

## FREQUENCY OF DIFFICULT INTUBATION IN OBESE PATIENTS WITH NECK CIRCUMFERENCE TO THYROMENTAL DISTANCE RATIO $\geq 5.0$

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### ABSTRACT

**Objective:** To determine the frequency of difficult intubation in obese patients with neck circumference to thyromental distance ratio (NC/TM)  $\geq 5.0$ .

**Study Design:** Cross sectional study.

**Place and Duration of Study:** Department of Anaesthesia, Forward Treatment Centre, Kel (Azad Kashmir) and Combined Military Hospital (CMH) Malir. Six months, from Jun 2015 to Nov 2015.

**Material and Methods:** A total of 94 patients between the ages of 18 and 50 years with body mass index (BMI)  $\geq 27.5$  kg/m<sup>2</sup> and NC/TM  $\geq 5.0$  who received general anesthesia requiring tracheal intubation for elective surgery (Orthopaedic, General Surgery, Urology & Gynaecology) were included in the study. Patients were induced general anaesthesia and orotracheal intubation was done by anaesthetist with at least 1 year experience. Number of intubation attempts were recorded in each patient. More than 3 attempts were considered difficult intubation.

**Results:** Eighty two (87.2%) out of 94 obese patients with BMI  $\geq 27.5$  kg/m<sup>2</sup> and NC/TM  $\geq 5$  had difficult intubation.

**Conclusion:** The NC/TM  $\geq 5$  was found good predictor for difficult intubation in obese patients.

**Keywords:** Difficult intubation, Neck circumference to thyromental distance ratio, Obese.

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### INTRODUCTION

Difficulties with endotracheal intubation significantly lead to the morbidity and deaths in patients undergoing anesthesia. Identification of conditions and patients who are at risk for airway management problems is mandatory and has remained the focus of many articles<sup>1</sup>.

We need accurate tests to predict difficult intubation, as failed tracheal intubation causes morbidity and mortality in patients undergoing general anesthesia. The absence of fool proof tests to predict difficult intubation usually results in unanticipated difficult intubation. Difficult tracheal intubation may occur in 0.5 to 18% cases<sup>2</sup>.

A lot of bedside physical examination tests have been studied in order to determine difficult laryngoscopy. The Mallampati score, thyromental distance, and a summation of risk factors (like

Wilson score) are used mostly<sup>3</sup>.

Airway assessment scales that have been proposed ranging from the simple tests, that fail usually to address many risk factors accompanied with a difficult airway, to the complex, that are not practical as a clinical tool. The apparent risk factors associated with difficult intubation are obesity, head and neck movement, jaw movement, receding mandible, buck teeth, Mallampatti scores, maxillary incisor characteristics, male sex, age 40-59 years, decreased mouth opening, short thyromental distance, and short neck<sup>4</sup>.

Ultrasound imaging was used for assessment of airway before intubation, but it is not clear that which ultrasonographic parameters are helpful as determinant of difficult trachea intubation<sup>5</sup>.

Difficult tracheal intubation is seen more commonly seen among fatty patients compared with non-obese patients. No classic predictor of difficult intubation has been found satisfactory in obese population. There is high risk of

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desaturation in obese patients during intubation which warrants research to identify new determinants of difficult tracheal intubation in obese patients<sup>6</sup>.

In a study by Kim and co-workers difficult tracheal intubation was more common in obese patients compared with non-obese patients i.e. 13.8% v/s 4.8%. Analysis showed that the Mallampati classification, the Wilson score, and NC/TM predict difficult intubation in obese people independently. Among the three risk factors mentioned above, NC/TM had the highest sensitivity and a negative predictive value<sup>7</sup>.

The consensus is lacking about how to measure obesity as a predictor of difficult tracheal intubation. Two researches used weight (kg),<sup>8,9</sup> and others used BMI. The clinical cut-off value which defines obesity by BMI has been applied from that used for other medical events and may not be appropriate for difficult tracheal intubation. One study did not demonstrate that morbidly obese patients were more at risk of difficult intubation than those with moderate obesity. In contrast other studies have suggested that the risk of difficult intubation increases with weight. High BMI is not strong but statistically important risk factor for difficult and failed tracheal intubation and may be more appropriate than weight in multivariate models of prediction of difficult tracheal intubation<sup>10</sup>.

Errors in the algorithm for unanticipated difficult airway are in fact due to unpreparedness. These considerations made the basis of this research which is aimed at finding a predictor that is easy to examine and that can better predict difficult tracheal intubations in obese people.

## **PATIENTS AND METHODS**

This was a cross sectional study. The study was carried out between Jun 2015 and Nov 2015 at the department of Anaesthesia, Forward Treatment Centre, Kel (Azad Kashmir) and Combined Military Hospital (CMH) Malir.

The sample size was calculated by using World health organization (WHO) sample size calculator version 2.0. Keeping confidence level 95%, desired precision 7%, prevalence 13.8% the sample size was 94.

Ninety four patients of both genders between 18 and 50 years age with BMI  $\geq 27.5$  kg/m<sup>2</sup>, NC/TM  $\geq 5.0$  and having American society of anaesthesiology (ASA) status I and II who received general anesthesia requiring endotracheal intubation for elective surgical procedure (Orthopaedic, General Surgery, Urology & Gynaecology) were considered in this study.

Patients having any of the following conditions were excluded from the study: inability to give consent, age less than 18 years or more than 50 years, BMI  $< 27.5$  kg/m<sup>2</sup>, NC/TM  $< 5.0$ , pregnancy, unstable cervical vertebrae, apparent abnormalities of anatomy of head/neck, recent surgery of head and neck, patients who had history of difficult intubation, patients with awake intubation, patients undergoing regional anesthesia and patients with trauma to face undergoing emergency surgeries.

The sampling technique employed was non-probability consecutive sampling.

After seeking permission from the hospital ethical committee, the aim and whole method of the study and risk benefit ratio were informed to the patients and a written consent was taken.

Body weight, height, BMI and the NC/TM were measured preoperatively.

After preoxygenation for 3 minutes, induction was given with injection propofol 2 mg/kg. Ability to ventilate with face mask was ensured during propofol apnea before giving muscle relaxant. Intubation was done 4 minutes after giving injection atracurium 0.5mg/kg intravenously with macintosh laryngoscope. Maintenance of anaesthesia was done with positive pressure ventilation by mask at isoflurane and oxygen before intubation. Intubation was performed by an anaesthetist with

minimum 1 year experience. No. of intubation attempts in each patient were recorded in a proforma by researcher. More than 3 intubation attempts were considered as difficult intubation. Brig Naveed Masood, Professor of Anaesthesiology was the consultant who supervised the cases. We kept a difficult intubation trolley as backup. It consisted of masks (different sizes & shapes), laryngeal mask airway (different sizes), stylets, oral and naopharyngeal airways, fiberoptic bronchoscope and cricothyrotomy set. Difficult Intubation guidelines as proposed by

**RESULTS**

Ninety four patients with inclusive criteria were selected for this study. Their weight, height, neck circumference, thyromental distance were recorded preoperatively.

The mean age was 38.83 ± 6.13 years. There were 8 (8.51%) patients in the age range of 21-30 years of age, 40 (42.55%) patients in the age range of 31-40 years and 46 (48.93%) patients in age range of 41-50 years (table-I).

The mean height was 160.62 ± 0.08 cm. There

**Table-I: Distribution of patients by age.**

Age (Years)	(n=94)	
	Frequency (%)	
21-30	8 (8.51)	
31-40	40 (42.55)	
41-50	46 (48.93)	
Mean ± SD	38.83 ± 6.13	

Key: SD Standard deviation.

**Table-II: Difficult intubation in different genders.**

Gender (n=94)	Difficult intubation	No Difficult intubation
	Frequency (%)	Frequency (%)
Male (40)	31	9
Female (54)	51	3

p=0.015

**Table-III: Difficult intubation in different Age groups.**

Age group in yrs(f)	Difficult intubation (%)	No Difficult intubation (%)
21-30 (8)	7 (87.5)	1 (12.5)
31-40 (40)	34 (85.0)	6 (15.0)
41-50 (46)	41 (89.13)	5 (10.87)

p=0.15

Difficult Airway Society were followed in cases of difficult/failed Intubation.

Whole data obtained through proforma was endorsed in the Statistical Package for Social Sciences (SPSS) Version 19.0 and analyzed. The study variables included age (in years), height (in metre), weight (in kg) and BMI (in kg/m<sup>2</sup>). Descriptive statistics was calculated. Mean and standard deviation were calculated for quantitative data i.e. age, height, weight, BMI and NC/TM. Frequencies and percentages were calculated for qualitative variables (gender & difficult intubation Yes/No). Chi square test was applied. Level of significance was taken as p<0.05.

were 3 (3.19%) patients in the height range of 131-140 cm, 7 (7.45%) patients in the height range of 141-150 cm, 35 (37.23%) patients in the height range of 151-160 cm, 42 (44.68%) patients in height range of 161-170 cm, 7 (7.45%) patients in the height range of 171-180 cm.

The mean weight was 80.44 ± 7.62 kg. There were 5 (5.32%) patients in the weight of 61-70 kg, 53 (56.38%) patients in the weight of 71-80 kg, 27 (28.72%) patients in the weight range of 81-90 kg, 8 (8.51%) patients in weight range of 91-100 kg, 1 (1.06%) patient in the weight range of 101-110 kg.

The mean BMI was 31.29 ± 2.80 kg/m<sup>2</sup>. There were 79 (84.04%) patients in the BMI range

of 27.6-33.5 kg/m<sup>2</sup>, 13 (13.83%) patients in the BMI range of 33.6- 39.5 kg/m<sup>2</sup>, 2 (2.13%) patients in the BMI range of 39.6-45.5 kg/m<sup>2</sup>.

The mean NC/TM was 5.30 ± 0.22. There were 52 (55.3%) patients in the NC/TM range of 5.01-5.25 k, 27 (28.72%) patients in the NC/TM range of 5.26–5.50, 9 (9.57%) patients in the NC/TM range of 5.51–5.75, 6 (6.38%) patients in the NC/TM range of 5.76–6.00.

Forty patients (42.6%) out of 94 were male while 54 (57.4%) were female. Gender shown

## DISCUSSION

Difficult tracheal intubation is seen more commonly among obese than non-obese people. No classic predictor of difficult tracheal intubation has been found satisfactory in obese population<sup>6</sup>.

The risk of difficult intubation increases as the degree of obesity increases<sup>6</sup>. The study by Gonzalez et al confirmed that problems with difficult intubation were seen more frequently in obese than in non-obese people. Neck

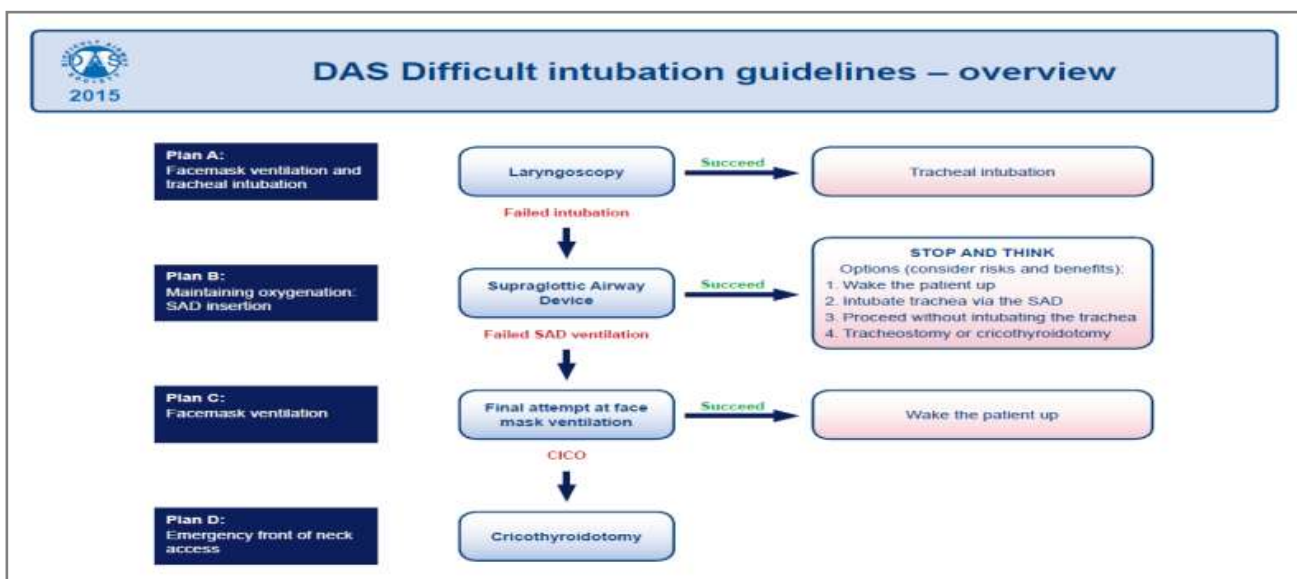


Figure: This flowchart forms part of the DAS guidelines for unanticipated difficult in adults 2015 and should be used in conjunction with the text.

strong association with different intubation (table-II).

Age did not show strong association with difficult intubaion (table-III).

Eighty two (87.2%) out of 94 patients had difficult intubation. We had two cases of Failed intubation who were later intubated using fiberoptic bronchoscope.

Chi-square test could not be applied to determine association between NC/TM ratio ≥5 and difficult intubation because our study included only patients with risk factor present i.e. NC/TM ≥ 5.

circumference and Mallampati score ≥ 3 have been identified as important predictors of difficult intubation<sup>1</sup>.

It is still challenging for researchers to find a bedside test which is useful for predicting difficult tracheal intubation<sup>1</sup>.

Gonzalez *et al* concluded that a difficult tracheal intubation (Intubation difficulty score ≥5) was accompanied with decreased thyromental distance, increased neck circumference, body mass index, and a Mallampati score of 3 or 4 in obese people. Their research supported the use of neck circumference before anaesthesia to determine a potentially difficult tracheal intubation<sup>1</sup>.



The Mallampati score, the Wilson score, and NC/TM ratio alone are associated with a difficult tracheal intubation<sup>11</sup>.

The consequences of obesity on difficult intubation and the use of available predictors are not clear. Kim *et al* found that intubation was more difficult in obese population compared with lean patients, and the ratio of the neck circumference to thyromental distance is a better method than the Mallampati score or simple neck circumference that were reported in the past to predict difficult intubation for such patients<sup>11</sup>.

Past research has identified that the significance of screening tests for prediction of difficult tracheal intubation is not unlimited when a single test is used. That is why, combinations of tests or risk factors may increase diagnostic value in comparison with the value of a test alone<sup>11</sup>.

Several researchers have combined multiple risk factors, e.g. the El-Ganzouri/Wilson scores, that are a multivariate risk index systems. Since above mentioned scores contain many predictors, they consume more time to perform. Therefore, combination of two of the most valuable risk factors may uplift the diagnostic value while not increasing the burden of test significantly<sup>11</sup>.

Among various predictors of difficult tracheal intubation, NC/TM were selected in obese patients as they have thick and short neck. The "intubation difficulty index", which is obtained by dividing Neck circumference (in cm) from thyromental distance (in cm), was highlighted by the scholars and evaluated as a new predictor of difficult intubation on the hypothesis that obese people with both a large neck circumference and a short neck might be more difficult to intubate than patients with a large neck circumference or a short neck alone. From our results, NC/TM proved to be a better indicator than either the Neck circumference or Thyromental distance alone<sup>11</sup>.

No study on this new predictor NC/TM has been performed in local population or published in local journal. In our study we have testified this new predictor for the first time.

In our study, frequency of difficult intubation in obese (BMI  $\geq 27.5$  kg/m<sup>2</sup>) with NC/TM  $\geq 5$  came out to be 87.2% (82 out of 94 patients).

## CONCLUSION

It is concluded from our study that NC/TM  $\geq 5$  alone good predictor of difficult intubation in obese patients. Frequency of difficult intubation in our study came out to be 87.2% (82 out of 94 patients) in obese (BMI  $\geq 27.5$  kg/m<sup>2</sup>).

## CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

## REFERENCES

- Gonzalez H, Minville V, Delanoue K, Mazerolles M, Concina D. The importance of increased neck circumference to intubation difficulties in obese patients. *Anesth Analg* 2008; 106: 1132-6.
- Khan ZH, Maleki A, Makarem J, Mohammadi M, Khan RH, Zandieh A. A comparison of the upper lip bite test with hyomental/thyrosternal distances and mandible length in predicting difficulty in intubation: A prospective study. *Indian J Anaesth* 2011; 55: 43-6.
- Rucker JC, Cole D, Guerina LR, Zoran N, Chung F, Friedman Z. A prospective observational evaluation of an anatomically guided, logically formulated airway measure to predict difficult laryngoscopy. *Eur J Anaesthesiol* 2012; 29: 213-7.
- Reed MJ, Dunn MJ, McKeown DW. Can an airway assessment score predict difficulty at intubation in the emergency department? *Emerg Med J* 2005; 22: 99-102.
- Wojtczak JA. Submandibular sonography: assessment of hyomental distances and ratio, tongue size, and floor of the mouth musculature using portable sonography. *J Ultrasound Med* 2012; 31: 523-8.
- Juvin P, Lavaut E, Dupont H, Lefevre P, Demetriou M, Dumoulin JL, Desmonts JM. Difficult tracheal intubation is more common in obese than in lean patients. *Anesth Analg* 2003; 97: 595-600.
- Shirgoska B, Netkovski J. Predicting difficult airway in apparently normal adult and pediatric patients. *Prilozi* 2013; 34: 155-59.
- El-Ganzouri AR, McCarthy RJ, Tuman KJ, Tanck EN, Ivankovich AD. Preoperative airway assessment: predictive value of a multivariate risk index. *Anesth Analg* 1996; 82: 1197-204.
- Wilson ME, Spiegelhalter D, Robertson JA, Lesser P. Predicting difficult intubation. *Br J Anaesth* 1988; 61: 211-6.
- Lundstrom 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 Anesthesia Database. *Anesthesiology* 2009; 110: 266-74.
- Kim WH, Ahn HJ, Lee CJ, Shin BS, Ko JS, Choi SJ et al. Neck circumference to thyromental distance ratio: a new predictor of difficult intubation in obese patients. *Br J Anaesth* 2011; 106: 743-8.