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"NECK CIRCUMFERENCE TO THYROMENTAL DISTANCE RATIO AS A PREDICTOR OF DIFFICULT INTUBATION IN OBESE PATIENTS: A PROSPECTIVE OBSERVATIONAL STUDY"

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Abstract

Background: Obesity has become a widespread health concern, and obese individuals are at a higher risk of airway-related complications. Difficult laryngoscopy and intubation are major challenges for anesthesiologists, contributing to significant perioperative morbidity and mortality. Several predictors for difficult intubation in obese patients have been studied, but the role of the neck circumference (NC) to thyromental distance (TMD) ratio as a predictor remains under-explored. This study aims to assess the predictive value of NC, TMD, and NC/TMD ratio for difficult intubation in obese versus non-obese individuals.

Methods: A prospective observational study was conducted in the ENT department of our institute after ethical approval. Patients requiring general anesthesia and tracheal intubation were included, with exclusions for restricted cervical movement, neck contractures, visible neck swelling, or oropharyngeal pathology. Demographic data, body mass index (BMI), NC (measured at the cricoid level), TMD, and modified Mallampati scores were recorded.

Results: The study included 200 patients (117 males, 83 females) with a mean age of 36.36 ± 8.04 years. The mean NC was significantly higher in obese (36.06 ± 1.92 cm) than in non-obese (34.21 ± 1.85 cm) ($p = 0.00$). The mean TMD was lower in obese (7.43 ± 0.66 cm) compared to non-obese (7.89 ± 0.65 cm) ($p = 0.00$). The NC/TMD ratio was significantly higher in obese patients (4.94 ± 0.49) compared to non-obese (4.35 ± 0.40) ($p = 0.00$). Among 200 patients, 18 had difficult intubation (4 non-obese, 14 obese), with a significant association between obesity and difficult intubation ($p = 0.013$).

Conclusion: The NC/TMD ratio is a reliable, cost-effective, and non-invasive predictor of difficult intubation in obese individuals. It provides better predictive accuracy than NC or TMD alone and can serve as an essential screening tool in preoperative airway assessment.

Keywords: Obesity, Difficult Intubation, Neck Circumference, Thyromental Distance, NC/TMD Ratio.

Introduction: Obesity has become more common practically everywhere, and obese people are at a higher risk of airway-related adverse outcomes than the general population. Difficult vision of the larynx in obese patients, which could lead to difficult intubation, is a serious issue for anaesthesiologists, and it accounts for 17% of airway injuries, with significant perioperative morbidity and death.[1]

Obesity is excess fat in body, World Health Organization defines obese person who has BMI ≥ 30 kg/m^2,[2] according to Misra et al for Asians definition has been to value ≥ 25 kg/m^2, but it doesn't affect acute management of airway.[3] Intubation difficulties are the second most common cause of anaesthetic malpractice claims. [4] The majority of disasters have happened when a potentially problematic airway was not identified early. [5] Despite the fact that obesity is assumed to increase the likelihood of difficult intubation, a higher BMI does not indicate difficult laryngoscopy. [6] According to Smitha et al the incidence of difficult laryngoscopy was 9.7% & intubation was 4.5% in Indian population. [7] Neck circumference might not indicated soft tissue at various topographic region when considered alone with in neck. Horner et al [8] demonstrated that more fat was present in areas surrounding the collapsible segments of the pharynx in obese patients with OSA'S using magnetic resonance imaging (MRI) measurements and Ezri et al [9] demonstrated that difficult laryngoscopy could be predicted in obese patients by quantifying the neck soft tissue at the level of the vocal cords and suprasternal notch using ultrasonography. They reported that the amount of pre tracheal soft tissue, quantified by ultrasound, was the only measure that fully distinguished an easy intubation from a difficult one. These results might explain why some obese patients are easy to intubate, whereas others not. This study conducted to predict intubation in obese person in comparison non-obese.

Material & Methods: A prospective observational study was conducted in department of ENT in our institute following approval from ethical committee. Purpose of study was explained patient or relatives of patient those who requiring general anaesthesia and tracheal intubation were included in this study.

Exclusion criteria

- Restricted cervical movement
- Burns patients with neck contracture
- Visible neck swelling or history of mandible fracture
- Oropharyngeal or laryngeal pathology

Routine data including name, age, height, body weight, ASA status and medical or surgical management details were recorded. Neck circumference was measure at cricoid level using non-stretchable measuring tape and thyromental distance from thyroid notch to mentum with neck extended with closed mouth in upright position by scale. Mallampati score modified by Samsoon & Young used to assess ease of intubation. Glottic visualization was assessed using modified Cormack & Lehane classification without external laryngeal manipulation. All preoperative, intraoperative & postoperative details were collected and data was analyzed using SPSS software version 20.

Image: Neck circumference measurement & TMD measurement

Results: Mean age group of 200 study subject (Male 117, female 83) was 36.36 + 8.04 years with highest 58 & lowest 20 years. 79 (39.5%) study subjects were from 31-40 years age group followed by 58 (29%) in 41-50 years age group, there was no significant difference in mean age of obese & non-obese (p = 0.068). Many subjects were brought in critical condition and orthopedic procedures were performed following intubation.

Table 1 - Comparison of NC, TMD & their ration in study subjects

Variable	Group	Mean	Std. Deviation	Std. Error Mean	P value
NC (cm)	Normal	34.21	1.85	0.19	0.00
	Obese	36.06	1.92	0.19	
TMD (cm)	Normal	7.89	0.65	0.07	0.00
	Obese	7.43	0.66	0.07	
NC/TMD	Normal	4.35	0.40	0.04	0.00
	Obese	4.94	0.49	0.05	

Mean neck circumference in obese (36.06 + 1.92 cm) was significantly higher than mean neck circumference in non-obese (34.21 + 1.85 cm) while TMD in obese was significantly lower in obese (7.43 + 0.66 cm) in comparison with non-obese (7.89 + 0.65 cm). NC/TMD ratio was significantly higher in obese (p = 0.00). (Table 1)

18 out 200 reported difficulty while doing intubation, 4 in normal & 14 in obese subject. On application of chi square test there was significant association between obese subjects having difficulty in intubation (chi square value - 6.105, p value - 0.013).

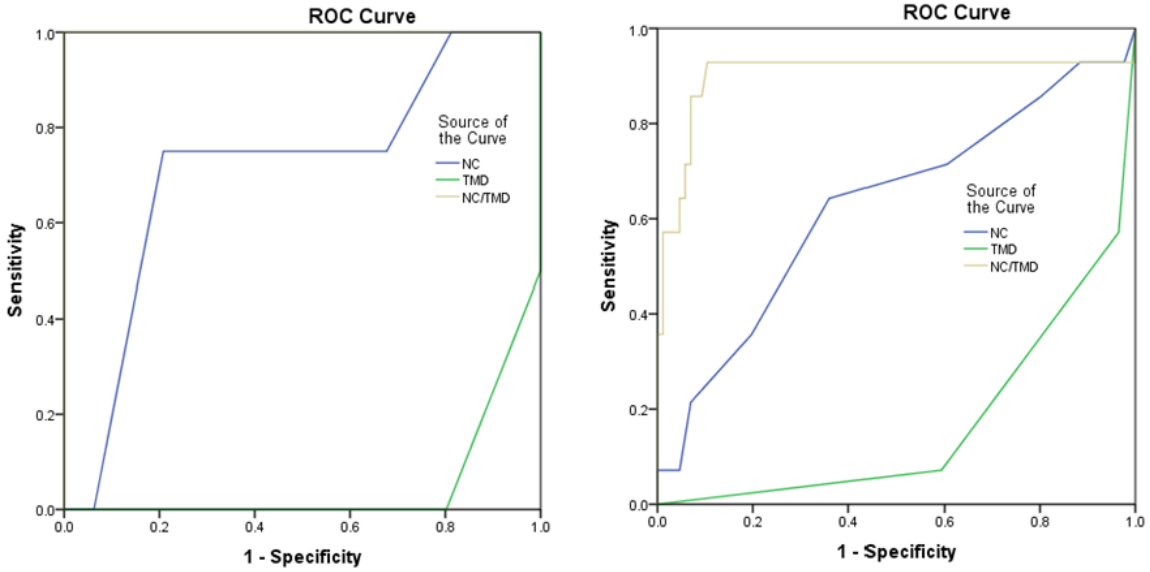

Figure 1: ROC curve for Normal (left) & obese (right) for predicting difficult intubation

Area under curve was highest for NC/TMD ratio followed by NC & least for TMD in obese (area 0.902, 0.627 & 0.168 respectively) & non-obese (area 1, 0.712 & 0.049 respectively), it means NC/TMD ratio & NC are better predictor of difficult intubation than TMD. (Figure 1)

Table 2: diagnostic accuracy for difficult intubation			
Non-obese subjects			
Variable	Cutoff	Sensitivity	Specificity
NC	≥ 35.5 cm	75 %	79 %
TMC	≥ 6.5 cm	50 %	0 %
NC/TMD	≥ 4.7	100 %	84 %
Obese subjects			
NC	≥ 36.5 cm	64 %	64 %
TMC	≥ 6.5 cm	57 %	4 %
NC/TMD	≥ 4.7	93 %	35 %

NC/TMD ratio ≥ 4.7 is better predictor of difficult intubation taking into consideration sensitivity & specificity both. Details of sensitive & specificity of NC & TMD as per above table. (Table 2)

Discussion: Incidence of difficult intubation in obese in this study is 14% while in literature, incidence of difficult intubation in obese ranges from 11% - 21%. [10] Incidence of difficult intubation in this study was 14% in obese & 4% in non-obese which was approximately similar with study Rose N et al (14.5% in obese & 7.2% in non-obese). [11] There was significant association between obese subjects having difficulty in intubation (p value - 0.013).
Securing airway access is more difficult in obese than in non-obese due to anatomical changes resulting from excess weight. There are several predictors used for difficult intubation like high Mallampatti score, male gender, advancing age, short neck by various authors.[9,12,13] Juvin et al did not find there classical factors suitable for prediction of difficult intubation in obese patients. [14] USG, MRI & CT of neck are useful for quantification of soft tissue in various parts of neck but availability & cost of these investigation limit their role. [9,10]
Mean age group of 200 study subject was 36.36 + 8.04 years and there was no significant difference in mean age of obese & non-obese (p = 0.068). Mean age of patients having easy intubation was 36.05 + 8.53 years and those with difficult intubation was 39.44 +
6.33 years (p=0.102) which was slightly lower than study conducted by Basil P M. [10]
NC/TMD in obese (4.94 + 0.49) was significantly higher than in non-obese (4.35 + 0.40) similarly in Rose N et al NC/TM was significantly higher in obese patients with difficult intubation with a mean of 5.53 + 0.91 compared to non-obese (4.62 + 1.56).[11]

Area under curve NC/TMD in ratio with larger area under curve than NC & TMD in obese with fairly sensitivity (93%) at cut off 4.7. Similarly in Rose N et al higher sensitivity (91.7%) was observed at cut off 4.9.[11] Nadia et al[15] and Kim et al[16] who used 4.99 and 5 respectively as cut off value for NC / TM ratio to predict difficult intubation in obese patients.
NC at 36.5 cm cut off was having 64% sensitivity & specificity in our study with area under curve 0.627, approximately similar area under curve (0.606) was observed in Rose N et al [11] while Hiremathe et al didn't find any association of neck circumference with difficult intubation. [17] NC/TMD ratio when compared with neck circumference & TMD in obese was having strong correlation with difficult intubation. Other studies also reported in similar manner and recommend to relies on NC/TMD rather than any other single test in obese. [8,9,15]

Conclusion: TC/TMD can be used as reliable bedside screening test for difficult intubation and it is cost effective, non-invasive and less time consuming technique.

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