

## Original Research Article

# Microvascular free flap for head and neck reconstruction: our experiences with 218 free flaps for head and neck reconstructions

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## ABSTRACT

**Background:** Defect following radical resection for advance head and neck cancers are complex and without doubt microvascular free flap offer the best reconstructive option. The purpose of this study is to investigate the flap survival rate and review each vascular compromised flaps.

**Methods:** This is a reviewed of 218 microvascular free flaps done for reconstruction of 204 head and neck patients. There were 112 (51.3%) radial forearm flaps (RFF), 82 (37.6%) fibula flaps (FF) and 24 (11%) anterior lateral thigh (ALT) flaps.

**Results:** There were 16 complete flap loss and 3 partial flap loss, giving an overall flap survival rate 91.8% (19/218) and flap survival in turn of complete loss 92.7% (16/218). In RFF, there were 7 complete and 1 partial flap loss, giving an overall flap survival rate 92.9% (8/112) and flap survival in turn of complete loss 93.8% (7/112). In FF, there were 6 complete flap loss, giving a flap survival rate 92.7% (6/82). In ALT flap, there were 3 complete and 2 partial flaps loss, giving an overall flap survival rate 79.2% (5/24) and flap survival in turn of flap complete loss 87.5% (3/24). In our series vascular flaps complications rate was 12.3% (27/218), with a salvageable rate of 29.6% (8/27). The most salvageable flap was RFF 46.6% (7/15).

**Conclusions:** The study re-enforce the learning curve in microvascular free flap and RFF is a good flap for a beginner.

**Keywords:** Free flaps, Flap survival, Flap vascular complications

## INTRODUCTION

Defect following radical resection for advance head and neck cancers are complex and are associate with large tissue defect as well as much functional disability. Head and neck is also the region where significant functional and cosmetic loss occurs as a result of cancer treatment.<sup>1,2</sup> Advancement in microvascular surgical technique have brought about a revolution in head and neck reconstructive

surgery; as re-vascularized tissue of requirement can be harvested to tailor fit any complex composite defect created after ablative radical resection with the most optimal functional outcome and excellent aesthetic.<sup>3-9</sup> Thus many head and neck cancers what were termed inoperable earlier, have become operable today with the possibility of reconstruction. This results in better survival as it allows require radical resection for advance head and neck malignancy.<sup>10,11</sup> Free flap also provide quicker

healing for the timely require post-operative radiotherapy. The purpose of our study was to investigate the flap survival rate and go into depth and study the vascular complications of each free flaps. Since there are few study available on the circumstances surrounding the decision to return to the operating theatre and the subsequent operative findings.

In this study we tried to discuss what we did before we return to operation theatre, how long we took decision to return to operating theatre, what make us to return to operating theatre, our primary operative findings at the time of attempted salvage on re-exploration and how we managed each vascular compromised flaps individually. The purpose of this study is to investigate the flap survival rate and review each vascular compromised flaps in detail, in the hope that this study will help us to better understand the problems with vascular compromised flaps.

## METHODS

This is a reviewed of patients who underwent microvascular free flap for head and neck reconstruction from 2012 to late 2021. Totally there were 218 microvascular free flaps done for reconstruction of 204 head and neck patients; as 6 patients had received synchronous double free flaps in the same surgical session and 8 patients underwent subsequent free flaps (4 for flap failures, 3 for second primary cancers and 1 for residual defect). There were 93 female and 111 male patients with a mean age of 51.7 years, youngest patient was 18 years and the oldest patient was 72 years of age. All the free flaps procedures were performed by the same otolaryngology head neck surgeon. The procedures were carried out in a normal general hospitals and the flaps were monitored by the ENT residents' doctor. Flaps are reviewed in year consecutive wise maintaining the sequential serial of the flaps or patients. Collection of patients details or records were done retrospectively as well as prospectively from hospital patients records, outpatient department follow up, surgeon maintained diary as well as surgeon personal records and re-collection of the patients including telephonic conversations regarding the patients. Flap survival as well as flap vascular complications which is the aim of this study, were not compromised or limited as all the flaps were personally monitor by the operating surgeon till patient got discharge or flap was totally fine. The study includes only the free flaps done by the same surgeon for head and neck reconstruction and free flap done for other region of the body by the same surgeon were excluded from the study. Ethical approval was not taken or as such not require as this study is more of a personal experience and personal records of the patients. We use simple percentage calculation to calculate our percentage of flap survival rate, vascular complications rate, and salvageable rate. No other statistical method was used or required. Patients were reviewed in turn of patient age and sex, the diagnosis, tumour sites and the defect created, types of free flaps done, radiation or chemotherapy history and lastly the vascular complications of the flap encountered.

Table 1 summarized the diagnosis of the patient, the defect created and the type of free flap done for each defect. There were 112 (51.3%) radial forearm flaps (RFF), 82 (37.6%) fibula flaps (FF) and 24 (11%) anterior lateral thigh (ALT) flaps. Oral with or without oropharynx defect following resection for cancer or pre-malignant lesion of the oral the cavity account for 90.8% (188/207) of all the defect. While 4.8% (10/207) were pharyngeal defects after resection for hypopharyngeal cancers, 2.4% (5/207) were lateral skull and neck defect (2 patients were following resection for fungating parotid/skin cancer, 1 patient for fungating ear cancer, 1 patient post electric shock temporal region skull defect and another 1 patient was post traumatic necrotic tissue loss of skull and upper posterior part of neck), 1.4% (3/207) were of maxillary defect following surgery for maxillary cancer and lastly one patient received 2 free flaps subsequently for mid facial defect following resection for aneurysm bone tumour of the face. Among the oral defect the most common defect was following resection for gingivobuccal mucosa cancer (50), followed by alveolus cancer (45), tongue cancer (30), floor of mouth cancer (15), ameloblastoma (11), oral cancer with skin involvement of through and through defect (11), cancer of lip (8), cancer of retro molar trigone (9), cancer of palate (2), giant cell tumour (GCT) of mandible (1) and lastly 4 patients of erythroleukoplakia. The study investigates the flap survival rate and look detail into the flap vascular complications individually. The study did not focus into complications which were not in direct relationship to the flap survival. In this paper we tried to discuss our primary experience encounter with each vascular compromised flaps in an elaborated way to view how each vascular complicated flaps were handled and managed.

Intraoperatively all patients were anticoagulated using topical irrigation of the donor and recipient vessels using diluted heparinized saline solution (100 u/ml) and 4% lignocaine. All patients were monitor in the intensive care unit (ICU) until their stabilization. The flap was monitored in turn of flap congestion or change in colour and bleeding test carried out whenever necessary using needle. Postoperatively flap monitoring was done by visual inspection of the flap's skin paddle.

Routine flap monitoring was done on 2 to 3 hourly basis on first postoperative day follow by 4 to 5 hourly basis till the patient is shift out of the ICU by the resident doctor on duty and on twice daily basis by the operating surgeon. Anticoagulant enoxaparin sodium was used in the initial years but at later years this practise was discontinue as we noticed it does not make the difference in turn of flap survival but rather cause significant bleeding in some of our patients except for the vascular compromised flap or vascular compromised and re-explored flap or patient who had underwent second free flap. Infusion ketorolac is use as a pain reliever without any noticeable problem. Also double veins anastomosis whenever possible became our practice at later years.

## RESULTS

Table 1 is a summary of the type of free flaps done for each defect. Out of 218 free flaps in our series, there were 16 complete flap loss and 3 partial flap loss giving an overall flap survival rate of 91.8 % (19/218) and the rate of flap survival in turn of flap complete loss 92.7 % (16/218). Totally we have done 112 RFF, of which there were 7 flaps complete loss and 1 flap partial loss giving an overall flap survival rate of 92.9 % (8/112) and the rate of flap survival in turn of flap complete loss 93.8 % (7/112) in RFF. In FF, out of 82 FF performed, there were 6 complete loss of flaps giving a flap survival rate of 92.7 % (6/82). Out of 24 ALT flaps done, there were 3 complete and 2 partial flaps loss giving an overall flap survival rate of 79.2 % (5/24) and the rate of flap survival in turn of flap complete loss 87.5 % (3/24). Below is the detail of vascular complications with each types of free flaps as we try to discuss in detail how we managed each type of vascular complicated flaps individually.

Table 2 is a summary of vascular complications of radial forearm flap (RFF). Fifteen RFF flaps had vascular complications, out of which 12 flaps underwent re-exploration and by re-exploration 7 vascular compromised flaps could be salvaged. Thus the salvageable rate of RFF flap in our series is 46.6% (7/15). In flap serial 4, in the morning of post-operative day 1 (POD 1) we noticed some congestion of the flap. The colour of the flap was monitor on hourly basis but as the flap became darker and increase in size, the patient was taken up for re-exploration on POD 2. The anastomotic vein was cut opened, flushed with diluted heparin solution and re-micro-anastomosis of the vein was performed. Anticoagulant enoxaparin continues post re-exploration. In spite of the re-anastomosis of the vein, the flap continues to deteriorate and hence the patient underwent pectoralis major myocutaneous flap (PMMF) for wound closure. In flap serial 7, darkening of the flap was noticed on POD1 evening. Urgently some stitches of the flap were open and the edges of the flap cut, and the blood was allowed to oases from the cut edges of the flap. Also thrombolytic agent streptokinase was injected locally into the flap and enoxaparin continue. But as the colour of the flap did not improve but rather deteriorate and increase in size, the flap was re-explored on POD 2. On re-exploration the anastomotic vein was found to be thrombosed. The thrombotic vein was cut open and flushed with diluted heparin solution. Whatever thrombose seen inside the lumen was milked out and re-micro-anastomosis of the vein performed. Anticoagulant enoxaparin continues post re-exploration. In this case too, the flap did not survive, so the patient underwent PMMF for defect closure. In flap serial 19, the flap started to develop congestion on POD1, immediately re-exploration was undertaken and on table we encounter anastomotic venous thrombosis probably caused by kinking due to long venous pedicle. The thrombotic vein was excised and flushed repeatedly with diluted heparin solution. Free venous out flow could be seen on table before we start to re-micro-anastomose the

vein. Re-micro venous anastomosis was done and the pedicle repositioned. The colour of the flap started to improved and we could salvage the flap in this case. In flap serial 25, we noticed some darkening in the colour of the flap on POD 2. On examination of the neck, the neck was tense. So the neck was immediately re-explored. On re-exploration there was haematoma in the surgical bed. Haematoma was evacuated and meticulous haemostasis carried out. Diluted heparin solution and 4% lidocaine were flushed around the pedicles. After the procedure the flap colour return to normal. Thus the flap could be salvaged. In flap serial 33, there was complete necrosis (white in colour) of the flap. This happened on POD4, so the flap was discarded and PMMF done to close the defect. In flap serial 46, on POD 2 patient develop neck haematoma but there was no colour change of the flap. Neck haematoma evacuated together with meticulous haemostasis carried out and corrugated drain kept after the procedure. Anticoagulant enoxaparin was discontinued post re-exploration. The flap could be save in this case. Flap serial 70 was a case of maxillectomy defect closure. The flap got detached from above on POD 3 causing complete necrosis of the flap. The patient was referred to dental department for obturator. Flap serial 87, on POD4 the patient had a vigorous cough following which there was sudden neck swelling with oral bleeding. Immediately patient was shifted to operation theatre and on opening the wound there was facial arterial spatter from the anastomotic site. Arterial micro-anastomosis was re-performed. There was no colour change of the flap in this case. In flap serial 99, on POD 3 flap colour turned dark. On re-exploration there were thrombosis in the drainage veins. The thrombotic veins were cut open at different level and flushed with diluted heparin-saline solution. But there was no free flow of the drainage veins in spite of the above measures, so the flap was abundant and the patient underwent second free flap (ALT) in the same session. Flap serial 106, a case of cancer hypopharynx with RFF reconstruction, had a persistence discharging fistula. On re-exploration, the flap was found to be necrosis, so the flap was discarded and the patient underwent PMMF to reconstruct the pharynx (this was a case of partial defect of the pharynx following total laryngectomy and partial pharyngectomy) as it was not a case of circumferential defect. In flap serial 110, flap colour change was noticed on POD 2. The wound was immediately re-explored. Intra operative, both the anastomotic veins were found to be thrombosed but the artery was pulsating well. Both the anastomotic veins were cut open and the thromboses inside the veins milked out and flushed repeatedly with diluted heparin solution. Free venous out flow could visibly be seen in one drainage vein and so re-micro anastomosis of one of the drainage vein could be done. Following the procedure, the colour of the flap return to normal. Flap serial 155 was a post chemo-therapy case, the flap become pale with negative to bleeding on POD 5. No re-exploration was attempted, only debridement of the necrotic flap was done and the wound was allowed to heal by secondary intension, in view of poor general condition in this elderly patient. In this patient the cephalic vein was

hard during the harvest of the flap due to post chemotherapeutic induced inflammation. Flap serial 168, a case of cancer tongue had post-operative alcohol withdrawal symptoms and because of excessive neck movement, on POD 3 he developed neck swelling. The patient was immediately shifted to operation theatre and on re-exploration of the neck, there was haematoma where the suction drain had sucked on to the pedicles. Only artery was required for re-micro-anastomosis. Soft corrugated drain was kept after the procedure. The flap survived the procedure. Flap serial 182 developed neck haematoma in the night of surgery. On re-exploration there was arterial sputter from anastomotic site which was re-anastomosed. Thus the flap was saved. Probably this case was due to poor suture quality. Flap serial 208 was a case of partial necrosis. On POD 6 the flap became dark. No re-exploration of the flap was attempted. Anticoagulant enoxaparin started and darkened edges of the flap debrided. This flap had partial necrosis after the intervention.

Table 3 is a summary of vascular complications of FF. There were 7 FF vascular compromised flaps and 5 flaps underwent re-exploration. And by re-exploration 1 vascular compromised flap (flap serial 123) was salvaged. In serial 9 flap, the FFF flap begins to change in colour on POD 1, the flap colour was monitor but as the darkening worsen and increase in size, and the flap was re-explored. On re-exploration there was haematoma with pedicles embedded in the haematoma causing thrombosis of the whole length of the anastomotic vein, so re-micro-vascular anastomosis was not possible. The flap was abandoned and the patient underwent 5<sup>th</sup> rib osteo-pectoralis major myocutaneous flap (5<sup>th</sup> rib OPMMF) for mandible defect reconstruction. In flap serial 18, the FF started to darken on POD 2 evening. The patient was taken up in the night for re-exploration. On re-exploration there was anastomotic vein thrombosis. The thrombotic vein was excised but grafting was required because of the shorten length. Anticoagulant enoxaparin continues post re-exploration. In spite of the above procedure the flap did not survived. This patient too underwent 5<sup>th</sup> rib OPMMF. In flap serial 26, darkening of the flap was noticed on POD 1. Emergency re-exploration was under taken. On re-exploration there was haematoma in the surgical bed causing anastomotic vein thrombosis but the artery was pulsating well. The thrombotic vein was cut open and flushed with diluted heparin solution and re-micro anastomosis of the vein done. Anticoagulant enoxaparin continues post re-exploration. In spite of the above procedures the flap did not survive, so this patient also underwent 5<sup>th</sup> rib OPMMF. In flap serial 44, the FF turns pale white noticed during morning round on POD 4 which was negative to pin prick bleeding test. So the flap was abandoned and the patient underwent 5<sup>th</sup> rib OPMMF. In flap serial 127, some darkening of the flap was noticed on POD 2 morning and so the patient was immediately taken up for re-exploration. Both the anastomotic veins were cut opened as the artery was pulsating well and the thromboses inside the veins were milked out and the lumen of the veins were flushed with diluted heparin solution; after

repeatedly flushing with diluted heparin solution, some sluggish venous oases became visible, so re-micro anastomosis of the veins performed. The patient was put on enoxaparin. The flap colour begin to improve after the procedure. In flap serial 157 the patient started to develop darkening of the flap on POD 4 around the edges, so urgent debridement of the flap edges was carried out with injection of thrombolytic agent streptokinase into the flap and the venous blood was allowed to oases out from the cut edges of the flap. Enoxaparin was started. Initially the flap colour appeared to stabilize. So the above procedures were repeated including superficial cut over the surface of the flap. But as the flap colour did not improve further but rather deteriorate, re-exploration was done the next day. On re-exploration there were complete thrombosis of both the anastomotic veins and so the flap was abandoned. The patient underwent 5<sup>th</sup> rib OPMMF 5<sup>th</sup> for the defect reconstruction. In 2018 we had another FF failure with flap serial number 159 on POD 5, here the reconstruction plate got dislodged and caused the flap failure. This patient did not undergo revision reconstruction. The reconstruction plate removed and the necrotic flap debrided and the defect allow to heal by secondary intention granulation. Thus in FF, out of 7 vascular compromised flaps only 1 flap could be salvaged.

Table 4 is a summary of vascular complications of ALT flap. In ALT flap we had 5 vascular compromised flaps. In flap serial 66, the flap started to develop congestion on POD 1. Enosaparin started and the patient re-explored. On re-exploration we encounter haematoma which we evacuated and after a thorough haemostasis followed by irrigation around the pedicles with diluted solution of heparin and 4% xylocaine, the wound was closed. But as the flap deteriorate further the patient was re-explored second time. On second time re-exploration the pedicles were totally thrombosed and the flap not salvageable. So the flap was abandoned and the patient underwent second free flap (RFF) for the defect closure. In flap serial 95, there was partial marginal necrosis. This was noticed only on subsequent follow up in the OPD at later date. This was a case of synchronous double free flap for reconstruction of a through and through oromandibular defect. The likely cause could be pressure from the reconstruction plate beneath. Re-approximation of the flap edges done. In flap serial 194 the darkening of the flap was noticed on POD 3. On re-exploration the flap was found not to be salvageable, so another free flap (RFF) had to be done for defect closure. In flap serial 199, congestion of the flap was noticed on POD 4. Enosaparin as well as aspirin started and on next day as there was no improvement, we debrided the edges of the flap and the blood was allowed to oases. In this case the main central part of the flap survived. Flap serial 207 became to darken on POD 1 afternoon. In this case we did only one drainage vein anastomosis. On re-exploration the anastomotic vein was thrombosed and since the flap was not in the position to salvage, the patient underwent second free flap (RFF) in the same sitting. Thus in ALT flap, there were 5 vascular compromised flaps but as 2 flaps were only partial necrosis no re-exploration done

and of the 3 flaps which underwent re-exploration none could be salvaged. In all the above ALT flap failure cases except the patient of double free flap the mandible continuity was intact. There was one case of arterial spasm encounter during ALT flap harvest. So the wound was closed and shifted to the other leg. Thus in our study there were totally 27 flaps with vascular complications causing vascular compromise to the flap; of which 20 vascular compromised flaps underwent re-exploration and by re-exploration 8 vascular compromised flaps could be

salvaged giving a salvageable success rate of 29.6 % (8/27) in our series. Of the 15 vascular complications with RFF, 7 RFF could be salvaged giving a salvageable rate of 46.6% (7/15) while of the 7 vascular compromised flaps with FF, only 1 flap could be salvaged and of the 3 ALT flaps which underwent re-exploration, none could be salvaged. Unfortunately, there was one dead post operatively in the ICU due to aspiration (FLAP serial 129) though the flap as such was fine. This patient was not tracheotomised.

**Table 1: Diagnosis, defect created and type of free flaps used to reconstruct the defect.**

Diagnosis	Defect created	RFAF flap	FF flap	ALT flap	Total area of defect
<b>Cancer (Ca) tongue</b>	More than half to near total tongue defect	30 (include 1 case for failed ALT flap)		1	30*
<b>Cancer gingivo-buccal mucosa/buccal mucosa</b>	Mucosa	42		1 (for failed RFF)	50**
	Mucosa and marginal mandibulectomy	6		2	
<b>Ca lip</b>	Lip and angle of mouth	6		2	8
<b>Ca floor mouth (fm)</b>	fm and undersurface tongue	1			
<b>Ca fom involving mandible</b>	Anterior arch mandible		14		15
<b>Ca alveolus</b>	Mandible		45		45
<b>Ca oral cavity with skin involvement</b>	Through-and-through oro-mandibular defect	3	11	3	11@
<b>Ca retromolar trigon</b>	Posterior mandible and oropharyngeal	2 (include 1 case for failed ALT flap)		8	9***
<b>Ca upper alveolus</b>	Maxilla	2			2
<b>Ca palate</b>	Palate and maxilla	2 (include 1 case for failed ALT flap)		1	2****
<b>Cancer maxilla</b>	Maxilla	3			3
<b>Ca hypopharynx</b>	Partial (total laryngectomy and partial pharyngectomy)	4			10
	Circumferential (total laryngopharyngectomy)	6			
<b>Fungating ca parotid</b>	Skull base and upper neck			2	2
<b>Fungating ca ear</b>	Skull base and upper neck			1	1
<b>erythroleukoplakia</b>	Mucosa	4			4
<b>Ameloblastoma</b>	Mandible		11		11
<b>Gct mandible</b>	Mandible		1		1
<b>Aneurysm bone cyst maxilla</b>	Maxilla and skin	1		1	1#
<b>Post electric shock tissue loss</b>	Temporal region			1	1
<b>Post traumatic necrotic tissue loss</b>	Skull base and posterior upper neck			1	1
					207 (total defects)
<b>Total</b>		112	82	24	218 (total flaps)

\*/\*\*/\*\*\*/\*\*\*\*All these defects underwent second free flap for flap failure; #same problem underwent 2 free flaps; @6 double free flaps and 4 FF double skin paddles and 1 mucosal inside flap.

**Table 2: Summary of vascular complications with RFF.**

Flap serial	Type of defect	Day of flap vascular complication	Action taken	Finding/intra-operative finding	What done	Result
<b>Flap-4</b>	Buccal mucosa	POD 1	Re-exploration POD 2	Venous thrombosis	Re-venous anastomosis	Failed
<b>Flap-7</b>	Buccal mucosa	POD 1	Re-exploration POD 2	Venous thrombosis	Re-venous anastomosis	Failed
<b>Flap-19</b>	Buccal mucosa	POD 1	Re-exploration POD 1	Venous thrombosis due to kinking?	Re-venous anastomosis and re-positioning of pedicle	Salvaged
<b>Flap-25</b>	Buccal mucosa	POD 2	Re-exploration POD 2	Venous thrombosis due to haematoma	Haematoma evacuated	Salvaged
<b>Flap-33</b>	Buccal mucosa	POD 4	No re-exploration	Necrosed flap		Failed
<b>Flap-46</b>	Tongue	POD 2	Re-exploration POD 2	haematoma	Haematoma evacuated	Saved
<b>Flap-70</b>	Maxilla	POD 3	No re-exploration	Flap got detached		Failed
<b>Flap-87</b>	Buccal mucosa	POD 4	Re-exploration POD 4	Arterial spatter	Arterial re-anastomosis	Saved
<b>Flap-99</b>	Buccal mucosa	POD 3	Re-exploration POD 3	Venous thrombosis		Failed*
<b>Flap-106</b>	Partial pharyngectomy	POD 13	Re-exploration POD 12	Necrosed flap		Failed
<b>Flap-110</b>	Buccal mucosa	POD 2	Re-exploration POD 2	Venous thrombosis	Re-venous anastomosis	Salvaged
<b>Flap-155</b>	Buccal mucosa	POD 5	No re-exploration	Necrosed flap		Failed
<b>Flap-168</b>	Tongue	POD 3	Re-exploration POD 3	Arterial anastomotic bleed	Arterial re-anastomosis	Saved
<b>Flap-182</b>	Tongue	Night of surgery	Re-exploration same night	Arterial sputter from anastomotic site	Arterial re-anastomosis	Saved
<b>Flap-208</b>	Tongue	POD 6	No re-exploration		Partial debridement of the necrotic part	Partial necrosis

\*underwent second free flap (ALT flap).

**Table 3: Summary of vascular complications with FF.**

Flap serial	Defect	Day of flap vascular complication	Action taken	Finding/intra-operative finding	What done	Result
<b>Flap-9</b>	Hemi-mandible	POD 1	Re-exploration POD 2	Venous thrombosis due to haematoma		Failed*
<b>Flap-18</b>	Hemi-mandible	POD 2	Re-exploration POD 2	Venous thrombosis	Re-venous anastomosis (grafting was required)	Failed*
<b>Flap-26</b>	Hemi-mandible	POD 1	Re-exploration POD 1	Venous thrombosis due to haematoma	Re-venous anastomosis	Failed**
<b>Flap-44</b>	Hemi-mandible	POD 4	No re-exploration	Necrosed flap		Failed***
<b>Flap-127</b>	Hemi-mandible	POD 2	Re-exploration POD 2	Venous thrombosis	Re-venous anastomosis	salvaged
<b>Flap-157</b>	Hemi-mandible	POD 4	Re-exploration POD 5	Venous thrombosis		Failed****
<b>Flap-159</b>	Hemi-mandible	POD 5	No re-exploration	Reconstruction plate dislodgement		Failed

\*\*\*/\*\*\*\*/\*\*\*\*\*All underwent 5th rib OPMMF; \*\*\*\*\*underwent PMMF.

**Table 4: Summary of vascular complications with ALT flap.**

Flap serial	Defect	Day of flap vascular complication	Action taken	Finding/intra-operative finding	What done	Result
Flap-66	Mucosa and marginal mandibulectomy	POD 1	Re-exploration POD 1	Venous thrombosis due to hematoma	Hematoma evacuated	Failed*
Flap-95	Through-and-through defect	Noticed on follow up at later date in OPD	No re-exploration	Partial marginal necrosis		Marginal necrosis
Flap-194	tongue	POD 3	Re-exploration POD 3	Venous thrombosis		Failed**
Flap-199	Posterior mandible and oropharynx	POD 4	No re-exploration		Debridement of the flap edges done	Partial necrosis
Flap-207	Palate and maxilla	POD 1	Re-exploration POD 1	Venous thrombosis		Failed** *

\*/ \*\*/ \*\*\*All underwent second free flaps (RFF).

## DISCUSSION

Problem of head and neck cancers especially oral cancers are enormous in our country and most of them unfortunately also come late. Most of the advanced cases of head and neck cancer happen among the poor because they are diagnosed late or delay in seeking the treatment. In view of the above reason there is an enormous requirement in our country for otolaryngologists to perform head and neck cancer surgery. Reconstruction with free flap has significantly changed the outcome of patient with head and neck cancer. What cancer was termed as inoperable earlier, has become operable today with the possibility of reconstruction by free flap. Today because of the advanced microvascular surgical technique, free flap for head and neck defects reconstruction has gained popularity in many centres. But microvascular free flap surgeries are not freely available in our country as it requires expertise and so are not commonly performed in all hospitals except in few medical colleges or tertiary referral centres. In fact, this was one of the reasons why microvascular surgery was started in our department. In centres where free flap is not possible, the only option available is local/pedicled flaps which limit the oncological resection and also cause a significant decrease in the quality of life of the patient in the rest of his/her life. The purpose of this study was to investigate the flap survival rate and also review each vascular compromised flap in detail in the hope to better understand the vascular complications, the causes of the vascular complications and the outcome of the vascular compromise flap after their management. In our study we primarily focus into flap survival and vascular complications which were directly related to the flap survival.

No doubt with the better microsurgical technique, the success rate of free flap is now very high. However

vascular complications and flap failure still occur. According to various literatures free flap complications are said to occur in 5-35% of cases depending on the centre where they are performed.<sup>12-16</sup> In our series flaps vascular complications rate was 12.3% (27/218). With the advancement in microsurgical technique the success rate of free flap surgery at the present time is reported to be in the range of 90% to 99%. Out of 218 free flaps in our series, there were 16 complete flap loss and 3 partial flap loss giving an overall flap survival rate of 91.8% (19/218) and excluding the partial flap loss, our success rate for flap survival was 92.7% (16/218). This is in accordance with most microsurgical centres.<sup>17-24</sup> In our series out of 27 vascular compromised flaps, 20 vascular compromised flaps underwent re-exploration and by re-exploration 8 vascular compromised flaps could be salvaged, giving a successful salvageable rate of 29.6% (8/27) in our series. According to various literatures successful flap salvage rate generally ranges from over 25% to over 90%.<sup>14,23,25-28</sup> In our series, RFF was the most common flap performed 112/218 (51.3%). There were 15 vascular complications with RFF and 7 vascular compromised flaps could be salvaged by re-exploration. This gives a salvageable rate of 46.6% (7/15) with RFF in our series. RFF is commonly used and in most instances is usually the choice in the reconstruction after head and neck tumour resections. Its advantage in oral reconstruction is that, it is thin and is therefore more suitable for mucosal replacement rather than other bulkier flaps. It also offers a good, long pedicle and is usable in both intraoral and extraoral defects in contrast to ALT flap which might be too bulky and risk of getting compromised especially when the mandible is intact. As shown in other study, RFF is low in failure rate.<sup>29</sup> This too is shown in our study with a flap survival rate of 93.8% (7/112). RFF too has a higher salvageable rate than composite flap.<sup>27</sup> This is also demonstrated in our study with a salvageable rate of 46.6% (7/15) than FFF

where only 1 out of 7 vascular compromised flaps could be salvaged and none in ALT flap. There were a total of 82 FF in our series with a flap survival rate of 92.7% (6/82). There were 7 vascular compromised flaps with FF but only 1 flap could be salvaged. All the failed FF underwent 5<sup>th</sup> rib OPMMF for the defect reconstruction except flap serial 159. In case of failed FF, 5<sup>th</sup> rib OPMMF may be a good alternative option as it is quick and easy to perform as shown in our earlier study<sup>30</sup> rather than going for second FF. In ALT flap, we had 3 complete and 2 partial loss of flaps. All this occurred in cases where mandible continuity was intact except in one partial flap loss which was a case of synchronous double flaps (flap serial 95). This might highlight that ALT flap may be too bulky and may have a risk of getting compromised especially when the mandible is intact.

Study has shown that with early recognition and early intervention, salvage of the compromised free flap is possible.<sup>17,27</sup> Kubo et al reviewed the management of the flap with venous compromise and suggested that surgical methods should be the first choice as it offers significantly higher salvage rates.<sup>31</sup> The successful salvage for compromised free flap vary depending upon the aetiology, timing of the salvage, experience of the centre etc. But as we know with an early recognition and intervention, salvage of the compromised flap is possible. Hence upon suspicion of vascular compromise of the flap, one should have a low threshold for return to the operating theatre for re-exploration. In Brown's series 73% of failed free flaps were successfully salvaged. Most of these were within 24 hours of initial operation.<sup>27</sup> In fact, salvage may not be possible if thrombosis occurred more than 3 to 4 days after surgery as seen in our study. So rather than re-exploration local debridement of the flap edges or leech's therapy may be prefer and may save the flap from complete loss as seen in our flap serial 199 and 208. Our salvage success rate is not good with FF and ALT flap. Successful outcomes of free flap surgery are influenced by many factors such as surgical technique, position of vascular pedicle, post-surgery monitoring etc. But the most important factor in avoiding free flap failure is the surgeon's operative experience and this is seen in our study as majority of our flaps vascular complications have occurred in our earlier flaps. Hence, the learning curve for all new microvascular surgeons is very important.

One of the limitation or drawback of this study was the non-systematization of the flap or patient records but rather based on surgeon personal records and re-collection of the patients.

## CONCLUSION

Mastering RFF and FF will be able to meet the require reconstruction for most of head and neck malignancies. The study re-enforce the learning curve in microvascular free flap as majority of our complications have occurred in our earlier flaps. RFF is a good flap for a beginner to begin with as it has a high success rate as well as high

salvageable rate. FF vascular complication is difficult to salvage and ALT flap may be too bulky in an intact mandible. This study also high light that microvascular surgery is practicable and feasible by otolaryngologist as micro surgery is part of all ENT training and practice. This could be further re-enforce if there could be short fellowship in microvascular surgery in the ENT-HN department.

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