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Original Article

Risk factors for postoperative adverse airway events in patients with primary oral cancer undergoing reconstruction without prophylactic tracheostomy

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A B S T R A C T

Objective: To identify risk factors associated with adverse airway events (AAEs) in primary oral cancer patients undergoing tumor ablation followed by free tissue transfer without prophylactic tracheostomy.
Methods: We retrospectively collected primary oral cancer patients who underwent tumor ablation surgery following free-tissue transfer without prophylactic tracheostomy during February 2017 to June 2019 in Chang Gung Memorial Hospital, Linkou Medical Center, Taiwan. 379 patients were included. Data were analysed from 2020 to 2021. Demographics, comorbidities, intraoperative variables and post-operative respiration profile were obtained from the medical record. Main outcome was postoperative AAEs, including requirement of endotracheal intubation after extubation and tracheostomy after prolonged intubation.
Results: Of the 379 patients, postoperative AAEs happened in 29 patients (7.6 %). In reintubation group, patients were older with more diabetes mellitus, hypertension and cerebrovascular disease. These patients had lower preoperative hemoglobin, creatinine, and albumin level with more intraoperative blood transfusion. In postoperative respiration profile, rapid shallow breathing index (RSBI) and PaO2/FiO2 (PF) ratio were poorer. On multivariate analysis, patient's age, tumor location, and cross-midline segmental mandibulectomy and a lower PF ratio were independent risk factors for postoperative AAEs.
Conclusions: In head and neck cancer patients that underwent tumor ablation followed by free tissue transfer without prophylactic tracheostomy, patient's age, tumor location, cross-midline segmental mandibulectomy and P/F ratio are associated with postoperative AAEs.

1. Introduction

Head and neck cancer has been the major cause of death for years worldwide, and oral cavity cancer is the sixth most common cancer in Taiwan, with the prevalence of 14.3 per 100,000 patients in 2020.[1,2] Currently, surgical resection with neck dissection followed by free flap reconstruction is the mainstay of treatment in most cases.[2,3] In oral cavity reconstruction, postoperative airway compromise is a major concern for both surgeons and anesthesiologists. The need for tracheostomy has also been the subject of much discussion.[4–11]

Prophylactic tracheostomy is currently performed to manage the airway in head and neck cancer patients undergoing free flap reconstruction in some centres, whilst others prefer to perform a selective tracheostomy in patients that fit specific protocol criteria.[12] A tracheostomy is indicated for patients who suffer from upper airway obstruction with prolonged endotracheal intubation that can potentially result in airway compromise caused by edema,

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haemorrhage or a bulky flap following free flap reconstruction surgery.[9,12] A prophylactic tracheostomy can reduce the risk of self-extubation in the postoperative period,[13] which is a common reason for doing so.

Complications of a tracheostomy include dysphonia, pneumonia, tracheal haemorrhage, tracheal stenosis, tracheoesophageal fistula, airway stenosis, mucus plugging and airway obstruction.[14,15] Patients who have had a tracheostomy recovered more slowly and undergo longer intensive care unit (ICU) and hospital stays than those who did not receive a tracheostomy,[5,16,17] which are the reasons for advocating against performing a prophylactic tracheostomy routinely.

To date, several studies have been conducted to evaluate the necessity of tracheostomies and there remains no consensus on the criteria for prophylactic tracheostomies in patients undergoing major head and neck surgery. The risk factors for adverse airway events (AAEs) in these patients are also not clearly defined. In the present study, we aim to identify the risk factors which potentially lead to an AAEs in patients who have undergone head and neck cancer ablative surgery and free flap reconstruction without prophylactic tracheostomy.

2. Methods

2.1. Study population

The study population consisted of primary oral cancer patients who underwent tumour ablation followed by microvascular reconstructive surgery without prophylactic tracheostomy ($n = 392$) at Chang Gung Memorial Hospital, Linkou Medical Center, Taiwan, between February 2017 and June 2019. We excluded patients with a follow-up period less than 6 months ($n = 5$) and patients with incomplete medical records ($n = 8$). 379 patients were enrolled for data analysis following approval by the Chang Gung Memorial Hospital Linkou institutional review board (approval number IACUC2020061904, approval date 1 Aug 2020).

2.2. Study variables

We collected patient demographic data, including age, gender, body mass index (BMI), tumor sites, TNM, cancer stage, American Society of Anesthesiology (ASA) score, reconstruction free flap types, baseline comorbidities - diabetes mellitus (DM), hypertension (HTN), liver disease (liver cirrhosis, hepatitis B virus or hepatitis C virus carrier), pulmonary disease (chronic obstructive lung disease and previous tuberculosis), heart disease (acute myocardial infarction, arrhythmia and angina) and cerebrovascular events. Preoperative laboratory data like creatinine (mg/dl), hemoglobin (g/dl), albumin levels (g/dl) were included. Operative variables collected include surgery methods, operative time, intraoperative blood loss and blood transfusion. Segmental mandibulectomy defects were classified by HCL classifications, as proposed by Jewer and Boyd et al in 1989.[18] Before extubation, the respiratory parameters were measured and ensured that they were as per institution weaning protocols to prevent immediate reintubation events. These following parameters were recorded - ventilator settings of respiratory rate (breaths/minutes), tidal volume (mL), fraction of inspired oxygen, FiO_2 (%), arterial blood gas: pH, partial pressure of oxygen, PaO_2 (mmHg), partial pressure of carbon dioxide, $PaCO_2$ (mmHg), bicarbonate, HCO_3^- (mmol/L), base excess (mmol/L), and respiratory index such as rapid shallow breathing index, RSBI, which is a ratio calculated as respiratory rate (breaths/minutes)/tidal volume (L), and PaO_2/FiO_2 ratio, which is calculated as PaO2 (mmHg)/FiO2 (%).

2.3. Outcomes

The main outcome of this study is postoperative AAEs. These adverse events were defined as: 1. Requirement for endotracheal intubation with mechanical ventilation because of respiratory failure due to airway compression causing severe respiratory distress, hypoxia or hypercapnia within 7 days after extubation; 2. Tracheostomy after prolonged intubation because of difficult weaning from mechanical ventilator support due to medical comorbidities.

2.4. Statistical analysis

Defined study variables were expressed as frequencies (percentages) or means ± standard deviations (SDs). Continuous variables were appropriately analysed with student t test or Mann–Whitney U test, and category variables with chi square test or Fisher's exact test accordingly. Univariate analysis was performed in all study variables to determine crude odds ratio. Multivariate analysis was used to estimate adjusted odds ratio to determine independent predictive risk factors for AAEs. All analyses were performed using R (version 4.0.3) (R Foundation for Statistical Computing, Vienna, Austria). The level of p-value <0.05 is indicated a statistical significance.

3. Results

3.1. Demographics

The study population was divided into non-reintubation and reintubation groups, and the comparison in demographic characteristics is summarized in Table 1. Among the 379 enrolled study population, AAEs occurred in 29 patients (7.7 %). The mean age was significantly older in the AAEs group (64.9 ± 13.6 years) compared to non-AAEs group (53.1 ± 12 years), $p < 0.001$. The distribution of tumor location was also different in each group ($p = 0.002$), and predominantly located in the gingiva (10/29, 34.5 % vs 65/350, 18.6 %), mouth floor (5/29, 17.2 % vs 14/350, 4 %), and tongue (4/29, 13.8 % vs 32/350, 9.1 %) in AAEs group. We also noted that there were more patients with tumor stages T3/T4 in the AAEs group (27/29, 93.1 %) compared to the non-AAEs group (296/350, 84.6 %), $p = 0.045$. Among the baseline comorbidities, percentage of diabetes mellitus, hypertension and cerebrovascular events were also higher in AAEs group (10/29, 34.5 % vs 61/350, 17.4 %, $p = 0.024$; 11/29, 37.9 % vs 76/350, 21.7 %, $p = 0.046$; 3/29, 10.3 % vs 4/350, 1.1 %, $p < 0.001$ respectively). There was no significant difference between the two groups regarding gender, BMI, ASA, overall cancer stage and reconstruction flap selection.

3.2. Operative variables

Comparing operative variables to non-AAEs group in Table 2, AAEs group had higher preoperative creatinine (1.16 ± 0.46 vs 0.95 ± 0.25 mg/dl, $p = 0.033$), lower hemoglobin (13.12 ± 0.22 vs 14.41 ± 1.8 g/dl, $p < 0.001$) and albumin level (4.26 ± 0.43 vs 4.47 ± 0.37 g/dl, $p = 0.004$). In patients who underwent segmental mandibulectomy, their mandible defects were classified by HCL classification, and there was significant difference in types of mandible defect ($p < 0.001$). Also, more patients underwent bilateral lymph node dissection (6/29, 20.7 % vs 21/350, 6 %, $p = 0.006$) and needed blood transfusion more than 2 units (14/29, 48.3 % vs 80/350, 22.9 %, $p = 0.002$) in the AAEs group. However, there were no differences noted in numbers of maxillectomy or marginal mandibulectomy, mean operative time and blood loss.

Table 1
Demographics.

Variables	Non-AAEs, n = 350	AAEs,n = 29	*p*
Age, years, mean (SD)	53.1 (12)	64.9 (13.6)	<0.001*
Gender (%)			0.992
Male	314 (89.7)	26 (89.7 %)	
Female	36 (10.3)	3 (10.3 %)	
BMI[a]**, kg/m^2, mean** (SD)	25.3 (4.5)	24.9 (4.6)	0.627
Overall Stage (%)			0.445
I/II	142 (40.5)	10 (34.5)	
III/IV	208 (59.4)	19 (65.5)	
ASA[b] (%)			0.461
I	5 (1.4)	0 (0.0)	
II	166 (47.4)	11 (37.9)	
III	179 (51.1)	18 (62.1)	
Tumor site (%)			0.002*
Buccal	200 (57.1)	9 (31.0)	
Gum	65 (18.6)	10 (34.5)	
Lip	19 (5.4)	0 (0.0)	
Mouth floor	14 (4.0)	5 (17.2)	
Palate	20 (5.7)	1 (3.4)	
Tongue	32 (9.1)	4 (13.8)	
T status (%)			0.045*
T1/T2	54 (15.4)	2 (6.9)	
T3/T4	296 (84.6)	27 (93.1)	
N status (%)			0.281
N(−)	228 (65.1)	16 (55.2)	
N(+)	122 (34.9)	13 (44.8)	
Flap reconstruction (%)			0.944
ALT[c]	219 (62.6)	18 (62.1)	
Fibular	49 (14.0)	4 (13.8)	
Forearm	66 (18.9)	7 (24.1)	
Others	16 (4.5)	0 (0.0)	
Pre-existing disease (%)			
Diabetes mellitus	61 (17.4)	10 (34.5)	0.024*
Hypertension	76 (21.7)	11 (37.9)	0.046*
Liver disease	25 (7.1)	4 (13.8)	0.195
Pulmonary disease	19 (5.4)	2 (6.9)	0.74
Heart disease	18 (5.1)	2 (6.9)	0.685
Cerebral vascular accident	4 (1.1)	3 (10.3)	<0.001*

*$p < 0.05$.
[a] BMI, body mass index.
[b] ASA, American Society of Anesthesiologist.
[c] ALT, anterolateral thigh flap.

Table 3
Pre-extubation respiratory parameters.

Variables	Non-AAEs, n = 350	AAEs, n = 29	*p*
Ventilator setting, mean (SD)			
Respiratory rate	14.2 (4.6)	16.6 (5.4)	0.014*
Tidal Volume (mL)	491.5 (219.5)	425.1 (200.5)	0.152
FiO2 (%)	34.8 (3.5)	34.7 (2.3)	0.78
Arterial blood gas, mean (SD)			
pH	7.44 (0.04)	7.45 (0.05)	0.29
PaO2 (mmHg)	141.96 (39.53)	126.59 (33.76)	0.047*
PaCO2 (mmHg)	39.32 (5.04)	38.83 (5.50)	0.629
HCO3$^-$ (mmol/l)	25.90 (2.59)	26.19 (3.13)	0.571
Base excess (mmol/l)	2.04 (5.96)	2.21 (3.27)	0.875
Respiratory Index, mean (SD)			
RSBI (breaths/min/L)[a]	36.56 (23.61)	48.95 (27.80)	0.015*
P/F ratio (mmHg)[b]	411.14 (117.19)	366 (95.53)	0.048*

*$p < 0.05$.
[a] RSBI, Rapid shallow breathing index is defined as the ratio of respiratory frequency (breaths/min) to tidal volume (L) = (f/VT).
[b] P/F ratio, PaO2(mmHg)/FiO2(%) Ratio.

3.3. Respiratory parameters

Differences in ventilator settings and respiratory parameters between two groups were demonstrated in Table 3. AAEs group had a higher average respiratory rate (16.6 ± 5.4 vs 14.2 ± 4.6 breaths/min, $p = 0.014$), and lower PaO_2 (126.59 ± 33.76 vs 141.96 ± 39.53 mmHg, $p = 0.047$) in arterial blood gas before extubation. Respiratory index, including RSBI and PiO_2/FiO_2 ratio were calculated and both values were poorer in AAEs group with statistically significant difference (RSBI: 48.95 ± 27.8 vs 36.56 ± 23.61 breaths/min/L, $p = 0.015$; PiO_2/FiO_2 ratio: 366 ± 95.53 vs 411.14 ± 117.19 mmHg, $p = 0.048$).

3.4. Univariate and multivariate analysis of reintubation event risk factors

A logistic regression model was used to determine risk factors associated with postoperative AAEs in the study population. In

Table 2
Operative variables in enrolled subjects.

Variables	Non-AAEs, n = 350	AAEs, n = 29	*p*
Creatinine (mg/dl), mean (SD)	0.95 (0.25)	1.16 (0.46)	0.033*
Used flap size (cm^2), mean (SD)	104.5 (20.2)	110.3 (23.1)	0.143
Hb (g/dL), mean (SD)	14.41 (1.80)	13.12 (2.22)	<0.001*
Alb (g/dL), mean (SD)	4.47 (0.37)	4.26 (0.43)	0.004*
Operative method (%)			
Wide excision	337 (96.3)	27 (93.1)	0.398
Maxillectomy	84 (24.0)	5 (17.2)	0.409
Marginal mandibulectomy	138 (39.4)	8 (27.6)	0.208
Segmental mandibulectomy (Location)[a] (%)	63 (18.0)	13 (44.8)	<0.001*
H	0 (0.0)	0 (0.0)	
L	48 (85.7)	8 (72.7)	
C	0 (0.0)	0 (0.0)	
HC	0 (0.0)	0 (0.0)	
LC	5 (8.9)	3 (27.3)	
LCL	3 (5.4)	0 (0.0)	
HCL	0 (0.0)	0 (0.0)	
HCH	0 (0.0)	0 (0.0)	
Lymph node dissection (%)			0.006*
None	23 (6.6)	0 (0.0)	
Unilateral LND	306 (87.4)	23 (79.3)	
Bilateral LND	21 (6.0)	6 (20.7)	
Operative time (min), mean (SD)	450.5 (128.4)	454.1 (141.4)	0.886
Blood loss (mL), mean (SD)	258.7 (207.1)	301.7 (209.0)	0.284
Blood transfusion ≥ 2U (%)	80 (22.9)	14 (48.3)	0.002*

*$p < 0.05$.
[a] Location, Jewler's classification of segmental mandibulectomy sites.

univariate analysis, age, tumor sites, previous history of diabetes mellitus, cerebrovascular events, preoperative creatinine, hemoglobin and albumin level, segmental mandibulectomy, blood transfusion, RSBI and PiO_2/FiO_2 ratio were all significant risk factors to predict postoperative AAEs (Table 4). A multivariate logistic regression model was conducted to adjust factors shown as statistically significant in univariate analysis, and we found age (adjusted odds ratio: 1.07, 95 % CI: 1.02–1.12, $p = 0.007$), tumor located at mouth floor or tongue (adjusted odds ratio: 8.22, 95 % CI:1.46–46.20, $p = 0.015$; 6.38, 95 % CI: 1.35–30.20, $p = 0.017$, respectively), cross midline segmental mandibulectomy (adjusted odds ratio: 11.88, 95 % CI:1.48–95.56, $p = 0.018$) and PiO_2/FiO_2 ratio (adjusted odds ratio: 0.25, 95 % CI: 0.06–0.99, $p = 0.043$) were independent risk factors for AAEs in our study population.

4. Discussion

Adverse airway events with prolonged intubation and unplanned reintubation in head and neck cancer patients who underwent tumor ablation followed by free tissue transfer are of great concern for both surgeons and anesthesiologists. From our study, we found that age, tumor located at mouth floor or tongue, cross midline segmental mandibulectomy, and PiO_2/FiO_2 ratio were independent risk factors associated with AAEs in patients who underwent major head and neck cancer surgery without prophylactic tracheostomy.

The role of prophylactic tracheostomy in head and neck cancer patients is still in debate.[12] Although a prophylactic tracheostomy could create a definite airway and thus prevent possible adverse airway events owing to airway compression after major head and neck cancer surgery, it might lead to an increase in overall morbidity and functional impairment.[14,15] Previous studies have tried to propose scoring systems to predict the necessity of elective tracheostomy when undergoing head and neck cancer surgery.[4,6,7,11] However, even in patients without prophylactic tracheostomy, adverse airway events were seen and were devastating for both the patients and clinicians. It is important to identify risk factors associated with postoperative adverse airway events in these patients. A few studies have tried to investigate the possible risk factors for adverse airway events,[8,19] but most of them were limited by case numbers or rare events and hence were unable to predict the possible risk factors accurately. Our study is by far the largest cohort of patients focused on these issues, and we have performed a multivariate analysis to investigate independent risk factors associated with adverse airway events.

Rujirojindakul et al in their study have emphasised the importance of head and neck surgery as an independent risk factor for emergency reintubation in the post anaesthetic care unit.[20] Reintubation carries substantial risk to the patient. Mathew et al in their study of emergency reintubation in patients undergoing otolaryngologic procedures found that there was an incidence of 0.19 % and that 77 % of them were preventable.[21] The risks of reintubation include serious cardiac and pulmonary complications, increased hospital stay, prolonged ICU stay, increased costs as well as an increased mortality risk to the patient.[20] Unplanned intubation has been found to be an independent predictor of 30 day mortality (OR: 9.2).[22]

The paucity of reports in the literature emphasize the importance of determining the potential risk factors to predict adverse airway events and thus improve surgical outcome for this specific high-risk group. Head and neck cancer surgery poses a high risk for failed extubation especially when surgery involves the aerodigestive tract. This has been mainly attributed to postoperative laryngeal edema, anatomical deformation after tumor resection, intraoral flap bulkiness, and also to some extent to post operative haemorrhage.[23] Dyspnea, upper airway compression, altered consciousness and unstable hemodynamics have been implicated to be the commonest reasons for emergent reintubation in the post-op ICU set up.[24] Emergency reintubation especially in head and neck cancer patients is fraught with difficulties such as trismus, edema of the upper airway, altered intraoral anatomy, bulky flap being some of the important ones. Due to these factors, these patients need fiberoptic assisted nasotracheal reintubation and sometimes a postoperative emergency tracheostomy. These facilities may not be

Table 4
Univariate and multivariate analysis of risks factors for adverse airway events.

Factors	Crude OR[a] (95 % CI)	p	Adjusted OR[a] (95 % CI)	p
Age	1.08 (1.04–1.11)	0.000*	1.07 (1.02–1.12)	0.007*
Tumor sites (vs. Buccal)				
Gum	3.42 (1.31–8.95)	0.011*	1.28 (0.33–4.92)	0.716
Lip	0.00 (0-Inf)	0.987	0.00 (0-Inf)	0.992
Mouth floor	7.94 (2.29–27.57)	0.001*	8.22 (1.46–46.20)	0.015*
Palate	1.11 (0.13–9.63)	0.922	1.35 (0.12–15.14)	0.805
Tongue	2.78 (0.79–9.80)	0.105	6.38 (1.35–30.20)	0.017*
Pre-existing disease				
Diabetes mellitus (yes vs. no)	2.49 (1.09–5.72)	0.028*	1.92 (0.59–6.20)	0.267
Cerebral vascular accident (yes vs. no)	9.98 (2.05–48.49)	0.004*	4.16 (0.42–41.39)	0.215
Preoperative lab data				
Creatinine (mg/dl)	3.04 (1.03–8.99)	0.041*	0.41 (0.08–2.12)	0.279
Hb (g/dL)	0.71 (0.59–0.87)	0.001*	0.494 (0.10–2.39)	0.371
Alb (g/dL)	0.25 (0.10–0.67)	0.005*	1.03 (0.73–1.45)	0.872
Segmental defects[b] (vs Non-segmental mandibulectomy[c])				
No-cross midline	2.72 (1.10–6.73)	0.027*	2.95 (0.76–11.51)	0.112
Cross midline	6.13 (1.45–25.81)	0.012*	11.88 (1.48–95.56)	0.018*
Blood transfusion (yes vs. no)	3.15 (1.44–6.91)	0.003*	1.33 (0.38–4.68)	0.655
Weaning profile				
RSBI (breaths/min/L)[d]	2.75 (1.17–6.47)	0.018*	1.84 (0.65–5.26)	0.245
P/F ratio (mmHg)[e]	0.26 (0.09–0.79)	0.015*	0.25 (0.06–0.99)	0.043*

*$p < 0.05$.
[a] OR, odds ratio; 95 % CI, 95 % confidence interval.
[b] Segmental defects, based on Jewler's classification to determine if mandible defects cross midline.
[c] Non-segmental mandibulectomy includes patients underwent tumor wide excision without mandibulectomy and marginal mandibulectomy.
[d] RSBI, Optimal cutoff value (42.89 breaths/min/L) calculated by receiver operating characteristic (ROC) curve was used for grouping.
[e] P/F ratio, Optimal cutoff value (443 mmHg) calculated by receiver operating characteristic (ROC) curve was used for grouping.

readily available in the post-op ICU compared to the operating rooms. A delay in reintubation can lead to serious complications as it exposes the patient to hypoxia and its ill effects. There is no definite consensus on the exact time of extubation in these patients but using the Difficult Airway Society Extubation Guidelines for these "at risk" patients might mitigate this to an extent.[25,26]

These high risk patients therefore not only require thorough preoperative anaesthesia planning with regards to airway management but also a comprehensive assessment and regular monitoring for optimisation of post-op ICU care. This is critical to enhance the surgical outcomes in this specific high risk group. A multidisciplinary team approach with surgeons, anaesthetists, respiratory therapist in a well-equipped ICU set up with essential equipments such as fiberoptic scopes and tracheostomy sets for emergent airway management is essential for improving outcomes in this specific disease group.

In our series, tumour location in the tongue and mouth floor was one of the independent risk factors for AAEs. Upper airway anatomy and muscle function is important in keeping the airway open, and the largest airway dilator muscle is the genioglossus, which makes up most of the tongue.[27] As such, postsurgical change in muscular support might raise concern for collapse of the airway. The bulky free flap could also lead to the occlusion, or partial occlusion of the oral cavity and oropharynx.[9] Several studies have tried to utilise preoperative parameters to develop scoring systems to predict the requirement for prophylactic tracheostomy in the head and neck cancer surgery. They report that patients with tumors located at tongue and floor of mouth were more likely to require prophylactic tracheostomy.[4,11] In Ledderhof et al.'s study, resection of the mouth floor tumor was found to have a higher rate of adverse airway events.[9] Our results were consistent with the previous studies. Therefore, mouth floor and tongue cancers after tumor resection and free flap reconstruction are more likely to induce upper airway narrowing and adverse airway events in patients without prophylactic tracheostomy.

Cross midline segmental mandibulectomy is also an independent risk factor for adverse airway events in our multivariate analysis. Segmental or marginal mandibulectomy would be performed in tumors involving the mandible,[28] and mandibulectomies may affect the hyoid and laryngeal suspension, thereby increasing the risk of aspiration while swallowing.[4] Midline crossing is an important surgical factor which causes a change in the postsurgical anatomical structure, leading to the narrowing of the upper airway.[28] Mandibulectomy was a parameter included in the previous scoring systems, especially for cross-midline mandibulectomies, with a relatively higher percentage of prophylactic tracheostomy.[4,6] Patients undergoing mandibulectomies have greater difficulty in maintaining a secure airway that some studies[8,9] have specifically addressed the need for prophylactic tracheostomy in patients undergoing mandibulectomy. We found that a mandibulectomy tended to result in a surgeon performing a prophylactic tracheostomy based on this current study.

Reintubation is an important event for patients on mechanical ventilation in the ICU. The impact of weaning parameters before extubation on the adverse airway effects in patients undergoing head and neck cancer resection and flap reconstruction surgery is not discussed in the current literature. The PaO_2/FiO_2 ratio is an indicator of adequate oxygenation, and a PaO_2/FiO_2 ratio $\geq$150–300 is one of the objective measurements in the criteria for deciding to discontinue the ventilatory support.[29] Miu et al conducted a study to build a model to predict extubation failure in critically ill patients and concluded that patients with lower PaO_2/FiO_2 ratio and patients with more frequent spontaneous breathing trials prior to extubation were risk factors for extubation failure.[30–32] In our present study, we mainly focused on patients undergoing head and neck cancer tumor resection followed by reconstructive surgery, and concluded that a lower PaO_2/FiO_2 ratio is the statistically significant predictor for adverse airway events from our multivariate analysis.

Our study has several limitations. First and foremost is that it's a retrospective study design and hence carries the disadvantages of such a design. Further our study principally focuses on head and neck cancer patients without prophylactic tracheostomy and such a narrow selection excludes patients who have potentially suffered adverse airway events. Also, despite a careful review of medical records there might be bias resulting from potential recording errors. A causal inference cannot be claimed as this is a retrospective study. However, our study is by far the largest series in literature on this significant clinical problem which makes this study valuable and relevant.

5. Conclusion

Older age, tumor located near central airway like mouth floor or tongue, surgical methods including cross-midline segmental mandibulectomy and worse PiO_2/FiO_2 ratio before patients extubation were independent risk factors associated with AAEs in head and neck cancer patients who underwent wide excision of the tumor followed by microsurgical reconstruction surgery without prophylactic tracheostomy. Our study therefore offers a broad guideline in determining the selection of potential patients for prophylactic tracheostomy. However further studies are warranted to determine definite factors for a prophylactic tracheostomy.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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