

Complications and loss of free flaps after reconstructions for oral cancer

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Abstract

The aim of this retrospective study was to analyse the incidence of complications and loss of flaps after primary reconstructions for oral cancer in 191 patients at our hospital over the five years 2005–2010. The patients' clinical and personal details, characteristics of the tumours, types of microvascular flap, complications, and outcomes were recorded. The soft tissue flaps used most often were the fasciocutaneous radial forearm free flap (RFFF) (n = 86, 45%) and the anterolateral thigh free flap (ALTFF) (n = 48, 25%) while the most commonly used osseous flap was the deep circumflex iliac artery flap (DCIA) (n = 25, 13%). There were postoperative complications that required intervention in a quarter of the patients, most often in the age group 41–50 years (p = 0.018). Older age was not associated with the development of complications. The overall survival of all free flaps was 181/191 (95%), and the only significant individual predictor of loss of a flap was reconstruction with a DCIA (p = 0.016), five of the 25 of which were lost. We conclude therefore that DCIA free flaps are associated with an increased risk of failure; the method of osseous reconstruction for maxillofacial reconstruction should be selected carefully; and carefully chosen older patients do not seem to be at increased risk of morbidity.

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Keywords: Free flap reconstruction; complication; microsurgery; deep circumflex iliac artery flap; outcome; elderly

Introduction

Malignant tumours of the oral cavity often require extensive resections that leave large defects in the soft and hard tissue, which may lead to loss of function such as swallowing, speech, and mastication, and may also compromise breathing.

Microvascular free flaps are often necessary in the reconstruction of these extensive defects to maintain function and facial symmetry.^{1,2} Reconstructions with such flaps are long

and complex procedures that require many resources and much preoperative planning. The most commonly used free soft tissue flaps are the radial forearm free flap (RFFF) and the anterolateral thigh free flap (ALTFF), whereas the fibular flap is the most used osseous free flap, followed by the deep circumflex iliac artery flap (DCIA), and the scapular free flap. Survival rates range between 85%–100%.^{3–8} However, despite good survival rates, overall free flap morbidity is reported to be as high as 28%–50%.^{3,4,9–11}

Common failures of these flaps include thrombosis of the arterial or venous anastomosis, infection, development of a fistula, wound dehiscence, haematoma, and haemorrhage.^{6,12,13} Vascular thrombosis requires immediate

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re-exploration to salvage the flap and prevent necrosis.¹³ Such complications prolong hospital stay, increase morbidity and mortality, and decrease quality of life while increasing the overall cost of treatment.¹⁰ It is therefore important to be able to identify the factors that predict failure or complications, and minimise their risks. Secondary reconstructions are less successful than primary reconstructions.^{14,15}

The aim of the present study was to identify the types and rate of complications after primary reconstruction with microvascular free flaps after resections of oral cancer during a five-year period at the Oral and Maxillofacial department of the University Hospital, Helsinki, Finland.

Patients and methods

We designed and implemented a retrospective cohort study in which we included the casenotes of all patients who had had primary reconstruction with a microvascular free flap after resection of oral cancer at our hospital between January 2005 and December 2010. Patients who had secondary reconstructions were excluded. The internal review board of the Division of Musculoskeletal Surgery, Helsinki University Hospital approved the study.

For each patient the following data were recorded: age, sex, histopathological type and anatomical site of the tumour, postoperative staging of squamous cell carcinoma (SCC), type of microvascular flap used, postoperative complications that required operation, and time between reconstruction and surgical treatment of the complication. The anatomical sites of the tumours were classified as: tongue; floor of the mouth; soft palate and oropharynx; buccal mucosa; mandibular gingiva; maxillary gingiva; mucosa of the hard palate; mandible; and maxilla. Complications that required intervention were grouped/patient as: vascular compromise; infection, or wound dehiscence, or both; haemorrhage or haematoma; partial necrosis; pharyngeal swelling; and failure of osteosynthesis. Based on the duration of time between reconstruction and treatment of the complication, complications were classified as early (fewer than 15 days) or late (15 days or more). Early complications were further classified as follows: <24 hours; 24–72 hours; 73 hours–7 days; and 8–14 days.

Statistical analysis

Data were analysed by using GraphPad Prism version 5.00 (GraphPad Inc). The two-tailed Mann Whitney test and one-way ANOVA with Bonferroni post hoc correction were used to assess the significance of differences between groups, and the chi squared test to assess the significance of differences between failure and different variables. Probabilities of less than 0.05 were accepted as significant. The primary end points were complication requiring intervention, vascular compromise, and loss of the flap.

Table 1
Personal and clinical details of patients (n = 191).

	No. (%) of patients
Sex:	
Male	112 (59)
Female	79 (41)
Age groups (years)	
29–40	7 (4)
41–50	15 (8)
51–60	51 (27)
61–70	63 (33)
71–80	40 (21)
81–91	15 (8)
Histopathological type of tumour:	
Squamous cell carcinoma	169 (89)
Small salivary gland carcinoma	16 (8)
Bony tumour:	6 (3)
Sarcoma	3
Metastatic tumour	2
Primary intraosseous carcinoma	1
Stage of squamous cell carcinoma:	
I	55
II	24
III	17
IVA	68
IVB	5
Anatomical site of tumour:	
Tongue	56 (29)
Gingiva/mandible	40 (21)
Floor of the mouth	36 (19)
Gingiva/maxilla	17 (9)
Buccal mucosa	17 (9)
Soft palate/oropharynx	14 (7)
Hard palate mucosa	5 (3)
Mandible	3 (2)
Maxilla	3 (2)

Results

A total of 300 patients treated surgically for head and neck malignancy between 2005 and 2010 were identified from the database of the Department of Oral and Maxillofacial Diseases. Of these, 197 had been treated by primary microvascular free flap reconstruction. Six patients had incomplete data, leaving 191 patients for the final analysis.

Table 1 shows clinical and personal details of the patients. Most of the patients were male and the mean (range) age was 64 (29–91) years. A total of 176/191 required neck dissection (93%). Table 2 shows the most commonly used flaps.

Postoperative complications that required surgical intervention are shown in Table 3. Routine elective tracheostomy is not used in our clinic. Patients are monitored closely postoperatively and tracheostomy done only if pharyngeal swelling develops. Two patients showed signs of pharyngeal swelling that required tracheostomy, and for both the swelling was diagnosed within 24 to 72 hours of operation.

Table 4 shows the association between complications and patients' variables.

Eleven flaps were lost, the rate of flap loss/patient and loss/flap being 5.8% and 5.5%, respectively (Table 5). All

Table 2

Types of flaps used for reconstruction. The total number of free flaps was 200 as in nine patients two free flaps were used simultaneously.

Type of free flap	No. (%)
Radial forearm (RF)	86 (45)
Anterolateral thigh (ALT)	48 (25)
Deep circumflex iliac artery (DCIA)	25 (13)
Scapula/parascapula	7 (4)
Other single flaps:	18 (9)
Serratus	4
Rectus abdominis	3
Latissimus dorsi	3
Fibular	3
Lateral arm	3
Temporoparietal	1
Tensor fascia lata	1
Two simultaneous flaps:	7 (4)
ALT + DCIA	3
ALT + fibula	2
RA + DCIA	2

four venous thromboses that occurred within 24 hours of operation were saved, whereas the three that occurred later were lost. The one arterial thrombosis that occurred within 24 hours was lost. There was no significant association between loss of a flap and sex, age, histopathological type of tumour, stage of SCC, or anatomical site of tumour. Osseous flaps were significantly more likely to fail than soft tissue flaps ($p=0.016$). The only significant individual predictor of flap loss was reconstruction with a DCIA flap ($p=0.016$) (Table 4). Loss of the flap was treated successfully in all 11 patients: seven flaps were replaced with another microvascular free flap, and four with a pectoralis major myocutaneous flap.

Discussion

Free flaps are considered to be the main technique for reconstruction of large defects in the soft and hard tissue after

resection of tumours in the head and neck. Despite free flaps having good overall survival, complications are fairly common and are reported to be as high as 28%–50%.^{3,4,9–11} We found both early and late postoperative complications that required intervention in a quarter of the patients. The overall survival of all free flaps was 181/191(95%). This is consistent with results reported from other centres, where the survival rate of free flaps has been reported to range between 85%–100%.^{3–6,8} It is natural that there should be a learning curve, with an increased number of complications and failures in the beginning. However, our reconstructions were all done by the same surgeons between 2005 and 2010 and so were not influenced by these early difficulties.

The DCIA was the flap most often used in our series. As this was a retrospective study the choice of free flap used was based on the subjective preference of the surgeon. Microvascular reconstructions have been done at our clinic since the early 1990s, the DCIA was the first osseous free flap to be introduced, and was the most popular osseous flap at the beginning of this series. Later, the use of the fibular flap increased.

Our only significant predictor of loss of a flap was the use of the DCIA for reconstruction. Five DCIA flaps out of a total of 11 were lost. Wilkman et al also found that the DCIA was associated with a significantly greater loss than other osseous free flaps.¹⁶ In a meta-analysis by Markiewicz et al the DCIA flap was associated with a seven-fold increase in failure compared with the RFFF in mandibular reconstruction.⁵ The fibular free flap has been shown to be the most stable, and has the least bony resorption compared with scapular or iliac crest flaps.¹⁷ The DCIA provides a good stock of bone and soft tissue, but the skin island is often scarce and the pedicle of limited length, and it might require additional vein grafting, which may lead to more complications. Among older patients the presence of atherosclerosis may prevent the use of the fibular flap, so evaluation of the vascular status is essential to prevent donor site morbidity.

Table 3

Types of complication that required intervention ($n=48$) and time of occurrence of complications in the 191 patients. Early complications occurred within 15 days of operation, and late complications after 15 days. Early complications were further classified as (I) <24 hours, (II) 24 to 72 hours, (III) 73 hours to 7 days, and (IV) 8 to 14 days.

Type of complication	No. (%) of patients	No. of early complications				Late complications
		I	II	III	IV	
Infection and/or wound dehiscence	15 (8)	–	–	3	5	7
Vascular compromise:	11 (6)	5	1	2	3	–
Venous thrombosis	7	–	–	–	–	–
Arterial thrombosis	3	–	–	–	–	–
Venous + arterial thrombosis	1	–	–	–	–	–
Partial necrosis	9 (5)	–	–	2	3	4
Haemorrhage or haematoma:	9 (5)	3	3	2	–	1
Haemorrhage	5	–	–	–	–	–
Haematoma	4	–	–	–	–	–
Pharyngeal swelling	2 (1)	–	2	–	–	–
Failure of osteosynthesis	2 (1)	–	–	–	–	2
Total	48 (25)	8	6	9	11	14

Table 4

The associations between the patients' variables and complications that required intervention, vascular compromise, and loss of the flap.

	Total No.	No. (%) complications	No. with vascular compromise	No. of flaps lost
Sex:				
Female	79	33	5	7
Male	112	15 (19)	6 (5)	4 (5)
Age group (years):				
29–40	7	0	0	0
41–50	15	8*	2	2
51–60	52	17	5	6
61–70	63	14	4	3
71–80	39	5	0	0
81–91	15	4	0	0
Squamous cell carcinoma	169	41 (24)	10 (6)	9 (5)
Small salivary gland carcinoma	16	4	1	2
Bony tumour:	6	4	0	0
Sarcoma	3			
Metastatic tumour of jaw	2			
Primary intraosseous carcinoma	1			
Stage of squamous cell carcinoma:				
I	55	11	2	2
II	24	3	1	1
III	17	5	1	1
IVA/IVB	73	21	6	5
Anatomical site of tumour:				
Tongue	56	9	1	0
Gingiva/mandible	40	13	4	4
Floor of the mouth	36	9	3	3
Gingiva/maxilla	17	7	2	2
Buccal mucosa	17	3	0	1
Soft palate/oropharynx	14	2	0	0
Hard palate mucosa	5	1	1	1
Mandible	3	2	0	0
Maxilla	3	2	0	0
Type of flap:				
Radial forearm fasciocutaneous	86	19	3	3
Anterolateral thigh	48	10	1	1
Deep circumflex iliac artery	25	9	3	5**
Scapula/parascapula	7	3	1	0
Other single flaps	18	4	3	2
Two simultaneous flaps	7	3	0	0

* $p = 0.018$.** $p = 0.016$.

We did not find that older age increased the risk of failure of the flap or complications, which is important as most patients with oral cancer are over the age of 60 and the age of patients is slowly increasing.⁷ Several studies have confirmed our findings that greater age is not associated with increased risk of failure of the flap and complications.^{3,18–21}

We found that complications were most common in the age group 41–50 years. Because older patients tend to have more coexisting conditions, the selection for those to have curative ablative surgery is made with more consideration than that of younger patients, who are treated more aggressively despite their general condition. This may bias the results. However, according to our results if preoperative risk factors are taken into consideration even extensive surgery including reconstruction with a free flap may be safe in older patients.

The lowest failure and complication rates in our series were in the ALT free flap group, with a failure rate of 1/48 (2%). ALT flaps have proved to be reliable, with low morbidity

at both donor and recipient sites.²² The RFFF was the flap used most often, in 86/191 cases (45%). Like other centres, our failure rate (3.5%) was low (23).²³ The RFFF is commonly used in the reconstruction of cancers of the head and neck, and its advantage in oral reconstruction is that it is thin and is therefore more suitable for mucosal replacement than other bulkier flaps. It also offers a good, long pedicle and is usable in both intraoral and extraoral defects.

The most common complications were infection or wound dehiscence, or both, in 15 (8%), vascular compromise in 11 (6%), partial necrosis in nine (5%), and haemorrhage or haematoma in nine (5%) of the patients. Venous thrombosis was over twice as common as arterial thrombosis. Of the 48 patients with free flap complications, 34 had complications during the first 14 days postoperatively, and 14 had late complications. Those that developed within the first 24 hours were vascular compromise and haematoma. Arterial thrombosis occurs more typically within the first postoperative days

Table 5

A total of 11 flaps were lost. Specifics of flaps used, reason for loss, and time of loss.

Type of free flap	Postoperative days at loss of flap	Reason for loss of flap
DCIA	2	Arterial thrombosis
DCIA	9	Venous thrombosis
DCIA	12	Venous thrombosis
DCIA	11	Wound dehiscence
DCIA	810	Infection and failure of osteosynthesis
RF	<1	Arterial thrombosis
RF	4	Arterial and venous thrombosis
RF	5	Venous thrombosis
TFL	130	Infection
ALT	390	Infection

DCIA = deep circumflex iliac artery; RF = radial forearm; TFL = tensor fascia lata; and ALT = anterolateral thigh.

and is less likely to result in salvage of the flap than venous thrombosis.¹³ Our three arterial thromboses all developed within the first four days of operation and they all led to loss of the flap. The one arterial thrombosis that occurred within 24 hours was also lost.

Common causes of arterial thrombosis are bleeding, extrinsic compression, and kinking of the vessel.¹³ All four of the venous thromboses that developed within 24 hours of operation were saved, whereas the three later venous thromboses were lost. Overall vascular compromise usually occurs within two days of operation. Early postoperative monitoring for the detection of flap-associated complications is important, but later frequent monitoring should not be forgotten.

In conclusion, DCIA free flaps are associated with a significantly increased risk of failure, which may be the result of poor selection of either patient or flap, the inexperience of the surgeon, or complications during the operation. Osseous free flaps should be chosen carefully for reconstruction after resection of a tumour. Carefully selected older patients are not at increased risk of complications or failure of a free flap. Frequent postoperative monitoring for the detection of complications is important, and may prevent loss of the flap.

Ethics statement/confirmation of patients' permission

The internal review board of the Division of Musculoskeletal Surgery, Helsinki University Hospital, Finland approved the study. Patients' permission was obtained.

Conflict of interest

We have no conflicts of interest.

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