European Journal of Plastic Surgery (2019) 42:577–582
https://doi.org/10.1007/s00238-019-01533-x

ORIGINAL PAPER

Palatal fistulas complicating osseomyocutaneous reconstruction of oncological maxillectomy defects

Nicholas Tang[1] · Peter Tao[2] · Julian Liew[1] · Tim A. Iseli[2] · David Wiesenfeld[3] · Kirstie MacGill[1] · Anand Ramakrishnan[1]

Received: 7 February 2019 / Accepted: 16 April 2019 / Published online: 23 April 2019

Abstract

Background Free flap reconstruction is the standard method for reconstructing large maxillary defects. Palatal fistula is an uncommon complication following reconstructive surgery. This study aims to describe the incidence, etiology, and management of palatal fistulae following reconstruction of oncological maxillectomy defects.

Methods A total of 108 patients from a single institution who underwent maxillectomy surgery between 2008 and 2014 were retrospectively reviewed. Ninety-two patients had resection of the hard palate. Sixty-eight patients underwent immediate free flap reconstruction of the palate; 55 had reconstruction of the hard palate with skin, and thirteen had reconstruction of the hard palate with muscle.

Results The incidence of palatal fistulae in the reconstructed palates was 12% (11 patients) in this series: five after muscular reconstruction of the hard palate and six after cutaneous reconstruction. Muscular reconstruction of the hard palate is associated with a significantly higher incidence of palatal fistulae compared with cutaneous reconstruction ($p = 0.015$). The Cordeiro classification, smoking, diabetes, immunosuppression, and radiotherapy were not significant risk factors ($p > 0.05$).

Conclusions Based on our experience, we caution against attempting direct closure for established palatal fistulae, the majority of patients who had attempted direct closure of their fistulae failed to achieve resolution.

Keywords Maxillectomy · Head and neck oncology · Palatal fistulae · Oroantral fistulae

Introduction

Palatal fistulae following free flap reconstruction of maxillectomy defects present a significant surgical problem. Palatal fistulae are communications between the sinonasal and oral cavities. They cause clinical problems including hypernasal speech and oronasal regurgitation of food and drink that can lead to chronic sinus infections, significant functional impairment [1], and can adversely impact the quality of life. These complications can potentially prolong hospital stay and delay the commencement of adjuvant oncological therapy [1, 2]. While small palatal fistulae can be managed expectantly or with direct repair, fistulae occurring after reconstruction of the palate following oncological resection usually result in much larger defects not amenable to direct closure, locoregional flap reconstruction, or satisfactory prosthetic obturation [3].

The aim of this study is to determine the relationship between perioperative risk factors and fistula formation following maxillectomy reconstruction, as well as to establish the incidence and management of palatal fistula. The risk factors examined were prior radiotherapy, extent of operative defect, smoking status, diabetes, immunosuppression, and type of palatal reconstruction.

A retrospective analysis of patients who underwent maxillectomy was performed at our institution, a tertiary head and neck oncology referral center, to assess the incidence and management of palatal fistulae.

✉ Nicholas Tang
nsjtang@gmail.com

[1] Department of Plastic & Reconstructive Surgery, The Royal Melbourne Hospital, 300 Grattan Street, Parkville, Victoria 3050, Australia

[2] Department of Otolaryngology, Head & Neck Surgery, Nose and Throat Surgery, The Royal Melbourne Hospital, 300 Grattan St, Parkville, Victoria 3050, Australia

[3] Department of Oral and Maxillofacial Surgery, The Royal Melbourne Hospital, 300 Grattan St, Parkville, Victoria 3050, Australia

Methods

Approval for the study was obtained from the Melbourne Health Human Research Ethics Committee Reference Number 2014193.

One hundred eight patients who underwent maxillectomy surgery at the Royal Melbourne Hospital, Victoria, Australia, between the 1st of January 2008 and the 1st of June 2014 were identified through the Australian Comprehensive Cancer Outcomes and Research Database, the head and neck multidisciplinary meeting database, and clinical coding from medical records.

Data was extracted from the head and neck databases and clinical records. Patient demographics, extent of resection, histopathology, previous radiotherapy treatment, adjuvant radiotherapy, diabetes, smoking and immunosuppression status, and the incidence and management of palatal fistulae were recorded [4].

Maxillectomy defects were categorized according to the classification system described by Cordeiro et al. (Fig. 1) [4].

Statistical analysis was performed using IBM ® SPSS ® software (Chicago, IL, USA, 2013).

Results

One hundred eight consecutive patients were identified and included in our study. Sixty-seven patients were male (62%). The average age of the patients at the time of resection was 61 years of age. Squamous cell carcinoma was the predominant histopathology, occurring in 66 patients (61%) (Table 1).

Of the 108 patients, 92 underwent resection of the hard palate (Cordeiro types II and III) (Table 2).

Sixty-seven patients underwent type II subtotal maxillectomy, 16 patients underwent type IIIA total maxillectomy, and nine patients underwent type IIIB total maxillectomy and orbital exenteration. Eleven patients (12%) developed a palatal fistula. Of these patients, eight had a type II subtotal maxillectomy, two patients had a type IIIA total maxillectomy, and one patient had a type IIIB total maxillectomy and orbital exenteration. Seven patients developed fistulae due to dehiscence at the posterior inset between the flap and the soft palate. Four patients developed fistulae secondary to flap necrosis; three of these had partial flap necrosis and one complete flap necrosis.

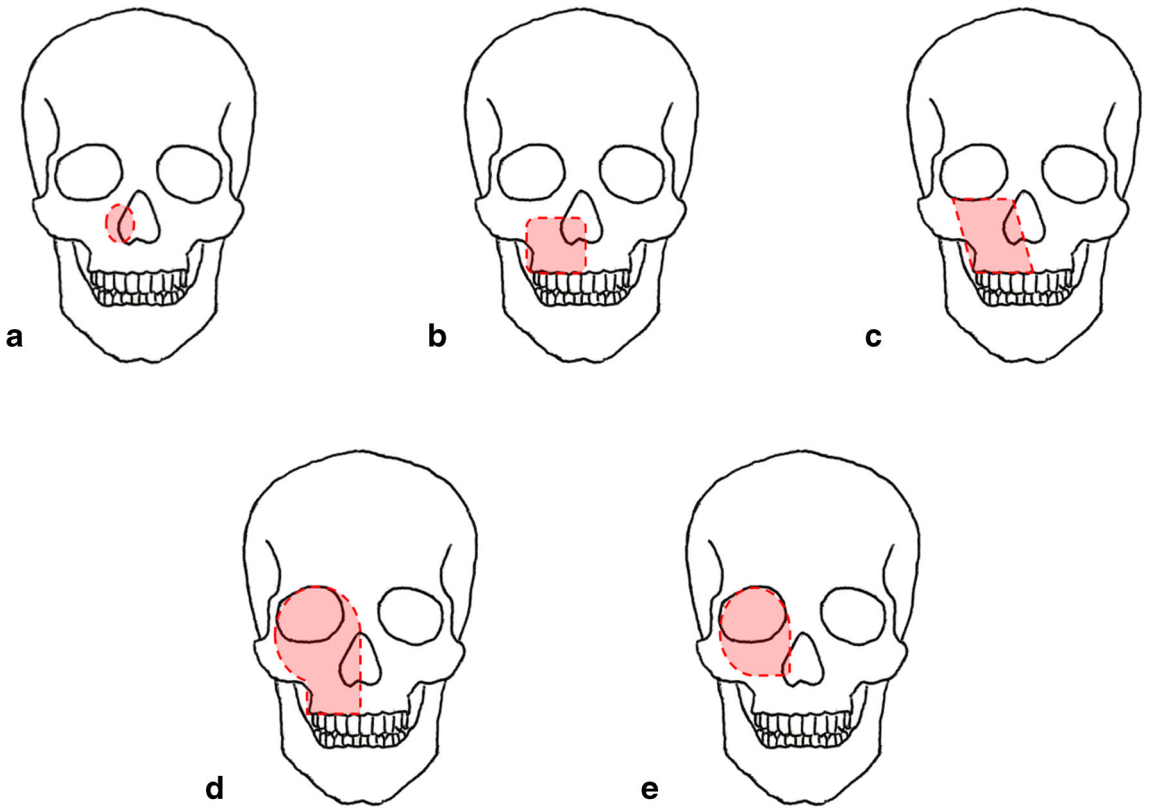

Fig. 1 The Cordeiro Classification of maxillectomy defects [4]. **a** Type I (limited maxillectomy)—resection of one or two walls of the maxilla, excluding the palate. **b** Type II (subtotal maxillectomy)—resection of the maxillary arch, palate, anterior, and lateral walls with preservation of the orbital floor. **c** Type IIIa (total maxillectomy)—resection of all six walls of the maxilla, with preservation of orbital contents. **d** Type IIIb (total maxillectomy)—resection of all six walls of the maxilla, with exenteration of orbital contents. **e** Type IV (orbitomaxillectomy)—orbital exenteration and resection of the upper five walls of the maxilla with preservation of the palate

Table 1 Operative pathology

Pathology	Number of patients
Squamous cell carcinoma	66 (61%)
Verrucous	2 (2%)
Well differentiated	16 (15%)
Moderately differentiated	30 (28%)
Poorly differentiated	18 (17%)
Adenocarcinoma	8 (7%)
Salivary gland carcinoma	6 (6%)
Adenoid cystic carcinoma	1 (1%)
Mucoepidermoid carcinoma	5 (5%)
Ameloblastoma	3 (3%)
Sarcoma	4 (4%)
Melanoma	4 (4%)
Basal cell carcinoma	2 (2%)
Other	15 (14%)
Total	108

A committee of seven senior head and neck reconstructive surgeons determined the reconstructive options at the weekly head and neck multidisciplinary team meeting. Sixty-eight of 92 patients (74%) who underwent resection of their hard palate had immediate free flap reconstruction. Of the 11 patients who developed palatal fistulae (Table 3), five patients had muscular reconstruction of the hard palate (iliacus muscle from four deep circumflex iliac artery flaps and flexor hallucis longus muscle from one free fibula flap) and six had skin reconstruction (skin paddles from three radial forearm free flaps, two free fibula flaps, and one anterolateral thigh free flap). Fourteen patients underwent locoregional flap reconstruction, 11 patients received prosthetic obturation, and ten patients had their defects closed primarily (Table 2).

The initial management of the palatal fistulae (Table 4) was direct closure in six patients, prosthetic obturation in one patient, and healing via secondary intention in four patients. Of the six patients who underwent primary repair, five developed recurrent fistulae. Of the patients with recurrent fistulae, three were managed conservatively and two underwent a second free flap reconstruction achieving resolution. The patient who was initially managed with an obturator subsequently underwent delayed local flap reconstruction, resulting in a resolution of the fistula. Ultimately, only four patients achieved resolution of their fistulae.

Ten patients received previous radiotherapy to the head and neck and three of the ten patients had further adjuvant radiotherapy. In total, 55 patients (51%) received adjuvant radiotherapy. Of the patients who developed palatal fistulae, none had prior radiotherapy and ten received adjuvant radiotherapy. However, in all ten patients, the fistulae developed prior to the commencement of radiotherapy.

Of the patients who underwent resection of the hard palate, 40 patients were current or ex-smokers, ten patients had diabetes, and seven patients were immunosuppressed from hematological malignancy or chemotherapy.

Discussion

The present series is the largest published series of free flap reconstruction for oncological maxillary defects. Palatal fistulae are an uncommon complication following maxillectomy and palatal resection; the incidence of palatal fistulae in our population was 12%. Smaller series have found a similar

Table 2 Type of maxillary reconstruction according to the Cordeiro Classification

Method of maxillary reconstruction	I	II	IIIa	IIIb	IV	Totals
ALT FF	3 (23%)	14 (21%)	4 (25%)	1 (11%)	1 (33%)	23
Free fibula FF		9 (13%)	7 (44%)	1 (11%)		17
Radial forearm FF		11 (16%)				11
DCIA FF		4 (6%)	4 (25%)			8
Rectus abdominis FF		3 (4%)		6 (67%)		9
Combination FF		2 (3%)		1 (11%)		3
Parascapular FF		1 (1%)				1
Pectoralis major		1 (1%)				1
Pedicled flap						0
Local flap	3 (23%)	8 (12%)	1 (6%)		2 (67%)	14
Obturator	1 (8%)	10 (15%)				11
Primary closure	6 (46%)	4 (6%)				10
Total	13	67	16	9	3	108

Number of patients according to the Cordeiro Classification (percentage)

ALT, anterolateral thigh; *DCIA*, deep circumflex iliac artery; *FF*, free flap

Table 3 Summary of patients who developed palatal fistula

Patient no.	Age at operation	Extent of defect (Cordeiro Classification)	Operative pathology	Free flap reconstruction	Palatal reconstruction—flap component
1	54	IIIa	Papillary adenocarcinoma	DCIA FF	Muscular
2	68	II	Poorly diff. SCC	Free fibula FF	Skin
3	47	II	Ameloblastoma	Free fibula FF	Muscular
4	43	II	Moderately diff. SCC	Radial forearm FF	Skin
5	36	II	Intermediate-grade adenocarcinoma	Radial forearm FF	Skin
6	72	IIIb	Poorly diff. SCC	Free fibula FF	Skin
7	64	II	Well-diff. SCC	DCIA FF	Muscular
8	71	II	Carcinoma ex ameloblastoma	DCIA FF	Muscular
9	63	IIIa	Poorly diff. SCC	DCIA FF	Muscular
10	47	II	Moderately diff. SCC	Radial forearm FF	Skin
11	82	II	Moderately diff. SCC	ALT FF	Skin

ALT, anterolateral thigh; *DCIA*, deep circumflex ilia artery; *FF*, free flap; *SCC*, squamous cell carcinoma; *diff.*, differentiated

incidence of fistula formation between 5 and 10% [5–8]. Similarly, the reported incidence of post-operative fistulae following primary cleft palate repair is at 8.6%, with a significantly higher incidence demonstrated in higher Veau classes and with no statistically significant difference in fistula rates when comparing unipedicled and bipedicled palatal repair techniques [9].

We hypothesized the larger and more complex defects would have a greater risk of fistula formation; however, our results demonstrated that the Cordeiro Classification did not correlate with the incidence of palatal fistulae (p value = 0.995) (Table 5).

Many studies have identified neoadjuvant radiotherapy as a significant risk factor for free flap failure and fistula formation [10–12]. Our study did not demonstrate a correlation between neoadjuvant or adjuvant radiotherapy with fistula formation as none of the patients who developed fistulae had prior radiotherapy in our study.

Our study also did not demonstrate a correlation between smoking and fistula formation (p value 0.513) (Table 5). This is supported by two studies, Lee et al. and Choi et al., which demonstrate smoking does not increase the risk of complications following head and neck reconstructive surgery [12, 13].

Our study also did not detect a correlation between diabetes mellitus or immunosuppression with fistula formation (p-values 0.849 and 0.159, respectively) (Table 5).

In this series, the four main free flaps used for reconstruction were deep circumflex iliac artery flap, radial forearm flap, fibula flap, and anterolateral thigh flap. The component of the free flap used for palatal reconstruction was either muscle or skin. Insetting and suturing muscle to mucosa for a palatal defect is technically more difficult

Table 4 Management of patients with palatal fistula

Patient no.	Initial management of palatal fistula	Resolution of palatal fistula after initial management	Definitive management of palatal fistula	Resolution of palatal fistula after definitive management
1	Primary repair	No	Free flap (rectus abdominis)	Yes
2	Conservative	N/A	Conservative	No
3	obturator	No	Local flap	Yes
4	Primary closure	No	Conservative	No
5	Primary closure	No	Free flap (radial forearm)	Yes
6	Primary closure	Yes	–	Yes
7	Conservative	N/A	Conservative	No
8	Conservative	N/A	Conservative	No
9	Primary closure	No	Conservative	No
10	Primary closure	No	Conservative	No
11	Conservative	N/A	Conservative	No

Table 5 Analysis of risk factor for developing palatal fistulae

		Palatal fistulae	No fistulae	*p* value
Palatal reconstruction	Skin	6	49	
	Muscle	5	8	0.015
Cordeiro classification	II	8	59	
	IIIa	2	14	
	IIIb	1	8	0.995
Smoking status	Never	8	44	
	Past	2	25	
	Current	1	12	0.513
Diabetes	Diabetes	1	9	
	No diabetes	10	72	0.840
Immunosuppression	Immunosuppression	2	5	
	No immunosuppression	9	76	0.159

than suturing skin to mucosa. However, the muscular component has an advantage as it may swell initially to provide watertight obturation, and then later atrophies to decrease bulk of the reconstruction. Muscle also undergoes mucosalization to provide a more natural long-term appearance [14]. The cutaneous component of free flaps is usually more independent of the bony component allowing for greater flexibility in the palatal inset. The cutaneous component can also be inset to allow an epithelial surface for both the oral and nasal surfaces of the palate thereby reducing the risk of flap contracture and flap dehiscence.

Our series supports the hypothesis that the incidence of palatal fistula is higher in muscle reconstruction compared with skin reconstruction (p value = 0.015) (Table 5).

In this series, five of the six patients failed direct closure of their palatal fistulae. If palatal fistulae occur after oncological reconstruction, we caution the reconstructive surgeon from resuturing small palatal dehiscence unless the primary etiology of the fistula has been addressed.

In the reconstruction of complex maxillectomy defects, we prefer to use osseofasciocutaneous flaps where possible, as we believe the cutaneous component is more reliable in palatal reconstruction. Although we routinely attempt to reconstruct the palate with the cutaneous component of the free flap, sometimes the only feasible option is to use the muscular component for palatal reconstruction due to the size of the defect and a lack of skin perforators from the vascular pedicle of the free flap.

Compliance with ethical standards

Funding No funding was received in relation to the research presented or preparation of the manuscript.

Conflict of interest Nicholas Tang, Peter Tao, Julian Liew, Tim A Iseli, David Wiesenfeld, Kirstie MacGill, and Anand Ramakrishnan declare that they have no conflict of interest.

Ethical approval Approval for the study was obtained from the Melbourne Health Human Research Ethics Committee Reference Number 2014193.

Informed consent Informed consent was regarded as unnecessary in this retrospective study following ethics approval.

References

1. Ng RW, Wei WI (2005) Elimination of palatal fistula after the maxillary swing procedure. Head Neck 27(7):608–612
2. Anavi Y, Gal G, Silfen R, Calderon S (2003) Palatal rotation-advancement flap for delayed repair of oroantral fistula: a retrospective evaluation of 63 cases. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 96(5):527–534
3. McCarthy CM, Cordeiro PG (2010) Microvascular reconstruction of oncologic defects of the midface. Plast Reconstr Surg 126(6): 1947–1959
4. Cordeiro PG, Santamaria E (2000) A classification system and algorithm for reconstruction of maxillectomy and midfacial defects. Plast Reconstr Surg 105(7):2331–2346
5. Futran ND (2001) Retrospective case series of primary and secondary microvascular free tissue transfer reconstruction of midfacial defects. J Prosthet Dent 86(4):369–376
6. Foster RD, Anthony JP, Singer MI et al (1996) Microsurgical reconstruction of the midface. Arch Surg 131:960–966
7. Moreno MA, Skoracki RJ, Hanna EY, Hanasono MM (2010) Microvascular free flap reconstruction versus palatal obturation for maxillectomy defects. Head Neck 32(7):860–868
8. Muneuchi G, Miyabe K, Hoshikawa H, Hata Y, Suzuki S, Igawa HH, Mori N (2006) Postoperative complications and long-term prognosis of microsurgical reconstruction after total maxillectomy. Microsurg. 26:171–176
9. Hardwicke JT, Landini G, Richard BM (2014) Fistula incidence after primary cleft palate repair: a systematic review of the literature. Plast Reconstr Surg 134(4):618e–627e
10. Fujioka M. Factors predicting total free flap loss after microsurgical reconstruction following the radical ablation of head and neck cancers

11. Benatar MJ, Dassonville O, Chamorey E, Poissonnet G, Ettaiche M, Pierre CS, Benezery K, Hechema R, Demard F, Santini J, Bozec A (2013) Impact of preoperative radiotherapy on head and neck free flap reconstruction: a report on 429 cases. J Plast Reconstr Aesthet Surg 66:478–482
12. Choi S, Schwartz D, Farwell G et al (2004) Radiation therapy does not impact local complication rates after free flap reconstruction for head and neck cancer. Arch Otolaryngol Head Neck Surg 130: 1308–1312
13. Lee DH, Kim SY, Nam SY, Choi SH, Choi JW, Roh JL (2011) Risk factors of surgical site infection in patients undergoing major oncological surgery for head and neck cancer. Oral Oncol 47:528–531
14. Syme DB, Shayan R, Grinsell D (2012) Muscle-only intra-oral mucosal defect reconstruction. Plast Reconstruct Surg 65(12):1654–1659