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RESEARCH ARTICLE

SUPRACLAVICULAR ARTERY FLAP: A SAFE, VERSATILE AND A RELIABLE FLAP “A NEW WORKHORSE” IN HEAD AND NECK RECONSTRUCTION; OUR CLINICAL EXPERIENCE

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Abstract

Background: Anterior cervical contractures of the neck represent a great challenge for plastic and reconstructive surgeons. Necks can be reconstructed with a wide range of surgical techniques. The supraclavicular flap is easy to harvest without the need for free tissue transfer. It provides a relatively large flap for neck resurfacing with tissue very similar to that of the neck.

Material and Methods: This study was carried out in the Plastic Surgery Department of GMC Srinagar between November 2015 and October 2019. It involved 50 patients (40 females and 10 males), in whom supraclavicular artery flap was done to reconstruct head and neck. Follow-up period ranged from 2-27 months (average 12.3). **Results:** The study involved 50 patients. Mean age was 26.5 years (range 57-12 years). Thirty five patients had post-burn neck contractures, five patients had portwine stain face, three had marjolin ulcer, four patients had post traumatic and three had post bear maul defect. We harvested unilateral flaps in all of patients. In thirty five patients the flap was pedicled, three had adipofascial pedicle and twelve were islanded. The size of the reconstructed defect ranged from 23x10 to 14x6, and the size of the flap varied from 16x7cm to 25x11. Mean length was 21.7 cm. We used a partial thickness skin graft for donor site closure in 41 cases and closed primarily in 9 cases. Flap was used to resurface neck in 35 patients, face resurfacing in 10 patients, as intraoral lining in 3 patients. The following complications occurred: hematoma in 3 cases, partial distal necrosis in 2 cases, and donor site graft loss in 3 cases. Follow-up period ranged from 2-27 months

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 constitutes an alternative to local flaps, while providing equivalent functional results, and must be an integral part of the head and neck reconstructive surgeons' therapeutic armamentarium.

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Introduction:-

The anterior neck is a very difficult area to reconstruct because the neck connects the head to the body with multidirectional and complex motility. Therefore, post-burn neck contractures and post tumor excisional soft tissue defects of the neck represent a great challenge for plastic and reconstructive surgeons. Anterior cervical contractures are characterized by restrictions in range of neck motion, especially extension. Moreover, patients with soft tissue defects of the neck require reliable local, regional or free flaps to reconstruct both form and function.¹ The necks of these patients can be reconstructed with a wide range of surgical techniques, including local flaps, regional flaps, free flaps,² pre-expanded flaps,³ and perforator flaps.⁴ Among the different options available, the supraclavicular artery flap is excellent option, as it is similar in colour, thickness and texture to the recipient area, and the operative technique is simple. In the past decade, this flap has been widely used and discussed.⁵ Anatomical studies supporting it have been performed.⁶ The pre-expanded flap⁷ and bilobed flap versions⁸ have been developed. Moreover, a new subtype based on the anterior supraclavicular artery perforator flap has been harvested with satisfactory results.⁹ In 2009, Vinh et al. reported a high survival rate in a large series study of supraclavicular flaps used specifically to treat neck contractures.¹⁰ Therefore, the pedicled or islanded supraclavicular fasciocutaneous flap provides thin, pliable, well-vascularized tissue with an excellent match in terms of skin colour and texture, and is ideal for replacing external skin losses in neck reconstruction.¹¹ In the current study we aim to present our clinical experience of using the supraclavicular flap for head and neck reconstruction.

Anatomical Basis of Flap:

The supraclavicular artery 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 suprascapular artery in 7% of cases¹². 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 overlying 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. The artery arises 3 cm above the clavicle at a distance of about 8 cm from the sternoclavicular junction and about 2 cm from the sternocleidomastoid muscle. The supraclavicular artery anastomoses distally to branches of the posterior circumflex humeral artery, allowing the skin paddle to be extended from the supra-clavicular region to the lateral surface of the shoulder, beyond the deltoid muscle insertion. Two venae 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.^{13,14}

Material and Methods:-

This study was carried out in the Plastic Surgery Department of GMC Srinagar between November 2015 and October 2019. It involved 50 patients (40 females and 10 males), in whom supraclavicular artery flap was done to reconstruct soft tissue defects of varied etiology in head and neck region. Follow-up period ranged from 2-27 months (average 12.3). The following absolute and relative exclusion criteria were considered in the study. Absolute criteria: patient not fit for surgery, burnt donor site, previous block dissection of the neck or previous neck irradiation. Relative criteria: smokers and diabetic patients. The smokers were supposed to stop smoking at least one month before the procedure and diabetic patients were ensured to have good diabetic control before the procedure.

Results:-

The study involved 50 patients (40 females and 10 males). Mean age was 26.5 years (range 12-57 years). Thirty five patients had post-burn neck contractures, five patients had portwine stain face, three had marjolin ulcer, four patients had post traumatic and three had post bear maul defect (Table1).

Etiology	No of patients	Percentage
PBC neck	35	70 %
Portwine stain	5	10 %
Trauma	4	8 %
Marjolin ulcer	3	6 %
Bear Maul	3	6 %

Total	50	100 %
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Table 1:- Etiology.

In thirty five patients the flap was pedicled, three had adipofascial pedicle and twelve were islanded. The size of the reconstructed defect ranged from 14x6 to 23x10cm, and the size of the flap varied from 16/7 to 25/11cm. We harvested flaps of various lengths according to the size of defects after excision of cicatrizing tissue. Flap length ranged from a minimum of 16 cm to a maximum of 25 cm. Mean length was 21.7 cm. Flap was used to resurface neck in 35 patients, face resurfacing in 5 patients, as intraoral lining in 3 patients (Table 2).

Table 2:- Usage of flap.

Flap usage	No of patients	Percentage
Neck	35	70%
Face	10	20%
Intra oral lining	3	6%
Temporal fossa	1	2%
Nasal reconstruction	1	2%
Total	50	100%

In 9 patients (18%) donor site was closed primarily with no need for skin graft, and in 41 patients (82%) donor site was closed with partial thickness skin graft. The following complications occurred: hematoma in 3 cases, partial distal necrosis in 2 cases, and donor site graft loss in 3 cases (Table 3). Follow-up period ranged from 27-2 months (average 12.3).

Table 3:- Complications.

Complications	No of patients	Percentage
Haematoma	2	4 %
Distal flap necrosis	2	4 %
Partial donor site graft loss	3	6 %
Total	7	14 %

Surgical technique:

The patient lay in a supine position with pillows under the donor shoulder for proper exposure. The entire upper limb was abducted to 90 degrees on a small table beside the patient. All the patients had general anaesthesia. Anaesthesiologists gave special consideration to intubation. In the event of difficult intubation due to severe neck contracture, anaesthesiologists used laryngeal masks, and fiberoptic laryngoscopy. The neck and the entire arm and hand were sterilized with povidine iodine solution. Skin incision was started on the distal part of the flap, reaching to the subfascial plain. Dissection of the flap proceeded in the same plain from distal to proximal toward the pedicle using electrocautery. Also, sutures were placed to keep the fascia and the dermis together. Once we were in the vicinity of the pedicle, we switched to blunt dissection to avoid injuring the pedicle. In post-burn contracture cases, the entire cicatrix was excised, maximum extension was obtained, and haemostasis was then done very carefully. At the flap inset stage, the flap was rotated medially. After the flap was inset, the wound was closed in two layers; the subcutaneous one was secured with absorbable suture (polyglactin 2/0) and the skin secured with a non-absorbable one (polypropylene 4/0).

Postoperative Period:

All the patients lay with their heads semi-flexed to prevent severe extension or flexion, and prevent the pedicle from being severely stretched or kinked in the recovery room. The patients continued to receive IV antibiotics for 7-10 days. The flap was monitored after the procedure: every 4 hours on the first day, then every 12 hours over the following days to assess temperature, colour, capillary refilling, pin-prick test, firmness, possible hematomas, drains, the patient's general condition, position and airway. The drain was removed after 48 hours. The patients were discharged 10 to 14 days postoperatively and pedicle was detached after three weeks in patients with pedicled flap and followed-up at regular intervals. The patients were followed regarding full range of movement, delayed complications, aesthetic appearance and patient satisfaction.

Secondary procedures:

Secondary procedures included those simple procedures done during follow up to obtain maximum results patients operated for PBC neck. Flap thinning was done in twenty five patients, to improve cosmetic out come. Z-plasty was performed in four cases that developed a small contracture band at the edge of the flap. The procedure was simple and the cases were discharged the following day. Dog-ears were excised in four cases with pedicled flaps. This was done three months after the procedure when flap vascularity had been established. This too was a very simple procedure, and the patients were discharged the following day.

Discussion:-

Reconstruction of the soft tissue defects of the head and neck is often complex and requires the use of local, regional or free flaps to ensure anatomical, functional and cosmetic rehabilitation. 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 like Pectoralis Major (PMMC) are difficult to position in certain sites (e.g. oropharynx). Sacrifice of a muscle at the donor site is associated with morbidity. Microanastomosed fasciocutaneous flaps (radial forearm flap, anterolateral thigh flap) provide thin, flexible, well vascularized tissue to cover large defects. However, not all patients are ideal for this long surgery, which requires an experienced multidisciplinary team. In these difficult cases, regional flaps remain the reference technique and the supraclavicular artery flap is an ideal solution for these patients, as it is a reliable flap with a constant vascular pedicle. In a series of 349 supraclavicular artery flaps, the complete necrosis rate was 1.4% and the partial necrosis rate was 6.9%¹⁵. The supraclavicular flap is considered the 'workhorse' of local neck reconstruction flaps due to a number of reasons, namely quick and easy harvesting technique, close match as regards texture and colour of neck skin, a very wide arc of rotation and relatively long pedicle if designed as an island flap, allowing nearly all of the flap surface area to be settled in relatively large defects. Also, its pivot point is just adjacent to the neck, allowing more utilization of the whole flap surface area unlike other local flaps like deltopectoral or trapezius flaps. It has more simple surveillance after the procedure regarding free tissue transfer. Its donor site over the shoulder can be well hidden. In our study, flap length ranged from a minimum of 16 cm to a maximum of 25 cm, with a mean of 21.7 cm. This result is very similar to that of Loghmani et al. Their clinical series was on ¹⁸ patients with post-burn neck contracture. Maximum length was 24 cm and minimum was 16 cm, with a mean of 21.2 cm.¹⁶ In 2012, Balakrishnan and Sivarajan conducted 16 cases of supraclavicular flap for release of neck contractures. Mean length of their flaps as 22.7 cm. The difference comes from harvesting flaps of up to 33 and even 35 cm without complications.¹⁷ In the current study, minimum width was 7 cm and maximum was 11 cm, with a mean width of 9.7. This coincides with a mean width of 10.1 cm in the Loghmani et al.³¹ study. Vinh et al. reported a similar result, with a maximum width of 11 cm. On the other hand, Balakrishnan and Sivarajan reported a much wider range of flap width, up to 27 cm with a mean width of 21.8 cm. They think that the reason for this is recruitment of the external jugular vein and middle supraclavicular nerve in the flap.³² Flap width is extremely important to regaining both function and aesthetic appearance through neck resurfacing with a relatively wide flap. In other words, besides a free flap, e.g. a free anterolateral thigh flap, only a supraclavicular flap of such width can be used as a local resurfacing flap. This is due to its reasonable width that is used to completely fill the neck defect, i.e. no part is consumed in the rotation arc as its pivot point is just adjacent to the neck. Survival rate in our study was 100% (50 cases). Balakrishnan and Sivarajan reported a 100% survival rate,¹⁷ whereas Loghmani et al. reported a 96.9% survival rate.¹⁶ That is what Sadu et al. explained in their study, confirming that when the flap can be settled well in the defect without tension, it is advisable to leave a cuff of soft tissue around the pedicle.¹⁸ So, as a golden rule, stop any further dissection once you reach the defect comfortably with the harvested flap. In our study complication rate was 14%. We reported that hematoma in 2 cases (4 %), partial distal necrosis in 2 cases (4%), and donor site graft loss in 3 cases (6%). All our cases were managed conservatively, hematomas were immediately drained. The flaps with partial distal necrosis were debrided and healed with dressings, patients with partial donor site graft loss were managed conservatively. Vinh et al.¹⁰ reported 3.9% distal superficial necrosis, whereas Loghmani et al.¹⁶ and Balakrishnan and Sivarajan¹⁸ reported 6.3% (1 case) and 9.3% (3 cases) respectively.

Conclusion:-

The supraclavicular artery island flap is safe, simple, reliable and versatile fasciocutaneous flap that is easily and rapidly harvested. It has a reliable vascular pedicle that can be even islanded with minimal donor site morbidity. It has become a new workhorse and a safe alternative to many local flaps for Head and Neck reconstruction, for soft

tissue defects of varied etiology. It provides excellent functional and cosmetic results and must be an integral part of the head and neck reconstructive surgeons' therapeutic armamentarium.



A young girl with post burn deformity face



Intraoperative picture of SCA Flap



Post-operative profile of patient after three months

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