Supraclavicular artery island flap in head and neck reconstruction

S. Atallah a, A. Guth b, F. Chabolle a,c, C.-A. Bach a,∗,c

a Service de chirurgie ORL et cervico-faciale, hôpital Foch, 40 rue Worth, 92150 Suresnes, France
b Service de radiologie, hôpital Foch, 40, rue Worth, 92150 Suresnes, France
c Université de Versailles Saint-Quentin en Yvelines, UFR de médecine Paris Ouest Saint-Quentin-en-Yvelines, 78280 Guyancourt, France

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ABSTRACT

Due to the complex anatomy of the head and neck, a wide range of pedicled or free flaps must be available to ensure optimal reconstruction of the various defects resulting from cancer surgery. The supraclavicular artery island flap is a fasciocutaneous flap harvested from the supraclavicular and deltoid regions. The blood supply of this flap is derived from the supraclavicular artery, a direct cutaneous branch of the transverse cervical artery in 93% of cases or the supraclavicular artery in 7% of cases. The supraclavicular artery is located in a triangle delineated by the posterior border of the sternocleidomastoid muscle medially, the external jugular vein posteriorly, and the median portion of the clavicle anteriorly. This pedicled flap is thin, malleable, and is easily and rapidly harvested with a reliable pedicle and minimal donor site morbidity. It can be used for one-step innervated reconstruction of many types of head and neck defects. It constitutes an alternative to local flaps, while providing equivalent functional results and must be an integral part of the cancer surgeon’s therapeutic armamentarium.

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1. Introduction

The objective of reconstruction after head and neck cancer surgery is not limited to closure of the defect, but must allow three-dimensional functional and cosmetic rehabilitation with skin of a similar colour and texture to that of the recipient site. The closer the donor site is situated to the recipient site, the more likely the skin will present a comparable quality. Use of the skin of the shoulder, close to that of the face and neck, appears ideal, as it allows reconstruction of a functional anatomical unit with skin equivalent to the original skin.

Shoulder flaps have been studied sporadically since their first use in 1842 [1] as a random flap. The description of the supraclavicular artery island flap (SCAI) as an axial pedicle flap by Lambert was published in 1979 [2]. A better knowledge of the vascular anatomy of the shoulder region demonstrated the reliability and reproducibility of this flap. The indications for supraclavicular artery island flap were therefore extended to head and neck reconstruction, particularly in the context of head and neck cancer, in the 2000s [3].

This article describes the anatomical basis, flap harvesting technique and the main characteristics of the supraclavicular artery island flap.

2. Anatomical basis

The supraclavicular artery island flap is a fasciocutaneous flap harvested from the supraclavicular and deltoid regions. The blood supply of this flap is derived from the supraclavicular artery, a direct cutaneous branch of the transverse cervical artery in 93% of cases or the supraclavicular artery in 7% of cases [3]. The transverse cervical artery is a branch of the thyrocervical trunk, which arises from the third part of the subclavian artery. It divides into two main branches: the supraclavicular artery supplying the skin and a branch supplying the trapezius muscle.

The constant supraclavicular artery measures 1 to 1.5 mm in diameter and allows the creation of a 3 to 4 cm pedicle. It is always located in a triangle delineated by the posterior border of the sternocleidomastoid muscle medially, the external jugular vein posteriorly, and the median portion of the clavicle anteriorly (Fig. 1). The artery arises 3 cm above the clavicle at a distance of about 8 cm from the sternalclavicular junction and about 2 cm from the sternoclavicular joint. The supraclavicular artery anastomoses distally to branches of the posterior circumflex humeral artery, allowing the skin paddle to be extended from the supraclavicular region to the lateral surface of the shoulder, beyond the deltoid muscle insertion.

Two vein comitantes accompany the supraclavicular artery. One vein drains into the transverse cervical vein. The second vein drains into the external jugular vein or subclavian vein.
The vascular territory of the supraclavicular artery extends from the supraclavicular region to the rotator cuff. The area of this angiosome is about 10 cm wide by 22 cm long [2,4]. The supraclavicular sensory nerve is composed of 3 to 5 branches supplying the skin of the shoulder. They are superficial cutaneous branches of the cervical plexus derived from C3 or C4, which then leave the posterior border of the sternocleidomastoid muscle to travel inferiorly and posteriorly to become superficial just above the clavicle and below the sternocleidomastoid muscle. One or two branches accompany supraclavicular vessels.

3. Flap harvesting technique

Duplex ultrasound can be performed before the operation to identify the supraclavicular artery and ensure the integrity of the pedicle. The patient is placed in the supine position, a bolster is placed beneath the shoulder blades to expose the supraclavicular region. The patient’s head is turned towards the opposite side of the flap donor site.

The origin of the supraclavicular vessels is located in a triangle delineated by the posterior border of the sternocleidomastoid muscle medially, the external jugular vein posteriorly, and the median portion of the clavicle anteriorly.

The flap is harvested in a zone defined by the edge of the trapezius muscle posteriorly and a parallel line as far as the deltoid muscle anteriorly (Fig. 2). The size of the paddle can range from 4 to 12 cm wide and 20 to 30 cm long [4]. Skin, subcutaneous tissue and fascia are incised over the deltoid muscle. Fascia may be sutured to the skin by a 4-0 vicryl suture. Dissection is continued in the subfascial plane over the deltoid and the flap is harvested from distal to proximal. Dissection in the subfascial plane over the deltoid muscle allows harvesting of the overlying fascia to ensure better vascular protection (perifascial anastomotic network). Perforating vessels of the deltoid muscle are cauterized during harvesting of the paddle and dissection is easily continued as far as the supraclavicular fossa.

The pedicle is identified by transillumination in the middle third of the flap. The skin and subcutaneous tissue are carefully incised to preserve the pedicle according to the desired dimensions of the paddle. The spinal nerve, which crosses the deep portion of the posterior triangle of the neck underneath the sternocleidomastoid muscle, is identified and preserved as far as its point of entry into the trapezius muscle.

Depending on the defect to be covered and the required arc of rotation, the vascular pedicle can be cautiously dissected as far as its origin (Fig. 3a and b). Section of the transverse cervical artery after its division into a supraclavicular cutaneous branch releases the
pedicle and increases the arc of rotation of the flap. Identification of the nerve pedicle at this level allows its section or its preservation to obtain a sensory innervated flap.

The flap is tunneled under the skin of the neck to reach the defect to be repaired, by avoiding torsion of the pedicle.

The generally self-closing donor site is sutured over a suction drain. Harvesting of a very large flap (>22 cm) may require skin graft to the donor site. The long-term appearance of the scar is usually satisfactory (Fig. 4).

4. Discussion

Reconstruction of the soft tissues of the head and neck after cancer resection is often complex and requires the use of local, regional or free flaps to ensure anatomical, functional and cosmetic rehabilitation. The type of flap must be chosen carefully in order to preserve the donor site. A thin, malleable flap with a texture and colour similar to those of the recipient site is ideal for repair of head and neck defects. Local flaps would be ideally adapted, but their use is often compromised by previous surgery or radiotherapy. Very large regional myocutaneous flaps are difficult to position in certain sites (e.g. oropharynx). Sacrifice of a muscle at the donor site is associated with morbidity and sequelae. Microanastomosed fasciocutaneous flaps (forearm flap, anterolateral thigh flap) provide thin, flexible, well vascularized tissue to cover large defects. However, not all patients are eligible for this long surgery, which requires an experienced multidisciplinary team. In these difficult cases, regional flaps remain the reference technique and the supraclavicular artery island flap is an ideal solution for these patients, as it is a reliable flap with a constant neurovascular pedicle. In a series of 349 supraclavicular artery island flaps, the complete necrosis rate was 1.4% and the partial necrosis rate was 6.9% [5].

Flap harvesting is easy and rapid, taking only 40 min to 60 min depending on the surgeon’s experience [6]. Due to its rapid harvesting and the site of the flap in a usually neutral region (not operated, not irradiated), use of this flap can be considered in multioperated patients or patients with major comorbidities.

The supraclavicular artery island flap is thin, hairless, with a colour and texture similar to those of the face. The thin dermis and the absence of body hair facilitate use of this flap in the oral cavity and oropharynx. This malleable, well-vascularized tissue can be de-epithelialized and then buried in the neck or mediastinum to close tracheoesophageal fistulas [7]. Supravacularinnervation can be preserved during flap dissection, allowing sensory reconstructions, for example in a neopharynx.

Vascular island harvesting, which offers an arc of rotation of 180° of the flap, allows the closure of defects ranging from the middle third of the face to the mediastinum.

Large skin paddles, measuring up to 30 cm long, can be harvested, although distal ischaemia of the skin paddle has been reported for flaps longer than 22 cm [8]. These “extreme” flaps should be reserved for young patients with a perfect vascular status.

Level V neck dissection can damage the supraclavicular artery pedicle, but this dissection is rarely performed and, when it is necessary, the surgeon can usually preserve the vascular pedicle. A history of level V neck dissection or radical dissection does not constitute a contraindication to the use of this flap. Duplex ultrasound examination can be performed before harvesting the flap to ensure the presence and integrity of the vascular pedicle.

The supraclavicular artery island flap can be an alternative to the myocutaneous flap or pectoralis major muscle flap. With time, the pectoralis major muscle atrophies and forms an adhesion responsible for decreased range of neck flexion and extension. The absence of the pectoralis major muscle in the shoulder results in a reduction of the range of external and internal rotation and adduction. These sequelae limit the patient’s activity. Harvesting of a supraclavicular artery island flap preserves the muscles and motor nerves of the shoulder and therefore preserves the normal range of motion of the shoulder [9].

Donor site complications such as scar dehiscence or seroma have been reported in 0 to 15% of cases [9] and can be treated by local wound care. The donor site is self-closing for flaps up to 16 cm wide [3]. Local flaps or skin graft have also been proposed to ensure closure of the donor site. The long-term appearance of the scar is satisfactory, although widening of the scar may be observed. Patients report mild-to-moderate rapidly resolving shoulder pain after flap harvesting. Contact with the flap in the reconstructed site is experienced in the shoulder by 20% of patients [10]. Identification of the nerve pedicle during flap dissection allows nerve section to avoid postoperative dysaesthesia.

The donor site surgical morbidity is low, associated with a short hospital stay and the functional results are equivalent to those of other techniques. This flap constitutes an excellent option for patients with vascular disease preventing microsurgery, multioperated patient or patients with advanced cancer.

5. Conclusion

The supraclavicular artery island flap is a thin, malleable fasciocutaneous flap that is easily and rapidly harvested, with a reliable pedicle and minimal donor site morbidity. It can be used for one-step innervated reconstructions of many types of head and neck defects. It constitutes an alternative to local flaps, while providing equivalent functional results, and must be an integral part of the head and neck cancer surgeon’s therapeutic armamentarium.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References


