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Neck Circumference and Mallampati Test a Predictor for Management Difficult Airway in Obese Patients: A Retrospective Observational Study

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Abstract: ***Background: Airway management can be challenging in anaesthetic procedures in the obese patients. Preoperative airway evaluation in obese patient requires particular care and attention. In this study we assessed classical bedside tests and included neck circumference (NC). Method: We retrospectively evaluated the preoperative airway evaluation records of 489 obese [body mass index (BMI) >30 kg/m2] patients who had undergone sleeve gastrectomy. Thyromental Distance (TMD), Sternomental Distance (SMD), Mallampati Score (MLP), NC values are recorded in the preoperative airway evaluation were compared with intubation score (IS) and Cormack and Lehane's scale. Results: The results indicate that, in the patient with large NC, and higher MLP score were the predictors of potential intubation problems. Conclusion: We found that problematic intubation was associated with increasing NC, and a MLP score of 3 to 4. Neck circumference should be assessed preoperatively to predict difficult intubation in obese patients.***

1. Introduction

Airway evaluation is one of the most important points of preoperative patient assessment. Because of difficult tracheal intubation (DTI) can be significant cause of morbidity and mortality in anesthetic practice. The American Society of Anesthesiology's (ASA) defined a difficult airway as the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with facemask ventilation of the upper airway, difficulty with tracheal intubation, or both [1]. Several studies have identified risk factors associated with management of the difficult airway. These factors play a critical role in airway evaluation to take precautions for difficult airway management. Numerous studies have reported obesity is a risk factor for endotracheal intubation [2,3,4]. Nevertheless some studies have showed no proof that tracheal intubation is more difficult in obese patients than in Body Mass Index (BMI) normal patients [5,6,7].

We designed this retrospective study to evaluate the airway difficulty in the obese patients.

2. Method

Trial Design and Setting

The retrospective clinical trial NCT 03597880 was carried out in Yeditepe University Hospital from October 2015 to January 2018. After ethics Committee approval (number: 1399/791 chairperson:T.Ç), 489 record of the patients were examined who were ASA class II-III , undergone sleeve gastrectomy, aged from 18 to 65 years and obese (BMI ≥ 30 kg/m2). Patients with a history of trauma to the airway or cranial, cervical and facial regions, or were edentulous or requiring awake intubation, patients with restricted motility of the neck and mandible (e.g., cervical disc disorders or rheumatoid arthritis) and inability to sit were not included in the study.

In our clinic, each patient is routinely assessed before operations. Current and historical medical condition, demographics like age, gender and weight and routine test results about airway conditions are recorded. TMD, SMD, NC and MLP are routinely evaluated. SMD, TMD and NC are recorded in centimeters. MLP value is determined according to MLP calsification rate. Mallampati classification without phonation; class I: soft palate, fauces, uvula, and pillars visible; class II: soft palate, fauces, and uvula visible; class III: soft palate and base of uvula visible; and class IV: soft palate not visible. Height and weight is used to calculate BMI.

In the operating room, patients are positioned with pillows or towels under their shoulders, with the head elevated and neck extended in the sniffing position. Each patient in the study was routinely monitored by an electrocardiogram, pulse oximetry, and noninvasive arterial blood pressure. Patients were breathed 100% oxygen by facemask for a minimum of 3 minutes. Mask ventilation difficulties were duly recorded. Laryngoscopy number, laryngoscopy view is graded according to Cormack and Lehane's scale was used as follows: Grade 1 view, the vocal cords were completely visible; Grade 2, only the arytenoids were visible; Grade 3, only the epiglottis was visible; and Grade 4, the epiglottis was not visible. All other additional devices or methods used, like whether another anesthesiologist's help was needed to ensure intubation success were also recorded routinely. A Video laryngoskope and a fiberoptic intubation [8] were used as additional methods.

The total number of attempts of tracheal intubation was used to assess IS from 1 to 5. IS >2 were considered a DTI [9]. Files of 489 patients were inspected retrospectively and

TMD, SMD, NC ve MLP values which were recorded before the operations were compared to IS, Cormack and Lehane's scales recorded during induction.

3. Results

A total of 489 patients were evaluated in this retrospective study. Demographic data and preintubation variables are shown in table 1.

DTI was observed in 40 (8.17%) patients. There were no failed intubations.

There was a statistically significant difference between NC measurements according to the Cormack-Lehane scores ($p < 0.01$) (table 2.)

There was a statistically significant difference between MLP scores according to Cormack-Lehane scores ($p < 0.01$). In the MLP score 1 group, Cormack-Lehane Score 1 ratio was high, in the MLP score 2 group, in the Cormack-Lehane score 1 and 2 cases, in the MLP score 3, in the Cormack-Lehane Score 3, MLP score 4 the proportion of cases with Cormack-Lehane score 4 was high.

There was a statistically significant difference between measurements of NC according to the number of laryngoscopy ($p < 0.01$).

There was a statistically significant difference between MLP scores according to the number of laryngoscopy ($p < 0.01$). The rate of cases with MLP score 2 was higher than the cases with laryngoscopy numbers 1 and 2. The rate of cases with MLP score 3 was higher than the number of cases with MLP score 4 and the number of cases with laryngoscopy was 3 and 4 in MLP score 4 (table 3.)

There was a statistically significant difference between NC measurements according to the use of additional method or device ($p < 0.01$).

The average of the neck circumference of the group using the additional method is significantly higher than that of the additional method.

There was a statistically significant difference between MLP scores according to the use of additional methods ($p < 0.01$). The use of additional method or device are significantly higher in groups with MLP scores of 3 and 4 (table 4.).

4. Statistical Analysis

While the findings obtained in the study were evaluated, the IBM SPSS Statistics 22.0 program was used for the statistical analysis. When the study data were evaluated, the normal distribution of the parameters was evaluated by Kolmogorov-Smirnov test and the normal distribution of the parameters was appropriate. Onewave Anova test was used for comparison of groups with normal distribution in comparison of descriptive statistical methods (Mean, Standard deviation) as well as descriptive statistical methods Tukey HSD test. Student t test was used in the comparison between the two groups. Chi-square test was used for comparison of qualitative data. Significance was assessed at $p < 0.05$ level

5. Discussion

This study showed that neck circumference and Mallampati score were identified as important predicting factors in obese patients.

Several systematic reviews of upper airway diagnostic screening tests have been published. Finding a bedside test that is effective for predicting difficult intubation is still challenging. There are too many parameters to predict the difficult airway and a number of those parameters are concomitant. Other factors, such as the experience of the clinician, makes prediction even more difficult.

Results of studies about airway management in obesity have different conclusions. While some studies reported that obesity was an indicator for a difficult airway management [2,3,4,10,11], some others reported that it did not create difficulties [5,6,9,12] .

Juvin et al. showed that intubation was difficult in obese patients, but the incidence of difficult laryngoscopy (Cormack-Lehane Score 3-4) was similar in obese and non-obese patients [13].

This suggests that a high BMI score may independently can complicate airway management or can be evalutated together with other parameters such as MLP score, NC. In fact, it is possible to evaluate these associations with further investigations such as USG [14]. But it is often not possible to use complicated evaluation methods when we visit our patients at bedside.

Previously, DTI was defined as proper insertion of the endotracheal tube with conventional laryngoscopy which required more than three attempts, or more than ten minutes by ASA. In 2013, this definition was updated as tracheal intubation requires multipl attempts, in the presence or absence of tracheal pathology [1].

The incidence of DTI was found to be 8,17% in this study. This ratio is similar to the general population as the incidence found in previous studies [15, 16,17,18].

During our study we observed that an increased neck circumference can be a sign of a potential difficulty in airway management. A circumference of 43 cm and above would estimate Cormack Lehane score of 3-4, 46 cm and above would estimate the number of laryngoscopy of 3 or more, 49 cm and above would estimate the necessity of using additional method for intubation. Magalhaes et al also found that a neck circumference above 40,7 cm indicates a difficult airway [19].

Helene Gonzales and colleagues [13] reported that increased neck circumference is one of the significant indicators of difficult airway in both obese and normal weight patients, and Langeron et al. [20] reported that similar results in obese patients. Reduced functional residual capacity and an increased tendecy for desaturation in obese patients makes it

more difficult to control the airway. This is the result of changes in pharyngeal structures, face, neck, thorax and abdomen [21]. Neck circumference is one of the most important parameters.

Another consequence of our study was that the scores of Cormack and Lehane and laryngoscopy attempt number were high in patients with MLP 3-4. Law AJ et al. also reported, modified MLP 3-4 and increased neck circumference are criterias indicating difficult masking and difficult laryngoscopy [22].

In a meta analysis, MLP assessment [23] was found to be limited to accurately foresee difficult airway. In another metaanalysis [24] MLP alone was inadequate but it could be useful when used with other tests. In our study, we found that MLP is sensitive to estimation of a potential difficult airway. However, the neck circumference also increased in patients whom MLP is 3 or 4 . Therefore we also conclude that MLP alone is inadequate, despite showing a statistically significaty difference, but very useful when used in combination with other tests.

Retrospective design of our study is among our limitations. However, we think that retrospective evaluations reflect the daily routine. Another limitation is that patients are not grouped in terms of BMI, such as obese, super obese, and morbid obese. Saasouh W. et al. already showed that, high BMI is a difficulty for tracheal intubation, but there is no additional increase in odds with further increase in BMI [25] .

In conclusion, our study showed that a difficult intubation was associated with an increased neck circumference and a high Mallampati score in obese patients. Still, more studies are required in order to make certain judgments in this regard.

References

[1] Abfelbaum JL, Hagberg CA, Caplan RA et al. Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology. 2013;118: 251-70.
[2] Kim W.H, Ahn H.J, Lee C.J et al. Neck circumference to thyromental distance ratio: a new predictor of difficult intubation in obese patients. British Journal of Anaesthesia 2011;106:743-8.
[3] Arunotai S, Panita L. A validation study of the intubation difficulty scale for obese patients. Journal of Clinical Anesthesia 2016;33:86-91.
[4] Shiga T, Wajima Z, Inoue T et al. Predicting difficult intubation in apparently normal patients. A meta-analysis of bedside screening test performance. Anesthesiology 2005;103:429–37
[5] Brodsky JB, Lemmens HJ, Brock-Utne JG et al. Morbid obesity and tracheal intubation. Anesth Analg 2002;94:732–6
[6] Bond A. Obesity and difficult intubation. Anaesth Intensive Care 1993;21:828–30
[7] Ezri T, Medalion B, Weisenberg M et al. Increased body mass index per se is not a predictor of difficult laryngoscopy. Can J Anaesth 2003;50:179–83
[8] Ali A, El Solh. Airway management in the obese patient. Clin Chest Med 2009;30:555-568
[9] Dohrn N, Sommer T, Bisgaard J et al. Difficult tracheal intubation in obese gastric bypass patients. Obes Surg. 2016 Nov;26(11):2640-2647.
[10] Baker P. Assessment before airway management. Anesthesiol Clin. 2015;33:257-78.
[11] Rudin D, Haki L. Anesthetic challenges in the obese patient. J Anaesth 2012;26:758-765.
[12] Lundstrom LH, Moller A, Rosenstock Ch. et al. 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 anesthesia database. Anesthesiology 2009;110:266-74.
[13] Gonzalez H, Minville V, Delanoue K et al. The importance of increased neck circumference to intubation difficulties in obese patients. Anesth Analg. 2008;106:1132-6.
[14] Ezri T, Gewurtz G, Sessler DI et al. Prediction of Difficult Laryngoscopy in Obese Patients by Ultrasound Quantification of Anterior Neck Soft Tissue. Anaesthesia 2003;58:1111–4.
[15] Carin A.H, Christiane V.H, Junaid K. A retrospective analysis of airway management in obese patients at a teaching institution. Journal of Clinical Anesthesia 2009;21:348-351.
[16] Hirmanpour A, Safavi M, Honarmand A et al. The predictive value of the ratio of neck circumference to thyromental distance in comparison with four predictive tests for difficult laryngoscopy in obstetric patients scheduled for caesarean delivery. Adv Biomed Res. 2014 Sep 30;3:200.
[17] Workeneh SA, Gebregzi AH, Denu ZA. Magnitude and Predisposing Factors of Difficult Airway during Induction of General Anaesthesia. Anesthesiol Res Pract. 2017;2017:5836397
[18] Honarmand A, Safavi MR. Prediction of difficult laryngoscopy in obstetric patients scheduled for caesarean delivery. Eur J Anaesthesiol. 2008;25:714-20.
[19] Edno M, Felipe O.M, Catia S.G et al. Use of simple clinical predictors on preoperative diagnosis of difficult endotracheal intubation in obese patients. Rev Bras Anestesiol. 2013;63:262-266.
[20] Langeron O, Birenbaum A, Le Saché F et al. Airway management in obese patient. Minerva Anestesiol. 2014;80:382-92.
[21] Caitriona M, David T.W. Airway management and oxygenation in obese patients. Can J Anesth 2013;60:929-945.
[22] Law AJ, Broemling N, Cooper RM, et al. The difficult airway with recommendations for management anticipated difficult airway. Can J Anaesth 2013;60:1119-38.
[23] Lee A, Fan LT, Gin T, et al. A systematic review (meta-analysis) of the accuracy of the Mallampati tests to predict the difficult airway. Anesth Analg 2006;102:1867–78.
[24] Lundstrom LH, Vester-Andersen M, Moller AM, et al, Danish Anaesthesia Database. Poor prognostic value of

the modified Mallampati score: a meta-analysis involving 177 088 patients. Br J Anaesth 2011;107:659–67.
[25] Saasouh W, Laffey K, Turan A, et al. Degree of obesity is not associated with more than one intubation attempt: a large centre experience. Br J Anaesth. 2018;120:1110-1116.

Table 1: Patient data

Patients	489
Gender F/M	271/218
Age (year)	40 (18-67)
Height (cm)	168 (147–195)
Weight (kg)	120 (89–243)
Body mass index (kg/m2)	42,6 kg/m^2 (32,9–67,8)
ASA II/III	286/203

ASA: American Society of Anesthesiologists physical status classification

Table 2: Assessment Based on Cormack-Lehane Scores

		Cormack-Lehane					
		1 (n=91)	2 (n=250)	3 (n=126)	4 (n=22)	Total (n=489)	[1]p
		Mean±SD	Mean±SD	Mean±SD	Mean±SD		
TMD		6.89±0.55	6.83±0.63	6.87±0.64	6.65±0.79	6.85±0.63	**0.393**
SMD		12.75±0.6	12.76±0.67	13.61±10.03	12.67±0.83	12.97±5.12	**0.460**
NC		41.53±4.06	43.46±5.09	45.28±5.35	49.68±6.54	43.85±5.34	**0.001****
		n (%)	n (%)	n (%)	n (%)		[2]p
MLP	**1**	46 (%50.5)	131(%52.4)	55(%43.7)	7(%31.8)	239(%21.7)	**0.001****
	2	29 (%31.9)	51 (%20.4)	25 (%19.8)	1 (%4.5)	106 (%48.9)	
	3	16 (%17.6)	54 (%21.6)	39 (%31)	5 (%22.7)	114 (%23.3)	
	4	0 (%0)	14 (%5.6)	7 (%5.6)	9 (%40.9)	30 (%6.1)	

[1]*Oneway ANOVA test*
[2]*Ki-Kare test* ***p<0.01*
TMD: Thyromental Distance
SMD: Sternomental Distance
NC: Neck Circumference
MLP: Mallampati Score

Table 3: Evaluations Based on Number of Laryngoscopy

		Number of Laryngosgopy					
		1 (n=342)	2 (n=68)	3 (n=39)	4 (n=40)	Total (n=489)	[1]p
		Mean±SD	Mean±SD	Mean±SD	Mean±SD		
TMD		6.84±0.58	6.96±0.66	6.85±0.77	6.68±0.76	6.85±0.63	**0.160**
SMD		13.05±6.11	12.78±0.69	12.84±0.72	12.76±0.71	12.97±5.12	**0.967**
NC		42.49±4.54	44.28±5	48.18±4.85	50.55±5.44	43.85±5.34	**0.001****
		n (%)	n (%)	n (%)	n (%)		[2]p
MLP	**1**	182(%53.2)	35(%51.5)	14 (%35.9)	8(%20)	239(%48.9)	**0.001****
	2	72 (%21.1)	15(%22.1)	9(%23.1)	10 (%25)	106(%21.7)	
	3	76 (%22.2)	15 (%22.1)	10 (%25.6)	13 (%32.5)	114(%23.3)	
	4	12 (%3.5)	3 (%4.4)	6 (%15.4)	9 (%22.5)	30 (%6.1)	

[1]*Oneway ANOVA test* [2]*Ki-Kare test* ***p<0.01*

Table 4: Additional Method or Device Usage Status Evaluations

		Additional Method			
		No (n=449)	Yes (n=40)	Total (n=489)	[1]p
		Mean±SD	Mean±SD		
TMD		6.81±0.61	6.68±0.76	6.85±0.63	**0.151**
SMD		12.99±5.34	12.76±0.71	12.97±5.12	**0.786**
NC		43.25±4.92	50.55±5.44	43.85±5.34	**0.001****
		n (%)	n (%)		[2]p
MLP	**1**	231(%51.4)	8 (%20)	239(%21.7)	**0.001****
	2	96 (%21.4)	10 (%25)	106 (%48.9)	
	3	101 (%22.5)	13 (%32.5)	114 (%23.3)	
	4	21 (%4.7)	9 (%22.5)	30 (%6.1)	

[1]*Student t test* [2]*Ki-Kare test* ***p<0.01*