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# PREDICTIBILITY OF ROUTINE PREOPERATIVE AIRWAY ASSESSMENT PREDICTORS FOR PERFORMING INTUBATION IN OBESE PATIENTS: A PROSPECTIVE OBSERVATIONAL STUDY

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## ABSTRACT

Obesity and its associated health concern represents major causes of morbidity and mortality and have enormous impact on health care spending. Obese patients present special challenge for the anaesthesiologist in airway management. Management of the airway is central to the practice of anaesthesia. Therefore, a study was performed to determine the usefulness of pre-operative assessment of airway in predicting difficult intubation in obese patients. Also to verify the predictability of preoperative airway assessment predictors while performing laryngoscopy in obese patients. So, a prospective observational study was conducted in pre-anaesthetic clinic (PAC) & operation theatre of 350 bedded Superspeciality Hospital, Bhopal Memorial Hospital and Research Centre, Bhopal after obtaining institutional ethics & scientific committee approval. Six variables that may predict difficult intubation were taken. Also each predictor were separately assessed for the predictability of difficult intubation on intubation difficulty scale, and strength of association was found between predictor and IDS score. Statistical analysis was performed using statistical software SPSS Version 20. With the study performed we came to conclude that among the classic risk factors for difficult intubation a Modified Mallampati score of 3 or 4 is a risk factor in obese patients. Mallampati class 3-4 should alert the anaesthesiologist to the possibility of difficult intubation in obese patients. We also found out that Modified Mallampati test, Thyromental distance, Delikan test are the better predictors of difficult intubation

**KEYWORDS:** Obesity, Intubation difficulty scale (IDS), Modified Mallampati test, Thyromental distance, Delikan test.

## INTRODUCTION

Difficulty in intubation is usually associated with difficulty in exposing the glottis by direct laryngoscopy. This involves a series of maneuvers like extending the head, opening the mouth, displacing and compressing the tongue into the submandibular space and lifting the mandible forward. The ease or difficulty in performing each of these maneuvers can be assessed by one or more parameters.[1] Much of the morbidity specifically attributable to managing a difficult airway comes from an interruption of gas exchange (hypoxia and hypercapnia), which may then cause brain damage and cardiovascular activation or depression.[2] Although the traditional methods of assessing the airway by Mallampati score[3] and Wilson risk sum score[4] are widely accepted, these tests suffer from poor sensitivity with only moderate specificity and have a limited positive predictive value.[5,6]

The Mallampati score estimate the size of the tongue relative to the oral cavity[3,7] and may possibly indicate whether displacement of the tongue by the laryngoscope blade is likely to be easy or difficult. In addition, it assesses whether the mouth can be opened adequately to permit intubation. The Mallampati test assesses not only pharyngeal structure but also head and neck mobility. Recent investigation[8] has suggested that craniocervical extension relates to mouth opening, and limited head or neck mobility may result in a poor Mallampati scores.

Thyromental distance is considered to be an indicator of mandibular space. It could have been measured from inside or outside the mentum.

Mouth opening indicates movement of the temporomandibular joint and that significantly limited mouth opening hinders exposure of the larynx. Several studies based on multivariate analysis[4,9] indicated that limited mouth opening is strongly associated with difficult intubation, but meta-analysi[10] suggests that mouth opening is not a useful test.

Measurements of head and neck movement (delikan test), presence or absence of receding mandible, the presence of prominent maxillary incisors(buck teeth) and all the above parameters yielded poor to moderate sensitivity and moderate to fair specificity in various previous study and meta-analysis.[10]

This study is an attempt to verify the diagnostic accuracy of these bedside tests for predicting difficult intubation in obese patients.

## MATERIALS AND METHODS

A Prospective observational study was conducted in pre-anaesthetic clinic (PAC) & operation theatre of 350 bedded Superspeciality Hospital, Bhopal Memorial Hospital and Research Centre, Raisen Bypass Road, Near Karond Chauraha, Bhopal- 462038, Madhya Pradesh, India. After obtaining institutional ethics & scientific committee approval. Written informed consent was obtained from all the patients.

### Sample size and justification of sample size calculation

Sample size for the study will be according, to the hospital based study sample size, based on confidence interval

$$N=t^2\times p(1-p)\div e^2$$

Where t= 95% confidence interval (t=1.96 standard value at 95%)
p= prevalence / incidence %.
e= allowed error 5%= 0.05.

The overall incidence of difficult intubation was 15.8 % in obese patients according to meta-analysis[10], therefore 205 obese patients participated in our study.

### Inclusion criteria

1. Adults of both sexes between 25 to 65 of ages, scheduled for elective surgeries.
2. ASA physical status I & II.
3. BMI $\geq$ 30.

### Exclusion criteria

1. Patients with pre-existing cardiac disease, severe renal or hepatic dysfunction.
2. Patients with known distortion of anatomy (such as head and neck cancer).
3. Use of cervical collar.
4. Obstetric patients.
5. Inability to sit.
6. Patients refusal.

## METHOD OF STUDY

All the preoperative airway assessment were done evening before surgery by a single observer. Six variables that may predict difficult intubation were taken for the study. They are as follows:

- Mandibular recession present.
- Thyromental distance $\leq$ 6.5cm.
- Modified mallampati grading 3 & 4.
- Mouth opening less than 2 finger.
- Presence of buck teeth.
- Delikan test abnormal.

Each patient was routinely monitored by an electrocardiography, pulse oximetry, noninvasive blood pressure and measurements of end tidal carbon dioxide and oxygen tension in the operating room. A Macintosh no.3 laryngoscope blade was used for the first laryngoscopy in every case. Direct laryngoscopy and intubation was done in every case by the Consultant Anaesthesiologist who have at least 8 yr. of experience in Anaesthesiology and who will be blinded to preoperative assessment. Finding of above predictors were verified with the view obtained by laryngoscopy as per Cormack and Lehane grading.[11] Irrespective of the patients labeled as difficult intubation or not OT was ready invariably for difficult intubation.

### Cormack and lehane grading

Grade I: Visualization of entire vocal cords.
Grade II: Visualization of posterior part of the laryngeal aperture.
Grade III: Visualization of epiglottis.
Grade IV: No glottis structure seen.

The above predictors were then assessed with Cormack and Lehane grading for the prediction of difficult intubation &

1. Sensitivity.
2. Specificity.
3. Positive predictive value.
4. Negative predictive value.
5. Accuracy of the predictors was determined.

### Statistical Analysis

Statistical analysis was performed using statistical software SPSS Version 20.Sensitivity, Specificity, positive predictive value, negative predictive value and accuracy for each predictors was found with Cormack and Lehane grading.

## OBSERVATION AND RESULT

205 patients were studied, out of which 119 were male and 86 were female with mean weight of 87.8kg, height 164.9cm and BMI 32.4kg/$m^2$. The frequency of patients in various categories are given in Table 1.

**TABLE 1: FREQUENCY OF PATIENTS IN VARIOUS CATIGORIES OF PREDICTOR.**

| S.NO. | | Frequency | Percent |
|---|---|---|---|
| 1. | **Mandibular Recession** | | |
| | Difficult | 26 | 12.7% |
| | Not difficult | 179 | 87.3% |
| 2. | **TMD** | | |
| | Difficult | 44 | 21.5% |
| | Not difficult | 161 | 78.5% |
| 3. | **Mallampati Test** | | |
| | Difficult | 47 | 22.9% |
| | Not difficult | 158 | 77.1% |
| 4. | **Mouth Opening** | | |
| | Difficult | 17 | 8.3% |
| | Not difficult | 188 | 91.7% |
| 5. | **Buck Teeth** | | |
| | Difficult | 33 | 16.1% |
| | Not difficult | 172 | 83.9% |
| 6. | **Delikan Test** | | |
| | Difficult | 28 | 13.7% |
| | Not difficult | 177 | 86.3% |

**TABLE 2: DEMOGRAPHY OF STUDY POPULATION (MEAN AGE, WEIGHT, HEIGHT & BMI).**

| | N | Mean | Std. Deviation |
|---|---|---|---|
| Age(yr.) | 205 | 47.1073 | 11.86394 |
| Weight(kg) | 205 | 87.8537 | 5.67917 |
| Height(cm) | 205 | 164.9317 | 6.23991 |
| BMI($kg/m^2$) | 205 | 32.4488 | 1.89109 |

During the study no intubation was impossible. Clinical data of each predictors from the obese patients was collected, tabulated and analyzed to obtain sensitivity, specificity, positive predictive value, negative predictive value and accuracy of predictors.

**TABLE 3: DISTRIBUTION OF PATIENTS WITH RESPECT TO MANDIBULAR RECESSION & CORMACK LEHANE.**

| | | CORMACKLEHANE | | Total |
|---|---|---|---|---|
| | | DIFFICULT | NOT DIFFICULT | |
| MANDIBULAR RECESSION | DIFFICULT | 19 | 7 | 26 |
| | NOT DIFFICULT | 58 | 121 | 179 |
| **Total** | | **77** | **128** | **205** |

Mandibular recession: Sen = 24.68%, Sp = 94.53%, PPV=73.07%, NPV = 67.59% Acc=68.2%.

**TABLE 4: DISTRIBUTION OF PATIENTS WITH RESPECT TO TMD & CORMACK LEHANE.**

| | | CORMACKLEHANE | | Total |
|---|---|---|---|---|
| | | DIFFICULT | NOT DIFFICULT | |
| TMD | DIFFICULT | 32 | 12 | 44 |
| | NOT DIFFICULT | 45 | 116 | 161 |
| **Total** | | **77** | **128** | **205** |

TMD: Sen = 41.56%, Sp = 90.63%, PPV=72.72%, NPV = 72.04%, Acc=72.19%.

**TABLE 5: DISTRIBUTION OF PATIENTS WITH RESPECT TO MALLAMPATI & CORMACK LEHANE.**

| | | CORMACKLEHANE | | Total |
|---|---|---|---|---|
| | | DIFFICULT | NOT DIFFICULT | |
| MALLAMPATI | DIFFICULT | 38 | 9 | 47 |
| | NOT DIFFICULT | 39 | 119 | 158 |
| **Total** | | **77** | **128** | **205** |

Mallampati grading: Sen = 49.35%, Sp = 92.97%, PPV=80.85%, NPV = 75.31% Acc=76.58%.

**TABLE 6: DISTRIBUTION OF PATIENTS WITH RESPECT TO MOUTH OPENING & CORMACK LEHANE.**

| | | CORMACKLEHANE | | Total |
|---|---|---|---|---|
| | | DIFFICULT | NOT DIFFICULT | |
| MOUTH OPENING | DIFFICULT | 14 | 3 | 17 |
| | NOT DIFFICULT | 63 | 125 | 188 |
| **Total** | | **77** | **128** | **205** |

M.O: Sen = 18.18%, Sp = 97.66%, PPV=82.3%, NPV = 66.48%, Acc=67.8%.

**TABLE 7: DISTRIBUTION OF PATIENTS WITH RESPECT TO BUCK TEETH & CORMACK LEHANE.**

| | | CORMACKLEHANE | | Total |
|---|---|---|---|---|
| | | DIFFICULT | NOT DIFFICULT | |
| BUCK TEETH | DIFFICULT | 20 | 13 | 33 |
| | NOT DIFFICULT | 57 | 115 | 172 |
| **Total** | | **77** | **128** | **205** |

Buck teeth: Sen = 25.97%, Sp = 89.84%, PPV=60.60%, NPV = 66.86%, Acc=65.85 %.

**TABLE 8: DISTRIBUTION OF PATIENTS WITH RESPECT TO DELIKAN TEST & CORMACK LEHANE.**

| | | CORMACKLEHANE | | Total |
|---|---|---|---|---|
| | | DIFFICULT | NOT DIFFICULT | |
| DELIKAN TEST | DIFFICULT | 24 | 4 | 28 |
| | NOT DIFFICULT | 53 | 124 | 177 |
| **Total** | | **77** | **128** | **205** |

Delikan test: Sen = 31.17%, Sp = 96.88%, PPV=85.71%, NPV = 70.05%, Acc=72.19 %.

## DISCUSSION

The primary objective of our study was to verify the predictability of routine preoperative airway assessment predictors for performing intubation in obese patients. For this we had undertaken Modified Mallampati grading, Thyromental distance, Mouth opening, Delikan test, Mandibular recession and buck teeth as predictors of difficult airway. Statistics were applied to find sensitivity, specificity, positive predictive value, negative predictive value and accuracy for each predictors.

According to Shiga et al[10], Juvin et al[13], Brodsky et al[14] Mallampati grading has probably been the best single risk factor for difficult intubation in the obese population. But Benumof et al[2] described, the sensitivity, specificity and negative predictive value of the Mallampati score to be poor and this calls into question the validity of this predictive factor in clinical practice. However in our study also Mallampati grading has been the best predictor of difficult intubation in clinical practice but its sensitivity, specificity was found to be low.

In the meta-analysis by Shiga et al[10] tests such as Mallampati score, Wilson Risk score, thyromental distance and mouth opening offered poor to moderate sensitivity (20-62%) and moderate to fair specificity (82-97%) and concluded that clinical value of bedside screening tests for predicting difficult intubation remains limited.

In our study also sensitivity and specificity of Modified Mallampati grading, Thyromental distance, Mouth opening, Delikan test, Mandibular recession, buck teeth are 49.3%, 41.5%, 18.18%, 31.1%, 24.65%, 25.9% & 92.9%, 90.6%, 97.6%, 96.8%, 94.5%, 89.8% respectively which are in accordance with previous study results.

## SUMMARY AND CONCLUSION

This prospective study tests the accuracy of various predictors of airway assessment for difficult intubation in obese patients. Among the classic risk factors for difficult intubation a Modified Mallampati score of 3 or 4 is a risk factor in obese patients. Mallampati class 3-4 should alert the anaesthesiologist to the possibility of difficult intubation in obese patients. We have find out that Modified Mallampati test, Thyromental distance, Delikan test are the better predictors of difficult intubation.

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