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"PREDICTORS OF DIFFICULT AIRWAY"

Anaesthesiology

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ABSTRACT

With the rapid advancement of anesthesia-related technologies, innovative devices such as video laryngoscopes and supraglottic airway devices (SGAs) have significantly enhanced the efficiency and safety of airway management for anesthesiologists and other healthcare providers. Despite these technological breakthroughs, managing difficult airways remains a critical challenge in clinical practice. A difficult airway is defined as a situation in which experienced professionals encounter challenges in ventilation using face masks or in performing tracheal intubation with standard tools such as stylets. The consequences of such difficulties can be severe—unconscious patients may experience inadequate oxygenation, potentially leading to irreversible brain injury or even death. The ability to accurately predict the likelihood of a difficult airway before surgery is essential. It allows anesthesiologists to make thorough preoperative preparations and be equipped to act swiftly should airway complications arise. To address this need, a variety of predictive methods have been proposed. These strategies aim to improve the identification of at-risk patients, enhance clinical decision-making, and ultimately reduce the incidence of airway-related complications during anesthesia. **Objectives:** To study preoperative prediction methods for difficult tracheal intubation in adult patients undergoing various surgical procedures under General anesthesia. **Materials And Methods:** It is a prospective observational study of 60 patients with ASA physical status 1-2 patients, aged 19-70 years, who underwent elective surgery with endotracheal intubation were included.. During the pre-anesthetic visit, patients were evaluated by 7 preoperative airway assessment factors, including the following: Mallampati classification, thyromental distance, head & neck movement, body mass index (BMI), buck teeth, inter-incisor gap, and upper lip bite test (ULBT). After endotracheal intubation, patients were divided into 2 groups based on their Intubation difficulty scale (IDS) score estimated with 7 variables: normal (IDS < 5) and DI (IDS ≥ 5) groups. The incidence of Total airway score (> 6) and high score of each airway assessment factor was compared in two groups: odds ratio, confidence interval (CI) of 95%, with a significant P value ≤ 0.05. **Results:** Among the total 60 patients, in the difficult intubation (DI) group, which had an IDS > 5, there were 7 patients (11.8%); in the normal (N) group, which had IDS ≤ 5, there were 53 patients (88.2%). There were no failures of intubation in patients with IDS≤ 5. **Conclusion:** In the present study, Total airway score of the airway assessment factor was more than 6 points or if the ULBT was class III, the prediction of difficult endotracheal intubation was possible. The Wilson score and the LEMON method are commonly used among all the different airway predictors.

KEYWORDS

INTRODUCTION

A difficult airway (DA) is a clinical situation where a trained anesthesiologist struggles with face mask ventilation, tracheal intubation, or both, extending to supraglottic airway devices, direct tracheal access, and extubation considerations[1]. Despite technological advancements enhancing airway management safety, managing difficult airways remains a critical challenge. Inadequate oxygenation in unconscious patients due to a DA can lead to severe consequences like brain injury or death.

Predicting the likelihood of a DA before surgery is crucial for thorough preparation and swift intervention. Various predictive methods aim to identify at-risk individuals, improve clinical decision-making, and reduce airway-related complications during anesthesia[2].

While no universal definition exists, DA generally means that achieving adequate oxygenation and ventilation is challenging, influenced by patient factors, the clinical setting, and practitioner skills. The American Society of Anesthesiologists Task Force defines a DA as difficulty with face mask ventilation (inability to maintain 92% oxygen saturation or prevent inadequate ventilation), supraglottic device ventilation, or tracheal intubation. Difficult laryngoscopy occurs when no vocal cord portion is visible (Cormack and Lehane Grade IV)[3].

Difficult endotracheal intubation requires over three attempts or more than ten minutes using conventional laryngoscopy.

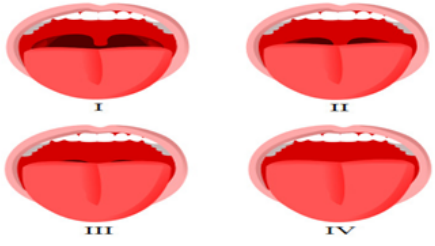
Predicting Difficult Intubation

Tracheal intubation is best achieved in the classic "sniffing the morning air" position in which the neck is flexed and there is extension at the cranio-cervical (Atlanto-Axial) junction. This aligns the structures of the upper airway in the optimum position for laryngoscopy and permits the best view of the larynx when using a curved blade laryngoscope. Abnormalities of the bony structures and the soft tissues of the upper airway will result in difficult intubation.

Pregnant patients, those suffering from facial/ maxillary trauma, those with small mandibles or intra-oral pathology such as infections or tumors are all more likely to present difficulties during intubation[4].

Mallampati Classification

Class I: soft palate, uvula, and pillars are visible
Class II: soft palate and uvula are visible
Class III: only the soft palate and base of the uvula are visible
Class IV: only the hard palate is visible



Mallampati suggested a simple screening test which is widely used today in the modified form produced by Samsoon and Young[5]. The patient sits in front of the anesthetist and opens the mouth wide. The patient is assigned a grade according to the best view obtained. Clinically, Grade 1 usually predicts an easy intubation and Grade 3 or 4 suggests a significant chance that the patient will prove difficult to intubate. The results from this test are influenced by the ability to open the mouth, the size and mobility of the tongue and other intra-oral structures and movement at the craniocervical junction.

Thyromental Distance :

This is a measurement taken from the thyroid notch to the tip of the jaw with the head extended. The normal distance is 6.5cm or greater and is dependent on a number of anatomical factors including the position of the larynx. If the distance is greater than 6.5cm, conventional intubation is usually possible. If it is less than 6cm intubation may be impossible[6].

Head And Neck Movement

Extension at the atlanto-axial joint should be assessed by asking the patient to flex their neck by putting their head forward and down. The neck is then held in this position and the patient attempts to raise their face up testing for extension of the atlanto-axial joint. Laryngoscopy is optimally performed with the neck flexed and extension at the atlanto-axial joint. Reduction of movement at this joint is associated with difficulty.

BMI

Classification	BMI (kilogram/m^2)
Underweight	<18.5
Normal weight	18.5-24.9
Overweight	25-29.9
Obesity Class 1	30-34.9
Obesity Class 2	35-39.9
Extreme Obesity Class 3	>40

BUCKED TEETH classified as mild, moderate and severe.

INTER incisor gap With the mouth open maximally, measure the distance between the incisors or alveolar margins. If the gap is less than 3 cm, its a PREDICTOR of difficult intubation.

Upper Lip Bite Test

Class I (lower incisors bite above the vermilion line),
Class II (lower incisors bite below the vermilion line), and
Class III (unable to bite the upper lip).
Class I and II are considered predictors of easy intubation, while Class III suggests a potential difficult airway.

Objectives

To study preoperative prediction methods for difficult tracheal intubation in adult patients undergoing various surgical procedures under General anesthesia.

MATERIALS AND METHODS

A cross-sectional study was conducted at Mahadevappa Rampure Medical college, Kalaburgi during the period of January 2023-January 2024 on 60 patients in department of anesthesiology. Data was analyzed using appropriate inferential statistics.

Patients with ASA physical status 1-2 patients, aged 19-70 years, who underwent elective surgery with endotracheal intubation were included. During the pre-anesthetic visit, patients were evaluated by 7 preoperative airway assessment factors, including the following: Mallampati classification, thyromental distance, head & neck movement, body mass index (BMI), buck teeth, inter-incisor gap, and upper lip bite test (ULBT). After endotracheal intubation, patients were divided into 2 groups based on their Intubation difficulty scale (IDS) score estimated with 7 variables: normal (IDS < 5) and DI (IDS ≥ 5) groups. The incidence of Total airway score (> 6) and high score of each airway assessment factor was compared in two groups: odds ratio, confidence interval (CI) of 95%, with a significant P value ≤ 0.05.

Airway factors	Score		
	0	1	2
Mallampati classification	Class I	Class II	Class III−IV
Thyromental distance (cm)	> 6.5	6−6.5	< 6
Head & neck movement (°)	> 90	90	< 90
BMI (kg/m^2)	< 25	≥ 25	-
Buck teeth	No	Mild	Severe
Inter-incisor gap (cm)	> 5	4−5	< 4
ULBT	Class I	Class II	Class III

Study Design : Prospective observational Study

Source Of Data : The source of the data was collected from the patients posted for elective surgeries at Basaveshwar Teaching & General Hospital, attached to Mahadevappa Rampure Medical College, Kalaburagi during the time period of January 2023-January 2024.

Sample Size Estimation: 60cases

Inclusion Criteria

1. Age group 19-70 years
2. Patients posted for elective surgeries under general anesthesia
3. Pateints of ASA I and ASA II

Exclusion Criteria

1. Patients with pre-existing airway abnormalities.
2. Patients with a documented history of difficult airway management.
3. Patients posted for emergency surgeries
4. Psychiatric disorders
5. Pregnant women

Statistical Analysis And Observation

After collecting the data, all the variables will be examined for outliers and non-normal distributions. The Categorical variables are expressed as Frequency and Percentage. The Quantity variables are expressed as mean and standard deviation. Descriptive statistics are used to evaluate baseline characteristics. Paired and unpaired t-test will be used to calculate p value. p value <0.05 will be statistically significant. The statistical analysis will be performed using test of significance (Chi square test) and statistical software package SPSS 20.0 version.

Results of Airway Assessment Study (n=60)

Table 1. Patient Demographics and Clinical Variables

Group	Mean Age	Mean BMI	Mean TAS
DI	48.9	30.1	9.2
Normal	47.0	21.7	3.2

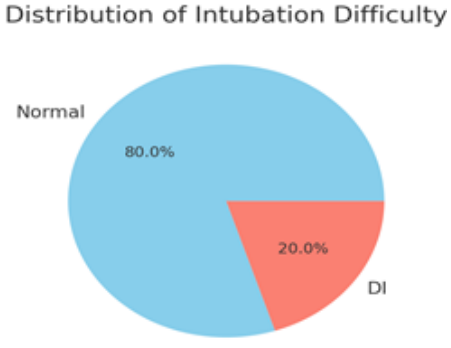


Figure 1. Distribution of Intubation Difficulty

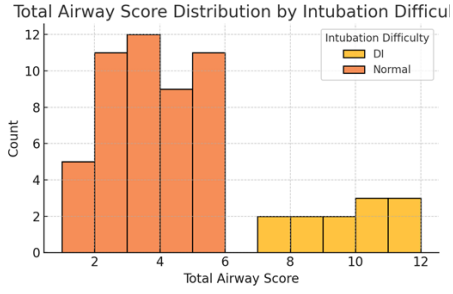


Figure 2. Total Airway Score Distribution by Intubation Difficulty

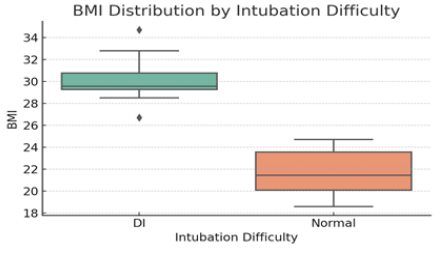


Figure 3. BMI Distribution by Intubation Difficulty

Table 2. Statistical Analysis of Key Variables

Variable	Group 1 Mean (Normal)	Group 2 Mean (DI)	P-value	Significant
Age	47.0	48.9	0.704	No
BMI	21.7	30.1	0.000	Yes

Total Airway Score	3.2	9.2	0.000	Yes
ULBT (Class III Frequency)	0	12	0.000	Yes

DISCUSSION

This simulated analysis of 60 patients identified significant associations between difficult intubation and higher total airway score (TAS), body mass index (BMI), and ULBT class III. These findings mirror results reported in prior clinical literature, such as the study by Seo et al. (2012), reinforcing the reliability of using ULBT and TAS as predictive tools. In particular, a TAS greater than 6 and ULBT class III were strong indicators of increased intubation difficulty. These variables remain crucial for preoperative screening in anesthesia practice.

CONCLUSION

This study reaffirms that total airway score and upper lip bite test class III are statistically significant predictors of difficult intubation. Utilizing these parameters in clinical assessments can enhance early identification and preparedness for airway challenges, ultimately improving patient safety outcomes.

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