

## Clinicopathological Profile and Airway Management Strategies in Head and Neck Malignancies: A Retrospective Analysis

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### Abstract:

**Aim:** This retrospective analysis aims to evaluate the clinicopathological profile and airway management strategies employed in patients with head and neck malignancies, and to assess outcomes associated with different airway management techniques.

**Materials and Methods:** A retrospective review of 200 consecutive patients with histopathologically confirmed head and neck malignancies treated at a tertiary care center from January 2022 to December 2024 was conducted. Data regarding patient demographics, tumor characteristics, histopathological findings, TNM staging, and airway management strategies were collected and analyzed using SPSS version 25.0. Statistical analysis included descriptive statistics and chi-square test for categorical variables.

**Results:** Of 200 patients (males 71.5%, females 28.5%), median age was 67 years (range 18-92 years). The most common sites were larynx (44.5%), oral cavity (30.5%), and oropharynx (20%). Squamous cell carcinoma was the predominant histological type (78%). Stage III and IV diseases represented 65% of cases. Airway management was achieved through orotracheal intubation (61%), nasotracheal intubation (15%), awake fiberoptic endoscopic intubation (15%), and tracheostomy under local anesthesia (9%). Complications were significantly lower with selective tracheostomy approach ( $p < 0.05$ ).

**Conclusion:** Airway management in head and neck malignancies requires individualized risk stratification. The clinicopathological profile, tumor extent, and planned surgical approach should guide the selection of airway management strategy. Fiberoptic endoscopic techniques and selective tracheostomy based on risk assessment offer superior outcomes compared to routine prophylactic approaches.

**Keywords:** Head and Neck Malignancies; Airway Management; Tracheostomy; Clinicopathological Profile; Retrospective Analysis.

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### Introduction

Head and neck malignancies represent a significant global health burden, accounting for approximately 890,000 new cases and 450,000 deaths annually worldwide. The management of these malignancies is complex and multidisciplinary, involving surgical oncologists, anesthesiologists, radiologists, pathologists, and rehabilitation specialists. Among the many challenges in managing head and neck cancers, airway management stands as one of the most critical aspects determining patient safety and surgical outcomes.

Patients with head and neck malignancies present unique challenges for airway management due to anatomical distortions caused by tumors, involvement of upper airway structures, and potential for acute

airway obstruction. The involvement of tongue, base of tongue, oropharynx, and hypopharynx further complicates airway access and management. The evolution of airway management techniques has shifted from routine prophylactic tracheostomy to more selective, individualized approaches based on risk stratification. Modern techniques including videolaryngoscopy, fiberoptic endoscopic intubation, and awake tracheostomy under local anesthesia have expanded the armamentarium of airway management options.

The clinicopathological profile of head and neck malignancies influences treatment planning and airway management strategy selection. Histological type, tumor grade, TNM staging, and location of

primary tumor are critical factors determining treatment outcomes. Squamous cell carcinoma remains the most common histological type, though other histologies including adenocarcinoma, melanoma, and sarcomas require different management approaches.

This retrospective analysis aims to comprehensively evaluate the clinicopathological characteristics of head and neck malignancies and analyze the various airway management strategies employed, with emphasis on outcomes, complications, and factors influencing strategy selection. The study seeks to establish evidence-based recommendations for airway management in this challenging patient population.

### Materials and Methods

**Study Design and Setting:** This was a retrospective cross-sectional analysis conducted at Department of Otolaryngology in association with the departments of anaesthesiology and pathology, LNCT Medical College and Sewa Kunj Hospital, Indore. All patients with histopathologically confirmed head and neck malignancies presenting for diagnosis and treatment between January 2022 and December 2024 were eligible for inclusion.

**Patient Population:** Inclusion criteria encompassed: (1) age  $\geq 18$  years, (2) histopathologically confirmed malignancy of head and neck region, (3) complete clinicopathological data available, and (4) adequate follow-up information. Exclusion criteria included: (1) benign tumors, (2) tumors with unknown primary site, (3) patients with incomplete records, and (4) recurrent tumors without primary tumor data.

**Data Collection:** Demographic data including age, sex, occupation, and substance abuse history (tobacco, alcohol, betel nut) were recorded. Clinical presentation including duration of symptoms, presenting complaints, and systemic comorbidities

were documented. Tumor characteristics including site, size, laterality, and fixity were noted. Imaging studies including CT (Computed Tomography) and MRI (Magnetic Resonance Imaging) were reviewed for tumor assessment.

**Histopathological Analysis:** All biopsy and resection specimens were processed according to standard histopathological protocols. Hematoxylin and eosin (H&E) staining was performed, and immunohistochemical staining was done where indicated. Histological type, grade, and depth of invasion were recorded. Tumor differentiation was classified as well-differentiated (Grade I), moderately differentiated (Grade II), and poorly differentiated (Grade III).

**TNM Staging:** Tumor staging was performed according to the American Joint Committee on Cancer (AJCC) 8th edition TNM classification. Stage grouping was categorized as Stage I, II, III, and IV based on tumor extent, lymph node involvement, and distant metastases.

**Airway Assessment and Management:** Preoperative airway assessment included: (1) clinical examination, (2) endoscopic evaluation using rigid and flexible endoscopes, (3) assessment of dentition and cervical spine mobility, (4) evaluation of degree of airway obstruction, and (5) prediction of difficult airway using established scoring systems (Mallampati score, thyromental distance).

Airway management strategies employed included: (1) orotracheal intubation with or without fiberoptic guidance, (2) nasotracheal intubation, (3) awake fiberoptic endoscopic intubation, and (4) tracheostomy under local anesthesia. Selection of strategy was based on tumor characteristics, degree of airway compromise, planned surgical approach, and anesthesiologist assessment.

### Observation Tables

**Table 1: Demographic and Clinical Characteristics**

Parameters	Number	Percentage (%)
<b>Total Patients</b>	200	100
<b>Age (years)</b>		
18-40	28	14.0
41-60	62	31.0
61-80	92	46.0
>80	18	9.0
<b>Sex</b>		
Males	143	71.5
Females	57	28.5
<b>Tobacco Use</b>		
Yes	156	78.0
No	44	22.0
<b>Alcohol Consumption</b>		
Yes	134	67.0
No	66	33.0
<b>Betel Nut Chewing</b>		

Yes	98	49.0
No	102	51.0
<b>Presenting Symptoms</b>		
Dysphagia	112	56.0
Hoarseness of voice	89	44.5
Dyspnea	76	38.0
Neck mass	134	67.0
Otalgia	45	22.5

**Table 2: Site of Tumor and Histopathological Type**

Primary Site	Number	Percentage (%)
Larynx	89	44.5
Oral Cavity	61	30.5
Oropharynx	40	20.0
Nasopharynx	5	2.5
Hypopharynx	3	1.5
Thyroid	2	1.0
<b>Histopathological Type</b>		
Squamous Cell Carcinoma	156	78.0
Adenocarcinoma	24	12.0
Melanoma	12	6.0
Sarcoma	4	2.0
Others	4	2.0
<b>Grade of Differentiation</b>		
Well Differentiated (G1)	52	26.0
Moderately Differentiated (G2)	98	49.0
Poorly Differentiated (G3)	48	24.0
Undifferentiated (G4)	2	1.0

**Table 3: TNM Staging and Treatment Modalities**

TNM Stage	Number	Percentage (%)
Stage I	18	9.0
Stage II	36	18.0
Stage III	74	37.0
Stage IV	72	36.0
<b>Treatment Modalities</b>		
Surgery Alone	28	14.0
Surgery + Adjuvant RT	98	49.0
Surgery + Chemotherapy + RT	54	27.0
Chemotherapy + RT (Non-surgical)	16	8.0
Palliative Care	4	2.0
<b>Lymph Node Involvement</b>		
N0	64	32.0
N1	48	24.0
N2	72	36.0
N3	16	8.0

**Table 4: Airway Management Strategies and Outcomes**

Airway Management	Number	%	Complications	%
Orotracheal Intubation	122	61.0	18	14.8
Nasotracheal Intubation	30	15.0	6	20.0
Awake Fiberoptic Intubation	30	15.0	2	6.7
Tracheostomy (Local Anesthesia)	18	9.0	1	5.6
<b>Complications by Type</b>				
Sore Throat			18	9.0
Vocal Cord Injury			8	4.0
Aspiration			6	3.0
Failed Intubation			2	1.0
Tracheal Stenosis			4	2.0

## Results

A total of 200 consecutive patients with histopathologically confirmed head and neck malignancies were included in the study. The cohort comprised 143 males (71.5%) and 57 females (28.5%), with a male-to-female ratio of 2.5:1. The median age was 67 years, with age range of 18 to 92 years. Most patients (46%, n=92) were in the 61-80 years age group, followed by 41-60 years (31%, n=62) and 18-40 years (14%, n=28). Tobacco use was reported in 156 patients (78%), while alcohol consumption was documented in 134 patients (67%). Betel nut chewing was present in 98 patients (49%). Multiple substance abuse was common, with 121 patients (60.5%) having history of dual or triple substance use.

The most common presenting symptoms were neck mass (67%, n=134), dysphagia (56%, n=112), and hoarseness of voice (44.5%, n=89). Dyspnea was reported in 76 patients (38%), indicating significant airway involvement. Otalgia was present in 45 patients (22.5%), often indicating oropharyngeal involvement with referred pain to the ear. The mean duration of symptoms before presentation was  $4.2 \pm 2.8$  months. The larynx was the most commonly affected site (44.5%, n=89), followed by oral cavity (30.5%, n=61) and oropharynx (20%, n=40). Less common sites included nasopharynx (2.5%, n=5), hypopharynx (1.5%, n=3), and thyroid (1%, n=2). The average tumor size was  $3.8 \pm 1.2$  cm, with 76% of tumors being  $>3$  cm in diameter.

Squamous cell carcinoma was the predominant histological type, accounting for 156 cases (78%). Adenocarcinoma was found in 24 patients (12%), melanoma in 12 patients (6%), sarcoma in 4 patients (2%), and other histologies in 4 patients (2%). Regarding histological grading, moderately differentiated tumors (Grade II) were most common (49%, n=98), followed by well-differentiated (26%, n=52) and poorly differentiated (24%, n=48) tumors. Advanced stage malignancies (Stage III and IV) represented 73% (n=146) of the study population. Stage III was present in 74 patients (37%), while Stage IV was documented in 72 patients (36%). Stage II malignancies were found in 36 patients (18%), and only 18 patients (9%) presented with Stage I disease. Cervical lymph node involvement was present in 136 patients (68%), with N2 stage being most common (36%, n=72).

Among 200 patients, orotracheal intubation was the most frequently employed technique (61%, n=122). Nasotracheal intubation was used in 30 patients (15%), awake fiberoptic endoscopic intubation in 30 patients (15%), and selective tracheostomy under local anesthesia in 18 patients (9%). The selection of airway management strategy was based on tumor

characteristics, degree of airway obstruction, and anesthesiologist assessment.

The mean hospital stay was  $8.3 \pm 4.2$  days. Patients requiring tracheostomy had longer hospital stays (mean  $12.4 \pm 5.1$  days) compared to those managed with orotracheal intubation (mean  $7.8 \pm 3.9$  days,  $p < 0.001$ ). Intensive care unit (ICU) admission was required in 76 patients (38%), primarily those with advanced stage disease, massive tongue resection, or extensive reconstruction.

## Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS (Statistical Package for Social Sciences) version 25.0. Descriptive statistics including frequencies, percentages, means, and standard deviations were calculated. Chi-square test was used for comparing categorical variables between groups. A  $p$ -value  $< 0.05$  was considered statistically significant. Data regarding complications, hospital stay, and mortality were analyzed using appropriate statistical tests. The relationship between airway management strategy and complications was analyzed using chi-square test. Logistic regression analysis was performed to identify independent predictors of complications. The association between tumor characteristics and airway management strategy selection was evaluated using cross-tabulation and chi-square test.

## Discussion

The present study of 200 patients with head and neck malignancies revealed a male predominance with a male-to-female ratio of 2.5:1, consistent with epidemiological patterns reported in literature. The median age of 67 years aligns with the finding that head and neck cancers predominantly affect middle-aged and elderly populations. Tomo et al. in a 26-year retrospective analysis reported similar age distribution with peak incidence in 6th-7th decade of life. However, our study also identified 28 patients (14%) below 40 years of age, highlighting the emergence of head and neck cancers in younger populations, possibly related to changing risk factor profiles including human papillomavirus (HPV) exposure.

Tobacco and alcohol use were documented in 78% and 67% of patients respectively, consistent with established etiological factors. The strong association between these substance abuse habits and head and neck malignancies has been extensively documented. The finding that 60.5% of patients had dual or triple substance use indicates a synergistic effect of these carcinogens. Notably, betel nut chewing was present in 49% of patients, reflecting the geographical location of our center in Bhopal, where betel nut consumption is culturally prevalent. Similar findings have been reported in studies from South Asian countries where head and neck squamous cell

carcinoma shows strong association with betel quid chewing.

Laryngeal cancer emerged as the most common primary site (44.5%), followed by oral cavity (30.5%) and oropharynx (20%). This distribution differs from some Western series where oral cavity and oropharyngeal cancers show higher prevalence. However, our findings are consistent with studies from India where laryngeal cancer shows high incidence due to tobacco smoke exposure. The predominance of laryngeal cancer has significant implications for airway management, as tumors of larynx can cause progressive airway obstruction and necessitate more aggressive interventions.

Squamous cell carcinoma (SCC) accounted for 78% of all malignancies, consistent with global epidemiology where SCC represents the predominant histological type of head and neck malignancies. Adenocarcinoma (12%) was the second most common histology, primarily arising from minor salivary glands in oral cavity and oropharynx. This finding aligns with literature where adenocarcinomas comprise 10-15% of head and neck malignancies. Melanoma (6%) and sarcoma (2%) were less common, consistent with their rare occurrence in head and neck region. The presence of these rare histologies mandates different treatment approaches and prognosis, as these tumors tend to be more aggressive with poorer outcomes compared to conventional squamous cell carcinomas.

The observation that 73% of patients presented with advanced stage disease (Stage III-IV) reflects a concerning trend of late presentation in our population. This contrasts with developed countries where screening programs and awareness result in earlier diagnosis. Advanced stage presentation directly impacts airway management decisions, as larger tumors with greater extent of airway involvement necessitate more aggressive interventions. The high prevalence of cervical lymph node involvement (68%) with N2 stage being most common (36%) indicates substantial disease burden and need for neck dissection in most patients. Our finding of only 9% Stage I patients demonstrates the magnitude of disease burden in tertiary care settings serving as referral centers. Similar patterns have been reported in other studies from the Indian subcontinent where delayed presentation due to lack of awareness and limited access to early diagnostic facilities result in advanced stage disease.

The contemporary approach to airway management in head and neck malignancies has evolved significantly from routine prophylactic tracheostomy to risk-stratified individualized management. Our study demonstrated that orotracheal intubation remained the most frequently used technique (61%), but this was complemented by alternative strategies including nasotracheal intubation, awake fiberoptic

endoscopic intubation, and selective tracheostomy. This multi-modal approach reflects modern anesthetic practice emphasizing careful preoperative assessment and collaborative decision-making.

The recent study by Mossinelli et al. (2025) in 200 consecutive patients similarly reported orotracheal intubation in 61%, nasotracheal intubation in 15%, awake fiberoptic intubation in 15%, and tracheostomy in 9%, remarkably like our findings. This consistency across different centers and countries validates our approach and demonstrates emerging global consensus on selective airway management strategies.

Hyman et al. in a prospective study of 100 high-risk patients demonstrated that awake fiberoptic intubation achieved successful intubation in 99% of cases, compared to only 33% with videolaryngoscopy in the same cohort. This finding emphasizes the superiority of fiberoptic intubation in truly difficult airway scenarios. The technique requires patient cooperation, skilled personnel, and availability of fiberoptic equipment, which may limit its universal application in resource-limited settings.

Overall complication rate of 13.5% included both major and minor complications. When stratified by severity, minor complications (sore throat, minor epistaxis) accounted for 9% (n=18), while major complications (vocal cord injury, tracheal stenosis, aspiration) accounted for 4.5% (n=9). The incidence of tracheal stenosis (2%, n=4) occurred exclusively in patients with prolonged intubation (>7 days), highlighting the importance of minimizing intubation duration where possible. Aspiration, documented in 6 patients (3%), occurred in immediate postoperative period primarily in patients with significant intraoperative blood loss or alterations in consciousness. All 6 cases occurred in patients with orotracheal intubation, emphasizing the need for careful suctioning and attention to airway protection during initial extubation.

The present study's findings demonstrate consistency with contemporary global practice while highlighting regional variations. Mossinelli et al. (2025) reported similar airway management distribution and complication patterns in their European cohort, suggesting emerging international consensus on selective approach. However, our higher frequency of laryngeal cancer (44.5% vs 30-35% in Western series) reflects different epidemiological patterns related to tobacco smoking prevalence in our region.

The complication profile in our study aligns with published reports. A meta-analysis by Rodrigues et al. examining airway management complications in head and neck surgery reported sore throat in 8-15%, vocal cord injury in 3-6%, and tracheal stenosis in 1-3% of intubated patients, all within the range observed in our series. The superior outcomes with

selective tracheostomy approach (5.6% complications) compared to routine prophylactic tracheostomy (historically 15-25% with morbidity including difficulty with decannulation and tracheostenosis) validate the paradigm shift toward selective strategies.

The application of modern airway assessment tools including videolaryngoscopy and fiberoptic techniques has expanded the options available to anesthesiologists. While our study primarily documented orotracheal and nasotracheal intubation success rates, the incorporation of these advanced techniques for difficult airway management reflects evolution toward safer practices. The low complication rate (6.7%) with awake fiberoptic intubation validates recommendations from difficult airway societies to employ these techniques in predicted difficult intubation scenarios.

### Conclusion

The study demonstrates that contemporary airway management has evolved toward selective, individualized approaches rather than routine prophylactic strategies. The selection of strategy should be guided by tumor characteristics, anticipated airway compromise, planned surgical approach, and anesthesiologist assessment. The paradigm shifts from routine prophylactic tracheostomy to selective approach based on risk stratification represents significant evolution in airway management philosophy. Enhanced training in advanced airway techniques including fiberoptic endoscopy and videolaryngoscopy expands capabilities and improves safety.

Future research should focus on prospective validation of risk stratification tools, development of institutional protocols incorporating multidisciplinary input, and expansion of training in advanced airway techniques. Implementation of evidence-based practices as demonstrated in this study can improve outcomes, reduce morbidity, and enhance patient safety in the challenging management of head and neck malignancies.

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