

Supra-Clavicular Artery Flap in Head and Neck Reconstruction

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Abstract

Background: To study results of supraclavicular artery flap in head and neck reconstruction in terms of its reliability, clinical applications, and functional and aesthetic outcome

Methods: In this descriptive study 71 patients who got supraclavicular flap reconstruction were included. When both supra-clavicular areas were found to be suitable for flap donation, the non-dominant side was selected as the donor site. In case of patients having only one supraclavicular area suitable for flap donation, that available donor-site was used. Pre-operatively, a 10 MHZ hand held Doppler probe was used to exactly locate and mark the origin and course of the supraclavicular vessels, and flap design was outlined on the selected donor-site according to the analyzed dimensions of the defect. Per-operatively, the defect was prepared and its dimensions were mapped out with the help of a template. The planning in reverse was used to confirm or correct the flap design already marked. The flap was elevated and inset into the defect with a suction drain underneath. The donor site was widely undermined and closed directly in most of the cases with another suction drain in place. Where primary closure was not achievable or considered unsafe even after wide undermining, the defect was reduced in size with advancement of the surrounding skin margins and the residual defect was split-skin grafted. Postoperatively, patients were observed for survival of the flap, and any early flap or donor-site complication. The patients who underwent release of neck contractures were advised to wear a Philadelphia neck collar two weeks postoperatively. At each follow-up, the flap and donor site were examined for any late complications.

Results: All flaps survived with only 5 flaps having marginal tip necrosis with acceptable postoperative course

Conclusion: Supra-clavicular artery flap is technique of choice for medium to large defects of

the cervico-facial region of middle face with reach up to zygomatic arch

Introduction

For the plastic and reconstructive surgeons restoration of both form and function in the head and neck region remains a challenge because of visibility of the head and neck during social contact and from the fact that these regions have high range of three dimensional movements. Causes of soft tissue defect in this region arise mainly from trauma, tumours, congenital anomalies, burns and infections. ¹ These deformities can be classified into six major anatomic groups: upper aerodigestive tract, mandibular, midfacial, cranial base, cutaneous, and scalp. ² With the advent of more options in reconstructive surgery the outcome in head and neck surgery has got better. ^{4,5} In head and neck reconstruction, a reconstructive surgeon seek a thin, pliable flap with colour and texture match along with minimal donor-site morbidity. ⁶ Skin grafts, local flaps, pedicled fascio-cutaneous, and muscle or myocutaneous flaps, enteric flaps, tissue expansion techniques and free tissue transfer have been used in head and neck reconstruction depending on the size and complexity of the defect. ⁷⁻¹⁴ Vacuum-assisted closure (VAC) has also been reported as a safe and useful reconstructive tool for complex defects of the head and neck region. ¹⁵ Each option has got its own merits and demerits. The skin graft has the obvious disadvantages of colour mismatch and postoperative graft contracture. ¹⁶ Tissue expansion methods produce enough like tissue with good color and texture match but they require multiple operations, have high rate of complications and are more expensive. ¹³ Free tissue transfer is an attractive option and when used as a super thin flap does provide excellent coverage. However it requires long operating time, equipment and skills. ⁶

As a basic concept, first formulated by Gillies in 1920, the more adjacent the donor site is, the better the skin will match the recipient. ¹⁷ The head and neck region

itself suffers from a lack of local tissues available for reconstruction. The areas which are adjacent to the head and neck are chest and shoulder.¹⁸ Most of the anterior and posterior-based flaps are myocutaneous and are preferred for reconstruction of deeper defects. For resurfacing of defects in the head and neck, fasciocutaneous flaps are preferred. The supraclavicular artery flap, is an extremely reliable, local, pedicled fasciocutaneous flap. It is based on the supraclavicular artery, which is a branch of the transverse cervical artery, or, less frequently, of the suprascapular artery. Its skin paddle consists of a defined region around the shoulder cap. It offers thin and pliable skin with good colour and texture match and minimal donor site morbidity. It is simple to learn and quicker to perform. It can be harvested as either a skin pedicled flap or an island flap (vascular pedicled flap). The island flap has the advantages of a long pedicle with wide arc of rotation. It does not require microsurgical expertise and the donor defect can be closed primarily. It can be pre-expanded to cover larger defects and further reduce donor site morbidity. An additional advantage is that when used for neck resurfacing after release of post-burn contractures, this skin can stretch postoperatively to allow further improved neck contour and mobility. The most common indication of this flap, so far, has been seen in resurfacing of neck after release of post burn contractures. Apart from neck, it can be used to resurface defects of, chin, cheek oral cavity and thorax.^{6, 19-24}

Patients and Methods

This Descriptive study was conducted at the Department of Plastic Surgery, Nishtar Hospital Multan from January 2009 to November 2015. A total 71 patients who got supraclavicular flap reconstruction were included. Patients with scars/previous surgery in the area of the supraclavicular artery flap and those requiring radical neck dissection on the side of the flap, were excluded. All patients were counseled preoperatively about a visible scar over the supra-clavicular and deltoid region with the possibility of stretching of the scars. When reconstruction of the defect had been planned along with resection of the tumor, specific investigations like orthopantomogram, paranasal sinuses views, CT scan and MRI were carried out to know proper extent of the tumour and therefore to judge the defect size. Defects were analyzed and measured pre-operatively. When both supra-clavicular areas were found to be suitable for flap donation, the non-dominant side was selected as the donor site. In case of patients having only one

supraclavicular area suitable for flap donation, that available donor-site was used. Pre-operatively, a 10 MHZ hand held Doppler probe was used to exactly locate and mark the origin and course of the supraclavicular vessels, and flap design was outlined on the selected donor-site according to the analyzed dimensions of the defect. Per-operatively, the defect was prepared and its dimensions were mapped out with the help of a template. The planning in reverse was used to confirm or correct the flap design already marked. The flap was elevated and inset into the defect with a suction drain underneath. The donor site was widely undermined and closed directly in most of the cases with another suction drain in place. Where primary closure was not achievable or considered unsafe even after wide undermining, the defect was reduced in size with advancement of the surrounding skin margins and the residual defect was split-skin grafted. Postoperatively, patients were observed for survival of the flap, and any early flap or donor-site complication. The drains were removed on 2nd postoperative day. The first dressing was changed on the fifth postoperative day. Where interrupted skin stitches or skin staples were used, they were removed and replaced by steri strips. The patients were discharged between 5 to 7 days after operation. After discharge, the first follow-up visit was on the 10th postoperative day when sub-cuticular stitches were removed. The patients who underwent release of neck contractures were advised to wear a Philadelphia neck collar two weeks postoperatively. All the patients were subsequently followed-up at one, three and six months. Some patients were followed-up for even more than six months. At each follow-up, the flap and donor site were examined for any late complications, the functional and aesthetic restorations were assessed and donor-site appearance was observed. Flap outcome and aesthetics were also assessed.

Results

Age of the patients ranged from 16 to 60 years, with the mean age of 34.01 years. Post-burn neck contractures were found in 40 cases (55.5%) followed by squamous cell carcinoma in 20 cases (27.8%). In 43 cases (60.6%) Neck was the site requiring flap reconstruction followed by cheek in 12 cases (16.9%) (Table 1; Figure 1&2). The flap length ranged from 12 to 25 cm (mean length in cm + SD = 17.9 ± 3.9 cm) while flap width ranged from 6 to 12 cm (mean width in cm + SD = 8.8 ± 1.8 cm). In 52 (73.2%) patients, we were able to close donor-site primarily after undermining the surrounding edges. We were able to cover area up to zygomatic arch.

Table.1 Supra-clavicular flap-demographic profile

Gender	Male	39 (54.9%)
	Female	32 (45.1%)
Age	Age range	No. of patients
	16-20 years	3
	21-30 years	29
	31-40 years	30
	41-50 years	6
	51-60 years	3
	Total	71
	mean age = 34.01 ± 2.3 years	
Etiology of Defect	Etiology	No. of cases
	Post-burn neck contractures	40 (55.5%)
	squamous cell carcinoma	20 (27.8 %),
	road traffic accidents	8 (11.1%)
	high voltage electrical injury	2(2.8 %)
	neurofibromatosis of face and neck	1 (1.4%)
Site requiring flap coverage	site	No. of cases
	Neck	43 (60.6%)
	cheek	12 (16.9 %)
	chin in	7 (9.9 %)
	oral cavity	5 (7.0%)
	the jawline	4 (5.6%)

All the flaps used for oral cavity lining were islanded. In 19 patients (26.8%), a split thickness skin graft (STSG) for wound closure. The average operating time was found to be 1.9 ± 0.4 hours with a range of 1.5 to 3.0 hours. Of 71 flaps , 66 (93.%) flaps fully survived and 5 (7.0%) underwent partial thickness necrosis at the distal portion of flap. The hospital stay of all the patients ranged from 5 to 10 days (Mean Of Hospital Stay in days + SD = 7.6 ± 2.09 days).All of our patients were followed-up for a minimum duration of 6 months (Mean follow-up duration in months + SD = 9.2 ± 1.7 months). Regarding donor site, 2 (2.8%) patients had donor-site dehiscence; whereas in 1 patient contour irregularity of the donor-site was noted in early postoperative period. After 6 months,4 (5.6%) patients developed scar widening, one (1.4%) patient developed hypertrophy of donor-site scars, and one (1.4%) patient continued to have contour irregularity of the donor-site. During follow up 64 (90.1%) patients had no complaints regarding cosmetics while 7 patients were satisfied with donor-site appearance.

Discussion

In present study main indication was post burn neck contracture followed by squamous cell carcinoma similar to Pallua and Naoh¹⁸. While elevating flap in squamous cell carcinoma we only included those patients where simultaneous neck dissections were not anticipated. The most common site requiring reconstruction was the neck region followed by the cheek ,chin, oral cavity, jaw line in our audit . Pallua et al and Di Benedetto et al have used this flap for almost similar type of defect locations.^{18,21} In two of them, the cause of this tip necrosis was found to be haematoma formation under the distal area of the flap despite the placement of a suction drain which probably blocked by clotted blood. The haematoma was drained, necrosed part was debrided and the resulting raw area was covered by advancement of the flap. In the other patient, it was probably too much tension across the distal edges of the flap which led to tip necrosis. The necrosed area was debrided and the resulting defect was closed primarily by advancing the flap. Di Benedetto et al. have reported marginal necrosis in 2 (8%) out of thier 25 patients.¹⁹ It can be assumed that the reasons for high success rate are predictable vascular anatomy and a wider arc of rotation. We were able to close donor site primarily by undermining of the edges in defect size less than 10 cm. However in defects larger than 10 cm we had to use small split skin grafts. We encountered Scar issues



Figure 1:A man of 42 years presented with squamous cell cancer of cheek. Pedicle flap done. after inseting



Figure 2:Supraclavicular FLAP used after post-burn neck contracture release

in few cases at donor-site like widening of scar, hypertrophic scarring and contour irregularity. In hypertrophic scarring we used pressure garment and silicone gel sheeting. Contour irregularity occurred in the same patient who had bulky flap appearance in front of the neck. Our experience regarding donor site closure shows that width of donor-site was not the only factor affecting donor-site closure. The circumference of shoulder and arm, and the bulk and pliability of the surrounding skin were found to be other factors affecting primary closure achievement. The more the circumference, the more the pliability and the thicker the surrounding edges the easier it was to get primary closure and vice versa. The patients requiring split skin grafts for donor-site closure in our study were either young or thin lean with small circumference shoulders and arms or had scarred surrounding skin or had a combination of these factors. The average hospital stay in our study was 7.3 days which is similar to that reported by Rashid et al. and Di Benedetto et al.^{6,21} Each patient was followed up for a period of at least six months. Chaudhry et al. have also presented their results after a follow-up of six months.²⁴ Follow-up period of some of other studies ranges from 1 to 4 years.^{6,18,19}

Flap was used both as a pedicle flap or as island flap and found it easy to learn and execute. Flap was successfully elevated up to zygomatic arch as in literature. Alves HR used this flap even above the zygomatic arch however we had yet to experience that.²⁰ Functional and aesthetic restorations were recorded at one, three and six months follow up. With the passage of time, a progressive improvement in the range of motion in reconstructed areas like neck, cheek, chin and oral cavity was observed. These results are comparable to those reported by Rashid et al.⁶ They used Watusi splint in all of their cases for postoperative stretching of the flap. They followed-up their patients at 3, 6 and 12 months, measured the width of the flap at each follow-up and found an average of 63% increase in width at one year. Instead of Watusi splint, we relied on Philadelphia neck collar for three months and stretching exercises for up to six months. Significant improvement in the range of motion in all the reconstructed areas was seen with the passage of time.

Just like the gradual improvement seen in function, the aesthetic appearance also kept on improving with the passage of time comparable to those reported by Di Benedetto et al. and Chaudhry et al.^{19,21} Predictable anatomy is a major advantage of this flap. Flap can be used both as pedicled or as an island flap with wider

arc of rotation. It can be tunneled giving a very good aesthetic result. It is possible to close the donor site primarily thus reducing the morbidity associated with a graft. There are advantages of using a local flap compared with free flap, such as better circulation, shorter operating time (approximately 2 hrs in this study), and better color and texture match.

Conclusion

1. Supraclavicular artery flap can be considered as a reconstructive technique of choice for medium to large defects of the cervico-facial region with reach up to zygomatic arch and may be used both islanded and pedicled.
2. Supra-clavicular flap is reliable, thin and pliable fasciocutaneous flap, and expands significantly postoperatively. We found it easy to learn, quick to perform and very reliable with limited donor site problems.

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