ISSN No:-2456-2165

Is there an Upper Limit on Thyromental Distance ?

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Conflicts of Interest: None

Abstract

➢ ***Background***

Preoperative evaluation is very important and necessary for anesthesiologists to preparation to difficult airway management. The shortness of SMD and TMD was interpreted as difficult intubation in all study, nevertheless is it possible that a predictor for difficult intubation which the TMD and SMD are above the average values? In this study we examined that is possible above the average values of TMM and SMM indicator for difficult intubation?

➢ ***Method***

Files of 116 patients were examined retrospectively and previously recorded TMD (thyromental distance), SMD (sternomental distance), MLP (modified mallampati score), NC (neck circumference), TMD/SMD, CL(Cormack and Lehane's) values were statistically evaluated.

➢ ***Results***

In our study, we observed that short could be a long TMD (7,5cm ≤ TMD) difficult airway indicator like short TMD (TMD ≤ 6.5 cm).

➢ ***Conclusion***

We found that problematic intubation was associated with increasing TMD as well as short TMD. Long TMD, as well as short TMD, should be assessed preoperatively to predict difficult intubation.

Keyword:- *Difficult Intubation, TMD, SMD*

I. INTRODUCTION

A difficult airway is defined by The American Society of Anesthesiology's (ASA) 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].

Airway evaluation is one of primary importance part of preoperative patient assessment. Failure to secure the airway is an important cause of morbidity and mortality in general anesthesia practice[2]. Several clinical tests have been proposed for preoperatively identifying patients who may have difficult laryngoscopy.

Based on these the data through from the airway assessment a strategy could emerge to cope with each event of the patient airway. Nevertheless, there is still no test or group of tests that can accurately predict difficult laryngoscopy. SMD (sternomental distance) and TMD (thyromental distance) are among the parameter of used for evaluation difficult airway. The shortness of SMD and TMD was interpreted as difficult intubation in all study, nevertheless is it possible that a predictor for difficult intubation which the TMD and SMD are above the average values?

In this study we examined that is possible above the average values of TMD and SMD indicator for difficult intubation?

II. METHOD

The retrospective clinical trial was carried out in Yeditepe University Hospital from January 2018 to January 2019. After Ethics Committee approval (number: 968 chairperson: Turgay Çelik), 200 records of the patients were examined who have undergone surgery with general anesthesia.

We included in our study a total of 200 patients who had received general anesthesia. These patient files were selected randomly from patient files that undergone surgery with general anesthesia. In these patients' files, we examined the values of MLP(modified mallampati), TMD (thyromental distance), SMD (sternomental distance), NC (neck circumference) already recorded in the preoperative anesthesia evaluation. A data of saved; while preoperative assessment: MLP, TMD, SMD, planned surgery procedure were recorded. In the operating room while general anesthesia induction and orotracheal intubation: mask ventilation difficulties, laryngoscopy number, laryngoscopy view is graded according to Cormack and Lehane's scale, all other additional devices or method used, lifting and/or Sellick maneuver, like whether another anesthesiologist's help was needed to ensure intubation success were also recorded. The demographic data of the patients were already documented.

MLP value is determined according to the MLP classification 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. TMD is measured along a straight line from the thyroid notch to the lower border of the mandibular mentum, with the head fully extended and the mouth closed [3]. SMD is measured from sternal notch to lower border of the mandibular mentum. Both measurements make with head fully extended and mouth closed [4].

ISSN No:-2456-2165

Cormack and Lehane's scale is 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. A Video laryngoscope and fiberoptic intubation [5] were used as additional methods. DTI (Difficult tracheal intubation) is defined as orotracheal intubation requiring more than 2 laryngoscopies, lasting more than 10 minutes, or requiring an alternate device (gum elastic bougie, supraglottic device, or vide laryngoscope), another anesthesiologist's help [6,7].

A total of 84 patients were excluded from the study because 27 of these patients had SAD (supraglottic airway device), 21 patients had undergone airway surgery, 33 of them were from a population such as pregnant and child, and 3 patients had a history of difficult intubation before. Files of 116 patients were examined retrospectively and previously recorded these values were statistically evaluated.

III. STATISTIC

While the findings obtained in the study were evaluated, the IBM SPSS Statistics 22.0 program was used for the statistical analysis. Demographic data were calculated using min-max, mean and standard deviation. The evaluation between TMD and SMD data and difficult intubation and difficult mask was calculated by independent samples t-test. The correlation between TMD and SMD data and MLP and CL was calculated by Pearson Correlation test.

Chi-Square (Monte Carlo with 99% CI) was calculated by Fisher Exact Test in the evaluation between difficult intubation and difficult mask for MLP and CL. Difficult intubation with TMMD/ SMD data was calculated with independent samples t-test. TMD and SMD clusters were calculated according to difficult intubation with K-Means cluster. TMD / SMD grouped according to TMD / SMD cluster ratios. TMD / SMD groups with difficult intubation Chi-Square (Monte Carlo with 99% CI) was calculated by the Fisher Exact Test. Significance was assessed at $p < 0.05$ level.

IV. RESULT

A total of 200 patients data were evaluated in this retrospective study. Demographic data and pre-intubation variables are shown in table 1. 116 of these files were found to comply with the study criteria. DTI was observed in 14 (12%) patients. There were no failed intubations. Of the patients, 35 had undergone general surgery, 26 had orthopedics, 24 had female births, 17 had urology and 14 had undergone plastic surgery.

There was a statistically significant correlation between TMD, MLP, NC (neck circumference) and difficult intubation (*p=0.002*). (Figur1) The ratio of patients with TMD short (less than 6.5 cm) was 33 patient among all patients, and among the patients with difficult intubation was 6. A statistically significant correlation was found between short TMD and difficult intubation. (*P=0.001*) The ratio of patients with TMD long (over 7.5 cm) was 48 among all patients, and among the patients with difficult intubation was 8.

There was a statistically significant correlation between long TMD and difficult intubation

(*P=0.12*) and difficult mask (*p=0.180*) (table 2)

There was a statistically significant correlation between TMD, MLP, CL. (*p=0.001, p = 0.001*).(Table 3)

V. DISCUSSION

In our study, we observed that short could be a long TMD (7.5 cm ≤ TMD) difficult airway indicator like short TMD (TMD ≤ 6.5 cm) (Figur 1). When the difficult airway is unknown may be to cause not adequate preparation for induction and difficult intubation. For this reason, preoperative evaluation is very important and necessary for anesthesiologists to preparation to difficult airway management [8].

An airway risk evaluation before every anesthesia procedure is recommended by the 2013 Practice Guidelines for Management of the Difficult Airway from the American Society of Anesthesiologists [1]. It has been reported, the incidence for difficult airway among from 1.5% to 13% in patients undergoing general anesthesia [9,10,11,12,13,14]. The incidence of the difficult airway was similarly a previous studies,11,20 % in our study [15,16,17].

Many parameters were mentioned to predict difficult airway. Some anatomical landmarks as TMD, NC, the ratio of Neck circumference to thyromental distance (NC/TMD), MLP, the ratio of height to thyromental distance (RHTMD) help to anticipate difficult airway [16,18,19,20,21]. TMD is significant a part of airway management guidelines and has been the most questioned of all the bedside tests. On account of the simple structure and easy measure TMD has become is one of the most used parameters.

Moreover, there is still no exact predictor or superior alternative [1,10,22]. TMD has been identified by Patil et al. in 1983 as the noninvasive score for the prediction of difficult airway [22]. It is measured as the straight distance from the thyroid notch to the mandible while the head is fully reclined and therefore the mandibular space. In the event of it is short, direct opinion at laryngoscopy may be hard. There is a wide range of cut-off values are ranging from 5.5 to 7 cm for TMD and sensitivity and specificity values are variable like a range of cut-off values.

Sahah et al. show that TMD showed high specificity despite low sensitivity [23]. The reason why these values are reported differently among various studies may be the difference between the observers or the anthropological characteristics of the studied group. Shiga et al. deduced from a meta-analysis which including 35 study that due to

different cut-off points(4–7 cm), TMD diagnostic value is ineffectual [24].

There are so many studies have examined with patient, non-patient and mannequin different outcomes [25]. This studies widely focused on short TMM as predictor difficult airway. Sushil et al. recommended the evaluation of TMD with the patient size but did not mention TMD values above 7 cm [26]. Patil et al. showed hat TMD ≤ 6.0 was difficult airway indicator. In our study, this value was found to be 6.5 cm. There were many studies about short TMD that ıt is indicated to difficult airway [22,27,28,29].It was not mentioned in any of these studies whether TMD exceeds an upper value or not. However, the long TMD may make it difficult to visualize with preventing by reach the tongue root by laryngoscope, like short TMD can make it difficult the vision by preventing the laryngoscope from settling in the tongue root.

In recent studies, mentioned the importance of short TMD and SMD in airway evaluation, but no long TMD or long SMD has been discussed [30,31]. In our study, we found that TMD could be a difficult airway indicator as long as it is short. In the patient population we examined, 8.1 cm ≤ TMD was difficult airway indicator. But it was not significant that the SMD was long.

We agree that such as an NC/TMD, Height /TMD the ratio of TMD with other data rather than the numerical value is more guiding. [32,33,34]. However, it may be the short neck which provides the same ratio numerically and the long neck which provides this ratio. We believe that the ratio can be acceptable but in the long neck may prevent laryngoscopy can be difficult.

Retrospective design of our study is our limitations. Because of the retrospective design of the study, the measurements made by several different anesthesiologists are also among our limitations.

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

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	Gender/N	Min-Max	Mean±SD
Age; years	K/60	18-64	40,9 ± 10
	E/56	18-65	40,3 ± 11
	Total/116	18-65	40,6 ± 10
Weight; kg	K/60	49-104	69,3 ± 11
	E/56	65-125	82,6 ± 10
	Total/116	49-125	75,7 ± 13
Height; cm	K/60	144-180	163,43 ± 7,1
	E/56	150-190	174,05 ± 8,6
	Total/116	144-190	168,56 ± 9,5

N:number, kg: kilogram, cm: centimeter, SD: Standard deviation

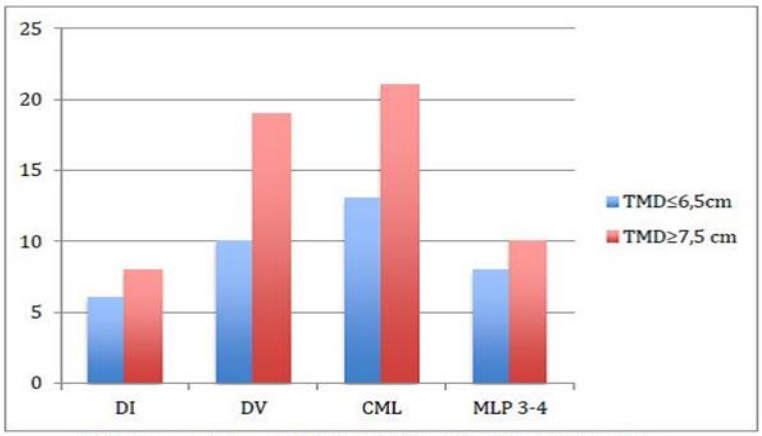
Table 1:- Demographic Data

		Mean Difference	Std. Error Difference	95% CI Lower	95% CI Upper	p
DI	TMM≤6,5cm	0,59	0,17	0,25	0,93	0,001**
	TMM≥7,5 cm	-0,91	0,18	-1,26	-0,55	0,0001**
DV	TMM≤6,5 cm	0,54	0,14	0,27	0,82	0,0001**
	TMM≥7,5 cm	-0,57	0,15	-0,86	-0,26	0,0001**

Independent samples t-test
DI: Difficult intubation, DV: Difficult Mask Ventilation, CI: Confidence Interval of the difference, *: p<0,05; **: p<0.01

Table 2:- Thyromental Distance Evaluation Pursuant to Difficult Intubation and Difficult Mask Ventilation

***Graphic 1:** Difficult Airway Prediction pursuant to Thyromental Distance of ≤6,5cm and ≥7,5 cm*



TMD: Thyromental Distance, DI: Difficult Intubation, DV: Difficult Mask Ventilation; CML: Cormack-Lehane Scale, MLP: Mallampati Classification