OBSERVATIONAL STUDY FOR COMPARISON OF BEDSIDE TESTS FOR DIFFICULT AIRWAY IN LEAN VERSUS OBESE INDIAN FEMALE PATIENTS

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ABSTRACT

Introduction: Airway management is a crucial step while providing General Anaesthesia to patients undergoing surgery. Anticipation of difficult airway specially in high-risk groups like obese patients is of utmost importance for preparation of patient for Anaesthesia. This study aims to find out predictors of difficult airway in obese patients.

Materials and Method: Sixty female patients scheduled to undergo elective surgery under General Anesthesia with endotracheal intubation were enrolled in the study. Body Mass Index (BMI) of all patients was calculated and patients with BMI< 30 Kg/sqm were categorized as Lean patients and BMI > 30 Kg/sqm were considered obese patients. Thyromental distance, Hyomental distance and Sternomental distance were measured for all patients and their relation with BMI was studied.

Results: Demographic data was charted and parameters under study were compared in lean and obese patients. SMD of ≤12.5 cm, HMD < 6 cm and TMD <6.5cm considered as difficult airway were significantly associated with obese patients as compared to lean patients with p value < 0.001 in each case.

Conclusion: Thyromental distance, Hyomental distance and Sternomental distance are associated with difficult airway in obese patients as compared to lean patients.

Keywords: Airway, Obesity, Thyromental, Hyomental, Sternomental

Introduction

Airway management plays a crucial role in the management of patients in operating rooms and difficult airways can lead to major catastrophes in the practice of Anaesthesia.[1] Several bedside measurements are used for prediction of difficult airways in patients scheduled to undergo surgeries, some of them are well established and others are still under evaluation for accurate prediction of the same.[2] Obesity is related to increased peri operative morbidity and mortality due to complications caused mainly by metabolic syndrome and airway management. Obesity is an independent risk factor for difficult airway by causing difficult mask ventilation, difficult

intubation, poor respiratory reserves or additions of more than one of these factors.[3] Most reliable test for anticipation of difficult airway in obese patients is Neck Circumference.[4] Other bedside tests are not extensively studied in obese patients as compared to lean patients. Distance from mentum to sternum (sternomental distance, SMD), mentum to thyroid cartilage (thyromental distance, TMD) and mentum to hyoid (hyomental distance, HMD) are well established parameters for bedside evaluation of difficult airway in general population. [5,6,7,8]. The lesser the distance from mentum, more the airway management becomes difficult.

Thyromental distance (TMD) is distance between the thyroid notch and tip of mentum with full neck extension and closed mouth. TMD measures size of mandible and tells the relation of larynx to pharynx. TMD >6.5 cm is associated with easy laryngoscopy and intubation and TMD < 6.5cm is associated with difficult laryngoscopy and intubation.[5]

Hyomental distance (HMD) is the distance between mentum and hyoid bone. It gives an idea of mandibular space and it is not affected by age group of patients. HMD > 6 cm comes under Grade 1, 4.0-6.0 cm in Grade 2 and <4cm in grade 3. HMD< 4cm is associated with difficult airway.[6]

Sternomental distance (SMD) is the distance between suprasternal notch and tip of mentum measured with neck in full extension and mouth closed. It tells about the neck extension possible. SMD <12.5cm predicts difficult airway. [7,8]

The variation of these distances has not been evaluated specifically in obese patients, so far. In this study we evaluated and compared parameters of difficult airway as assessed by TMD, HMD and SMD in lean patients with BMI < 30 Kg/sqm and obese patients with BMI > 30 Kg/sqm.

Materials and Method

This prospective observational study was done after approval of institutional ethical committee and after obtaining written and informed consent of all the participants. Sixty female patients scheduled to undergo elective surgery under General Anesthesia with endotracheal intubation were enrolled in the study. Patients with abnormal airway anatomy (neck contractures, mass in the neck), previous neck surgery, pregnancy, restricted mouth opening, thyroid swelling or Cushing's disease, cervical spine pathology, patients on steroid therapy were excluded. All patients were subjected to the pre-anaesthetic assessment and a thorough systemic and airway examination was done. Weight of all patients was charted in Kilograms(Kg) and height in centi-meters(cm) of all the patients were noted with wall mounted gauge. The height was later converted into meters to calculate BMI (Body Mass Index) in kg/square-meters. Single investigator carried out all the measurements under identical conditions to ensure standardization. Patients with BMI< 30 Kg/sqm were classified as lean patients and patients with BMI > 30 Kg/sqm were classified as obese patients.

Along with other airway parameters sternomental distance(cm) was measured as the straight distance between the upper border of the manubrium sterni and the bony point of the mentum with the head in full extension and the mouth closed, hyomental distance(cm) measured from just above

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the hyoid bone to the tip of the most anterior part of the mentum in neutral position and thyromental distance(cm) measured as the distance from the thyroid notch to the inner margin of the mental prominence when the head will be fully extended (cm). All the distances were measured with patient in supine position, in midline with patient's head in neutral position, neck in full extension and mouth closed, using non stretchable measuring tape. The measurements obtained were estimated to nearest 0.5mm. Sternomental distance (SMD) ≤12.5 cm was considered as difficult airway (DA) and > 12.5 cm was considered as easy airway (EA). HMD < 6 cm was considered as difficult airway (DA) and > 6 cm was considered as easy airway (EA). TMD < 6 cm was considered as difficult airway (DA) and > 6.5 cm was considered as easy airway (EA).

At the end of the study period, data was compiled and entered into Microsoft Excel spreadsheet. Analyses was performed by using SPSS 20 software package (SPSS Inc., Chicago, IL, USA). All data was summarized as mean ± SD for continuous variables, numbers and percentages for categorical variables. The variables were assessed for normality using the Kolmogorov Smirnov test. A $p<0.05$ was accepted as statistically significant.

Results

Range of all the demographic data like age, weight, height, BMI, sternomental distance, Thyromental distance and Hyomental distance is charted in Table 1. Mean and standard deviation was calculated for all the data. Distribution of TMD, HMD and SMD with respect to number of patients having easy and difficult airway are charted in Table 2. As shown in Table 3, SMD of ≤12.5 cm, HMD< 6 cm and TMD<6.5cm considered as difficult airway were significantly associated with obese patients as compared to lean patients with p value < 0.001 in each case.

Table 1: Demographic variables

Demographic variables	Range	Mean (SD)
Age(years)	25-62	46.00(9.97)
Weight (Kg)	55-100	66.35(8.09)
Height (cm)	142-162	153.37(4.21)
BMI(Kg/sqm)	25-40	28.28
Sternomental distance (cm)	3-9	7.39(1.32)
Hyomental distance (cm)	5-15	10(1.65)
Thyromental distance (cm)	32-41	35.31(1.99)

Table 2: Distribution of Airway Parameters in the patients studied

Airway parameter	Measurement	Number of cases
Sternomental distance	≤ 12.5 cm (Difficult Airway)	5
	> 12.5 cm (Easy Airway)	55
Hyomental distance	< 6cm (Difficult Airway)	4

	> 6cm (Easy Airway)	56
Thyromental distance	<6 (Difficult Airway)	3
	> 6.5 cm (Easy Airway)	57

Table 3: Airway Parameters in Lean versus Obese Patients

Sternomental distance	Number of cases		p-value
	Lean Patients (BMI < 30)	Obese Patients (BMI 30 or more)	
≤ 12.5 cm (DA)	1	4	0.001
> 12.5 cm (EA)	46	9	
Hyomental distance	Number of cases		p-value
	Lean Patients (BMI < 30)	Obese Patients (BMI 30 or more)	
< 4cm (DA)	0	3	0.001
>4 cm (EA)	47	10	
Thyromental distance	Number of cases		p-value
	Lean Patients (BMI <30)	Obese Patients(BMI 30 or more)	
< 6cm (DA)	0	3	0.001
> 6.5cm (EA)	47	10	

Discussion

Obesity is associated with a battery of complications in patients undergoing surgeries. BMI of more than 30 kg/sqm is related to a higher incidence of metabolic syndrome, obstructive sleep apnea (OSA) and changed pulmonary mechanics. Obese patients are shown to have difficulty in mask ventilation and rapid desaturation as compared to lean patients. Though BMI and fat distribution are direct estimates of various complications but there is still a controversy regarding whether obesity contributes to difficult intubation. Failure to intubate can have life threatening complications like hypoxic organ damage, airway injuries, hematoma and cardiac arrest. As per the existing literature only parameter directly correlated to difficult intubation is Neck circumference. In this study we compared three different distances from mentum in obese patients with BMI>30 Kg/sqm and in non-obese patients with BMI<30 Kg/sqm. This study found that the TMD, SMD and HMD indicating a difficult airway are associated with patients having BMI>30Kg/sqm. This signifies that obese patients are at a higher risk of difficult endotracheal intubation than non-obese patients with respect to same parameters measured for difficult intubation in both the groups. Along with the factors like adipocity, rapid desaturation and OSA leading to difficult airway, decreased SMD, TMD, HMD pose additional threat to loss of airway. In a similar study by B.N Jaja et al distances from mentum were studied in Nigerian population

where they found that TMD and SMD have a negative correlation with BMI.[9] They studied these parameters in both male and female patients. These different findings than the current study might suggest a role of ethnicity for correlation of BMI and distances from mentum. Wong and Hung et al also found difficult intubation based on ethnicity. In their study they found that Asian population is difficult to intubate than Caucasian population.[10]

Sangeeta et al conducted observational study for predicting accuracy of bedside test like BMI, neck circumference and TMD for difficult intubation in Indian population. They concluded that NC/TMD ratio is a good predictor of difficult intubation.[2] High BMI is associated with snoring due to accumulation of fat around the neck and pharynx. It has a positive correlation with OSA and other complications but grade of obesity does not correlate well with difficult intubation. [11,12] In contrast to this kheterpal et al found that BMI> 30 Kg/sqm was associated with difficult intubation. [13]

As compared to lean patients, obese patients are difficult to intubate as assessed by Intubation Difficulty Scale (IDS) in a study conducted by Shailaja et al. They found that in obese patients 11% patients had difficult intubation and in lean patients only 7% patients had difficulty in intubating the airway. Their results were significant with p value of 0.049. They attributed this due to differences in neck circumference and sternomental distance in obese and lean patients. [14]

Smith et al studied incidence and predictors of difficult airway in lean and compared them with obese surgical patients in a large prospective observational study in tertiary care institute. They found that TMD ($p<0.001$) and SMD ($p<0.001$) were significantly reduced in obese patients as compared to patients with normal BMI and intubation was more likely to be difficult in obese patients. They further stated that BMI alone was not associated with difficult airway but BMI in association with these anthropometric parameters could predict difficult airways with precision.[15]

Shashi Meena et al studied predictors of difficult airway in patients with BMI<25 Kg/sqm versus patients with BMI> 25Kg/sqm. They studied Intubation Difficulty score including SMD and TMD and concluded that obese patients are difficult to intubate and mask ventilate as compared to lean patients as per these parameters.[16]

Farhad et al evaluated thyromental height for predicting difficult laryngoscopy in morbidly obese patients based on Cormack Lehane grading. They concluded that accuracy of thyromental height in predicting difficult laryngoscopy is 93% with positive predictive value of 98%. Thyromental height is the distance from anterior border of mentum to thyroid cartilage. Similar to thyromental distance (distance between the thyroid notch to tip of mentum with neck fully extended and mouth closed) evaluated in this study, thyromental height also represents submandibular space and anterior position of larynx.[17]

Johann et al compared predictors of difficult airway in obese and non-obese patients and similar to the present study they concluded that incidence of difficult intubation was 88.6% in obese

patients and 11.4% in non-obese patients. They studied ratio of neck circumference and thyromental distance rather than thyromental distance alone. In contrast to this study, they found that this ratio results in false positive estimate of difficult airway in their patients. [18]

Therefore, our results have drawn attention into re-exploring the assessment of various distances from mentum for their utilisation alone or with other parameters for assessment of difficult tracheal intubation in obese patients.

Conclusion:

Thyromental distance, Hyomental distance and Sternomental distance are useful bedside tests having a positive association for prediction of difficult airway in obese patients as compared to lean patients. These distances alone or in combination with other tests can prove to be easy and useful parameters for prediction of difficult airway in obese patients.

Limitation:

This study is a demographic observational study comparing obese and lean patients for measurement of three distances from sternum namely Thyromental distance, Hyomental distance and Sternomental distance which are predictors of difficult intubation. The study population could have been followed up further intra operatively to assess mask ventilation score and difficult intubation score to establish the association of these tests for prediction of level of difficulty in airway management in thin and obese patients. This warrants a serial study in obese patients for evaluation of these distances with difficult intubation.

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