



# Airway management techniques in head and neck cancer surgeries: a retrospective analysis

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## Abstract

**Background** The aim of this study was to conduct a retrospective analysis of modalities of airway management and its impact on patients undergoing head and neck cancer surgeries.

**Materials and methods** A retrospective review of the medical record of 500 patients operated from January 2008 to December 2013 was conducted at our institute. Patients were reviewed for a mode of airway management, a total length of post-operative hospital stay (PLOS), and incidence of elderly patients in the total number of head and neck cancer surgeries posted for various diagnostic and definitive treatments.

**Results** Out of 500 patients, 462 patients (92.4%) underwent nasal intubation, of which 320 underwent fiberoptic (FO) intubation (64%), 7 underwent tracheotomies after completion of surgery (1.4%), and 3 underwent at the beginning of surgery (0.6%). The remaining 38 patients (7.6%) underwent oral intubation.

**Conclusion** Nasotracheal intubation using fiberoptic bronchoscopy is the most preferred technique for the management of a difficult airway. Efficient airway management during the perioperative period significantly reduces the post-operative length of hospital stay and morbidity.

**Keywords** Airway · Tracheostomy · Intubation · PLOS

## Introduction

In India, head and neck cancer is considered to be the most common amongst all types of cancer [1]. Difficulty in airway management in the head and neck cancer patients is mainly due to the anatomic and physiologic changes, as well as due to radiotherapy and chemotherapy [2]. Airway management is

considered to be challenging in these patients with regard to its inherent problems of difficult airway either due to mass, a receding jaw, restricted mouth opening, and neck movement or due to associated comorbidities. The size and location of tumor are the crucial factors in determining the appropriate instruments; as in laryngeal tumor, it is quite often to have debris over the laryngoscope which will hinder the view

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obtained by laryngoscope [3]. Neck stiffness is commonly seen in patients with post-operative radiotherapy due to contracture, resulting in inadequate neck extension which will ultimately result in compromised airway management. Appropriate preoperative assessment and a guaranteed airway from surgery to discharge are the hallmarks for definitive planning and to avoid any complications during intubation or bag-mask ventilation, as well as to reduce the morbidity related to the procedure [4].

The aim of the study was to conduct a retrospective analysis of modalities of airway management in head and neck cancer patients and to observe the effect of airway management technique on post-operative length of hospital stay (PLOS). The objective was to calculate the incidence of emergency tracheostomy.

## Materials and methods

A retrospective review of the medical records of 500 patients was conducted, who underwent head and neck surgery from January 2008 to December 2013 at our institute. Ethics committee approval was obtained from the Institutional Review Board. Written informed consent was obtained from all patients before undergoing surgery. Patient records were reviewed for a mode of airway management, a total length of post-operative hospital stay, and the incidence of elderly patients in the total number of head and neck cancer surgeries. In addition, the *modified Mallampati score*, *ASA grade*, the incidence of preexisting comorbid conditions, and the type of surgery were also recorded. All male and female patients with ASA grades of I to III and age ranging from 26 to 82 years and requiring surgery for head and neck cancer were included. Patients with a carcinoma of the larynx and those requiring minor surgical procedures under sedation were excluded from the study.

The data were tabulated in Microsoft Excel software 2013 and subjected for statistical analysis using IBM SPSS 23 (IBM Inc., Chicago). Descriptive analysis for mean age, frequencies, and percentages for categorical data were done. One-sample *T* test was done to evaluate the significance of the data.

## Results

A total of 500 patients were studied in this retrospective analysis; descriptive analysis was done for age, and frequencies and percentages for categorical data were obtained. Mean age was  $67.15 \pm 15.24$  years. Out of 500 patients, 92.4% ( $n = 462$ ) patients underwent nasal intubation, of which 69.27% ( $n = 320$ ) patients underwent awake fiberoptic nasal intubation with the assistance of tracheal blocks and 30.73% ( $n = 142$ ) underwent nasotracheal intubation under sedation with the guidance of the Magill forceps and Macintosh laryngoscope.

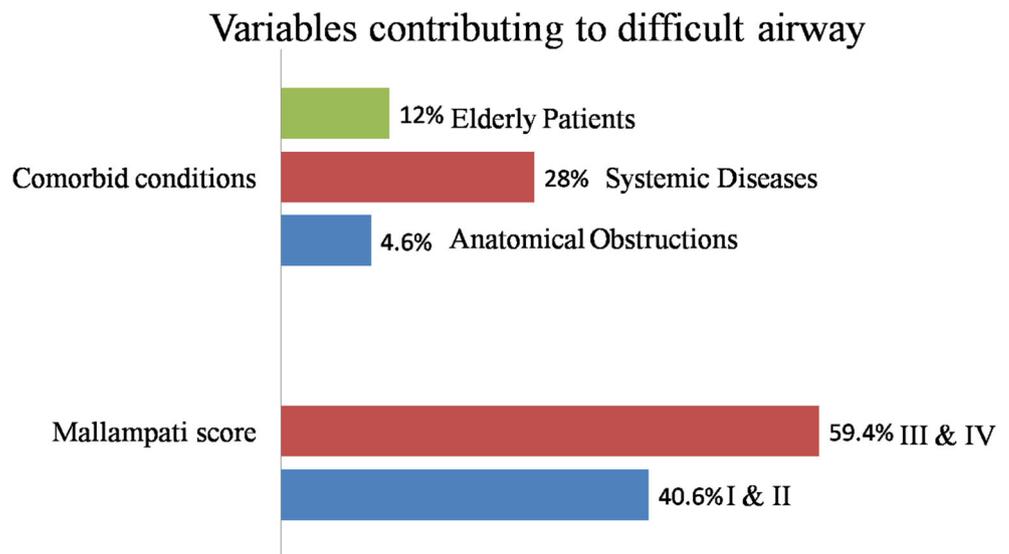
Seven patients underwent tracheotomy after completion of surgery in which basic airway was secured by a nasal route at the beginning of surgery, and 0.6% ( $n = 3$ ) patients underwent tracheostomy at the beginning of surgery; the rest 7% ( $n = 35$ ) patients underwent oral intubation (Fig. 2).

59.4% ( $n = 297$ ) patients with the modified Mallampati score of class III/IV were electively fiberoptically intubated; 4.6% ( $n = 23$ ) patients with anatomical obstructions, i.e., huge tumor on tongue, a possibility of tracheal deviation, obese patient, limited cervical spine mobility, difficult mask ventilation, were electively fiberoptically intubated. Twenty-eight percent patients ( $n = 140$ ) were medically compromised with systemic diseases like diabetes, hypertension, asthma, and chronic obstructive pulmonary disease. Twelve percent patients were elderly belonging to the age group of more than 60 years (Fig. 1). A total of 10 patients who needed intraoperative tracheostomy had previously undergone surgery as well as CTRT, and some had existing systemic compromise which may have required prolonged intubations or ventilator support. 0.6% ( $n = 3$ ) required emergency bedside tracheostomy in post-operative period after extubation. Thirty-nine percent patients underwent surgery for free flap reconstruction, and the average time of surgery was  $5.9 \pm 1.02$  h\*; 35% patients underwent surgery with distant or local flap reconstruction, and the average time of surgery was  $3.5 \pm 0.56$  h\*; 26% patients underwent surgeries with no reconstruction, and the average time required was  $2.5 \pm 0.37$  h\* ( $*p < 0.05$ —statistically significant). 75.4% ( $n = 377$ ) patients were extubated within 6–8 h of procedure; 24.6% ( $n = 123$ ) patients were extubated within 14 h of surgery as all patients underwent flap reconstruction and the average length of surgical time was 5.6 h. Twelve percent patients were above 65 years of age. The average post-operative length of hospital stay was 5.2 days (Table 1). PLOS in patients with tracheostomy was 7.6 days and that without tracheostomy was 4.2 days (Table 2). Data was analyzed using one-sample *T* test and independent *T* test, and *p* value less than 0.05 was considered to be statistically significant (Fig. 3).

## Discussion

The management of airway in head and neck patients is very challenging for anesthetists. Anatomical and physiologic changes in head and neck cancer (HNC) patients worsen the airway management in the perioperative period [3]. Thorough knowledge of the airway anatomy, size, and location of the tumor, type, and vascularity is crucial to evaluate. Large tumor mass in the perioral region affects the instrumentation during airway preparation. Along with the anatomical and pathological hurdles, head and neck cancer patients are also complicated by the consequences of chemotherapy and radiotherapy. Preoperative radiotherapy leads to fibrosis and strictures of

**Fig. 1** Variables contributing to difficult airway in head and neck cancer surgery patients



neck structures resulting in difficult bag-mask ventilation and intubation [5]. Also, head and neck surgeries are lengthy procedures with increased operative hours leading to edematous airway tract and thus increasing the risk for post-operative airway compromise [4]. Preoperative assessment is crucial in HNC patients to make a decision regarding the selection of airway management modality. Mouth opening, the Mallampati score, size of mandibular space, and range of neck motions are some important physical features in the assessment of airway difficulty.

Based on the preoperative assessment, patients were planned for fiberoptic, nasotracheal, oral intubation or

tracheostomy. Factors compromising airway were categorized according to the Mallampati score and associated comorbid conditions like anatomical obstructions, systemic illness, and advanced age (Fig. 1). All patients under this category were electively intubated using fiberoptic (FO) technique.

The following protocols were used at our institute:

1. Anesthetics spray to anesthetize the laryngeal airway and nasal decongestant to reduce the laryngotracheal secretions.
2. Preoxygenation with adequate bag-mask ventilation was given.

**Table 1** Evaluation parameters analyzed for airway management in preoperative, perioperative, and post-operative period for head and neck cancer patients

(A) The Mallampati score		
i) I and II	40.6% (203)	
ii) III and IV	59.4% (297)	
(B) Comorbid conditions		
i) Anatomical obstructions	4.6% (23)	
ii) Medical illness (asthma, COPD, diabetes, HTN)	28% (140)	
iii) Age (> 60 years)	12% (60)	
(C) Technique of airway	In percentage (%)	
i) Total nasal (FO + direct nasal)	92.4	
ii) Oral	7	
iii) Fiberoptic nasal	59.4	
iv) Tracheostomy (elective intraoperative)	2	
v) Tracheostomy (emergency-post-op)	0.6	
<i>p</i> value (one-sample <i>T</i> test)	< 0.001**	
(D) Surgical procedure	Number of patients	Ave. time of surgery
i) Free flap reconstruction	39% (195)	5.9 ± 1.02 h*
ii) Distant flap/local flap	35% (175)	3.5 ± 0.56 h*
iii) No reconstruction	26% (130)	2.5 ± 0.37 h*

\**p* < 0.05—statistically significant

\*\*Highly significant

**Table 2** Comparison of post-operative length of hospital stay

Procedure	Mean	SD	Mean difference	<i>p</i> value
With tracheostomy	7.6	2.1	3.4 ± 1.1	< 0.001**
Without tracheostomy	4.2	1.18		

\*\*Statistically significant ( $p < 0.001$ )

- Once the action of short-acting muscle relaxant (Scoline) is achieved, then, nasal/oral intubation was done using the assistance of Magill's forceps under direct laryngoscopy with the Macintosh laryngoscope.
- Patients for elective fiberoptic-guided intubations were given tracheal blocks and FOB-guided awake intubation was done.

69.7% patients were managed by FO intubation. Seven patients underwent tracheostomy after completion of surgery. The need for tracheostomy can be reduced if proper preoperative planning is done and mode of securing airway is planned beforehand. There are less chances of failed intubation or unsuccessful intubation if proper protocol is followed. Patients requiring prolonged intubation or ventilator support of more than 48 h are indicated for elective tracheostomy in post-operative period [6]. Handling tracheostomized patient is difficult in HNC as it obstructs the breathing circuit during neck dissection. Occasionally, post-tracheostomy patients may end up with complications such as tracheoesophageal fistula, tracheal stenosis, and airway distortion [7]. No such complication was observed in our sample group and patients were de-cannulated gradually.

Crosher and Supkis Jr. DE noted that tumor location and extent of tumor resection are crucial factors in determining the extubation timing. Free flap carries less chances of airway obstruction as compared with distant bulky pectoralis major flap [8, 9]. In our study, there were 39% patients who underwent surgery with free flap reconstruction, 35% underwent distant flap reconstruction, and 26% required no reconstruction. But we did not

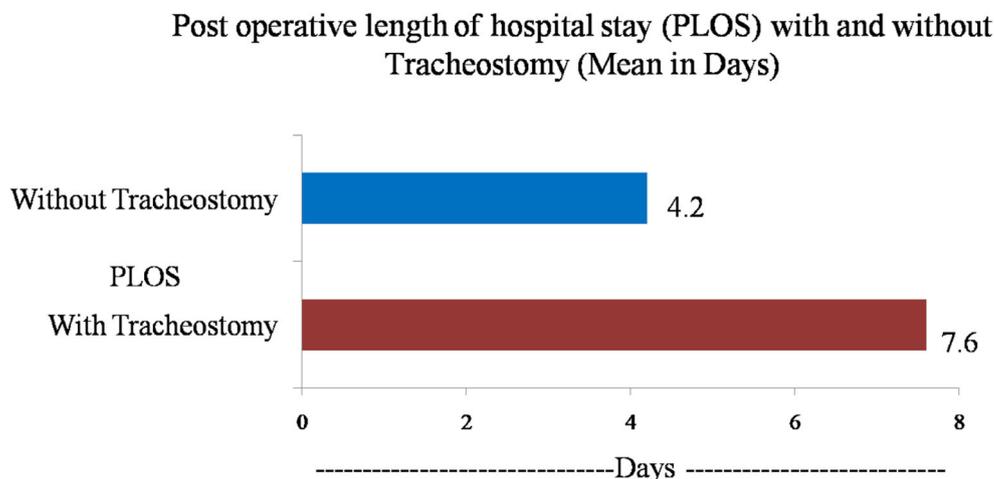
find any significant relationship with airway obstruction and type of reconstruction used. Three patients had airway compromise post-operatively for which the emergency tracheostomy was performed. Out of these, two were elderly patients requiring no reconstruction and the other was a known case of COPD, who had undergone free flap reconstruction along with resection and neck dissection. All three patients were unable to maintain the post-extubation oxygen saturation ( $SpO_2$ ) above 80. We observed that along with the type of surgery, coexistent comorbid conditions play a role in airway compromise as well as increase in post-operative length of hospital stay.

When the period of intubation is less than 48 h, it results in less complication in patients with nasotracheal intubation [10, 11]. In our study, 75.4% patients were extubated within 6–8 h of the post-operative period while 24.6% were extubated within 14 h post-operatively as all patients underwent flap reconstruction. In post-operative period, we have not observed any complication in view with the airway patency.

Length of the operative procedure is of utmost importance, as lengthy procedure increases the post-operative morbidity because of impaired homeostasis, prolonged immobility which results in urine retention and thermal homeostasis, etc. [12]. In our study, the average total length of surgery was 5.6 h which is quite less resulting in no complication mentioned earlier.

The time interval between the date of surgery to the date of discharge or death is considered as post-operative length of hospital stay, i.e., PLOS. If the PLOS is significantly increased, it will result in infection, economic problems, and agitation of family members, and also in *mortality* and *morbidity* [13, 14]. Average PLOS in our study was 5.2 days, which is significantly less compared with that in the study by Penel et al. who reported a median post-operative stay of 21 days in 260 patients [9]. Average PLOS in our study for patients who underwent tracheostomy (13 patients) was 7.6 days and for those who had no tracheostomy (487 patients) was 4.2 days (Table 2; chart 2). There is a significant difference between PLOS in patients with

**Fig. 3** Comparative analysis of mean post-operative length of hospital stay in patients with tracheostomy and those without tracheostomy



## Modes of Airway Management

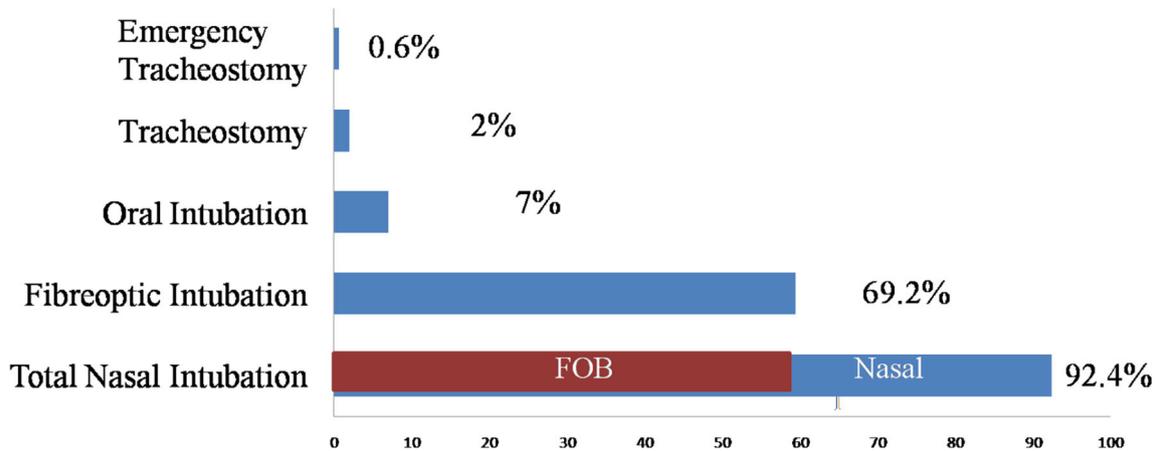


Fig. 2 Different modes of airway management used in head and neck cancer surgeries

tracheostomy and those without tracheostomy (mean standard deviation of  $3.4 \pm 1.1$  and  $p$  value  $< 0.001^*$ , statistically significant). Perioperative care in terms of preventions of hypothermia, intravenous fluid management, and pain management have significant effect on the post-operative recovery of patients.

### Conclusion

Fiberoptic nasotracheal intubation is the most preferred technique in the management of a difficult airway. Rate and incidence of a tracheostomy can be controlled by proper preoperative planning. Modality of airway management, an average time of surgery, and perioperative care of patients along with the existent comorbidities have a significant impact on PLOS and morbidity.

### Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethics approval** Ethics committee approval was obtained from Institutional Review Board.

**Informed consent** Informed consent was obtained from all participants who were included in the study.

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