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Tracheostomy or delayed extubation after maxillofacial free-flap reconstruction?

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Abstract

Tracheostomy is commonly done to secure the airway after free-flap reconstruction in the head and neck, but it can have serious complications. We reviewed the outcomes of 78 patients who had microvascular free-flap reconstruction for maxillofacial pathology. Twenty-five had primary tracheostomy and 53 delayed extubation 24–48 hours after operation. Both groups had similar operations, and the duration of stay in the intensive therapy unit (ITU) was almost identical. However, the overall hospital stay was significantly longer (27.2 days) in the tracheostomy group than in the delayed extubation group (20.4 days, $p = 0.03$). Three patients who had a tracheostomy had serious complications related to the procedure (12%), including cardiorespiratory arrest when the tracheostomy tube was obstructed. Only one patient in the delayed extubation group required a delayed (secondary) tracheostomy for persistent oedema of the airway and failed delayed extubation (2%), and a further two had a tracheostomy for other reasons (4%). Of those who had delayed extubation, 50 (94%) did not ultimately require a tracheostomy, which is consistent with other studies. We have used our data to develop an algorithm to help clinicians decide when tracheostomy is needed. In general, primary tracheostomy should be considered for patients who have maxillofacial free-flap reconstruction and bilateral neck dissection, or those with oropharyngeal tumours who need additional access procedures. Delayed extubation is safe after free-flap reconstruction and unilateral neck dissection in patients who do not have conditions such as obstructive sleep apnoea or poor lung function.

Keywords: Tracheostomy; Free-flap; Extubation; Airway; Maxillofacial; Reconstruction

Introduction

The methods used to secure the airway after free-flap reconstruction of the head and neck are controversial. Some clinicians do a tracheostomy routinely while others keep patients intubated overnight, and aim to extubate the following day (delayed extubation). In a survey of British maxillofacial units, 30% would "usually" and 39% would "almost always" do an elective tracheostomy for uncomplicated free-flap maxillofacial operations.[1] However, the procedure carries risks. Complications range from minor problems such as hypertrophic scarring to life-threatening events such as blockage of the tube and respiratory arrest, and rates vary between 4% and 45%.[2–6] We know of no universally accepted algorithm or scoring system to help clinicians choose the most appropriate method of managing the airway,[7,8] but reported evidence suggests that patients who do not have a tracheostomy recover faster and have a shorter stay in hospital than those who do. [5,9–11] Restricting the use of tracheostomy to selected cases has also become an important part of some ERAS (enhanced recovery after surgery) programmes.[12] Unfortunately, it can be difficult to compare the outcomes of operations on the head and neck between

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patients who have had a tracheostomy and those who have not because of the diverse range of coexisting conditions and the different operations.[10,13]

At the Oral and Maxillofacial Surgery (OMFS) Unit at St George's Hospital, London, UK, tracheostomy is done only in selected patients who have free-flap reconstruction. We retrospectively audited the postoperative management of the airway (tracheostomy or delayed extubation) in these patients, and reviewed the cases that required a secondary or delayed tracheostomy, and those with serious complications related to the procedure.

Material and methods

Patients who had microvascular free-flap reconstruction by the OMFS team at St George's Hospital between April 2013 and April 2015 were included. Reconstruction was done for malignant (such as squamous cell carcinoma) or benign disease (such as ameloblastoma or osteoradionecrosis). Patients were divided into two groups: those who had a tracheostomy at the time of operation (primary tracheostomy), and those who were kept intubated and admitted to the intensive therapy unit (ITU) with the aim of being extubated in the following 24-48 hours (delayed extubation). The consultant surgeon and anaesthetist evaluated all the patients before and after operation according to the protocol of the unit. Generally, from an anaesthetic point of view, tracheostomy was recommended for patients with obstructive sleep apnoea, obesity, or those with a grade III or IV laryngoscopy view or poor lung function, or both. Tracheostomy apparatus consisted of a cuffed, non-fenestrated tracheostomy tube with an inner cannula that was inserted though a routine surgical approach. Patients in this group were subsequently admitted to the ITU. Those in the delayed extubation group were admitted to the ITU at the end of the operation with the endotracheal tube in place. The next morning, they were assessed by both the OMFS and ITU teams to find out if they could be safely extubated before transfer to the surgical ward.

Patients whose operations did not involve a free-flap, and those who did not have sufficient data, were excluded from the study. We obtained information on each case from patients' notes, and from theatre, operative, and pathology records, discharge summaries, clinical letters, and radiographs. Details included sex, age at operation, TNM staging, site and subsite of the maxillofacial tumour (anterior, posterior, midline), type of free-flap (soft tissue, composite), type of neck dissection, and whether it was unilateral or bilateral. We also documented all coexisting conditions, serious inpatient complications, additional procedures, and returns to theatre, as well as all serious complications that resulted from the tracheostomy, and which patients required a delayed tracheostomy. Statistical analysis was completed with the help of Minitab® software Version 17.2 (Minitab Ltd, Coventry, UK).

Table 1
Summary of results from both groups. Data are number (%) unless otherwise stated.

	Tracheostomy group (n = 25)	Delayed Extubation group (n = 53)
Median (range) age (years)	57 (60)	64 (64.5)
Male: female ratio	17: 8	23: 30
Diagnosis:		
SCC	21	42
Osteoradionecrosis	2	6
Ameloblastoma	0	3
Post trauma	1	1
Other malignancy	1 (adenoid cystic carcinoma)	1 (cribriform adenocarcinoma)
T-stage:		
1	4 (19)	12 (29)
2	11 (52)	12 (29)
3	0	3 (7)
4	6 (29)	15 (35)
Mandibulectomy:		
Segmental	4	15
Unilateral neck dissection	2	14
Bilateral neck dissection	2	1
Marginal	0	8
Unilateral neck dissection		8
Oral tongue/floor of mouth:	14	19
Unilateral neck dissection	1	18
Bilateral neck dissection	13	1
Buccal:	0	5
Unilateral neck dissection		5
Oropharyngeal:	5	1
Unilateral neck dissection	5	1
Midface:	0	5
Unilateral neck dissection		5
Lip/chin/skin/post trauma	2	0
Type of free-flap:		
Radial	20	31
ALT	1	1
Composite radial	0	5
Fibular	2	5
DCIA	2	11
Delayed trache required	N/A	3 (5.6)
Median (range) nights in ITU	1 (1–6)	1 (1–9)
Median (range) duration of stay	22 (8–57)	16 (9–49)
Gastrostomy	12 (48)	9 (8.6)
Return to theatre	5 (20)	10 (18.9)

(SCC = squamous cell carcinoma; ALT = anterolateral thigh, DCIA = deep circumflex iliac artery flap; ITU = intensive therapy unit).

Results

Eighty-four maxillofacial reconstructive operations were done over a 2-year period. Six patients who did not have free-flaps were excluded from the study (Table 1). Of the remaining 78, 63 (81%) were treated for squamous cell carcinoma (SCC), 8 (10%) for osteoradionecrosis, and 7 (9%) for other diagnoses (Table 1).

The group consisted of 40 men and 38 women, with a median (range) age of 61.8 (28–92) years. Pre-existing conditions and postoperative complications were similar in both groups. The types of operation are summarised in Table 1.

Of note, about three-quarters of patients who had segmental mandibulectomy, and all of those who had marginal mandibulectomies, did not have a tracheostomy. Around 40% of those who had resection of tumours of the tongue or floor of the mouth had a tracheostomy, as most required a bilateral neck dissection (n = 13/14). The risk of postoperative oedema of the airway is higher with bilateral neck dissection than with unilateral dissection, so most patients with tumours at these sites, which crossed the midline, had a tracheostomy. Three patients in the tracheostomy group who had unilateral neck dissections had a tracheostomy for anaesthetic reasons (obstructive sleep apnoea, obesity, and possible difficult reintubation). Of note, lip split mandibulotomy was done as an additional access procedure in all patients in the tracheostomy group who had oropharyngeal tumours resected. None of those with buccal or midfacial tumours required a tracheostomy.

Return to theatre and delayed tracheostomy

Five patients from the tracheostomy group (20%) and 10 from the delayed extubation group (19%) required a return to theatre. Three (6%) in the delayed extubation group required a secondary tracheostomy. One had multiple further operations one week postoperatively, including removal of a failed free-flap and an operation for a small bowel obstruction. Another, who had a deep circumflex iliac artery (DCIA) free-flap and unilateral neck dissection for a T4aN2bM0 SCC of the mandible, had had three failed extubations in the ITU. The reasons for this included persistent laryngeal oedema (the cause of which was uncertain) and a cough that reduced respiratory effort. This patient had smoked for a long time and had a background of chronic obstructive pulmonary disease resulting in poor lung function. Tracheostomy was done 4 days after the initial reconstruction.

The third patient required a delayed tracheostomy 2 days postoperatively because of low oxygen saturations that necessitated a high fraction of inspired oxygen (FiO2), but was difficult to wean off the ventilator. He also had excessive oropharyngeal secretions and initial intubation was difficult. Further investigation showed that he had had a cardiac ischaemic event resulting in pulmonary oedema, and he died 2 weeks after operation, probably from sepsis from an ischaemic bowel.

Serious complications of tracheostomy

Three patients (12%) (all from the tracheostomy group) had serious complications that were related to the tracheostomy. The first had a cardiorespiratory arrest on the ward when the tube was blocked, and required resuscitation. This was successful, but the patient subsequently had aspiration pneumonia and needed a long hospital admission (45 days). The second had had a radiologically-inserted gastrostomy tube (RIG) one week after partial glossectomy and free-flap reconstruction because of difficulties swallowing. Unfortunately, the tracheostomy tube became dislodged during the procedure and was reinserted into a false passage. The patient subsequently lost his airway and went into cardiorespiratory arrest. He was successfully resuscitated and transferred to the intensive care unit for further monitoring. He made a good recovery and was discharged after a prolonged admission. The final patient had a history of alcoholism and became extremely agitated on the sixth postoperative day despite having been on the alcohol detoxification pathway. He partially removed his own tracheostomy, which was replaced by nurses who inadvertently created a false passage. He developed subcutaneous emphysema, removed his tube again, and absconded from the ward. Later that day he was returned by the emergency services complaining of difficulty breathing. His tracheostomy was successfully reinserted and he was discharged home after 10 days.

ITU and duration of stay in hospital

The duration of initial postoperative stay in the ITU was similar in both groups (mean (SD) tracheostomy group: 1.96 (1.79) and delayed extubation group 1.98 (1.634) nights; median: 1 night for both). The overall duration of hospital stay was significantly longer in the tracheostomy group than in the delayed extubation group (mean (SD): 27.2 (12.57) compared with 20.4 (13.08) days, $p < 0.032$; median (range) 22 (8–57) compared with 16 (9–49) nights). However, 48% (n = 12) in the tracheostomy group had a gastrostomy for enteral feeding and 8.6% (n = 9) in the delayed extubation group, which increased in the duration of stay.

Discussion

Free-flap reconstruction of the head and neck is complex and involves many factors that can potentially contribute to complications. Postoperative management of the airway varies, and tracheostomy or delayed extubation are reported more commonly than immediate extubation. Although there is no definitive guide for securing the airway in these cases, published papers show that routine use of tracheostomy can be associated with adverse outcomes.

Patel et al[11] prospectively reviewed 796 patients who had free-flap reconstruction of the head and neck, and found that tracheostomy was an independent predictor (OR 1.88) for higher rates of postoperative complications such as lower respiratory tract infections. A study by Clark et al[9] supported these findings and showed in a similar population that tracheostomy was not only an independent predictor of surgical complications (OR 2.46), but also the most important predictor of increased median hospital stay (9.5 compared with 16 days). This is consistent with Castling et al,[5] who found that patients who had tracheostomy-related complications had a longer hospital stay than those who did not (14 compared with 25 days). In our study, those who had a tracheostomy had a significantly longer mean hospital stay than those who

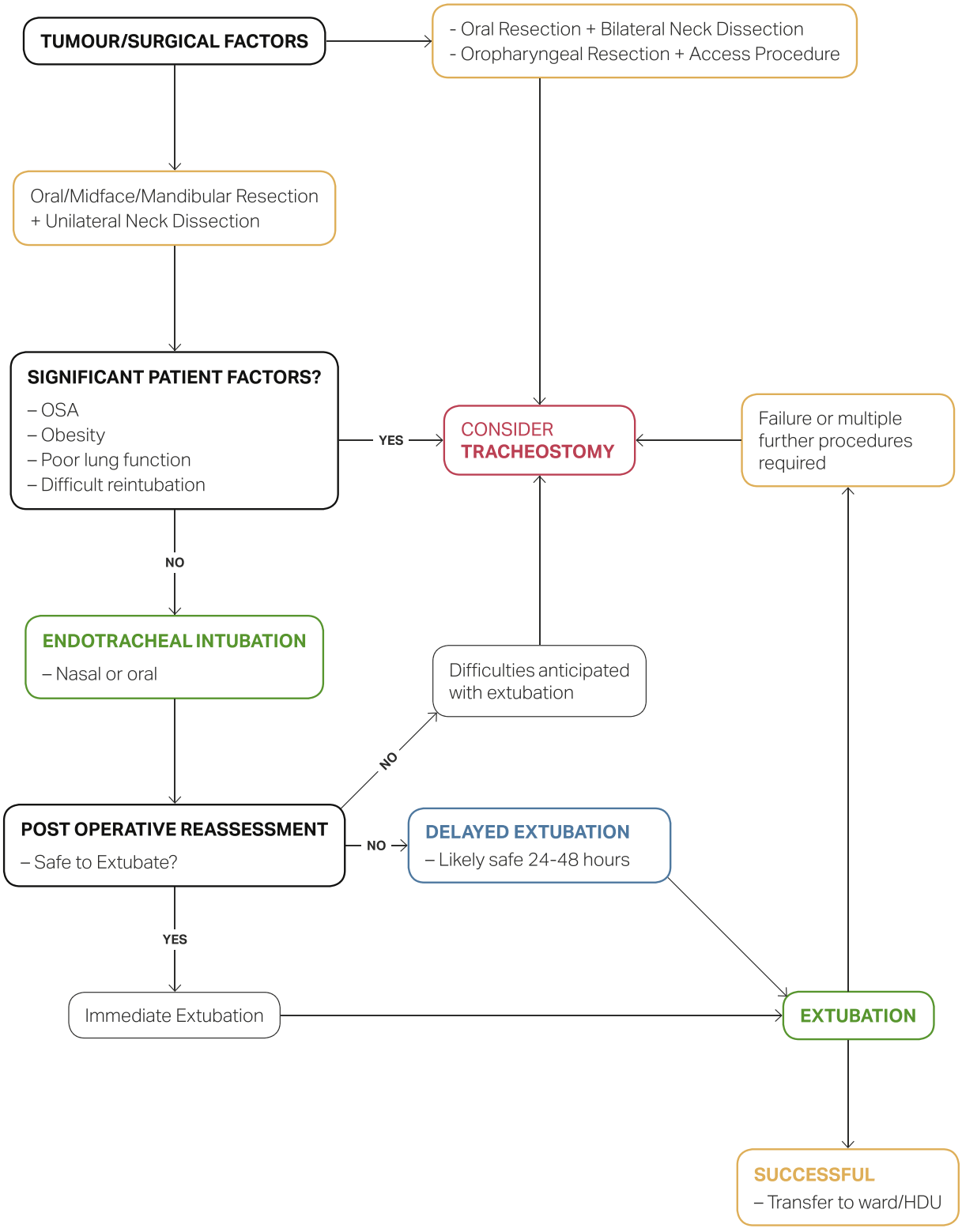

Fig. 1. Algorithm to show management of the airway after maxillofacial free-flap reconstruction (HDU = high dependency unit).

had delayed extubation, but these results must be interpreted with caution, as other factors, such as insertion of RIG, can delay discharge.

Various scoring systems have been produced to help clinicians decide which patients may benefit from a tracheostomy.[8,14] The system described by Cameron et al[8] used data from 148 patients who were divided into three groups: those who had an elective tracheostomy, those ventilated overnight through an endotracheal tube, and those extubated at the end of the operation. Although simple to use, it did not correlate well with the findings of other authors who retrospectively studied their practice.[15] In their review of 104 patients who required free-flap reconstruction for oral cancer, Lee et al[7] found the system unreliable, as many of their patients who had scores greater than five and did not have a tracheostomy, still made a satisfactory recovery. Other studies have shown that patients who have had maxillectomy or mandibulectomy can have successful outcomes without the routine use of tracheostomy.[16,17] A scoring system should therefore act as a tool in the clinician's armamentarium rather than a decision-making system alone.

Our data agree with those of Coyle et al[10] who compared patients who had free-flap reconstruction at two head and neck units: one in which primary tracheostomy was done routinely and the other in which overnight intubation was done (50 patients in each). There were fewer lower respiratory tract infections and airway complications, and better recovery, including a faster return to function, in those who did not have a tracheostomy. The authors also suggested that delayed extubation is more cost-effective because operating times, the duration of stay in the ITU, and overall hospital stay, are shorter.

Of those who had delayed extubation in our study, 50/53 (94%) did not ultimately require a tracheostomy. Overall, no specific airway-related problems were noted when patients had further procedures under general anaesthetic, and only one required a tracheostomy because of multiple returns to theatre.

Tracheostomy is not routinely required for control of the airway after free-flap reconstruction, and should be done in selected cases only. We have developed an algorithm to help clinicians decide which patients may be suitable for delayed extubation or tracheostomy (Fig. 1).

Conflict of interest

We have no conflicts of interest.

Ethics statement/confirmation of patients' permission

All authors declare that there are no ethical issues associated with this retrospective study. Patient data have been anonymised.

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