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PREDICTIVE VALUE OF NECK CIRCUMFERENCE TO THYROMENTAL DISTANCE RATIO IN PREDICTING DIFFICULT INTUBATION IN OBESE AND NON OBESE PATIENTS

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ABSTRACT

AIM OF THE STUDY : To test the predictive value of Neck Circumference to Thyromental Distance ratio in predicting difficult intubation in Obese and Non obese patients.

MATERIALS: This is a Prospective, Observational study conducted in Rajiv Gandhi Government general hospital after getting approval from the Institutional Ethics Committee, l200 patients in the age group of 18 to 60 years were selected for this study. Only those satisfying the inclusion criteria were included in this study after getting their consent.

METHODS : Incidence of difficult endo tracheal intubation in 50 obese(BMI-27.5Kg/m2, according to Asian obesity criteria by WHO expert consultation) and 150 non obese was compared. Difficult intubation was determined using the Intubation Difficulty Scale (IDS>-5).The Neck circumference to Thyromental distance ratio was calculated for every case and its ability to predict difficult tracheal intubation was analyzed.

SUMMARY : This study was conducted in Institute of Anaesthesiology and Critical Care, Government Madras Medical College, Chennai. 150 non obese and 50 obese patients were selected and preairway assessment made with measurements- Inter Incisor Sternomental distance, Thyromental distance, Neck circumference and ratio. neck circumference to thyromental Distance Temporomandibular joint mobility was assessed with Upper Lip BiteTest. Statistical analysis showed that neck circumference to thyromental distance ratio - is the most sensitive parameter for identifying difficult intubation than IID, TMD, sMD, NC and ULFT inboth obese and non obese patients. This ratio can be used in combination with other simple bedside tests to identify difficult intubations. This ratio has a very low false negative prediction, making a false sense of security unlikely.

CONCLUSION :distance is a use Non obese patients, as this ratio has very and highly sensitive in identifying difficult intubation in both the concluded the ratio of neck circumference to Thyromental is a useful predictor of difficult intubation in both Obese and low false negative prediction pgroups.

KEYWORDS :

Introduction

The real problem is in patients, who seemingly have normal airways, but pose difficulties during laryngoscopy and intubation. These kinds of patients look apparently normal during pre anaesthetic checkup. So, appropriate plans should be made for managing a difficult airway in the pre operative period itself. Pre planned strategy results in improved patient outcome1")Visualization of glottis is essential for successful endotracheal intubation. This can be achieved with direct laryngoscopy when the patient is placed in sniffing position [slight flexion (35) of neck on chest and extension (80) of head on neckj, so that oral, pharyngeal and laryngeal axes get aligned with the laryngoscopist's eyesight. Optimal glottic view is obtained when the size of the tongue is proportional to the size of oropharynx. Adequate mouth opening facilitates casy insertion of laryngoscope blade and adequate mandibular space will make lateralization of tongue casy during laryngoscopy So, if any of the above requirements are inadequate, intubation may be difficult. Based on this, several predictors of difficuit intubation had been proposed.Mallampatti proposed that if size of tongue is proportionately larger compared to oropharyngeal space, visualization of glottis wouldbe difficult and intubation would be difficult. He developed Mallampatti Classification Later several predictors Distance (adequacy of mouth opening), Thyromental Distance adequacy of mandibular space), Sternomental Distance (length of neck)and Neck Circumference, etcNone of these tests are good predictors when used alone. Hencegroup indices like Wilson's score, Ane's simplified score andBenumof's 11 parameter analysis were developed to improve predictiveaccuracy. But these are cumbersome to use routinely. Combinatiowere single indices is used most commonly by anacsthesiologistsIt will be useful to find a simple bedside lest with good predictivevalue to identify difficult intubation. Such a test will be ideal forwidespread use. Neck Circumference to Thyromental distance ratio isbelieved to be such a test"

Aim Of The Study

To test the predictive value of Neck Circumference to Thyromental Distance ratio in predicting difficult intubation in Obese and Non obese patients

Exclusion Criteria

1. Patients undergoing general anaesthesia without endotracheal intubation.
2. Patients with upper airway pathology facio maxillary trauma.
3. Patients with cervical spine fracture.
4. Patients younger than 18 years of age.

Methods

Incidence of difficult endo tracheal intubation in 50 obese(BMI-27.5Kg/m2, according to Asian obesity criteria byconsultation'"1) and 150 non obese was compared. Dilficult intubationwas determined using the Intubation Difficulty Scale (IDS>-$)W110 expert

The Neck circumference to Thyromental distance ratio wascalculated for every case and its ability to predict difficult tracheal intubation was analyzed.

Materials

1. Measuring tape.
2. Weighing machine.
3. Direct laryngoscope with McIntosh blade.

Pre Operative Airway Assessment:

Patients who were satisfying inclusion criteria and had givenconsent were selected and a pre operative airway assessment was madecondaiway inies Whe Madifia Mallampatti score, Inter Incisor Distance, Thyromental Distance, Sternomental Distance, Neck Circumference and Upper Lip Bite TestNeck Circumference to Thyromental distance ratio was calculated.

Patients were also assessed for the presence of any loose teeth,buck teeth or dentures that may pose difficulties in airway management Neck Circumference to Thyromental distance ratio was calculatedfor all patients. Before induction monitors (ECG, Pulse oxide try, Noninvasive blood pressure and heart rate) were connected and baselinevital parameters were recorded. Patients in both obese and non obesegroups had undergone intravenous induction and muscle relaxation wasachieved with inj. Succinyl choline 2mg/kg i.v., after confirming theability to mask ventilate.

Patients were intubated by anaesthesiologists who have atleast 2years of experience in anaesthesiology. For males, Mclntosh blade size4 was used. For females, size 3 McIntosh blade was used. None of thepatients were desaturated during induction in both groups. All patientsin both groups had been successfully intubated without the need for anyalternative techniques or emergency surgical airway. Duringintubation, glottic view was assessed by Cormack Lehane grading andintubation difficulty scale was used for grading the intubation difficulty.

Intubation Difficulty Scale

In this scale intubation difficulty is graded from the sum of scoresof seven variables (NI to N7).

N1- No. of additional attempts (0 point if intubated in first atempt/1point for every additional intubation attempt)

N2- No. of additional operators (0 point il intubated by tirst operator/1point for every additional operator)

N3- No. of alternative intubation technique used (I point for everyalternate technique)

N4-Cormack Lehane glottic view (gradc I- N4-0, grade II- 4-1,grade Ill-N4-2, grade IV-N4-4)

N5- lifting force applied during laryngoscopy (N5-0, if little forcewas used., N5-1, if considerable force was used)

6- need of external laryngeal pressure (N6-0, if pressure was notneeded., N61, if pressure was used)

N7. vocal cord position (N7-0, if cords were abducted., N7-1, if cords were adducted

An intubation difficulty score of 5 or more is considered asdifficult intubation. Data from all the patients in both groups wereanalyzed using statistics software - SPSS 17.0 version.

Sensitivity, specificity, positive predictive value and negativepredictive value in detecting difficult intubation were calculated for themeasured indices.

Observation And Results

Airway dimension data were collected & tabulation done. SPSS software version 17 0 was used for statistical analysis.

Demographic Variables

200 Patients (50 obese and 150 nonobese) were included in this study

Age Distribution

Patients in the age group of 18 to 60 years were included in this study.

Study Index

Neck circumference/Thyromental distance ratio:

Obese patients have a higher incidence of NC/TMD ratio> 5 comparedto non obese. [p 0.000]

The following bar chart shows the incidences of easy and poor laryngoscopic views in obese patients with NC/TMD ratio <5 and those with ratio >=5.

The following bar chart shows the incidences of easy and poor laryngoscopic views in non obese patients with NC/TMD ratio 5 andthose with ratio>=5

In obese patients, there is no statistically significant difference inthe incidence of poor laryngoscopic view when the NC/TMD ratio is <5or >-. [p 0.780].

In non obese group, patients with NC/TMD> 5 have higher incidence of poor laryngoscopic view.

The following bar chart shows the incidences of easy and difficultintubations in obese patients with NC/TMD ratio <5 and those withratio>-5.

The following bar chart shows the incidences of easy and difficult intubations in non obese patients with NC/TMD ratio <5 and those with ratio >-=5

In Obese patients, there is no statistically significant difference in the incidence of difficult intubation when the NC/TMD ratio is <5 or 5 [p 0.122]. In Non obese group, patients with NC/TMD >S have ahigher incidence of difficult intubation [p 0.012].

Overall, when both groups are combined, difficult intubation is more common in those with NCTMD>-5 [p 0.000].

Outcome measures

Laryngoscopic view of the glottis (Cormack Lehane grading):

The following bar chart shows the incidences of easy and poor laryngoscopic views in obese and non obese groups.

There is no significant difference in the incidence of poorlaryngoscopic view (CL grades III & IV) between obese and non obese groups [p 0.089].

Intubation difficulty score

The following bar chart shows the incidences of easy and difficult intubations in obese and non obese groups.

Incidence of difficult intubation is more in the obese group compared to non obese group [p 0.003]

Sensitivity, Specificity, Positive Predictive Value And Negative Predictive Value Of Various Indices In Detecting Poor Laryngoscopic View In Obese Patients:

In Obese patients, NCTMD ratio >5 has the highest sensitivity(76.9%) in detecting poor laryngoscopic view (CL grade III & IV), compared to all other single indices like IID, TMD, SMD, NC & Upper lip bite test. The sensitivity is greater when compared to MMS III & IV whose sensitivity is 61.5%.

	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
MMS (III & IV)	61.5	59.4	34.8	81.5
IID<=3 cm	7.7	94.6	33.3	74.5
TMD<=6.5 cm	46.2	54.1	26.1	74.1
SMD<=12.5cm	7.7	67.6	7.7	67.6
NC>43 cm	0	97.3	0	73.5
ULBT class III	30.8	91.9	57.1	79
NC/TMD>=5	76.9	27	27	76.9

However, the positive predictive value of NCITMD s-5 in detecting poor laryngoscopic view is less (27%) when compared to ULBT class III (57.1%), which has the highest positive predictive value compared to all other single indices.

Sensitivity, Specificity, Positive Predictive Value And Negative Predictive Value Of

	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
MMS (III & IV)	52.2	65.35	21.4	88.3
IID <=3 cm	13	94.5	30	85.7
TMD <=6.5 cm	26.1	70.1	14.6	84
SMD <=12.5 cm	8.7	86.6	10.5	84
ULBT class III	30.4	87.4	30.4	87.4
NC/TMD >=5	52.2	70.9	24.5	89.1

Various Indices In Detecting Poor Laryngo Scopic View In Non Obese Patients:

In Non obese patients, the sensitivity & positive predictive value of NC/TMD >=5 (52.2% & 24.5% respectively) are comparable to MMS class II/IV in identifying poor laryngoscopic view (CL grades III & IV). These 2 indices have the highest sensitivity in identifying poor laryngoscopic view compared to other single indices.

Overall Sensitivity, Specificity, Positive Predictive Value And Negative Predictive Value

	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
MMS (III & IV)	55.5	64	25.3	86.7
IID <=3 cm	11.1	94.5	30.7	82.8
TMD <=6.5 cm	33.3	66.4	17.9	81.9
SMD <=12.5 cm	8.3	82.3	9.3	80.35
NC>43 cm	0	99.4	0	81.9
ULBT class III	30.5	88.4	36.6	85.3
NC/TMD >=5	61.1	60.9	25.5	87.7

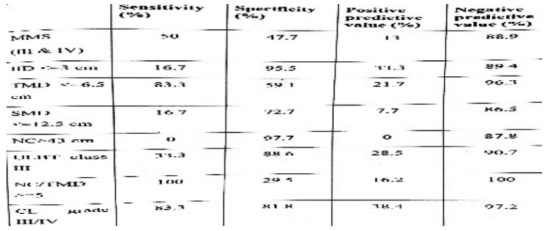
Of Various Indices In Detecting Poor Laryngoscopic View When Both Groups Are Combined:

The overall sensitivity (when both groups are combined) in identifying poor laryngoscopic view is highest for NC TMD ratio >=5 (61.1%), which is slightly higher than that of MMS class III/IV (55.5%).

Overall positive & negative predictive values are comparable for NC/TMD ratio and MMS.

Overall positive predictive value of ULBT class lll is higher (36.6%) when compared to NC/TMD > 5 (25.5%) or MMS class III/IV (25.3%).

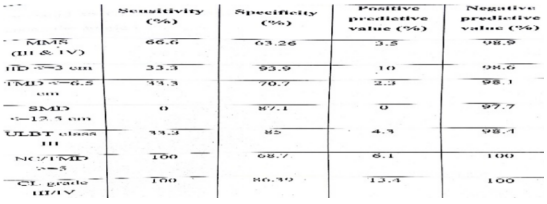
Sensitivityity, Specificity, Positive Predictive Value And Negative Predictive Value Of



Various Indices In Detecting Difficult Intubation In Obese Patients:

In Obese patients, NC/TMD-5 has the highest sensitivity (100%) in identifying difficult intubation (IDS> 5), among the single indices. This is greater than the sensitivity of C III/IV (83.3%). However, the positive predictive value of NC/TMD ratio >=5 is very poor (16.2%) when compared to Cormack Lehane grade III/IV (38.4%), which has the highest positive predictive value in predicting difficult intubation

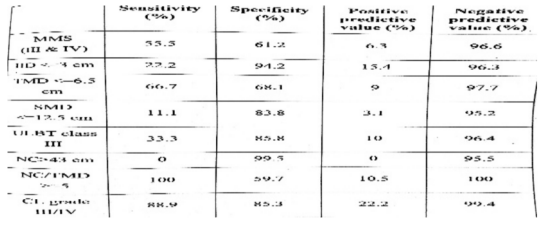
Sensitivity, Specificity, Positive Predictive Value And Negative Predictive Value Of



Various Indices In Detecting Difficult Intubation In Non Obese Patients:h

- In non obese patients, among the single indices, NC/TMD-s & CL grades III/IV have the highest sensitivity (100%) and negative predictive value (100%) in identifying difficult intubation (IDS >-5). However the positive predictive value in identifying difficult intubation in non obese patients is very low (6.1%) for NC MD>-5 when compared to CL grades III/IV (13.4%), which has the highest PPV among the single indices.

Overall Sensitivity, Specificity, Positive Predictive Value And Negative Predictive Value Of



Various Indices In Detecting Difficult Intubation When Both Groups Are Combined:

Overall (when both groups are combined), NC/TMD >=5 has the highest sensitivity (100%) in identifying difficult intubation, evengreater than the sensitivity of CL grades III/IV (88.9%). However, CL grade III/IV has the highest positive predictive value (22.2%) among the single indices. NC TMD):5 has a poor positive predictive value (10.5%) in predicting difficult intubation.

DISCUSSION:

Every anaesthesiologist aims to predict difficult laryngoscopy intubation during the pre anaesthetic assessment and plans the induction technique based on the predicted difficulty in intubation.

Unfortunately there are at present no simple bedside tests to accurately predict difficult intubation. Though some multivariate indices like Wilson's score, multivariate risk index (Arne et al), Benumof's 11 parameter analysis have improved predictive value than simple univariate airway measurements like Inter Incisor Distance,tal Distance, Sternomental Distance, etc., these indices are cumbersome to apply and time consuming.

The predictive value of these multivariate indices are still not adequate. This problem is mainly due to the very low incidence of difficult intubation(1-18% in various studies(1)).

According to 2005 WHO expert consultation criteria, a BMI-27.5 kg/m2 can be considered as obese in Asian population Public health action should be initiated targeting those people with BMI>-27.5kg/m2, as people with BMI more than this value are susceptible to cardiovascular morbidity and mortality compared to Europeans who suffer cardiovascular morbidity and mortality only with BMI>=-30 kg/m2. Hence we included patients with BMI <27.5 kg/m in the obese group and those with BMI 27.5 kg\ m2 in non obese group.

The overall incidence of difficult intubation in our study is 4.5%, which is comparable to the incidences in many other studies.

In our study, the incidence of difficult intubation in obese and non obese are 12% and 2% respectively. The incidence of poor laryngoscopic view (CL grades III IV) in obese and non obese are 26% and 15.3% respectively.

It had been shown in some studies that obese patients were more difficult to intubate than lean patients!1.7) The reasons may be due to excess fat deposition in areas surrounding the airway so that pharyngeal structures cannot be moved anteriorly during laryngoscopy resulting in impediment of glottic view8), Our study also shows that intubation is more difficult in obese population compared to non obese (p 0.003).

But our study results show that there is no statistically significant difference in the incidence of difficult intubation in both obese and non obese patients (p- 0.834 & 0.29 respectively) when they had Mallampatti class /II or Mallampatti class I/IV. Of the patients who had difficult intubation, 44% had a pre operative mallampati class either I or I1, showing that this parameter has high false negative prediction. There is no statistically significant difference in theew in both obese and non obese incidence of poor laryngoscopic vi patients (P values-0.502 & 0.377 respectively) when they Mallampatti class I/II or class II/IV. Our results comply with the results of a Meta Analysis conducted by Anna lee et al in 2006, on various studies on Mallampatti tests (original and modified) which concluded thatMallampatti tests had poor accuracy in predicting difficult intubation.

In our study more of obese individuals had NC/TMD ratio >=5 (74%) compared to non obese in whom only 32.6% had ratio >=5.

Our study showed that NC/TMD >=5 is 100% sensitive in identifying difficult intubation in both obese and non obese patients.

Non obese patients with NC/TMD-5 have a higher incidence of difficult intubation compared to those with a ratio <5 (0.012). Also the incidence of poor laryngoscopic view is higher in non obese patients with NC/TMD>5 (p0.03).

But in obese patients, there is no statistically significant difference in the incidences of difficult intubation or difficult laryngoscopy in those with NC TMD ratio >=5 or those with ratio <5 (p0.780). Also there is no statistically significant difference in the incidence of difficult intubation in obese patients with NC/TMD ratio >-5 or <5 (p 0.122). Our study shows that, this ratio has a poor positive predictive value in predicting difficulty in laryngoscopy and intubation. This may be due to very low incidence of difficult intubation as seen in many other studies.

But the negative predictive value of this ratio is 100% which shows that false prediction of easy intubation is almost nil with this ratio.

A test with high false positivity results in unnecessary costly and time consuming preparations for intubation and unnecessary traumatic awake intubation attempts in a patient who is actually having an easy airway. False negative prediction results in inadequate preparation and failure to secure airway and may result in hypoxic brain injury or ever death.

Hence avoidance of false negative prediction is more important than avoiding false positives". Our ratio has almost nil false negative prediction and also has 100% sensitivity in identifying difficult intubations.

Hence NCTMD ratio »-5 can be considered as an useful screening test in the pre operative period in identifying difficult intubation in both obese and non obese patients. Combining this ratio with other simple bedside tests may improve accuracy of prediction of difficult intubation.

CONCLUSION:

It isconcluded the ratio of neck circumference to thyromental distance is a useful predictor of difficult intubation in both Obese and non obese patients,as this ratio has very low false negative prediction and highly sensitive in identifying difficult intubation in both the groups.

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