THE PREDICTION OF DIFFICULT INTUBATION WITH BEDSIDE SCORING SYSTEMS

Arzu Gerçek, M.D. / Sema Lim, M.D. / F. Banu İşler, M.D.
Zeynep Eti, M.D. / F. Yılmaz Göğüş, M.D.

Department of Anesthesiology and Reanimation, School of Medicine,
Marmara University, Istanbul, Turkey.

ABSTRACT

Objective: The aim of this study was to evaluate the correlation of sex, age, bedside scoring systems and body mass index with laryngoscopic view in patients with clinically difficult intubation.

Methods: Five hundred patients, aged 20-70 years, were included in the study. The age, sex, weight and height of the patients were recorded preoperatively and body mass index was calculated. The patients were examined for Mallampati classification, thyromental distance, mouth opening, neck mobility and structure of maxillary teeth, and scored according to airway difficulty score. The body mass index was scored as an additional parameter. During laryngoscopy, Cormack-Lehane grading was done according to the view of the glottis. Three or more attempts required for intubation and / or more than 10 minutes time spent was accepted as difficult airway. For statistical analysis; oneway of ANOVA with post-hoc Tukey and Chi-square test were used and $p < 0.05$ was accepted as statistically significant.

Results: Thirty-three of 500 patients (6.6%) had difficult intubation. A significant correlation was found between clinically difficult intubation and thyromental distance ($p < 0.05$), Mallampati classification ($p < 0.01$) and mouth opening ($p < 0.01$). Also, Cormack-Lehane grading was found to be correlated with thyromental distance ($p < 0.05$), Mallampati classification ($p < 0.05$) and mouth opening ($p < 0.05$).

Conclusion: The difficult intubation was found to be correlated with Mallampati classification, thyromental distance and mouth opening.

Key words: Intubation (Intratracheal), Difficult

INTRODUCTION

The primary responsibility of the anesthesiologist as a clinician is to safeguard the airway, to preserve and protect it during induction, maintenance and recovery from the state of anesthesia (1). Besides this priority, adverse anesthetic outcomes in most of the instances have been traced partly or totally to airway difficulties or mismanagement. Unheralded airway difficulty may have been a formidable factor in a significant percentage of these cases. Appropriate strategy and its clinical execution, based upon a thorough and objective airway assessment should help to mitigate such airway related morbidity and mortality in clinical practice. The anatomical characteristics of patients can be evaluated by bedside assessment methods such as Mallampati classification, thyromental distance, mouth opening, neck mobility, structure of maxillary teeth (1-6).

The goal of this study was to evaluate the correlation between age, sex, thyromental distance, Mallampati classification, structure of maxillary teeth, mouth opening, neck mobility, body mass index and Cormack–Lehane grading in patients with clinically difficult intubation.

METHODS

After obtaining Institutional Ethics Committee approval and the patients' written consent, 500 patients, aged between 20–70 years, were included in the study, undergoing general anesthesia with oral endotracheal intubation. Patients with pregnancy, congenital or acquired lesion at face, neck or upper airway were not included in the study. Patients were examined preoperatively for Mallampati classification (Table I), thyromental distance, mouth opening, neck mobility and structure of maxillary teeth and were scored according to airway difficulty score (2). Additionally, we categorized patients according to the body mass index (BMI) (body weight (kg) x height (m)$^{-2}$) and scored at each category (Table II). Preoperative evaluation of patients was always carried out by the same anesthesiologist.

The age and sex of the patients and the number of attempts at tracheal intubation were also recorded. All of the patients were intubated orally using standard direct laryngoscopy with no:3 Machintosh blade. The airway evaluation and the intubation was performed by different anesthesiologists. So, the pre-intubation assessment did not influence the selection for type or size of the blade of the laryngoscope.

For all intubations, the first attempt was made by a junior anesthesiology resident, the second and later attempts were made by a senior anesthesiologist.

During laryngoscopy, Cormack-Lehane grading was carried out according to the view of the glottis (Table III).

Three or more attempts required for intubation and / or more than 10 minutes time spent by experienced anesthesiologists was accepted as difficult intubation (4).

For statistical analysis; oneway of ANOVA with post-hoc Tukey and Chi-square test were used and $p < 0.05$ was accepted as statistically significant.

Table I: Mallampati classification

Class I	Visualization of soft palate, uvula, anterior and posterior tonsils
Class II	All of the above except tonsils
Class III	Just base of the uvula
Class IV	Even uvula is not visualized

Table II: Airway Difficulty Score and Body Mass Index Score

	1	2	3
Thyromental distance	> 6 cm	5 –6 cm	< 5 cm
Mallampati classification	Class I	Class II	Class III – IV
Mouth opening	4 cm	2 – 3 cm	1 cm
Neck mobility	Normal	Reduced	Fixed flexion
Structure of maxillary teeth	Absent	Normal	Prominent
Body Mass Index	< 20	20 - 30	> 30

Table III: Cormack-Lehane Grading

Grade I	Total visualization of epiglottis and vocal cord
Grade II	Visualization of epiglottis and posterior part of the vocal cord
Grade III	Visualization of only epiglottis
Grade IV	Visualization of only soft palate

RESULTS

Three hundred and fifteen women aged 39.88 ± 13.55 years and 185 men aged 46.27 ± 15.06 years were included in the study. BMI score was 2.41 ± 0.60 in the female group and 2.40 ± 0.53 in the male group. There were no statistical differences in the demographic characteristics of the groups ($p > 0.05$).

Intubation was performed at the first attempt in 398 (79.6%) patients, at the second attempt in 69 (13.8%) patients, at the third attempt in 30 (6%) patients and at the fourth attempt in 3 (0.6%) patients. No complication was seen during intubation attempts.

The incidence of difficult intubation was 6.6% (33 patients); 19 of these patients were female (19/315; incidence of the difficult intubation 6%) and 14 of these patients were male (14/185; incidence of the difficult intubation 7.6%) ($p > 0.05$). No correlation was found between difficult intubation and age, sex ($p > 0.05$).

A significant correlation was found between difficult intubation and thyromental distance
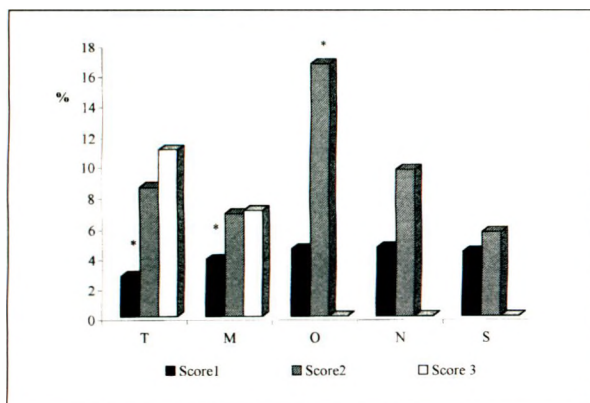
(p<0.05), Mallampati classification (p<0.01) and mouth opening (p<0.01) (Fig. 1). Cormack-Lehane grading was also found to be correlated with thyromental distance (p<0.05), Mallampati classification (p<0.05) and mouth opening (p<0.05) (Fig. 2). Difficult intubation was not found to be correlated with BMI, structure of maxillary teeth and neck mobility (no patient had a fixed neck) (p>0.05).

There was a significant correlation between thyromental distance, Mallampati classification and mouth opening (p<0.01), but not between neck mobility, structure of maxillary teeth and BMI (p>0.05).
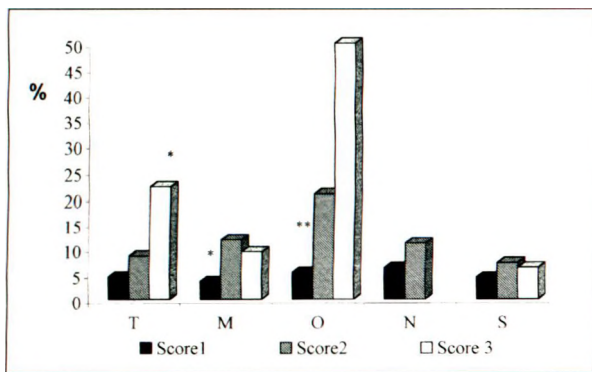
T: Thyromental distance, M: Mallampati classification, O: Mouth opening, N: Neck mobility, S: Structure of maxillary teeth
*: p<0.05 and **: p<0.01 when compared with other groups.

Fig.1: The incidence of difficult intubation according to bedside scoring system.

T: Thyromental distance, M: Mallampati classification, O: Mouth opening, N: Neck mobility, S: Structure of maxillary teeth
*: p<0.05 when compared with other groups.

Fig.2: The incidence of Cormack-Lehane grade III-IV according to bedside scoring system.

DISCUSSION

According to the results of this study, thyromental distance, Mallampati classification and mouth opening was found to be correlated with Cormack-Lehane grading and difficult intubation.

An ideal screening test for difficult intubation should allow diagnosis of all problematic cases without false positivities. Such a test does not exist, so to improve the quality of screening, bedside tests can be assessed together. The difficulty in maintaining the patency of the upper airway can be distinguished by thyromental distance and Mallampati classification and difficulty in alignment of the axis and visualization of the larynx is influenced by mouth opening, cervical spine mobility and structure of upper incisors. Although George E et al. (5) thought that methods of airway assessment were helpful but lack ed adequate sensitivity and specifity, there are many studies showing the high specificity and sensitivity of Mallampati classification, thyromental distance (1-4, 6-8).

We found the incidence of difficult intubation as 6.6%. The incidence of difficult intubation shows great variability and ranges between 0.05-18% (2,6-12). Different definitions of difficult airway and difficulty in standardization of intubation may lead to this great variability. In our study, to perform a standard intubation, the first attempt was made by a junior anesthesiology resident, the second and later attempts were made by a senior anesthesiologist with no:3 Machintosh laryngoscope blade.

It was reported that the incidence of difficult intubation was different between the two sexes and male patients had a higher incidence of difficult intubation (7,12). Although the incidence was higher in male patients in our study, we did not find any statistical difference between the two sexes. Also pregnant patients were not included in our study as Hung OR et al. (9) reported the changes of Mallampati scores in a patient during pregnancy. Mallampati scores deteriorated from I and II to III and IV during third trimester and then returned to the previous states on the day of labor.

The effect of obesity as a risk factor for difficult intubation is controversial. Rose DK et al. (7), Hung OR et al. (9), Voyagis G et al. (10)

considered obesity as a risk factor for difficult intubation. However, Ezri T et al. (12), Meyer R et al. (13), Bond A et al. (14), Brodsky JB et al. (15) found that the incidence of difficult intubation in morbidly obese patients was not higher than in normal subjects. In our study, we could not find any correlation between difficult intubation and BMI. There are some differences in the methods of the studies; Voyagis G et al. (10) defined difficult intubation as inadequate exposure of the glottis by direct laryngoscopy and BMI was scored <30 as normal, 30–40 as moderate obesity and >40 as morbid obesity in their study searching the incidence of difficult intubation in obese patients. We scored BMI as < 20 was thin, 20–30 was normal and >30 was obese. Voyagis G et al. (10) concluded that obesity contributes to difficult laryngoscopy whenever the weight gain is accompanied by an increase in the size of the tongue such that the relative proportions of the tongue versus the pharyngeal capacity are altered and Mallampati class is increased. On the contrary to Voyagis et al. (10), we searched for the effect of BMI in the normal population, not only in obese patients.

We could not find any correlation between BMI and either difficult intubation, Cormack-Lehane grading or Mallampati classification.

Rose DK et al. (7) and Ezri T et al. (12) reported that those above 40 years of age may carry risk for difficult intubation due to osteoarthritic changes and poor dentition. In our study, 14 of 33 patients with difficult intubation aged between 20–40 years, 14 of them aged between 40–60 years, 5 of them were older than 60 years and we could not find any correlation between age and Cormack-Lehane grade or difficult intubation.

There are some other superior facilities like three–dimensional computed tomography or intubation with fiberoptic bronchoscope, but routine application of these was not possible because of the high cost and technical insufficiencies. These techniques with high predictivity can be used in patients in whom the bedside scores were found to be high and there is a suggested high probability of difficult intubation (16).

The difficult intubation was found to be correlated with Mallampati classification, thyromental distance and mouth opening.

REFERENCES

1. *Mallampati SR. Clinical assessment of the airway. Anesthesiol Clin North Am 1995;13: 301-307.*

2. *Janssens M, Larry M. Airway difficulty score (ADS): a new score to predict difficulty in airway management. Eur J Anaesthesiol 2000;17:35, Abstract 113.*

3. *Mallampati SR, Gatt SP, Gugino LD. A clinical sign to predict difficult tracheal intubation: a prospective study. Can Anaesth Soc J 1985;32:429-434.*

4. *Janssens M, Hartstein G. Management of difficult intubation. Euro J Anaesthesiol 2001;18:3-12.*

5. *George E, Haspel KL. The difficult airway. Int Anesthesiol Clin 2000;38:47-63.*

6. *Randell T. Prediction of difficult intubation. Acta Anaesthesiol Scand 1998;42:136-137.*

7. *Rose DK, Cohen MM. The airway : problems and predictions in 18,500 patients. Can J Anaesth 1994;41:372–383.*

8. *Karkouti K, Rose DK, Wigglesworth, et al. Predicting difficult intubation: a multivariable analysis. Can J Anaesth 2000;47:730-739.*

9. *Hung OR, Morris I. Dynamic anatomy of upper airway: an essential paradigm. Can J Anaesth 2000;47:295-298.*

10. *Voyagis GS, Kyriakis GP, Dimitriou V, Verettou I. Value of oropharyngeal Mallampati classification in predicting difficult laryngoscopy among obese patients. Euro J Anaesthesiol 1998;15:330-334.*

11. *Angelard B, Debry C, Planquart X. Difficult intubations: A prospective study. Ann Otolaryngol Chir Cervicofac 1991;108:241-243.*

12. *Ezri T, Warters RD. The incidence of Class "Zero" airway and the Impact of Mallampati Score, Age, Sex and Body Mass Index on prediction of Laryngoscopy Grade. Anesth Analg 2001;93:1073-1075.*

13. *Meyer R. Obesity and difficult intubation. Anaesth Intensive Care 1994;22:314-315.*

14. *Bond A. Obesity and difficult intubation. Anaesth Intensive Care 1993;21:828-303.*

15. *Brodsky JB, Lemmens HJM, Brock-Utne JB, et al. Morbid obesity and tracheal intubation. Anesth Analg 2002;94:732-736.*

16. *Kanaya N, Kawana S, Watanabe H. The utility of three–dimensional computed tomography in unanticipated difficult endotracheal intubation. Anesth Analg 2000;91:752-756.*