



ORIGINAL RESEARCH PAPER

Anaesthesiology

CORRELATION OF EXTENDED MALLAMPATI SCORE, THYROMENTAL HEIGHT AND NECK CIRCUMFERENCE IN ASSESSING DIFFICULTY IN INTUBATION

KEY WORDS: Difficult airway, thyromental height, Intubation, Predictors, Laryngoscopy

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ABSTRACT

Airway management is a major concern to anesthesiologists and can contribute to perioperative mortality & morbidity if not managed in time. About 75-50% of cardiac arrests during general anesthesia are because of difficult intubation that causes inadequate oxygenation and/or ventilation. In this Prospective observational study three variable data viz. Extended Modified Mallampati score, Thyromental height & Neck circumference are obtained from every sample and their effectiveness in predicting a difficult intubation, which is calculated by a score called Intubation Difficulty Score was determined statistically. Our study shows that a combination of Extended modified Mallampati grading and Thyromental height and neck circumference is preferable for assessment of the airway because of its better Specificity and positive predictive value than taken alone. Also the ratio of neck circumference to thyromental height appears to be predicting difficult airway better than individual indices

INTRODUCTION

Airway management is a major concern to anesthesiologists and can contribute to perioperative mortality & morbidity if not managed in time. Up to 30% of anesthetic deaths have been stated in cases of compromised poorly managed airway. Airway assessment to identify the prediction of difficult intubation (DI) during general anesthesia is very important to maintain patient safety and prevent untoward events like hypoxia & brain damage. The aim of our study is to evaluate the occurrence of difficult tracheal intubation during general anesthesia in elective surgeries and to find out the key predictors of difficult intubation. Hence the recognition of this problem during preoperative anesthetic checkup is of headmost importance for the anesthesiologist. Various scoring indices for determination difficult intubation based on many parameters such as single or combined.

The recognition of difficult airway during pre-operative anesthetic check-up is of utmost importance for the anaesthesiologist. Various scoring indices for determination of difficult intubation based on many parameters such as single or combined parameters have been proposed over time. Nevertheless, the diagnostic accuracy of these screening tests has varied from trial to trial.

In a study which performed by Mashour and Sandberg in 2006, it was shown that the MMP with extension (Extended Mallampati Score) was associated with improved specificity and positive predictive value. Etezadi farhad et al (2013) showed that thyromental height appears promising as a single anatomical measure to predict the risk of difficult laryngoscopy. Multiple studies showed association between difficult intubation and increased neck circumference. The TMHT was performed as follows: The height between the anterior border of the thyroid cartilage (on the thyroid notch just between the two thyroid laminae) and the anterior border of the mentum (on the mental protuberance of the mandible) was measured, with the patient lying supine using a pillow with her/his mouth closed.

AIM & OBJECTIVES

The aim of the study is to know about the Correlation of Extended Modified Mallampati

score, Thyromental height & Neck circumference in assessing difficulty in intubation. Three variable data viz. Extended Modified Mallampati score, Thyromental height & Neck circumference are obtained from every sample and their effectiveness in predicting a difficult intubation, which is calculated by a score called Intubation Difficulty Score, is determined statistically.

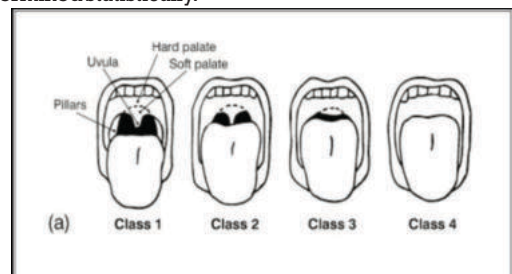


Figure 1: Modified Mallampati score

Source: Yonenaga K, Taga H, Eno Y, Watanabe M, Matsuo A, Itai S, et al. Association between the Mallampati score and maximal mouth opening in patients with obstructive sleep apnea. *Oral Science International*. 2021;18(2):116-9.

METHODOLOGY

This is a prospective observational study with sample size of 130. After obtaining approval from the institutional ethics committee, elective surgical cases requiring general anaesthesia aged 18 to 65 years of either sex belonging to ASA physical status class 1 and 2 were included in this study. Pregnant mothers, BMI > 35, patients with congenital anomalies or any obvious deformity of the airway were excluded from this study.

Preoperatively all the demographic data including age, weight, gender, BMI are obtained. Then the data required for the study are obtained including Extended Mallampati score (EMS), Thyromental height (TMHT) and Neck circumference (NC). Extended Modified Mallampati score is graded from 1 to 4, where each grade represents the range of visibility of faucial pillars, uvula, soft palate and hard palate and it is done with the patient's head fully extended. Thyromental height is

the height between the anterior border thyroid notch and anterior margin of mental symphysis when the neck is fully extended with mouth closed. Neck circumference is measured at the level of cricoid cartilage. Difficulty of intubation was assessed using the IDS, which was recorded by the senior anesthetist. The IDS is graded as follows:

- **N1**, number of additional intubation attempts.
- **N2**, number of additional operators.
- **N3**, number of alternative intubation techniques used.
- **N4**, laryngoscopic view as defined by Cormack and Lehane (grade 1, N4 - 0; grade 2, N4 - 1; grade 3, N4 - 2; grade 4, N4 - 3);
- **N5**, lifting force applied during laryngoscopy (N5 - 0 if inconsiderable and N5 - 1 if considerable); N6, needed to apply external laryngeal pressure for optimized glottic exposure (N6 - 0 if no external pressure or only the Sellick maneuver was applied).
- **N6** - 1 if external laryngeal pressure were used).
- **N7**, position of the vocal cords at intubation (N7 - 0 if abducted or not visible and N7 - 1 if adducted).

The IDS score is the sum of N1 through N7. A score of 0 indicated intubation under ideal conditions. The two groups of patients were classified further according to the IDS score. Those with an IDS score of ≥ 5 and < 5 were defined as the difficult and easy groups, respectively. In the operating theatre the patients were positioned with intubation pillow under the head with the neck extended. Each patient was monitored routinely with an electrocardiogram, pulse oximetry, and non-invasive arterial pressure. Patients breathed 100% oxygen through a facemask for 3 min. Anesthesia was then induced with Propofol 2mg/kg, fentanyl 2mcg/kg and vecuronium 0.1mg/kg. A size 3 Macintosh laryngoscope blade for adult female and size 4 Macintosh laryngoscope blade for adult male was used for the first laryngoscopy in each case. All tracheal intubations was performed by two anaesthetists with more than 2yr of experience and they were blinded to the assignment of the patient.

The laryngoscopic view was graded according to Cormack and Lehane's scale: grade 1, the vocal cords was completely visible; grade 2, only the arytenoids was visible; grade 3, only the epiglottis was visible; and grade 4, the epiglottis was not visible.

Statistical Analysis:

Statistical analysis was done using SPSS v20.0. All data were entered in Microsoft excel and the categorical variables were compared using chi-square test to obtain the p value. The Positive and negative predictive value, sensitivity and specificity were calculated in MS Excel. Receiver Operating Characteristic curve was plotted for individual indices using SPSS software and Area under the curve was calculated which is shown below.

RESULTS:

In this study of total 130 patients data were analyzed. We did not find any intubation failure during the study. The demographic data such as age, BMI, ASA grading, Extended Mallampati score (EMS), Neck circumference (NC), thyromental height (TMHT) and intubation difficulty score (IDS) were shown in table 1.

Table 1 Demographic characteristics of the samples

	IDS	N	Mean	SD	p-value
BMI	Easy	94	24.32	3.55	.022(S)
	Difficult	36	26.02	4.04	
WEIGHT	Easy	94	62.30	9.94	0.135(NS)
	Difficult	36	65.19	9.50	
AGE	Easy	94	38.61	13.07	.076(NS)
	Difficult	36	43.22	13.47	

IDS: Intubation Difficulty Score; N: number of samples; SD:

Standard deviation; BMI: body mass index; S: significant; NS: nonsignificant

The patients were divided into two groups. **Group 1:** easy intubation IDS < 5 ; **Group 2:** difficult intubation IDS ≥ 5 .

Table 2 Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the indices measured in identifying difficult intubation

Indices	Sensitivity	Specificity	PPV	NPV
Extended Mallampati score 3 and 4	55.6%	37.2%	25.3%	68.6%
Thyromental height ≤ 6.5 cm	97.2%	23.6%	33.6%	95.6%
Neck circumference ≥ 35.5 cm	72.9%	65.5%	45.7%	85.9%

The mean age of patients in group 1 was 38.6 ± 13 years and in group 2 was 43.2 ± 13.2 years

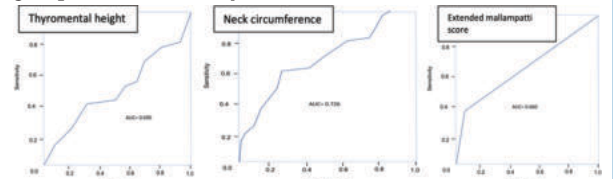


Figure 2 : Receiver operating characteristic curve analysis of TMHT, NC and EMS for difficult intubation. Each receiver operating characteristic curve is expressed as a solid line. (AUC: area under curve)

The mean BMI of patients were 24.34 ± 3.5 and 26.02 ± 4.04 in groups 1 and 2 respectively. We have also assessed various prediction factors for difficult intubation such as neck circumference (NC), thyromental height (TMHT) and extended Mallampati score (EMS). The NC, TMHT significantly correlated with difficult intubation. The ROC curves were shown in Figure 2. The cutoff points for difficult intubation were NC ≥ 35.5 cm, TMHT ≤ 6.5 cm and EMS III and IV. The sensitivity, specificity, positive predictive value, and negative predictive value were used to analyze the NC, TMHT and EMS tests. These tests demonstrate the accuracy of indicators.

DISCUSSION

Airway assessment includes

- History
- Physical examination
- Clinical tests
- Imaging

Conventionally used clinical tests have moderate to poor sensitivity and specificity. *Mashour and Sandberg et al.* in 2006 have shown that extended mallampati scoring with craniocervical extension improves the specificity and predictive value of Mallampati airway evaluation. *Etezadi farhad et al.* in 2013 showed that thyromental height appears promising as a single anatomical measure to predict the risk of difficult laryngoscopy. A more caudal or anterior larynx is associated with difficult laryngoscopy and it can be expected to correlate with a shorter thyromental height. Various research studies and meta-analysis are trying to determine the method or combination best methods for predicting difficult intubation. Assessment of airway included physical examination, medical history, clinical and other tests. Successful identifications of physical features will help in the management of difficult airway management. The rate of difficult intubation (Cormack and Lehane grade 3 or 4 view) in patients with apparently normal airways was determined by two recent meta-analysis to be 5.8%. Studies showed that conventional tests such as Mouth opening, Modified Mallampati score and Thyromental height offered poor (20%) to moderate (62%) sensitivity and moderate (82%) to good (97%) specificity. *Brodsky et al.* (2002) previously identified neck circumference (NC) as an independent predictor of

difficult intubation. The risk of difficult intubation with increasing NC. **Gonzalez et al.** (2008) studied difficult intubation (defined as an IDS score of more than 5) prospectively, in 131 lean and obese patients. NC greater than 43cm was an independent predictor of difficult intubation and increased the risk of difficult intubation by 37%. Conversely, the predictive value of neck circumference in 180 obese patients, finding no association between neck circumference and difficult intubation. The BMI of more than 35 kgm² to be an independent predictor of difficult and failed intubation after observing a cohort of 332 consecutive patients. **Juvin et al.** (2003) compared 263 lean and obese individuals and found a higher incidence of difficult intubation in the obese individuals. Conversely, **Brodsky et al.** (2002) conducted a study of 100 morbidly obese patients and did not find obesity to be an independent predictor of difficult intubation. **Ezri et al.** (2003) reported that the more pre-tracheal soft tissue present at the vocal cords was a good identification of easy and difficult intubation in obese patients.

CONCLUSION:

In this study we found a 28.4% incidence of difficult intubation. The predictors NC and TMHT have a better predictive value than the extended modified Mallampati grading for difficult intubation. The TMHT ≤ 6.5 cm and NC ≥ 35.5 cm shows moderate to high sensitivity, specificity, positive predictive value and negative predictive value. Thus, we consider a preoperative value of TMHT ≤ 6.5 and NC ≥ 35.5 to be a better predictor of difficult intubation in non-obese patients.

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