epicondyle and another over the tip of the acromion (Ac). A line is traced between these two points. Posterior border of the Deltoid muscle should be localized and a line is drawn over it. The crossing point of these two lines indicates approximately the emergence point of perforator vessels. The *Posterior subcutaneous deltoid artery* courses between the lateral head of the Triceps and the posterior border of the Deltoid muscle (PBD), consequently, the posterior limit of the flap is always drawn posteriorly to this border. The anterior limit of the flap should always be anterior to the perforator emerging point (EP).

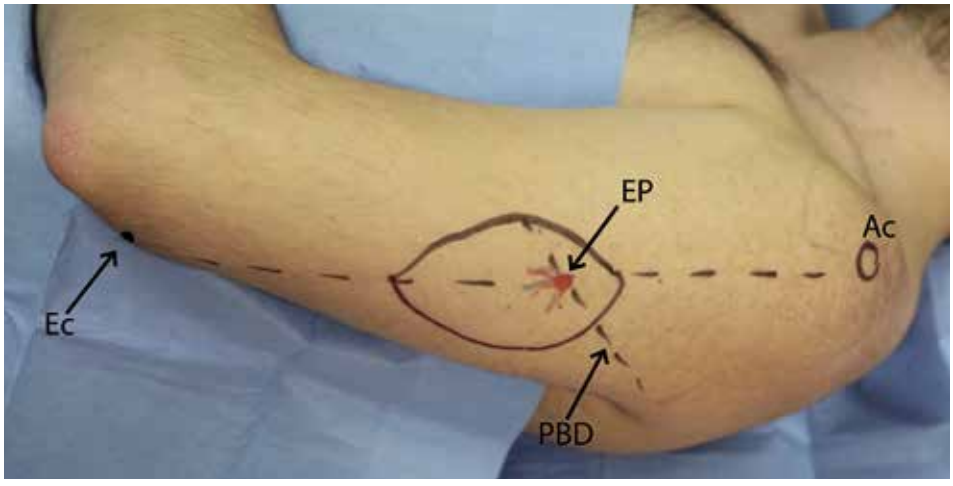


Figure 6.10. Acromial point (Ac) and Epicondyle point (Ec) are marked and a straight line drawn between them. Posterior border of the Deltoid muscle is outlined. The crossing point between both lines represents the area where the perforator vessel may emerge. However, previous Doppler examination will help with localizing emergence points of different perforator arteries (EP).

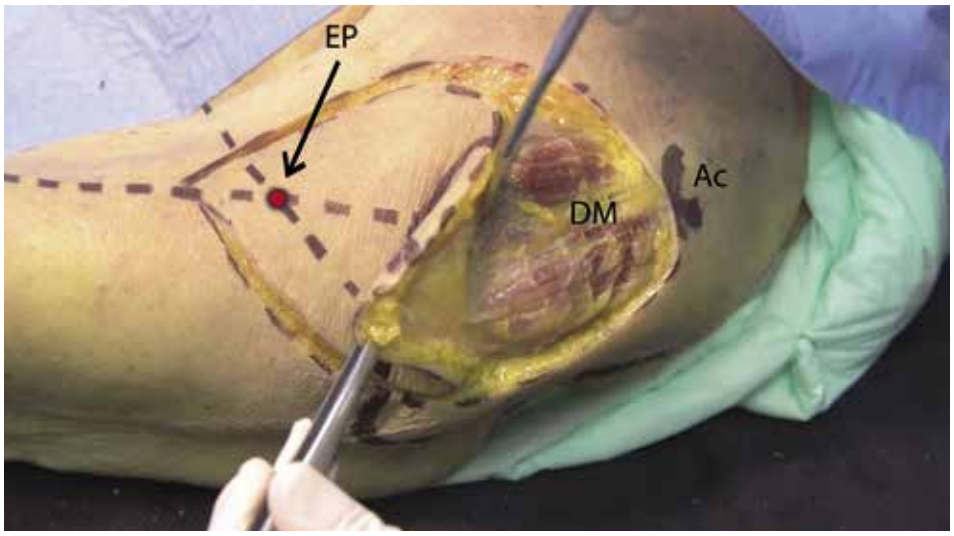


Figure 6.11. Cutaneous paddle is elevated from proximal to distal in a subfascial plane. However, great care has to be taken when elevating the flap on the posterior border of the Deltoid muscle, as it is there where the posterior deltoid subcutaneous artery can emerge. If it is decided to base the flap on a perforator vessel, dissection is continued.

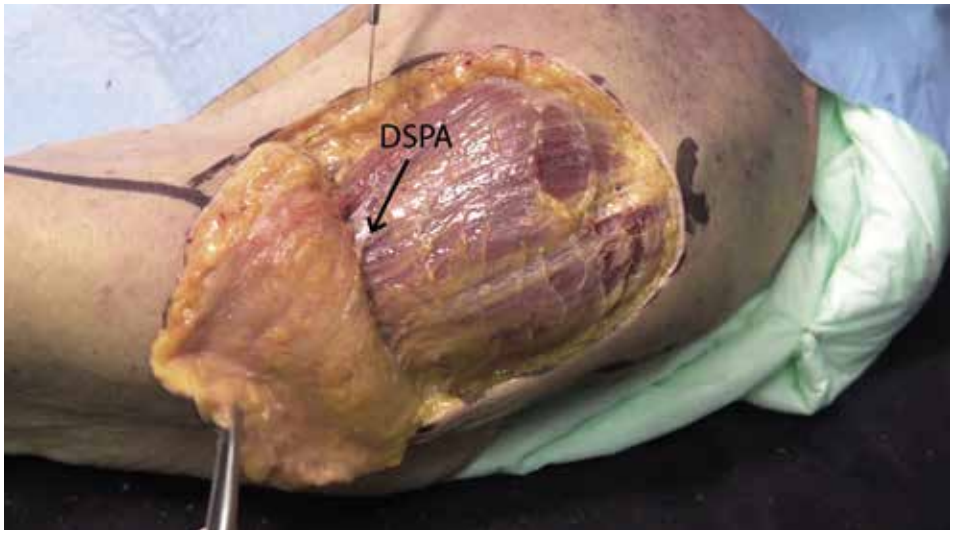


Figure 6.12. Harvesting the flap below the fascia will help both in localizing the selected perforator and splitting the muscle to dissect the vessels. Posterior border of the skin paddle is not incised, until a reliable perforator is safely isolated.

Figure 6.13. Muscle bundles and fibers are gentle split longitudinally to get access to the perforator vessel.

Figure 6.14. No muscle fibers are spared to dissect the perforator vessel into the muscle and get extra length for the pedicle. Muscle bundles are opened as much as necessary.

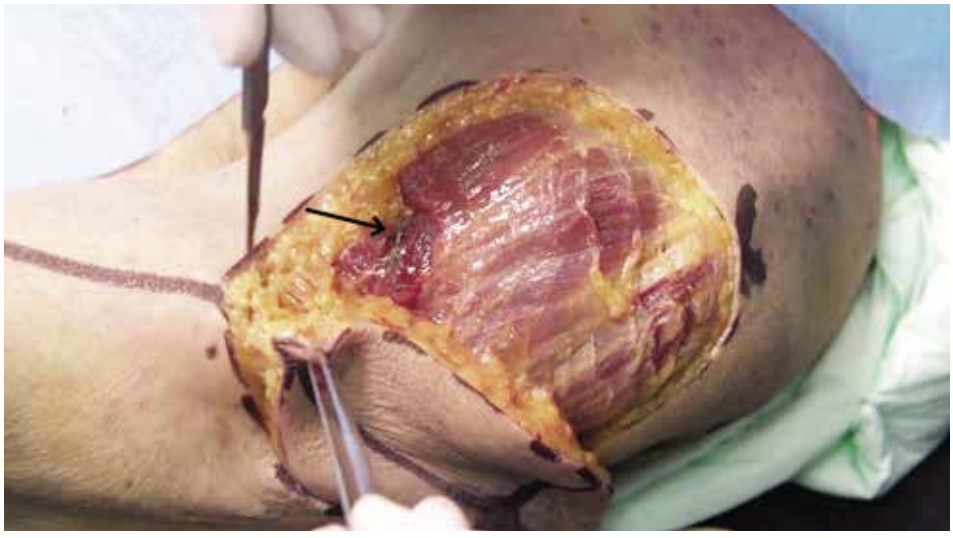


Figure 6.15. In this case the perforator vessel is seen probably coming from the anterior circumflex humeral artery at the anterior portion of the Deltoid.

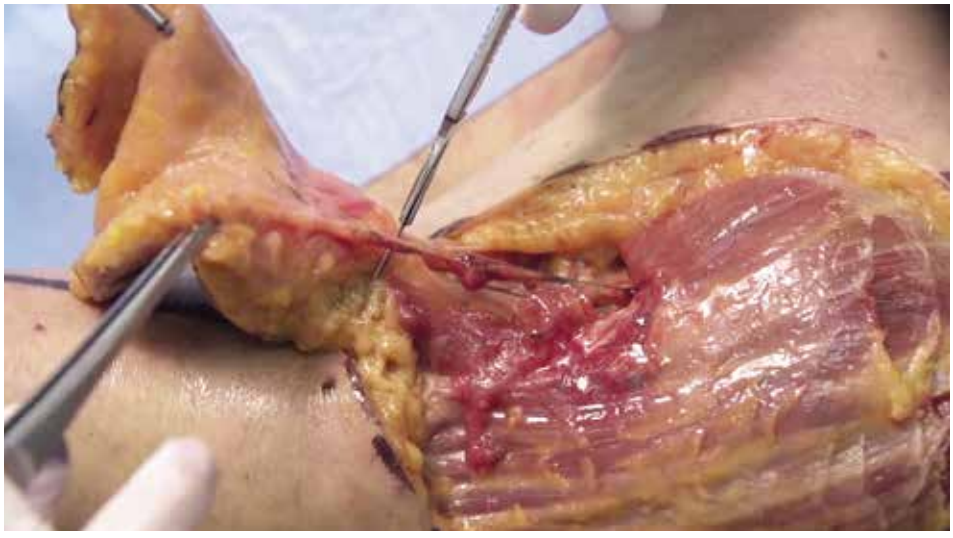


Figure 6.16. Once the vessels have been completely isolated at the desired length, the cutaneous paddle is completely incised and elevated.

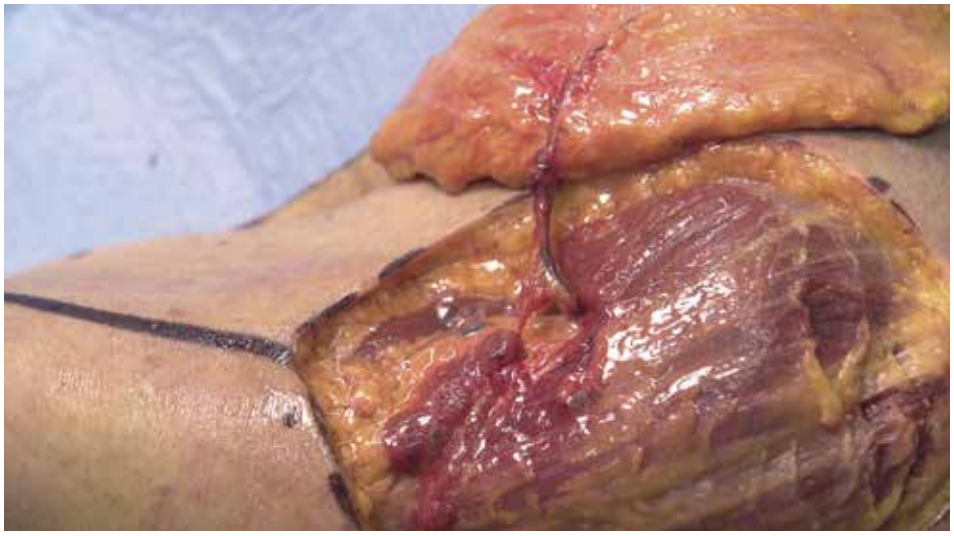


Figure 6.17. As a pedicled flap, it can easily reach the anterior axillary fold and the region around the acromion.