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Reconstruction of the face and neck with different types of pre-expanded anterior chest flaps: A comprehensive strategy for multiple techniques

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Summary *Background:* For large defects or deformities of the face and neck, the anterior chest area appears to be an excellent donor site that provides well-matched skin colour and texture. Many flap techniques based on the anterior chest area have been reported; however, there are few reports that focus on a treatment strategy for these different flap techniques.
Methods: A retrospective study was performed to propose a treatment algorithm. A total of 69 cases were reviewed from May 2005 to July 2011, in which different types of anterior chest flaps were performed for face and neck reconstruction. The reconstructive procedures, the defect characteristics and the complications were collected and analysed.
Results: Thirty-three pedicled thoracic branch of the supraclavicular artery flaps (the pedicled TBSA flap), 11 pedicled internal mammary artery perforator flaps (the pedicled IMAP flap), 8 free internal mammary artery perforator flaps (the free IMAP flap), 4 supercharged TBSA flaps, 17 prefabricated flaps and 3 supercharged prefabricated flaps were performed. The applications of six types of pre-expanded anterior chest flaps were described in an algorithmic approach.
Conclusions: A treatment strategy for face and neck reconstruction using six anterior chest flap techniques is proposed. It recommended a personalised flap planning according to the characteristics of deformities/defects and the regionally dominant vessels of the anterior chest area.

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The face is irreplaceable for the representation of one's identity and the expression of one's feelings. Burn injuries, surgical ablation and trauma often lead to full-thickness soft-tissue defects in the face and neck.[1,2] These defects may severely impact the appearance and function of the face, causing long-term mental suffering and gravely impacting physical and psychosocial status.[3] Besides, ideal donor sites for face and neck reconstruction are often damaged to some extent as a result of the accident. Therefore, the aesthetic and functional reconstructions of the face and neck are still the important challenges for plastic and reconstructive surgeons.

In some patients, the anterior chest soft tissue that is protected by the patient's clothing may remain relatively intact, and this area can provide the skin matched in colour, texture and thickness to that of the face and neck. In such cases, an individual flap design based on this region should be taken into consideration for cervico-facial reconstruction. Different types of flaps can be used from this area, including pedicled perforator flaps,[4–6] musculocutaneous flaps,[7–9] 'super-thin flaps',[10] prefabricated flaps[11,12] and free flaps.[13] These flap techniques are adopted *ad libitum* or according to each surgeon's preference, and no algorithm has been well established that might improve the aesthetic and functional outcomes while minimising costs and complications.

The authors reviewed all the cases from May 2005 to July 2011 in which different anterior chest flaps were performed to propose an algorithm for face and neck reconstruction according to the characteristics of deformities/defects and the regionally dominant vessels of the anterior chest area.

Patients and methods

For the purpose of this study, the anterior chest flap is defined as the axial pattern flap designed in the area bounded superiorly by the clavicle, inferiorly by a horizontal line at the level of the nipple, medially by the midline and laterally by the anterior axillary line. The skin and soft tissue of the anterior chest are primarily nourished by the supraclavicular artery, the internal mammary artery, the thoracoacromial artery and the lateral thoracic artery (Figure 1).[14] In this study, the anterior chest flaps pedicled by the thoracic branch of the supraclavicular artery (TBSA) or the second or third perforator of the internal mammary artery (IMAP) were performed, because these two vessels were closer to the recipient site for neck and lower face reconstruction.

The supraclavicular artery

The supraclavicular artery[15] arises from the transverse cervical artery in a triangle formed by the external jugular vein, the sternocleidomastoid muscle and the clavicle. It then proceeds towards the acromioclavicular joint and supplies the skin and the subcutaneous tissue from the supraclavicular region to the ventral surface of the deltoid muscles.[16,17] In addition to this conventional supraclavicular artery, Ma et al. described one branch, called the TBSA, which bifurcates nearly 2 cm above the middle of the clavicle bone, travels above the clavicle bone and extends to the subclavicular and anterior thoracic regions.[5,18]

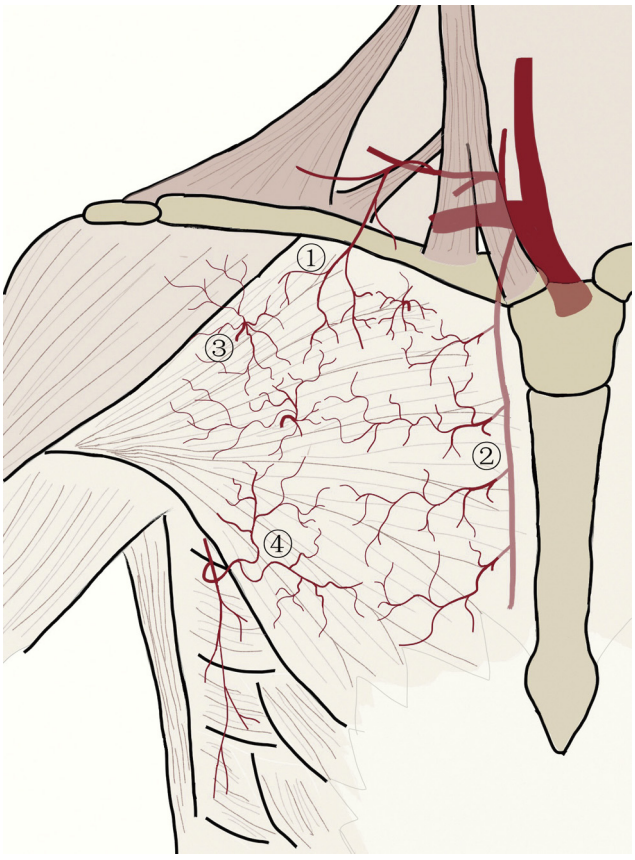

Figure 1 Vascular anatomy of the anterior chest area: perforators from the supraclavicular artery (①), the internal mammary artery (②), the thoracoacromial artery (③) and the lateral thoracic artery (④).

The internal mammary artery

The IMAPs[19] emerge into the flap from the intercostal spaces approximately 1 cm laterally from the sternum and proceed towards the deltopectoral groove. Among these perforators, the second and the third perforators typically have the largest diameters and may be regarded as the primary nourishing vessels of the flap.[20,21]

This retrospective study included 69 patients, of whom 49 were male and 20 were female, in whom 76 anterior chest flaps were designed for face and neck reconstruction. The ages of the patients at the time of surgery ranged from 4 to 54 years and the average age was 27 years. The causes of the defects included flame burn injuries in 49 cases, chemical burn injuries in 9 cases, electrical injury in 7 cases, trauma in one case and giant pigmented nevus in three cases.

Clinical data, such as the patients' preoperative and postoperative photographs, the results of colour Duplex scanning, the surgical details and the complications, were collected.

The preoperative evaluation that included colour Duplex scanning of the anterior chest was routinely performed (GE