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Original Research Paper

Anesthesiology

"NECK CIRCUMFERENCE AS A POTENTIAL INDICATOR OF DIFFICULT INTUBATION IN OBESE PATIENTS: A COMPARATIVE STUDY"

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ABSTRACT

Introduction: Airway management has always been a trending topic because its failure is one of the biggest threat in anesthesiology. The incidence of difficult laryngoscopy and intubation in obese patients is much higher than in the general population. Routine predictors of difficult laryngoscopy and intubation have been shown to be unreliable many times.

Aims & objectives: The aim of this study was to compare the incidence of difficult tracheal intubation, with the help of IDS score, between obese and lean patients along with bedside tests and neck circumference.

MATERIAL AND METHODS: The present study is a prospective comparative study between age group 18 – 50 years of both sexes belonging to ASA grade I & II. 60 patients will be divided into 2 groups (n = 30) obese & lean,will be schedule for surgeries under general aneasthesia. IDS scores, categorized as difficult intubation (IDS >5) or not (IDS ≤5), and the patient data, were compared between lean and obese patients. Preoperative measurements of BMI, neck circumference (at the level of the thyroid cartilage), mouth opening, sternomental distance and thyromental distance, medical history of obstructive sleep apnea syndrome, and some scores (Mallampati, Wilson, El Ganzouri) were recorded. The view during direct laryngoscopy was graded, and the IDS was recorded. Then we have compared patients with IDS >5 and ≤5, taking each item mainly neck circumference.

RESULT& CONCLUSION: The results indicate that difficult tracheal intubation is more frequent in obese than in lean patients (15.8% vs 4%; P = 0.03). In the patients with IDS >5, thyromental distance, BMI, large neck circumference, and Mallampati score≥3 were the only predictors of potential intubation problems. We found that neck circumference should be estimated preoperatively to predict difficult intubation which gives better accuracy in obese patients.

KEYWORDS : obese, IDS scores, neck circumference, Mallampati, Wilson, El Ganzouri scale, BMI, difficult intubation.

INTRODUCTION:

Difficult laryngoscopy and tracheal intubation occur in 1.5% to 13% of patients undergoing general anesthesia and have always been a major concern for anesthesiologists.(1) Different method has been introduced for management of difficult airway. However, early and accurate detection of difficult airway is essential for its safe management because difficult/delayed or failed intubation can have serious consequences and lead to high morbidity and mortality of the patients (2,3,4). Several studies have reported that endotracheal intubation is more difficult in obese than in lean patients.(5,6)

Opinions are divided as to whether or not tracheal intubation is more difficult in obese patients and available data are inconclusive (11). Many attempts have been made to develop well grounded predictors for difficult intubation or difficult laryngoscopy. Suggested predictors for difficult intubation include a history of obstructive sleep apnoea syndrome (OSAS), high Mallampati score,increased age, male, short neck, and the Wilson score.(6,7,8) Although obesity is thought to increase the risk of difficult intubation, increased body mass index (BMI) poorly predicts difficult laryngoscopy.(9)

The aim of this study was to compare the incidence of difficult tracheal intubation, by means of the IDS score, (12) between obese and lean patients assessed with classical bedside tests and neck circumference.

MATERIAL AND METHODS :

After approval from the Institutional Ethics Committee and informed written consent from patients, the present study was carried out in the Department of Anaesthesiology, Gandhi Medical College & associated hospitals (Hamidia and Sultania), Bhopal during period from march to october 2018. It was Randomized, comparative, Prospective study. 60 patients of ASA class I and II, aged between 18-50 years, of either sex (M/F), scheduled for surgeries under general aneasthesia, patients with a BMI of ≥30 kg/m2 were assigned to the obese group (Group 1) and those with a BMI of <30 kg/m2 were assigned to the lean group (Group 2).

INCLUSION CRITERIA: age 18-50yrs, ASA class I and II, patients going for elective surgeries under general anaesthesia. EXCLUSION CRITERIA: upper airway pathology (i.e., maxillofacial fractures, tumors, facial anomalies etc), cervical spine fractures, TM joint pathology, airway pathology,RA etc.

- Preoperatively, a complete medical history was obtained.
- Significant comorbidities, including snoring and diagnosis of OSA syndrome, were recorded if anythmg present.
- Height and weight measured to calculate BMI.
- Neck circumference (cm) (at the level of the thyroid cartilage) and the width of mouth opening (mm) (measured as the interincisor gap with the mouth fully opened) were measured.
- The thyromental distance (cm) and the sternomental distance (cm) were measured with the neck in full extention.

For each patient, other variables that may predict difficult intubation were collected: the modified Mallampati classification without phonation, presence or absence of impaired temporomandibular joint mobility (inability to move the lower teeth in front of the upper teeth); limited neck movement: inability to extend and flex the neck to a range around 90 degrees; presence or absence of abnormal protruding upper teeth. Then, the Wilson et al. and El Ganzouri et al. scores were calculated for assessment of difficult intubation.

MODIFIED MALLAMPATI classification (13) :

class I: soft and hard palate, uvula, and faucial pillars visible,
class II: soft and hard palate and uvula visible,
class III: soft and hard palate and base of uvula visible,
class IV: only hard palate visible.

- In the operating theatre room, the patients were positioned

with pillows under the head with the neck in extension. Each patient was monitored routinely with an ECG, pulse oximetry (SPO2), Heart Rate, Et-CO2 and non-invasive arterial pressure. 100% oxygen through a facemask for more than 3 min was given to all patients.

- Premedication was done with IV 0.04 mg/kg midazolam & glycopyyrolate 0.01mg/kg. Then induction with propofol (2–2.5 mg/kg), fentanyl (2 µg/kg) and succinylcholine (1mg/kg), Cricoid pressure was applied as described by Sellick (17) and released if it disturbed the intubation. All tracheal intubations were performed by senior anaesthetist. If SPO2 decreased to <90% during the intubation period, the event was recorded as a hypoxic episode. The laryngoscopic view was graded according to Cormack and Lehane's scale as follows:

grade 1: the vocal cords were completely visible;
grade 2: only the arytenoids were visible;
grade 3: only the epiglottis was visible;
grade 4: the epiglottis was not visible.

- Intubation difficulty was assessed with the IDS developed by Adnet et al.(12) on the basis of seven variables associated with difficult intubation, which were recorded by the anesthesiologist in charge of the patient. They are as follows:

N1: number of additional intubation attempts;
N2: number of additional operators;
N3: number of alternative intubation techniques used;

N4: laryngoscopy view as defined by Cormack and Lehane (grade 1,N4-0; grade 2,N4-1; grade 3,

N4-2; and grade 4, N4 -3);

N5: lifting force applied during laryngoscopy (N5 _ 0 if inconsiderable and N5 _ 1 if considerable);

N6: need to apply external laryngeal pressure to improve glottic pressure (N6-0 if no external

pressure or only the Sellick maneuver was applied,N6 -1 if external pressure was used);

N7: position of the vocal cords at intubation (N7-0 if abducted or not visible and N7-1 if adducted).

The IDS score is the sum of N1 through N7. A score of 0 indicated intubation under ideal conditions. An IDS score from 1 to 5 indicated slight difficulty, and an IDS score >5 indicated moderate to major difficulty. The two groups of patients were classified further according to the IDS score:

Group 1: those with an IDS score ≤5 (i.e easy and slight difficulty),and

Group 2: those with an IDS score >5 (i.e difficult intubation).

STATISTICAL ANALYSIS :

Data were analysed using SPSS software (version 12.0, SPSS Inc., USA). Variables are expressed as mean & SD or percent. The differences between the obese and lean groups were analysed using a Student's t-test. Differences between the difficult and easy groups in the obese patients were analysed using a binary univariate logistic regression model to determine the significant risk factors for difficult intubation. In the second step, all the significant variables from a previous step were entered in a binary multivariate logistic regression (forward-Wald) model to determine the independent risk factors for difficult intubation. Sensitivity, specificity, positive and negative predictive value were calculated to determine the significant risk factors for difficult intubation.

P < 0.05 was considered statistically significant.

OBSERVATION :

TABLE -1: DEMOGRAPHIC DATA OF ALL PATIENTS (OBESE & LEAN)

PARAMETER	GROUP OBESE	GROUP LEAN	P VALUE
AGE(18-50 Yrs)	34.47 ± 8.48	34.9 ± 5.97	<0.0001
Sex (M/F)	14/16	17/13	NS
ASA (I/II)	15/15	14/16	<0.0001
Height (in cm)	159.86 ± 3.78	160.66±3.79	<0.0001
Weight (in Kg)	115±20	65± 10	0.0001
BMI	36 ±5	24±4	<0.0001
Neck circumference	41.5±5.4	39±4.2	0.003
Thyromental distance	8±2	9.1±3	0.034
Sternomental distance	16.8 ±3.0	17.0 ± 2.9	NS
Mouth opening<35mm	7%	5%	NS
Mandibular recession	6%	5%	NS
Mandibular subluxation	3.3%	2.5%	NS
Buck teeth	8%	6%	NS
Mallampati Grade I/II/III/IV	15/8/6/1	17/10/3/0	0.007
Cormack score ≥3	9	3	0.0065
Sleep apnea syndrome	10%	0%	<0.045
Neck mobility <90°	11%	9%	NS
Wilson score >2	69%	20%	0.0001
El-Ganzouri >4	30%	12%	0.03
IDS >5	15.8%	4%	0.03

percentages or as mean ±SD. (BMI -body mass index; IDS- intubation difficulty scale).

GRAPH 2: SHOWING IDS>5 BETWEEN OBESE & LEAN PATIENTS GROUPS

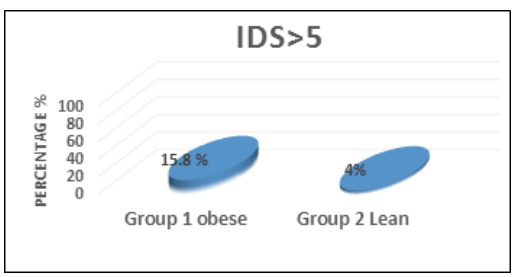

TABLE 2: DEMOGRAPHIC DATA COMPARISON OF IDS>5 & IDS ≤5

PARAMETER	GROUP 1 IDS >5	GROUP 2 IDS ≤5	P VALUE
BMI	43 ± 9.2	33.5 ± 3.6	0.0001
Neck circumference	46.5 ± 4.2	41±5	<0.0001
Thyromental distance	9±3	9.8±3	0.03
Mallampati Grade > III	65%	14%	<0.0001
Wilson score >2	76%	45%	0.021
El-Ganzouri >4	17.4%	21%	0.078

GRAPH 2: SHOWING NECK CIRCUMFERENCE BETWEEN TWO STUDY GROUPS IDS>5 & IDS ≤5

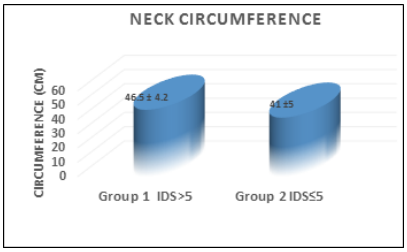

TABLE 3. TESTS FOR DIFFICULT INTUBATON

	SENSITIVITY	SPECIFICITY	PPV	NPV
Neck circumference >43cm	93	84	38	99
Mallampati Grade > III	66	87	33	96
BMI	84	51	14	96
Neck circumference + Mallampati Grade	60	92	44	96
Thyromental distance<6cm	100	82	34	100
Wilson score >2	76	59	17	96

NPV -negative predictive value; PPV -positive predictive value.

DISCUSSION:

A "difficult airway" has been defined as the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with mask ventilation, with tracheal intubation, or with both (16).The tracheas of obese patients are believed to be more difficult to intubate than those of normal-weight patients (8). A "difficult endotracheal Intubation has been defined as when proper insertion of endotracheal tube with conventional laryngoscopy requires more than three attempts or more than ten minutes."

This study confirms that problems with difficult intubation are more frequent in obese than in lean patients. Moreover, neck circumference and Mallampati score >3 were identified as important predicting factors.(18) The association between obesity and difficult intubation is still a matter of debate. This association was previously found in noncomparative studies or in studies of small numbers of patients.(6,11) There have been many attempts to develop a score to measure the complexity of endotracheal intubation. Most methods are quite complicated, involving numerous variables. An objective scoring system has been proposed to assess intubation difficulty: the IDS score, which has been validated,(12) and already used in obese patients.

Effectively, Juvin et al. showed that intubation was more difficult in obese patients, using IDS as in our study, whereas the incidence of difficult laryngoscopy (i.e., Cormack class III or IV) was similar in obese and lean patients, as in our results.(18)

Finding a bedside test that is potent for predicting difficult intubation is still very difficult task. Among the potential predictors we evaluated, BMI, thyromental distance,neck circumference, and a Mallampati score >3 were the only useful bedside test predictors of difficult intubation. Our results thus confirm the work of Brodsky et al.(10) who showed that neck circumference at the thyroid cartilage is a valuable predictor of difficult laryngoscopy in obese patients. Interestingly, all other predictors were almost similar in the two groups. Moreover, neck circumference also seems to be a predictive test in lean patients.

Circumference does not indicate the amount of soft tissue at various topographic regions within the neck. Distribution of fat in specific neck areas, especially the anterior neck, may provide a better indication of difficult intubation than neck circumference. By using magnetic resonance imaging measurements in obese patients with and without OSA syndrome, Horner et al. demonstrated that more fat was present in areas surrounding the collapsible segments of the pharynx in patients with OSA syndrome.(14) This may explain why some obese patients are easy to intubate/ventilate, while others are not. Furthermore, difficult intubation had been significantly associated with OSA. Erzi et al. tested the hypothesis that difficult laryngoscopy could be predicted in morbidly obese patients by the quantification of neck soft tissue at the level of the vocal cords and suprasternal notch using ultrasonography. Among the potential predictors of difficult laryngoscopy, the amount of pretracheal soft tissue quantified by ultrasound was the only measure that fully distinguished easy laryngoscopies from difficult one.(15)

SOME DEFINITIONs:

True positive - a difficult endotracheal intubation that had been predicted to be difficult.

False positive - an easy intubation that had been predicted to be difficult.

True negative - an easy intubation that had been predicted to be easy.

False negative - a difficult intubation that had been predicted to be easy.

Sensitivity _-the percentage of correctly predicted difficult intubations as a proportion of all intubations that were truly difficult, i.e True positives/(true positives - false negatives) Specificity - the percentage of correctly predicted easy intubations as a proportion of all intubations that were truly easy, i.e True negatives/(true negatives - false positives) Positive predictive value - the percentage of correctly predicted difficult intubations as a proportion of all predicted difficult intubations, i.e True positives/(true positives - false positives) Negative predictive value - the percentage of correctly predicted easy intubations as a proportion of all predicted easy intubations, i.e True negatives/(true negatives -false negatives)

RESULT:

There was no study protocol deviation and all patients successfully completed the study protocol and were cooperative with subsequent assessment. Hence, all patients (obese and lean, 30 in each group) were included for data analysis. Demographic data are shown in Table 1. No intubation was impossible in this series. The incidence of difficult intubation (IDS >5) was more frequent in the obese than in the lean patients (15.8% in group 1 vs 4% in group 2; P < 0.03, Table 1). Then, we compared patients (obese and lean) with an IDS score ≤5 and those with an IDS score >5 (Table 2). No difference was found between groups concerning: sex, ASA physical status, age, mouth opening <35 mm, mandibular recession, buck teeth, mandibular subluxation, Cormack score, OSA syndrome, neck mobility <90 degrees.

Logistic regression found that neck circumference and large BMI are independently correlated to a difficult intubation but neck circumference has better predictive value then BMI & other tests. Information on the accuracy of the tests and statistically significant difference between IDS ≤5 and >5 are given in Table 3. Problematic intubation was associated with increasing neck circumference and a Mallampati score of ≥3.

In conclusion, we found that a difficult intubation (IDS >5) was associated with thyromental distance, increasing neck circumference, BMI, and a Mallampati score of >3 in obese patients. This study supports the use of evaluating neck circumference preoperatively to predict a potentially difficult intubation.

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Conflicts of Interest: No.

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