EXTENDED SUPRACLAVICULAR ARTERY FLAP EXPLORING THE UNEXPLORED

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ABSTRACT

Objective: *To evaluate the role of an extended version of a supraclavicular flap in the reconstruction of head and neck defects.*

Materials and Methods: *This quasi-experimental study was conducted at the Plastic and Reconstructive Surgery Unit, Hayatabad Medical Complex, Peshawar, from January 2013 to December 2018. A total of 210 patients underwent reconstruction of the head& neck region. Extended supraclavicular artery flap was performed in all the patients who had soft tissue defects of the head &neck region resulting either from trauma, tumor excision, post-burn scarring or radio-necrosis. Patients with trauma to the root of the neck or those planned for neck dissection were excluded from the study. Hand-held Doppler was used for the identification of the supraclavicular artery and the flap markings made subsequently. After the flap design, it was dissected, elevated and set into the defect as an interpolation flap. After two weeks, the flap division was performed in the second stage, and the patients were kept in regular follow up to check the flap performance.*

Results: *There were 210 patients including 126 males and 84 females. The age of the patients ranged from 16 to 74 years, and the mean age was 42 years. There were 90 cases of post-burn deformities (42.85%), 74 cases of trauma (35.23%), 42cases of tumor resection(20%), 03 cases of radionecrosis (1.42%) and one case of hemifacial atrophy (0.47%). In 108patients (51.42%), the extended supraclavicular flap was used for defects of the upper and middle thirds of the face. The flap was used for lower face reconstruction in 62(29.52%) cases and neck reconstruction in 40(19.04%)patients. In all the cases, the flap was used as an interpolation flap. There was complete flap necrosis in one case, distal flap necrosis in four cases, and donor site dehiscence in three cases.*

Conclusion: *Extended Supraclavicular Flap is a reliable and versatile flap for soft tissue reconstruction of the head and neck region. The advantages are short operative time, short learning curve, minimal rates of failure and lesser donor site morbidity.*

Keywords: *Supraclavicular artery flap, head and neck reconstruction, facial reconstruction.*

INTRODUCTION

One of the primary goals of facial reconstructive surgery is the restoration of facial structures and function as close to normal as possible. The facial anatomy is particularly challenging for surgeons to reconstruct. To satisfy the patient's needs and to save time and resources, new ways are continuously explored by the researchers. Different methods, including grafts, local flaps, pedicle flaps, and microvascular free tissue transfer, are used in the reconstruction of face.[1] Although grafting is indicated in acute burns of face and neck, but their use is avoided in some instances due to the complications associated with the procedure of grafting.[2] Local flaps are ideal for use in the face region, but they cannot be used for more significant defects. Fasciocutaneous and musculocutaneouspedicle flaps are used in the head and neck region but according to Gillies principle of "like for like," the fasciocutaneous supraclavicular artery

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flap provides the ideal color, texture and bulk.[3-6]

The Reconstruction of head and neck defects is demanding and challenging for reconstructive surgeons. Much work has been carried out in designing appropriate flaps for head and neck reconstruction. The pectoralis major myocutaneous flap has been widely utilized in head and neck reconstruction and has been acknowledged as the workhorse of pedicled flaps in head and neck reconstruction.[3] In the present world where the free flaps have taken over, the pectoralis flap is still used as a workhorse for head and neck reconstruction procedures. However, certain complications like flap necrosis, suture line dehiscence, fistula formation, and hematoma formation are associated with the procedure of pectoralis major myocutaneousflap.[7] The massive bulk of the flap does not offer optimal results, which can be achieved only with a fasciocutaneousflap.[8]

The Supraclavicular flap, also known as the acromial flap and cervico-humoral flap, is based on the supraclavicular artery, which arises from the transverse cervical artery. The supraclavicular artery originates from the superficial branch of the transverse cervical artery and runs posteriorly and laterally over the surface of the trapezius and the acromial end of the clavicle, after which it penetrates the deep fascia and supplies the skin and subcutaneous tissue of the supraclavicular and shoulder region.[9] The supraclavicular artery further divides into two branches. A deltoid branch that supplies the acromial region and a thoracic branch that supplies the anterior thoracic region.[10] Based on the thoracic branch, the supraclavicular flap can be extended into the pectoral region. In a study regarding the anatomy of the supraclavicular area, it was found that at least four perforators were present in the supraclavicular area coming from the transverse cervical artery and venous perforators drain into superficial venous plexus. In the extended version, the distal portion of the extended supraclavicular flap is perfused through the cutaneous feeding vessels and perforator vessels of transverse cervical artery.[11] Supraclavicular artery flap is now commonly used in tumor cases and burns patients.[3,12,13] Some studies have shown that supraclavicular artery flap can also be used as a free flap.[14] Although its use as a free flap is still in infancy, it demonstrates the reliability of this flap and greater use of this flap in the future.

This study aimed to re-evaluate the role of the supraclavicular flap in the reconstruction of the head and neck by attempting a new extended version of the flap.

MATERIALS AND METHODS

This quasi-experimental study was performed over six years from January 2013 to December 2018 at the Plastic and Reconstructive Surgery Unit, Hayatabad Medical Complex, Peshawar. A total of 210 patients were included in the study. The patients having soft tissue defects of the head and neck region that required coverage were included in the study. Soft tissue defects arose from trauma, after tumor excision, burns, and post burn scarring and radionecrosis. Patients with penetrating trauma to the neck and those who were planned for neck dissection were excluded from the study.

The patients planned for surgery were admitted to the hospital. Detailed history, complete clinical examination, and necessary investigations were performed. Patients were counseled about the procedure, its purpose with risks and benefits. Informed consent was taken from all the selected patients. Identification of the supraclavicular vessels was performed with the help of hand held Doppler preoperatively. The first stage of flap dissection and inset were performed under general anesthesia, whereas, in the second stage, the flap divisions were performed under local anesthesia as day case surgery.

Flap Dissection and insetting

Stage 1:

In the first stage, the modified version of the traditionally used supraclavicular flap was used. This variant of the supraclavicular flap was named as Extended Supraclavicular Artery Flap (ESAF).In this variant, the flap skin and fascia over the shoulder; up to the level of the insertion of deltoid muscle was elevated to increase the dimensions of the flap. Incisions were made over the markings of the flap. Conventionally this flap is elevated from distal to the proximal end. We elevated the flap anteroposteriorly which markedly reduced the operating time of this procedure. The extended version of the supraclavicular artery flap, combined with interpolation of the flap, provided the room for manipulating the flap according to the requirements of the patients. The donor area was closed primarily in 126 cases whereas

split-thickness skin graft was applied in 84 cases. The first stage of the procedure was performed under general anesthesia and took 35 minutes on average.

Stage 2:

In young and healthy patients, the flap division was done on the fifteenth day. In patients with co-morbid conditions and osteoradionecrosis, the flap division was done on the twentieth day. In the second stage, pedicle division and flap in-setting were done. The second stage was done under local anesthesia, and the procedure took 20 minutes on average. SPSS version 20 was used for data analysis.

RESULTS

A total of 210 patients, 126 (%) males and 84 (%) females; mean age 42 years, range 16 to 74 years were included in this study. Soft tissue defects of the head and neck resulted from trauma, tumor excision, post-burn neck contracture release, hemifacial atrophy, and defects after radiation therapy. The details of the etiology of soft tissue defects are given in table 1.

An extended Supraclavicular artery flap was done in 210 patients over six years. Trauma and burn injuries were unusually high. In 108 patients (51.42%), the extended supraclavicular flap was used for defects of the upper and middle thirds of the face. The flap was used for lower face reconstruction in 62(29.52%) cases and neck reconstruction in 40(19.04%) patients. In all the cases, the flap was interpolated. The flap quickly reached to cover the temple and part of the forehead. Tissue expander was used in 32(15.23%) cases where a considerable flap was needed. The donor area was primarily closed in 164 (78%) of cases, and a split-thickness skin graft was placed in 46(21.90%) of the cases. Operative time for the stage- 1 was 35 minutes on average and 20 minutes for stage 2 of the flap division.

Table 1:

Etiology	n	%
Post Burn Contractures	90	42.85
Trauma	74	35.23
Tumors	42	20.0
Radionecrosis	03	1.42
Hemifacial atrophy	01	0.47
Total	210	100

Table 2:

Complication	n	%
Complete flap necrosis	01	2.77
Distal flap necrosis	04	11.11
Wound dehiscence	03	8.33
Scar widening	28	77.77
Total	36	100

Certain complications were observed postoperatively. We encountered complete flap loss in one patient, and the reason was that the patient lied on the operated side. Distal flap necrosis occurred in four patients flap and advancement was done in these cases. Flap donor site dehiscence was observed in three cases, and the sites were later covered with skin grafts. Details of complications are given in table 2.

The patient's satisfaction regarding the outcome of the flap was excellent. Eleven patients were not comfortable with the interpolated flap; however, most patients took it as part of the treatment and were not anxious by the interpolation.

Case 1

A 68year old male with basal cell carcinoma of the left cheek extending to the left temple underwent tumor excision, and the resultant defect was 7cm × 10 cm. The soft-tissue defect was covered with extended supraclavicular artery flap (figure 1).

a) Pre-op b) Post-op stage 1 c) Post-op stage 2

Figure 1:

Case 2

A young 26-year-old female with firearm injury involving the left side of the face and left ear underwent extended supraclavicular flap to cover the defect (figure 2).

a) Pre op defect b) coverage with supraclavicular flap

Figure 2:

Case 3

A 16 one-year-old male with post-burn scarring of the face. Tissue expansion of the supraclavicular flap was performed, and the resultant defect after scar excision was covered with the expanded supraclavicular flap (figure 3).

a) Expanded supraclavicular flap b) Flap inset stage 1 c) post-op stage 2

Figure 3:

DISCUSSION

Patients with soft tissue defects of the head and neck region usually present to the plastic surgery units. The restoration of structure and function is challenging because of the prominence of the region. Greater care is also required to restore the cosmesis. Certain procedures that have been developed for the purpose include skin grafts, local flaps, regional flaps, distant and microvascular free flaps.[3,15] The quality of the tissue used for reconstruction is essential for achieving good anatomic and functional outcomes.[16] The regional flaps for head and neck reconstruction are acquired from the anterior and posterior thorax, shoulders and supraclavicular region.[17]

The proximity of the supraclavicular flap to the head and neck region makes it ideal for facial reconstruction.[18] Conventionally, the supraclavicular artery flap is not extended beyond the level of the belly of deltoid muscle.[19] With our extended flap and interpolation, we achieved two main advantages, i.e. decreased distal flap necrosis and increased the reach of the flap (even up to the temporal area). The reason being; when the flap is interpolated the pedicle is free and not strangulated by an artificially created tunnel. Hartman et al. advised to avoid tunneling the flap in order to prevent compression of the pedicle, which ultimately leads to flap necrosis.[20] Di Benedetto also used a facial pedicle to obtain more reliable blood supply for the flap.[21]

Free flaps are extensively used in head and neck reconstruction. The reason being their superior color match and ideal bulk.[14,22-24] However, as reconstructive surgery is growing both in volume and importance throughout the world, the availability of time and resources are becoming major limiting factors to do lengthy and expensive procedures. In most places, it is not feasible to drain the resources of the patient and healthcare facility on a procedure that has comparatively high costs(much more in case of failure). Therefore, it is imperative to explore more reliable options like supraclavicular artery flap.[25-26] In recent studies, it was concluded that the supraclavicular flap provides an excellent alternative to the microsurgical free flaps in the reconstruction of head and neck defect.[27,28]

The extended supraclavicular flap can replace the myocutaneous flaps in head and neck reconstruction. In pectoralis major myocutaneous flaps, the complication rate reported in the literature varies from 63 to 35%.[29,30] Extended supraclavicular artery flap is very useful in female patients. It avoids breast mutilation as in case of significant pectoralis flap and avoids a visible scar on the forearm (in case of radial forearm free flap). This flap can also be used reliably in oncologic cases of head and neck reconstruction and patients with co-morbidities.[4]

The color and texture of the supraclavicular skin are well suited for facial resurfacing, and the thickness of the flap is almost always consistent with the skin of the face. In lean patients, the flap is thin, and in obese patients, the flap is bulky, and the resurfaced area does not have any significant discrepancy. Studies done on the supraclavicular flap commend that it gives the right color and texture match.[3,26,31,32]

The two-staged extended supraclavicular flap had a combined operative time of 45 to 60 minutes on average. The average time for stage 1 surgery was 35 minutes. Stage 2 was done as a minor procedure after two weeks of the stage-1 in healthy patients and after three weeks in patients with co morbidities. Stage 2 procedure was performed using a local anesthetic for the division and adjustment of the flap.

Regarding the management of facial atrophies, so far, microvascular flaps have been the mainstay of treatment.[33] We have tried to show the use of extended supraclavicular flap as filler in one of the patients. We believe that further work with expanded flaps may one day obviate the need for microvascular reconstruction in these patients.

CONCLUSION

An extended supraclavicular flap is a reliable

option for the reconstruction of soft tissue defects of the head and neck region. It is a thinfasciocutaneous flap with good color and texture. The flap is easy to harvest, has short operative time, a short learning curve with lesser donor site morbidity.

The extended supraclavicular flap has greater reach and fewer complications when used as an interpolation flap. Color and texture of the skin are well suited for facial resurfacing, and the skin thickness of the flap is consistent with the skin of the face. The de-epithelialized version of this flap can also be used as a dermal filler in lipodystrophies. The results of extended supraclavicular artery flaps are comparable to that of the free flaps with short operative time and comparatively minimal rates of failure.

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