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Microvascular Head & Neck reconstruction in an Institution During its formative Stage

Rout SK[1*], Giri SK[1], Panda R[2], Sahu RK[1], Suba S[1] and Mallik M[1]

[1]Department of Burns & Plastic Surgery, AIIMS Bhubaneswar, India

[2]Department of Trauma & Emergency Medicine, AIIMS Bhubaneswar, India

[*]Corresponding author:

Sunil Kumar Rout,
A – 104, Infocity Greens Apartment,
Sailashree Vihar, Bhubaneswar – 751021,
Odisha, India, Tel: 91-9937176025;
E-mail: drsunilrout@rediffmail.com;
plastic_sunil@aiimsbhubaneswar.edu.in

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1. Abstract

1.1. Background: Microvascular free tissue transfer is essential for ideal head and neck reconstruction. The reconstructive team is destined to face several hurdles to establish their role particularly in developing institutions. We tried to recollect such problems we came across and assess the outcome of our initial cases of free flaps.

1.2. Methodology: We reviewed the medical records of the patients underwent free flap reconstruction for head and neck defects from 1st October 2017 to 31st March 2021for a retrospective analysis.

1.3. Result: A total of 53 patients were operated during this period out of which majority was free RAFF (31) and fibula (18). In 6 of the cases we had total flap necrosis. The overall complication rate was 26.4 % and total flap failure rate was 11.3%.

1.4. Conclusion: Free flaps can be started with suboptimal gadgets and reasonable success can be achieved provided the team make a proper plan to develop the microvascular unit. Free RAFF and fibula are safer flaps to start with.

2. Introduction

Most of the defects in head and neck region resulting from excision of tumours require microvascular free tissue transfer for reconstruction. The tumours arising in this part of the body are usually malignant though large or locally invasive benign tumours are not very uncommon. Head and neck cancer are more prevalent in India due to a common habit of consuming tobacco especially in chewable form either with betel leaf or as gutkha (powdered tobacco kept inside cheek for a long time). Plastic surgeons have been playing an important role in the management of cancer of various region because most of them after excision with recommended normal margin, need to be reconstructed for restoration of form and function. This is accomplished by transfer of tissue from different parts of body. Historically the tissue for this purpose was borrowed from a region close to or within a reasonable distance, as local or regional flap. With the advent of microsurgery, the job has become easier provided the reconstructive team is trained and experienced enough with availability of requisite infrastructure. It has widened the armamentarium of the reconstructive surgeon because the technique enables the reconstructive surgeon to transfer tissues of variable composition as well as dimension. In this era, it is difficult to think about a fully functional cancer treatment unit without a reconstructive team competent in microsurgery. In public institutions of resource crunch nations, the challenges are manifold and it needs sincere effort to develop such a comprehensive unit. We are presenting the summary of cases who underwent reconstruction with free flaps during the initial years after inception of the unit of plastic surgery and analyze the difficulty faced in a developing public institution of India.

3. Materials & Method

After obtaining approval from the institute ethics committee, we reviewed the medical records of the patients operated between 1st October 2017 and 31st March 2021 for cancer of head and neck region. The patients operated for neoplasia of head and neck region,

those reconstructed using free tissue transfer were included in this study. Patients in whom head and neck reconstruction performed using local, regional or distant flaps transferred by extracorporeal technique were excluded from this study.

The flaps used for reconstruction, their dimension, components and the anastomotic details were analyzed. Data on post-operative complications related to reconstruction site including anastomotic complications necessitating re-exploration, revision of anastomosis, partial or total flap necrosis, surgical site hematoma or seroma, suture line dehiscence and any fistula were collected from the record and analyzed.

4. Result

A total of 53 patients were operated during this period for head and neck neoplasia in whom reconstruction was performed with microvascular tissue transfer. The distribution of disease in terms of anatomical site involved is mentioned in table 1. Out of the total patients 50 had squamous cell carcinoma, 2 ameloblastoma of mandible and 1 esthesioneuroblastoma of orbit.

Table 1: (Distribution of disease as per anatomical site)

Anatomical site involved	Number of cases
Gingiva-buccal mucosa involving mandible	21
Tongue	17
Buccal mucosa	10
Ameloblastoma of mandible	2
Larynx	1
Scalp	1
Orbit	1
Total	53

Composite defects were associated with larger soft tissue requirements with exception of only one case of ameloblastoma where a relatively lesser dimension of cutaneous component (7x4 cm) was harvested for monitoring of flap. Requirement of skeletal element ranged from 7 centimetres to 13 centimetres long with a mean length of 9.9 cm. The mean area of the flaps used for soft tissue reconstruction was 59 square centimetres with a minimum of 24 and maximum of 180 cm2. Flaps used for these reconstructions are depicted in figure 1. All mandibular reconstruction was done using free fibula osteocutaneous flap and soft tissue reconstructions done with Free Radial Artery Forearm Flap (RAFF), Latissimus Dorsi muscle (LD, Anterolateral Thigh flap (ALT), lateral Arm (LA) flap and Vertical Rectus Abdominis (VRAM) myocutaneous flap.

In 33 cases superior thyroid artery, in 19 cases facial artery and in 1 case superficial temporal artery was used as recipient artery. In all the cases internal jugular venous system was used as recipient vein. Superior thyroid vein was used as recipient vein in 27 cases, common facial vein in 18 cases, middle thyroid vein in 8 cases, lingual vein in 1 case, superficial temporal vein in 1 case and internal jugular vein itself in 2 cases. In 4 cases two veins were anastomosed. Among the RAFF cases, superficial venous system (cephalic vein) was used in 26 (83.9 %) and deep venous system (one of the venae comitantes) in rest 5 (16.1 %).

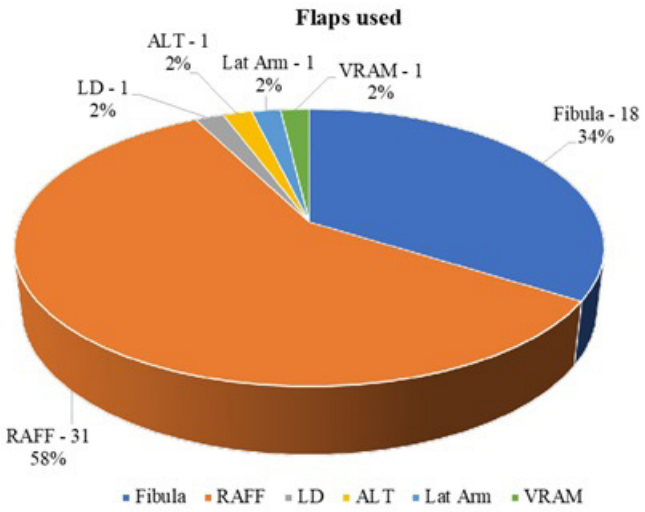

Figure 1: Various flaps used for reconstruction.

A total of 14 patients (26.4 %) developed post-operative complications related to the reconstruction site. Six patients (11.3 %) experienced complete necrosis of their flaps which included 2 RAFF and 4 fibula. Anastomotic complications were observed in 15 (28.3 %) of our cases. In 3 of them the artery and in 12 the vein was found to be thrombosed. In all of these cases revision anastomosis was performed as salvage procedure as soon as it got detected and 9 of them could be saved. Four (7.5 %) of them landed up with partial loss of flap out of which 3 were limited to few millimetres at the margins which could be managed with secondary suturing only. In one case of free fibula which had necrosis of its entire cutaneous component that required to be covered with a forehead flap and a deltopectoral flap. The major complications included such thrombotic occlusion of vessels leading to total flap necrosis. The minor surgical complications included partial flap necrosis, neck hematoma and parotid-cutaneous fistula. The details of post-operative complications are mentioned in table 2.

Table 2: (Post-operative complications)

Complication	Number of cases	% of cases
Arterial thrombosis	3	5.7
Venous thrombosis	12	22.6
Total flap necrosis	6	11.3
Partial flap necrosis	4	7.5
Neck hematoma	3	5.7
Parotid-cutaneous fistula	1	1.9

5. Discussion

Microvascular free tissue transfer is the technique of choice at present for reconstruction of head and neck defects resulting from excision of tumours [1-5]. Reconstruction in this region necessitates transfer of variable amounts of autogenous bone, soft tissue and combinations thereof, in order to achieve good form and function. The goal is well achieved by free flaps harvested from appropriate donor sites. In our center too, we preferred to do all the post excisional reconstructions in this region using free flaps unless contraindicated. Though technically demanding, by the time

of analysis of case records we found the technique to be most appropriate for this purpose.

Developing a dedicated microvascular reconstructive unit in a public institution during its formative period is a challenging job. It requires intent and enthusiasm to form a working team which include plastic surgeons, oncosurgeons, anaesthesiologists and the support staff. Most important elements in this context are trained and dedicated manpower of each strata and the necessary infrastructure. It is a fact that in resource crunch centers, every requirement is not provided in the beginning. To start with we had an opportunity to use the operating microscope that belonged to the ENT department which was not optimal for microvascular surgery. Also, we had our personal operating loupes to use. We did not have the best of the micro-instruments available in the department. With all these limitations we started doing the free flap cases and it took 22 months to own our Zeiss Pentero 800 microscope and the micro-instruments of acceptable brand. Other important aspect is the training of manpower, paramedical to be specific. In the beginning, we formulated a training program and taught the operation theater personnel to provide them the relevant information, handling and care of the micro-instruments and the microscope. We arranged teaching sessions for ICU nurses, resident doctors of department of anesthesiology and our own department to transmit the nuances of ideal post-operative care and monitoring of the flaps immediate after surgery. We informed the excision surgeons to take care of tributaries of internal jugular vein (IJV), external jugular vein (EJV) and handling minimum the potential recipient arteries while doing the neck dissection. We advised our anesthesia team to maintain the systolic blood pressure at normal level during and after the anastomosis without the help of vasopressors. The members of the operating team kept practicing anastomosis with available optical gadgets on chicken neck and femoral vessels. All the team members remained prepared for a long duration surgery and a possibility of return to operation room any time the situation demands.

We started with relatively safer flaps to have an encouraging success rate and gain confidence of the patients as well as the multidisciplinary treatment team. Most of the reconstructions were performed using free RAFF (figure 2) and fibula osteo-cutaneous flap (figure 3). RAFF is the ideal flap for reconstruction of the defects in buccal mucosa and tongue, owing to its good vessel caliber, ease of harvest and reasonable pedicle length [2, 6]. This flap offers thin and pliable tissue for reconstruction and leaves negligible donor site morbidity. We used RAFF in 31 of the 35 instances where only soft tissue was required for reconstruction. Similarly, fibula had been our flap of choice for reconstruction of composite mandibular deficiencies. In one of them skin paddle was used for monitoring of the flap whereas in all other cases, skin element was required for mucosal as well as skin deficiencies. The reason for fibula being preferable donor site are the availability of large volume of bone, wide peroneal vessel diameter and minimum donor site morbidity [7, 8]. Also, the pattern of vascular supply to this bone suits it best for segmental osteotomy necessary to achieve the desired contour of the mandible. The shorter length of its pedicle can be manipulated judiciously by utilizing the distal part of the bone.

Figure 2: Free Radial Artery Forearm Flap used for tongue reconstruction.

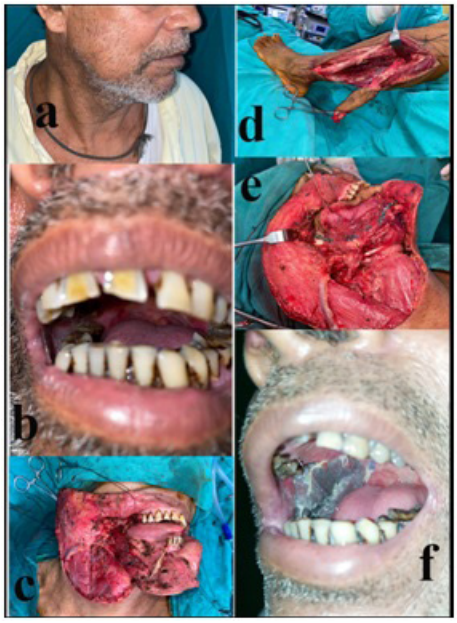

Figure 3: Free Fibula Osteo-cutaneous flap used for segmental mandible and buccal mucosa reconstruction.

We performed double vein anastomosis in only 4 of the 53 cases and found the decision to be justified. All the double vein anastomoses were performed in cases of RAFF where drainage after first vein anastomosis observed to be unsatisfactory. In one of these cases, second vein was anastomosed during re-exploration due to venous thrombosis and the flap could be salvaged with a marginal necrosis. We had complete necrosis of 2 RAAF and 4 fibula, where single vein was anastomosed. Six complete necrosis out of 49 cases (12.2 %) with single vein anastomosis can be considered comparable to the result of high-volume microvascular centers although all 6 cases of total flap necrosis was as a consequence to venous thrombosis. This finding does not agree with the conclusion derived by Riot S et al, Matthews JLK et al and Chaput B et al in

their systematic meta-analysis favoring double vein anastomosis though matches to that of Hanasono MM et al [9-12].

For RAFF, we used cephalic vein as the primary vein for anastomosis (84%) and could achieve satisfactory outcome. It has been observed that venous drainage from cephalic vein as a single vein is as good as a combination of two veins, one deep and other superficial [13]. Despite its lateral position, cephalic vein with reliable caliber and thicker wall feels sturdy to handle during anastomosis. Xie Y et al also observed in their meta-analysis on free RAFF that deep vein is marginally better in terms of venous thrombosis [14]. But they also found the success after revision anastomosis is better with cephalic vein and no significant difference between two veins in terms of flap survival. Hence, cephalic vein can be used safely for anastomosis as a single vein in cases of RAFF if found intact and the deep veins can be kept as reserve for rescue if needed.

Thrombosis at the site of anastomosis leading to re-exploration and anastomotic revision was observed to be the most common early surgical complication (28.3 % of total cases). In one of the free fibula osteocutaneous flap we lost the entire cutaneous component because of the inadvertent trauma to the sole perforator of peroneal artery supplying it. But, our team was not prepared to perform a perforator level anastomosis, hence kept our fingers crossed despite of an unsatisfactory flow. Later on, the viable bone was covered by locoregional flaps. We had 3 cases of neck hematoma developed as a result heparin administration, a desperate measure to improve anastomotic flow. The lone case of parotid-cutaneous fistula healed without any intervention towards the completion of adjuvant radiotherapy.

We had a better total complication rate (26.4 %) but poor flap survival (88.7 %) in comparison to those of Lahtinen S et al and Pohlenz P et al [15, 16]. Though our total number of flaps is less, we had a satisfactory flap survival rate in cases of RAFF (93.6 %). This corresponds to the observations of the other published reports [17, 18]. Venous thrombosis as the most common cause of flap necrosis agrees with literature [17, 19-22].

Our total flap failure rate in cases of free fibula is significantly high (22 %) in comparison to that of Naqvi SH et al (1.75 %), Verhelst PJ et al (12.4 %), Knitschke M et al (11.1%), Van Gemert JTM et al (13 %) and Gallegos-Hernández JF et al (16%) [7, 23-26]. Even in their systematic review and meta-analysis of free fibula flap, Awad ME et al also observed the total flap failure rate to be 7 % [27]. In all 4 cases of failure, the cause was found to be venous thrombosis. As the IJV system is more reliable in comparison to EJV, we most often preferred its tributaries for venous anastomosis [22]. But at the same time, we tried to avoid common facial vein as it used to be handled during neck dissection. In all our free fibula flaps those failed, common facial vein was used as recipient vein owing to the difficulty in reach of the pedicle.

6. Conclusion

Developing an efficient team capable of performing microvascular surgery is inevitable for a center providing dedicated cancer treatment. Local and loco-regional flaps cannot address the reconstructive issues adequately nor appropriately. Public run institutions of resource crunch nations have its inherent deficiencies and limitations during their formative years. Reconstructive teams need to be trained in microvascular techniques before embarking upon the management of head and neck malignancies. Flaps with more consistent anatomy as well as relative ease of harvest and anastomosis should be attempted to start with. More complex reconstructive options like perforator level anastomosis and chimeric flaps may be performed after the team gains the requisite experience and achieve success in conventional flaps. Lack of infrastructure though an initial hurdle, usually overcome in due course of time. One has to start with whatever available and arrangeable. The team should draw an appropriate road map and develop the protocol to be practiced during the initial period, which may be modified with experience. Though the challenges in this phase are manifold, following these principles definitely help to develop a competent team and gaining confidence of the physicians of other allied specialties involved in cancer treatment.

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