Original Research Article

Cervico-facial flap: a versatile option among various reconstructive options for skin defects in parotid surgery- our experience in a tertiary care center

Amritha Prabha, Garima Sarawgi*, Urvish Shah, Ganesh M. S., Abhinay Reddy, B. R. Keerthi, Hemanth G. N., Rahul Surapaneni, Khyati Melanta, Udayee Teja Bathala

Department of Surgical Oncology, Vydehi Institute of Medical Sciences and Research Center, Bengaluru, Karnataka, India

*Correspondence:
Dr. Garima Sarawgi,
E-mail: drgarima.sarawgi@gmail.com

ABSTRACT

Background: Cutaneous defects of the cheek and external ear present a reconstructive challenge. Even when free flap reconstructions and tissue transfer are commonly proposed, fewer patients with these malignancies are candidates for lengthy reconstructive surgery. The cost effectiveness, time consumption, long waiting period of head and neck malignancy patients and less availability of reconstruction teams in developing countries like India, are challenging factors.

Methods: In our study, retrospectively 46 cases operated for parotid neoplasm were identified and the operative reports were reviewed from September 2018 to April 2021. Data on patient demographics, pathological diagnosis, defect type, type of flap used, co-morbid disease, and smoking history was collected.

Results: The mean defect size was 4×5 cm, however for defects larger than 4×4 cm and lesser than 7 cm a cervico-facial flap was used for reconstruction. The average time for surgery was 2 and a half hours extra for the free flap reconstruction. Post-operative wound complications were higher in free flap reconstruction. Partial/DTN was observed in 16% patients and necrosis that needed intervention- 6% of all patients. Patients with cervico-facial flap reconstruction had an excellent final functional and cosmetic result, with good skin color and texture match.

Conclusions: The cervico-facial flap is a versatile technique with excellent vascularity and good esthetic outcome, which should be utilized liberally in the reconstruction of facial defects, slight modifications in the flap harvesting and careful selection of patient can give excellent results in moderate defects after parotid surgeries, especially in a resource limited country like India.

Keywords: Cervico-facial flap, Facial defect reconstruction, Parotid surgeries, Superficial and distal flap necrosis

INTRODUCTION

Cutaneous defects of the cheek and external ear present a reconstructive challenge. Even when free flap reconstructions and tissue transfer are commonly proposed for such defects, fewer patients with these malignancies are candidates for lengthy reconstructive surgery, more so ever the cost effectiveness, time consumption, long waiting period of head and neck malignancy patients and less availability of reconstruction teams in developing countries like India, are challenging factors. Esser first described the use of a cervico-facial advancement flap in head and neck surgery in 1918 and the technique has evolved considerably.[1] In patients with malignant lesions involving the cheek skin and/or external ear, mostly for parotid neoplasm, the cervico-facial flap can be used to

reconstruct the skin defects.[1,2] Evolution is mainly related to modification of incision sites and a deeper plane of dissection for raising the flap.[3]

The exposure required for elevation of this flap facilitates removal of the primary lesion, parotidectomy and or neck dissection, these rotation advancement flap reconstructions are best for smaller defects in a single-staged procedure, however for larger defects, other micro-vascular free flaps are better used.[5] Juri and Juri further refined these reconstructive methods by describing both up-ward advancement and forward rotation to cover cheek defects.[14]

In our study we describe our experience using a modified incision for the cervico-facial flap rotation for cheek defects with minimal tension of the defect closure in single staged procedure. We prefer all the dissections above the clavicle, limited to deeper subcutaneous planes alone, keeping in interest the safety of the neck vessels, preventing any exposure in case of infection or flap necrosis. Concern arises from these flaps due to their random blood supply, leading to distal edge necrosis due to extensive subcutaneous dissection and mobilization of the soft tissue.[1]

Here we describe patients operated for parotid neoplasm with cutaneous involvement, leading to parotid region or near external ear skin defects, reconstructed successfully with an anterior based cervico-facial flap with modification in the incision providing adequate oncology resection exposure, good defect coverage, leading to suitable cosmetic outcome.

METHODS

The study was undertaken after obtaining approval from the institute ethics committee. Convenience sampling method was used.

A retrospective study design was chosen, study done at Vydehi Institute of Medical Sciences, Bangalore. The study was conducted by department of surgical oncology from September 2018 to April 2021. Data on patient demographics, pathological diagnosis, defect type, type of flap used, co-morbid disease, and smoking history was collected. In our study, retrospectively 46 cases operated for Parotid neoplasm were identified and the operative reports were reviewed. The defects categorized and the pattern of reconstruction chosen based on the size of defect, site of defect, laxity of adjacent skin, pre-op margin assessment, extent and depth of normal vital structure involvement and the probable need of adjuvant treatment. Defect was closed by either primary closure, free flaps with micro vascular reconstruction, split skin grafts, local advancement and rotation flaps, pedicled PMMC flap or Cervico facial flap. Procedure was done for patients with parotid cancer involving the skin of cheek at parotid region or near external ear. The procedures were carried out under general anesthesia in all patients by the same team of

surgical oncologists and same micro-vascular reconstruction team, all patients underwent immediate reconstruction.

Inclusion criteria

All patients with parotid neoplasm, and a clearly defined defect size, flap design and reconstruction were included. The size of the defect was noted, and the location of the cheek defect was described prior to surgery.

Exclusion criteria

Any patients not fitting in inclusion criteria, patients not fit for general anesthesia, patients with extensive/metastatic disease.

RESULTS

The total number of operated parotid neoplasm cases included in our study was 46 (N=46). The defects in anterior cheek (N=15), posterior cheek and pre-auricular region (N=21), and lower lateral cheek and post auricular region (N=10) of the cheek resulted from excision of benign and malignant parotid neoplasm in 43 cases, with or without neck disease with skin involvement in seven patients, metastatic parotid tumor in two cases, patients not fit for general anesthesia in one case. The pattern of reconstruction was chosen based on the size of defect, site of defect, laxity of adjacent skin, pre-op margin assessment, extent and depth of normal vital structure involvement and the probable need of adjuvant treatment. The various reconstructions used were skin grafting, random local advancement and rotation flap (N=14), radial forearm free flap (N=5), antero-lateral thigh flap (ALT flap, N=4), pectoralis major myo-cutaneous flap (PMMC, N= 3) and cervico-facial flap or its variants (N=17). The mean defect size was 4×5 cm. For smaller defects, a local random mobilization of skin flap was used, however for defects larger than 4×4 cm and lesser than 7 cm a cervico-facial flap was used for reconstruction. For larger defects or deeper defects involving extensive neck dissection or bone resection a micro-vascular free flap or pedicle PMMC Flap was preferred. The average time for surgery was 2 and a half hours extra for the free flap reconstruction with respect to the other reconstruction flap modalities. Post-operative wound complications were higher in free flap reconstruction namely flap necrosis, wound infection and need for debridement and re surgery.

In our study the superficial marginal flap necrosis was observed in 5 of 46 patients (10%), only one of this (Distal Tip necrosis) DTN needed further management. Histology diagnosis included low grade mucoepidermoid carcinoma (11 cases), pleomorphic salivary adenoma (21 cases), lymphoepithelial tumor (1 case), adenoid cystic carcinoma (2 cases), Warthins tumor (3 cases), others (acinic cell carcinoma, high grade muco-epidermmoid carcinoma, metastatic carcinoma, myoepithelial tumor, 8 cases). The size of the defects ranged from 3×3 cm to 10×12 cm.

Twelve patients underwent simultaneous parotidectomy and/or neck dissection (N=12). 8 of the patients with total parotidectomy also had facial reanimation procedure (tarsoraphy) after sacrifice of the facial nerve (or its branches) for tumor clearance. Five of the patients underwent salvage procedure for parotid tumor recurrence after previous primary parotid surgery.

Post op hospital stay was 4-5 days for patients with local flaps and 7-10 days for patients with free flap reconstruction. The wound healed spontaneously over 3 weeks. Eight of the patients received postoperative adjuvant radiotherapy to the primary site and/or parotid bed and neck. Superficial marginal or partial flap necrosis occurred in 5 of the 31 patients who underwent cervico-facial or local advancement flap reconstruction. A mild degree of contour deficiency was noted in two patients. In two of these patients the necrotic distal flap tissue was debrided, one needed secondary suturing. Wound infection was there in 6 patients that were dealt with regular dressings and antibiotics in accordance with the pus culture sensitivity findings. Patients received post-operative adjuvant radiotherapy for unfavorable histology, findings like high grade Mucoepidermoid histology, Adenoid cystic histology perineural involvement, lymphatic infiltration, extra-capsular nodal spread, and multiple nodal involvements without deleterious effect to the flaps. The mean follow-up was 06 months (0 to 24 months). One of the 46 study patients died from the neck recurrence disease 17 months after further wide local excision and radical neck dissection. Another patient with recurrent high-grade tumor who underwent, total parotidectomy, and antero-lateral thigh micro-vascular free flap repair followed by adjuvant radiotherapy required a modified radical neck dissection for cervical lymph node metastases, was lost to follow up after 15 months until when he remained free of disease. The posterior part of scar was well merged with the hairline of patient and cervical portion of scar covered by clothing, externally no visible surgical scar was there in any of the patients with cervico facial flap reconstruction. All the patients had an excellent final functional and cosmetic result, with good skin color and texture match.

DISCUSSION

The cervico-facial flap is a versatile, easily applicable flap for covering skin defect in the parotid region. The blood supply to the flap is random, because it is elevated just below the subcutaneous layer. Owing to the random nature, there is a risk for compromised viability of the distal aspect of the flap. A preliminary report of an early experience using a deep-plane cervico-facial flap in five patients described one case of distal flap necrosis.[4] The report suggested that a dissection deep to the superficial musculo-aponeurotic system (SMAS) and the platysma muscle might improve flap survival.[3]

The arterial perforators to the platysma muscle originate in collaterals of the external carotid and subclavian arteries,

the occipital artery in the posterior aspect, the facial artery (sub-mental branch) in the superior and medial section, the superior thyroid in the midsection, and the thyrocervical trunk in the inferior section of the muscle.[7] By elevating the cervico-facial flap in a posterior and inferior based fashion, most of the perforators originating from the external carotid artery are transected; therefore, most of the contribution of the arterial blood supply originates from the thyro-cervical trunk and the random blood vessels from the anterior and inferior based subcutaneous plexus.[7]

Whetzel and Stevenson challenged the concept of additional blood supply to the flap by incorporation of the superficial musculo aponeurotic system (SMAS).[5] In his description of the vascular anatomy of the cervico-pectoral skin flap to the cheek, Becker noted that the skin flap was analogous to the familiar delto-pectoral flap of Bakamjian, with a blood supply from the internal thoracic artery perforators to the chest portion of the flap.[2] He speculated about nourishment from the platysma musculo-cutaneous perforators as well.[2,5] The idea of a platysma musculo-aponeurotic cutaneous randomized rotation flap brought a fresh perspective and a new insight to the skin defects that would otherwise need major micro-vascular reconstruction techniques.

The accumulated data suggest that the flap can be elevated with or without the superficial musculo-aponeurotic system.[10-12] The incorporation of the platysma is likely to contribute to the vascularity of the cervical skin and may decrease the risk for distal ischemia and necrosis. The venous drainage of the flap drains predominantly to the anterior jugular vein, external jugular vein when include with the flap, maintains patency of the proximal aspect of the vessel to avoid venous congestion.

Literature gives an extensive and diversified school of thought on various options on flap design. The first consideration in flap design is the location, shape, and extension of the defect to be reconstructed.[17-21] Horizontal defects of the cheek can be addressed by subcutaneous dissection of the cervical skin and consequent advancement of the resulting flap.[22,23] Small anterior and posterior defects can be corrected by mid line forehead flaps or by local skin advancement or rotation flaps from the remaining facial skin or from the sub-mental or sub-mandibular regions.[21-25] The bi-lobed cervico-facial flap has the advantage of using the retro-auricular and the pre-auricular skin, with the ability to cover defects 3 to 4 cm in diameter.[24]

In one study the authors described that for large defects of the cheek up to 10 cm in diameter, the flap is extended into the cervical and thoracic regions.[16] The incision follows the occipital hairline and should continue through a virtual line located about 2 cm posterior to the anterior border of the trapezius muscle. After passing the acromio-clavicular joint, the incision turns vertically along the axillary fold and then follows the lateral border of the pectoralis major muscle.[5,7,21-24] Previous reports have described a horizontal

or curvilinear release incision 2 to 3 cm above the nipple.[6] In one of the studies, an inframamary incision allowed for the same rotation pattern of the flap and offers a viable cosmetic outcome for reconstruction of men and women.[7,15] The dissection of the thoracic portion should include the fascia of the pectoralis major muscle, incorporating the internal mammary perforators to the muscle through an intact subcutaneous plexus.[24-26] The elevation of the cervical aspect of the flap should include the platysma muscle. If possible, the facial artery blood supply through its sub mental branch should be preserved. Care should be taken to avoid damage to the cervical and mandibular branches of the facial nerve.[1,3,17-22] As mentioned previously within the section on vascular supply, the advantage or disadvantage of incorporating the SMAS to the facial aspect of the flap lacks scientific anatomic basis.[16,21]

After the flap is elevated and rotated, a resulting skin defect is likely to be present in the donor site. In a bi-loped posterior based flap, the defect may be present in the retro-auricular area. In an extended thoraco-cervico-facial flap, the donor defect is usually in the chest. In most cases, undermining of the surrounding tissue allows for primary closure. Dog-ears can be excised primarily or secondarily, depending on the risk to the flap blood supply and later secondary tissue requirements.[7]

In our study medical charts were reviewed for patient demographic information, pathologic diagnosis, defect type, type of flap used, co-morbid disease, and smoking history. Surgical procedure conducted, type of reconstruction method used, post-op complications, treatment with adjuvant radio-therapy, long term outcomes with respect to cosmesis, oncological safety, outcome were noted. Length of operation and post-operative complications affecting cost were also noted. When possible, photographs taken at the time of surgery and during post-operative visits were reviewed. Table 1 contains the relevant collected data.

The institutional review board approved the study. Based on our experience with the flap patterns, with reference to the location and extent of parotid neoplasm the size of the defect was noted, and the location of the cheek defect was described prior to surgery. The laxity of skin in operative area and cervical region was also noted. Chin and antero-inferior cheek defects were not reconstructed with local advancement cervico-facial falp, owing to a unique challenge because of its proximity to nearby vital structures and the need of greater mobilization of a posterior based flap that would need donor site defect closure or extension of the flap to thoracic region.[11,12,15,18]

Inappropriate flap selection in this region and reconstruction can cause ectropion, flap tip necrosis and hence significant aesthetic and functional problems.[12,15] Smaller and posterior parotid region defects provide the best opportunity for direct closure, especially in elderly patients. Smaller pre-auricular and post-auricular sub-

mandibular adjacent defects were reconstructed mainly with the cervical (platysmal) portion of the cervicofacial flap. The flap design for this region was named after Mustarde, also called the Mustarde flap, as described originally by the author in one of his articles.[10] The cervico-facial reconstruction was with an anterior or posterior based cervico-facial flap was best used for defects in the aforementioned region. The design of the cervico-facial flap was modified based on the location and size of the defect.

Patients who underwent micro-vascular free tissue transfer reconstruction, underwent no primary reconstruction, or were reconstructed solely with skin grafts were also included in this study, to compare the outcomes.

Figure 1: Parotid lesion involving skin 4*5 cm.

Figure 2: Post surgical scar with cervicofacial reconstruction.

Figure 3: Cervico-facial reconstruction with donor site split thickness skin graft cover.

Figure 4: Cervicofacial flap showing DTN.

Table 2 compares the patient factors and complication rates, based on the review of published literature. Flap necrosis namely distal tip necrosis rate is between 3% and 27%. In our study the superficial marginal flap necrosis was observed in 5 of 46 patients (10%), only one of this needed further management. Jacono reported the largest series where patients had 27% wound complication as distal tip necrosis.[23]

Jacono and colleagues demonstrated in their study that incorporating the SMAS for patients with risk factors such as smoking or irradiation histories reduce the risk of distal tip necrosis, when compared to a simple cervico-facial superficial flap reconstruction.[23] In addition significant associations between the distal tip necrosis and larger defect size and hence flap mobilization was also noted in 4 of these studies.[17-25]

Published studies have found relatively low incidence rates of facial injury and only a few advanced cases that may require nerve sacrifice for clear margins. Otherwise experienced surgeons usually conduct surgeries, who may lead to a more favorable outcome, as shown in these studies and when facial injury occurs, it is usually transient.[27]

Table 1: Patients in our study.

Age (years)	Sex	Diagnosis	Surgery done	Defect size (cm)	Reconstruction	Complaints	Post-OP RT	Follow up (months)
29	M	Low Gr Mucoepidermoid	Lt total conservative parotidectomy	10×10	Thoraco cervico facial	Superficial marginal flap necrosis	No	24
49	M	Pleomorphic salivary adenoma	Superficial parotidectomy	6×6	Radial forearm free flap	-	No	20
15	F	Pleomorphic salivary adenoma	Superficial parotidectomy	7×6	Cervico facial	-	No	23
55	M	Recurrent PSA	Total conservative parotidectomy		Cervico facial	-	No	18
32	F	Pleomorphic salivary adenoma	Superficial parotidectomy	5×4	Local advancement	Wound infection	No	24
52	M	Pleomorphic salivary adenoma	Superficial parotidectomy	4×4	Cervico facial	-	No	18
52	F	Low Gr Mucoepidermoid	Total conservative parotidectomy	5×5	Cervico facial + Split thickness skin grafti	Lower eyelid ectropion	No	15
42	F	Pleomorphic salivary adenoma	Superficial parotidectomy	4×4	Cervico facial	-	No	12
41	M	Lymphoepithelial tumor	Total conservative parotidectomy	4×4	Cervico facial	-	No	12
47	M	Adenoid Cystic Carcinoma	Total parotidectomy+ SOHND+Tarsoraphy	6×7	Radial forearm free flap	-	Yes	10

Continued.

Age (years)	Sex	Diagnosis	Surgery done	Defect size (cm)	Reconstruction	Complaints	Post-OP RT	Follow up (months)
24	M	High Gr Mucoepidermoid Ca	Total parotidectomy+ Hemi-mandibulect-omy	8×7	PMMC flap	Wound infection	Yes	24
37	M	Pleomorphic salivary adenoma	Superficial parotidectomy	4×4	Skin grafting	-	No	18
17	F	Low Gr Mucoepidermoid Ca	Total conservative parotidectomy	5×5	Cervico facial+Split thickness skin grafti	-	No	22
58	M	Pleomorphic salivary adenoma	Superficial parotidectomy	3×3	Local advancement	-	No	18
20	M	Warthins tumor	Superficial parotidectomy	5×4	Cervico facial+Split thickness skin grafting	Skin grafting infection	No	20
66	F	Recurrent MECa	RT total parotidectomy+ FND+Tarsor-aphy	10×12	ALT free flap	Flap necrosis. cervical lymph nodal metastasis, re-surgery.	Yes	15 months then loss to follow up.
40	F	Low Gr Mucoepidermoid	Superficial parotidectomy	3×3	Local advancement	-	No	12
38	F	Pleomorphic salivary adenoma	Total conservative parotidectomy 10	10×8	ALT free FLAP	Wound infection	No	9
25	M	Pleomorphic salivary adenoma	Superficial parotidectomy	4×4	Local advancement and rotation flap	-	No	16
80	F	Recurrent PSA	Total conservative parotidectomy	3×4	Cervico facial	Wound infection	No	16
60	M	High Gr Mucoepidermoid Ca	Total parotidectomy+ SOHND+Tarso raphy	5×4	Cervico facial+Split thickness skin grafti	-	Yes	13
52	F	Warthins tumor	Superficial parotidectomy+ FND	7×8	Radial forearm free flap	-	No	8
46	F	Pleomorphic salivary adenoma	Superficial parotidectomy	4×3	Local advancement	-	No	21
67	F	Low Gr Mucoepidermoid Ca	Total conservative parotidectomy	5×6	Local advancement and rotation flap	-	No	9
63	M	Malignant mixed parotid tumor	Total parotidectomy+ SOHND+Tars-oraphy	10×10	ALT free flap	Marginal flap necrosis	No	15
65	F	Pleomorphic salivary adenoma	Superficial parotidectomy	4×4	Local advancement	-	No	20

Continued.

Age (years)	Sex	Diagnosis	Surgery done	Defect size (cm)	Reconstruction	Complaints	Post-OP RT	Follow up (months)
74	F	Myoepithelial carcinoma	Lt total conservative parotidectomy	4×4	Cervico facial+Split thickness skin grafti	-	No	11
55	F	Low Gr mucoepidermoid Ca	RT total parotidectomy+FND+Tarsora-phy	3×4	Local advancement and rotation flap	-	No	18
49	F	Oncocytic carcinoma	Radical parotidectomy+Marginal mandibulect	6×8	Radial forearm free flap	Wound infection	No	24
38	M	Metastatic adenocarcinoma	superficial parotidectomy+hemithyroidect-omy	7×5		PMMC flap	Yes	7
26	M	Adenoid cystic carcinoma	Radical parotidectomy+Tarsoraphy	3×4	Cervico facial	-	Yes	6
59	F	Low Gr mucoepidermoid Ca	Total parotidectomy+Hemi-mandibulecto-my	6×8	PMMC flap	-	No	18
53	M	Pleomorphic salivary adenoma	Superficial parotidectomy	4×5	Cervico facial	-	No	12
32	F	Adenoid cystic Carcinoma	Total conservative parotidectomy	3×3	Local advancement	Superior marginal flap necrosis	Yes	18
50	M	Warthins tumor	Superficial parotidectomy+FND	4×5	Cervico facial	-	No	6
21	F	Acinic cell carcinoma	Radical parotidectomy+MRND	11×10	ALT free flap	Recurrence at bed	Yes	6
46	F	Pleomorphic salivary adenoma	Superficial parotidectomy	3×3	Local advancement	-	No	10
41	M	Pleomorphic salivary adenoma ex ca	Superficial parotidectomy+FND	4×5	Local advancement and rotation flap	-	No	20
40	M	Low Gr Mucoepidermoid	Total conservative parotidectomy	3×4	Local advancement	-	No	12
56	F	Pleomorphic salivary adenoma	Superficial parotidectomy	3×2	Local advancement	-	No	18
28	F	Pleomorphic salivary adenoma	Total conservative parotidectomy	6×5	Cervico facial and deltopectoral flap	-	No	15
32	F	Recurrent high grade MECa	Total parotidectomy+SOHND+Tarsoraphy	6×7	Radial forearm free flap	Wound infection and neck recurrence Death	Yes	23

Age (years)	Sex	Diagnosis	Surgery done	Defect size (cm)	Reconstruction	Complaints	Post-OP RT	Follow up (months)
39	M	Pleomorphic salivary adenoma	Superficial parotidectomy	3×2	Local advancement	-	No	18
72	F	Pleomorphic salivary adenoma	Superficial parotidectomy	2×3	Local advancement	-	No	11
63	M	Low Gr Mucoepidermoid Ca	Total conservative parotidectomy	5×4	Cervico facial+Split thickness skin grafti	-	No	3
38	M	Pleomorphic salivary adenoma	Superficial parotidectomy	4×4	Cervico facial	-	No	Due in July

Table 2: Comparison of various published series.

Publication	Year	No. of patients	Mean age (years)	Defect (cm)	Flap necrosis (%)
Haitham et al	2017	74	38	6×7	3.00
Lim et al[29]	2017	31	39	-	9
Jacono et al[23]	2014	88	48	5×7	27
Rapstine et al[22]	2012	82	41	5×6	3
Liu Fa-Yu[21]	2011	21	48	-	8
Austen et al[26]	2009	71	50	5×6	9
Tan et al[25]	2006	18	37	4×5	5
Moore et al[11]	2005	33	32	-	23
Our study	2021	46	45	4×5	Superficial marginal flap necrosis was observed in 5 of 46 patients (10%), One needed intervention.

CONCLUSION

The cervico-facial flap is a versatile technique with excellent vascularity and good esthetic outcome, which should be utilized in the reconstruction of facial defects, specifically in moderate size defects after parotid surgeries. However, associated complications must be kept in mind and the patient should be well informed. The most important factor remains surgeon experience in patient selection and pre-operative planning the reconstruction. The field of reconstruction is constantly evolving with the integration of multiple disciplines. But time-tested local flaps should always be a part of a surgeon's armamentarium.

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