DOI: 10.7860/JCDR/2017/23937.9865

Cross Sectional Observational Study Performed to See for Relation of Mallampati Score and Extended Mallampati Score with Body Mass Index

SASHA MARIA MENON[1], SHAILAJA SAMPANGIRAMAIAH[2], MEGHA MATHEW[3]

ABSTRACT

Introduction: There is increasing incidence of obesity worldwide. Since obese patients have an increased fatty tissue distributed in a truncal fashion, they may have an important and negative impact on the airway patency and respiratory function. Various scoring systems have been used to predict difficult airway, the most commonly used universal bedside tool is the Modified Mallampati Scoring (MMS). It was shown that the Extended Mallampati Score (EMS) predicted difficult laryngoscopy better than the MMS in the obese populations.

Aim: To evaluate the association of Mallampati score and Extended Mallampati score in adults.

Materials and Methods: This cross-sectional prospective observational study was performed on 323 subjects. The selection method included convenience sampling technique. Patient data which included name, age, sex, weight, height, Body Mass Index (BMI) and Neck Circumference (NC), Mallampati Score, and EMS were collected by two observers, anaesthesiologists. The observers noted their findings of MMS and EMS on the same patient independently. Their findings were entered independently and disclosed only during analysis.

Results: There was good agreement between the observers (kappa value 0.635) for MMS and EMS. The intraobserver correlation coefficient was 0.8 for MMS ($p<0.001$) and 0.7 ($p=0.004$) for EMS which was significant. A positive correlation between sex and NC with BMI, MMS and EMS was seen.

Conclusion: From this study we concluded that there was no difference between the MMS and EMS. There was interobserver agreement between MMS and EMS and a positive correlation of body mass index with MMS and EMS was seen.

Keywords: Modified mallampati test, Neck circumference, Obesity

INTRODUCTION

Evaluation of airway is one of the essential requirements of preoperative assessment for any patient scheduled for surgery. Airway management remains one of the most important responsibilities of an anaesthesiologist [1]. Failure in managing the airway is the most important cause of mortality in patients undergoing general anaesthesia. About 50%-75% of cardiac arrests during general anaesthesia are because of difficult intubation [2]. The reported data for difficult intubation varies from 1.5%-13% [3] and is found to be 14% in the obese population [4].

The Body Mass Index (BMI) is a parameter recorded in every chart. It is a consistent data collected as standard of care in patient's mass (M) and height (H) based on the formula: BMI=Wt(kg)/Ht(m^2). Body mass index correlates with the amount of body fat. According to this index, people are further classified as underweight (<18.5 kg/m^2), normal (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), obese (30–34.9 kg/m^2), and morbidly obese (>35 kg/m^2) [4]. Lundstorm LH et al., in their study showed that that there was a significant but weak correlation between the BMI and risk of difficult intubation [5]. However, obesity has been identified as a risk of difficult mask ventilation; Kheterpal S et al., in their study did 22,660 attempts of mask ventilation and concluded that a BMI of 30 or more was an independent risk factor for the combination of difficult mask ventilation and difficult intubation [6]. The measurement of neck circumference has been seen to have a good correlation with age, weight, waist and hip circumferences, waist-to-hip ratio, and BMI for both genders and has been used recently to identify overweight and obesity [7]. NC correlates positively with changes in the systolic and diastolic pressure and other components of the metabolic syndrome and is considered as an index of upper body obesity [8].

Various scoring systems have been used to predict difficult airway, the most commonly used universal bedside tool is the MMS, given by Mallampati. Mallampati was born in Andhra Pradesh, India, in 1941 and was educated and immigrated to the United States of America in 1971. Whilst working, he encountered a patient who was difficult to intubate. The patient had a normal head and neck. He found that the tonsils and uvula were concealed by the base of the tongue; hence Mallampati suggested that this anatomical feature would be a sign of a difficult intubation. He subsequently validated this clinical sign and refined it to the four grade system that is now widely in use for preoperative airway assessment [9]. For performing the MMS examination, the patient must sit upright with his or head in neutral position; tongue maximally protruded and no phonation and the grading is done according to the visible structures [10].

There is increasing incidence of obesity worldwide and obese patients require detailed airway assessment, because of increased fatty tissue distributed in a truncal fashion, which often leads to negative impact on the airway patency and respiratory function. In a study performed by Mashour GA and Sandberg WS [11], it was shown that the EMS was associated with improved specificity and positive predictive value. In another study, Mashour GA et al., showed that the EMS predicted difficult laryngoscopy better than the MMT in the morbidly obese populations [12].

The aim study was to find the relation between grading of Mallampati score, Extended Mallampati Score and Body Mass Index and also to see for interobserver agreement between MMS and EMS.

MATERIALS AND METHODS

After obtaining institutional approval from Ethic Committee of our university and taking written informed consent from the subjects, this cross-sectional prospective observational study was performed on 323 subjects (from March 2016 to August 2016). According to a previous study conducted by Safavi M et al., the incidence of grade

2 MMS was 28% in the general population based on this we came to a conclusion on our sample size, the α-error level was fixed at 0.05 and power was set at 80%, and the sample size requirement was 310 subjects however we included 323 subjects [13]. Body mass index and age of the subjects were subgrouped and data was analysed using chi-square statistics.

The subjects included medical and nursing undergraduates/ postgraduates and consenting patients in the clinical outpatient departments. The selection method included convenience sampling technique. This prospective cross-sectional study was performed on patients who were above the age of 18 and had the ability to sit and open their mouth and had no previous history of burns or trauma to the airway or any tumours or mass in the laryngeal, facial and cervical region and had no restricted mobility of the neck and mandible (e.g., Rheumatoid arthritis or cervical disk disorders).

Patient data which included name, age, sex, weight, height, BMI and NC, Mallampati score, and EMS were collected. The subjects were in standing position and height was measured in centimeters, weight in kilogram and BMI was henceforth deducted from this. NC (cm) at the level of the thyroid cartilage was measured. Mallampati score and EMS (head in extension and eyes of the investigator should be in line with eye of the subject) were recorded.

Samsoon and Young's modification of the Mallampati test [3] recorded oral cavity structures visible upon maximum mouth opening with the patient seated and the head in neutral position, each subject is asked to open his /her mouth as much as possible and to protrude the tongue without phonation.

The view was classified as:

- Grade 1: Good visualization of the soft palate, fauces, uvula and pillars;
- Grade 2: Pillars obscured by the base of the tongue but the soft palate, fauces and uvula visible;
- Grade 3: Soft palate and base of uvula visible;
- Grade 4: Soft palate not visible;

EMS: The EMS was performed with the patient sitting, extension at the craniocervical junction, mouth open fully; tongue protruded maximally, no phonation, and the examiner eye–to eye [12]. EMS was classified as:

- Entire uvula clearly visible;
- Upper half of uvula visible;
- Soft and hard palate clearly visible;
- Only hard palate visible.

Our study included two observers, anaesthesiologists with more than two years experience in anaesthesia, who assessed the 323 subjects. The observers noted their findings of MMS and EMS on the same patient independently. Their findings were entered independently and disclosed only during analysis

RESULTS

Three hundred and twenty three patients were included in the study. Demographic characteristics; the mean for age, weight, height, BMI and NC are shown in [Table/Fig-1]. There was significant difference between males and females with regard to MMS and EMS, the proportion of patients with Grade 3 and Grade 4 for MMS (p=0.001) and EMS (p=0.001) was more in males than in females and was statistically significant as shown in [Table/Fig-2]. There was good agreement between the observers (kappa value 0.635) for MMS as seen in [Table/Fig-3] similarly there was good agreement between the observers (kappa value 0.715) for EMS as seen in [Table/Fig-4]. The intraobserver correlation coefficient was 0.8 for MMS (p<0.001) and for EMS was 0.7 (p=0.004) which was statistically significant as seen in [Table/Fig-5,6].

	Mean	Standard deviation
Age	42.34	14.8
Weight	63.10	13.94
Height	161.24	9.87
BMI	29.98	6.77
Neck circumference	14.43	1.28

[Table/Fig-1]: Demographic criteria, n = 323 (mean ± standard deviation).

	Sex Correlation MMS, p=0.001				
Sex	Class 1	Class 2	Class 3	Class 4	Total
Male	68	34	14	5	140
Female	133	41	9	0	183
Total	205	95	22	5	323
	Sex Correlation EMS, p=0.001				
Male	71	51	13	5	140
Female	139	35	5	0	183
Total	210	86	22	5	323

[Table/Fig-2]: Sex correlation

	Observer 2			
Observer	1	2	3	4
1	170	31	0	0
2	18	72	50	0
3	0	5	143	3
4	0	0	1	4

[Table/Fig-3]: MMT measure of agreement kappa value: 0.635.

	Observer 2			
Observer	1	2	3	4
1	188	22	0	0
2	13	70	3	0
3	0	5	15	2
4	0	0	2	3

[Table/Fig-4]: EMS measure of agreement kappa value: 0.715.

MMT	EMS			
	1	2	3	4
1	193	8	0	0
2	17	78	0	0
3	0	0	22	0
4	0	0	0	5
Total	210	86	22	5

[Table/Fig-5]: Intraobserver correlation (observer 1).

MMT	EMS			
	1	2	3	4
1	159	29	0	0
2	41	61	6	0
3	1	7	9	3
4	0	0	5	2
Total	201	97	20	5

[Table/Fig-6]: Intraobserver correlation (observer 2).

DISCUSSION

The results show a positive correlation of NC with BMI, MMS, and EMS in both male and female subjects. Several studies have examined the association of conventional anthropometric measures of obesity with NC [14-16]. Onat et al., found a strong correlation of NC with BMI, waist circumference, insulin resistance, and blood pressure [14]. Yang GR et al., found NC to have a strong correlation to BMI, WC, and metabolic syndrome in Chinese subjects having type 2 diabetes mellitus [15]. High Mallampati score and large NC have probably been the best single risk factor for difficult intubation in the obese [4,17,18]. NC can be used as an initial screening tool as it has been shown to contribute independently to overweight and obesity. It is a straightforward and inexpensive test that can be performed in any office with a tape measure.

A positive correlation of sex with BMI, MMS and EMS was seen. Camhi SM et al., reported that sex differences, and in some instances racial differences need to be considered when predicting adiposity from WC or BMI [19]. Ezri T et al., in their study found that an increased laryngoscopy grade had a positive correlation with increased age, male sex, protruding upper teeth, loose teeth, and increased airway class, but not with increased BMI which was similar to our study [20].

The Mallampati score is the most commonly used method to predict a difficult tracheal intubation by anaesthesia care providers [21]. The Mallampati score was found to estimate the size of the tongue relative to the oral cavity and indicated whether the displacement of the tongue by the laryngoscope blade was likely to be easy or difficult. It also assessed whether the mouth could be opened adequately to permit intubation. The Mallampati test evaluates not only the pharyngeal structure but also head and neck mobility but, due to its subjectivity, the test has proved to be an imperfect predictor of a difficult airway with low inter-rater reliability [22]. Another limitation is the lack of consensus on what constitutes a difficult airway. In a study done by Uribe AA et al., they found that an increased Mallampati score and BMI were predictors of difficult tracheal intubation in adult patients [23]. In our study we found a positive correlation of BMI with MMS and EMS. We also found a positive correlation of MMS and EMS between the two observers which were similar, while there was no correlation with regards to age. There was significant intraobserver correlation in the MMS and EMS groups. However, Safavi M et al., in their study reported that the EMS was a better predictor of difficult laryngoscopy than MMS [13]. The limitation to our study was that we did not confirm our findings with the Cormack–Lehane scale. The method allows grading the extent of glottis and laryngeal visualization using direct laryngoscopy. We plan to continue our study further and hence confirm our findings.

CONCLUSION

From this study we concluded that there was no difference between the MMS and EMS. There was interobserver agreement between the MMS and EMS and a positive correlation of BMI with MMS and EMS. On the basis of our findings the use of the MMS and EMS should be considered for routine airway screening.

REFERENCES

[1] Henderson JJ, Popat MT, Latto IP, Pearce AC. Difficult airway society. Difficult airway society guidelines for management of the unanticipated difficult intubation. Anaesthesia. 2004;59(7):675-94.
[2] Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, et al. A clinical sign to predict difficult tracheal intubation: a prospective study. Can Anaesth Soc J. 1985;32(4):429-34.
[3] Samsoon GL, Young JR. Difficult tracheal intubation: a retrospective study. Anaesthesia. 1987;42(5):487-90.
[4] Brodsky JB, Lemmens HJ, Brock-Utne JG, Vierra M, Saidman LJ. Morbid obesity and tracheal intubation. Anaesth Analg. 2002;94(3):732-36.
[5] Lundstrøm LH, Møller AM, Rosenstock C, Astrup G, Wetterslev J. High body mass index is a weak predictor for difficult and failed tracheal intubation: a cohort study of 91,332 consecutive patients scheduled for direct laryngoscopy registered in the Danish Anaesthesia Database. Anaesthesiology. 2009;110(2):266-74.
[6] Kheterpal S, Han R, Tremper KK, Shanks A, Tait AR, O'Reilly M, et al. Incidence and predictors of difficult and impossible mask ventilation. Anaesthesiology. 2006;105(5):885-91.
[7] Ben-Noun L, Sohar E, Laor A. Neck circumference as a simple screening measure for identifying overweight and obese patients. Obes Res. 2001;9(8):470-77.
[8] Ben-Noun LL, Laor A. Relationship between changes in neck circumference and changes in blood pressure. Am J Hypertens. 2004;17(5 Pt 1):409-14.
[9] Mallampati SR. Clinical sign to predict difficult tracheal intubation (hypothesis). Can Anaesth Soc J. 1983;30:316–17.
[10] Iohom G, Ronayne M, Cunningham AJ. Prediction of difficult tracheal intubation. Eur J Anaesthesiol. 2003;20(1):31-36.
[11] Mashour GA, Sandberg WS. Craniocervical extension improves the specificity and predictive value of the Mallampati airway evaluation. Anaesth Analg. 2006;103(5):1256-59.
[12] Mashour GA, Kheterpal S, Vanaharam V, Shanks A, Wang LY, Sandberg WS, et al. The extended Mallampati score and a diagnosis of diabetes mellitus are predictors of difficult laryngoscopy in the morbidly obese. Anaesth Analg. 2008;107(6):1919-23.
[13] Safavi M, Honarmand A, Amoushahi M. Prediction of difficult laryngoscopy: Extended mallampati score versus the MMT, ULBT and RHTMD. Advanced Biomedical Research. 2014;3:133.
[14] nat A, Hergenç G, Yüksel H, Can G, Ayhan E, Kaya Z, et al. Neck circumference as a measure of central obesity: associations with metabolic syndrome and obstructive sleep apnea syndrome beyond waist circumference. Clin Nutr. 2009;28(1):46-51.
[15] Yang GR, Yuan SY, Fu HJ, Wan G, Zhu LX, Bu XL, et al. Beijing Community Diabetes Study Group. Neck circumference positively related with central obesity, overweight, and metabolic syndrome in Chinese subjects with type 2 diabetes: Beijing Community Diabetes Study 4. Diabetes Care. 2010;33(11):2465-67.
[16] Hatipoglu N, Mazicioglu MM, Kurtoglu S, Kendirci M. Neck circumference: an additional tool of screening overweight and obesity in childhood. Eur J Pediatr. 2010;169(6):733-39.
[17] Shiga T, Wajima Z, Inoue T, Sakamoto A. Predicting difficult intubation in apparently normal patients: a meta-analysis of bedside screening test performance. Anaesthesiology. 2005;103(2):429-37.
[18] Juvin P, Lavaut E, Dupont H, Lefevre P, Demetriou M, Dumoulin JL, et al. Difficult tracheal intubation is more common in obese than in lean patients. Anaesth Analg. 2003;97(2):595-600.
[19] Camhi SM, Bray GA, Bouchard C, Greenway FL, Johnson WD, Newton RL, et al. The relationship of waist circumference and BMI to visceral, subcutaneous, and total body fat: sex and race differences. Obesity (Silver Spring). 2011;19(2):402-08.
[20] Ezri T, Warters RD, Szmuk P, Saad-Eddin H, Geva D, Katz J, et al. The incidence of class "zero" airway and the impact of Mallampati score, age, sex,and body mass index on prediction of laryngoscopy grade. Anaesth Analg. 2001;93(4):1073-75.
[21] Ezri T, Medalion B, Weisenberg M, Szmuk P, Warters RD, Charuzi I. Increased body mass index per se is not a predictor of difficult laryngoscopy. Can J Anaesth. 2003;50(2):179-83.
[22] Gupta A, Ommid M, Nengroo S, Naqash I, Mehta A. Predictors of difficult intubation: study in Kashmiri population. BJMP. 2010;3(1):307.
[23] Uribe AA, Zvara DA, Puente EG, Otey AJ, Zhang J, Bergese SD. BMI as a predictor for potential difficult tracheal intubation in males. Frontiers in Medicine. 2015;2:38.

PARTICULARS OF CONTRIBUTORS:

1. Postgraduate Student, Department of Anaesthesiology, Father Muller Medical College and Hospital, Mangalore, Karnataka, India.
2. Associate Professor, Department of Anaesthesiology, Father Muller Medical College and Hospital, Mangalore, Karnataka, India.
3. Undergraduate Student, Department of Anaesthesiology, Father Muller Medical College and Hospital, Mangalore, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Sasha Maria Menon,
Postgraduate Student, Department of Anaesthesiology, Father Muller Medical College and Hospital,
Mangalore, Karnataka, India.
E-mail: menonsasha8@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Sep 06, 2016**
Date of Peer Review: **Oct 25, 2016**
Date of Acceptance: **Dec 27, 2016**
Date of Publishing: **May 01, 2017**