

Anatomic Features of the Neck as Predictive Markers of Difficult Direct Laryngoscopy in Men and Women : A Prospective Study.

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ABSTRACT

Background: Recognising a potential difficult airway at the time of preanaesthesia check-up, is very crucial. Several bedside screening tests have been used in clinical practice for predicting the difficult laryngoscopy/intubation. Aim: The study was undertaken to compare diagnostic value of Thyromental distance(TMD) and ratio of height to thyromental distance (RHTMD) in predicting a Cormack Lehane grade ≥ 3 . Design: Prospective, comparative, observational study
Methods: 320 ASA 1 & 2 patients were subjected to pre-operative measurements of the thyromental distance (TMD) and ratio of height to thyromental distance (RHTMD) during the routine pre anaesthesia checkup. In the operating room, direct laryngoscopy performed with a Macintosh blade by an experienced anaesthetist not aware of the pre-op measurements. Difficult laryngoscopy was defined as inadequate exposure of the glottis (Cormack-Lehane grade 3 or 4) under direct laryngoscopy with a blade of appropriate length, without any external pressure or other manoeuvre applied. The preoperative data of TMD & RHTMD and the laryngoscopic findings are correlated to evaluate the sensitivity, specificity, Positive predictive value, & Negative predictive value of each test according to standard formulae. **Results:** RHTMD had a better sensitivity (65.3% vs 59.2% for TMD) as well as a better specificity (50.6% vs 45.8 for TMD) and positive and negative predictive values. **Conclusion:** Among the tests studied, ratio of height to thyromental distance proved to be more accurate test for predicting difficulty laryngoscopy.

Keywords: Difficult laryngoscopy, ratio of height to thyromental distance, thyromental distance.

INTRODUCTION

Difficult airway is a potentially dangerous incident, as it may result in airway or oesophageal injury, aspiration and severe hypoxemia with consequent brain damage and death.^[1] The ability to identify patients at risk of difficult tracheal intubation is important especially in patients with apparently normal airways. The difficulty of tracheal intubation has been strongly related with the direct laryngoscopic view, as classified by Cormack and Lahane (grades 1 to 4).^[2]

Grade 1: visualisation of entire laryngeal aperture

Grade 2: only posterior portion of laryngeal aperture seen

Grade 3: only epiglottis seen

Grade 4: no part of larynx seen

Laryngoscopy and subsequent intubation are considered difficult in patients with a laryngoscopic

view of Cormack Lehane grade 3 or 4. The reported incidence of difficult direct laryngoscopy ranges between 1.5% and 8.5 % in patients receiving general anaesthesia.^[3,4]

Several bedside screening tests- with the most popular being the Mallampati classification,^[5] mouth opening, thyromental distance,^[6] upperlip bite and head neck mobility – have been used in clinical practice for predicting the difficult laryngoscopy/intubation.^[7] Even though they are quite simple, most of them require patient's cooperation in order to be performed properly and thus assessed correctly. The aim of the present study was to evaluate certain anatomic features of the neck (thyromental distance, ratio of height to thyromental distance) that can be measured pre-operatively with minimal patient cooperation and to assess their diagnostic value in predicting difficult direct laryngoscopy.

MATERIALS AND METHODS

After Institutional Ethics Committee approval and written informed valid consent 320 patients in age

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group 18 to 65 years were enrolled for this observational study. Pre-operative measurements of the thyromental distance (TMD), ratio of height to thyromental distance (RHTMD) were performed in all patients using a measuring tape. The TMD is defined as the straight-line distance (cm) from the lower border of the thyroid notch to the bony point of the mentum, with the head extended and the mouth closed. Each patient's height was measured in centimeters from vertex to heel. Ratio of height to thyromental distance was calculated as follows: $RHTMD = \frac{HEIGHT \text{ (in cms)}}{TMD \text{ (in cms)}}$.^[8]

In the operating room, anaesthesia was induced with inj. Propofol 2mg/kg i.v. and muscle relaxant inj. vecuronium bromide 0.1 mg/kg i.v. given. Patient's head was kept in the "sniffing position". Direct laryngoscopy performed with a Macintosh blade by an experienced anesthetist, (having an experience of atleast 3 years in performing endotracheal intubations during general anesthesia procedures), not aware of the pre-op measurements. Difficult laryngoscopy was defined as inadequate exposure of the glottis (Cormack- Lehane grade 3 or 4) under direct laryngoscopy with a blade of appropriate length, without any external pressure or other manoeuvre applied.] The number of attempts and operators or the use of any alternate intubation techniques were noted. A maximum of 3 attempts of intubation were tried on each patient. After evaluation, if needed external laryngeal pressure was permitted for endotracheal tube insertion. The study ended after successful tracheal intubation was confirmed by assessment of chest movement, auscultation and capnography. The preoperative data of TMD & RHTMD and the laryngoscopic findings were correlated to evaluate the sensitivity, specificity, PPV, & NPV of each test according to standard formulas.

The primary end-point of the study was the diagnostic value of TMD, RHTMD in predicting a Cormack-Lehane grade ≥ 3 . Secondary end-points were differences between the genders regarding the optimal cut- off points and the accuracy of the studied tests with the use of gender-specific cut-off points based on ROC curve. All statistical calculations were done using computer programs Microsoft Excel 2015 and SPSS software. Continuous data was analysed using student "t test" while categorical data was analysed using chi square test. The level of statistical significance was taken as $p \leq 0.05$.

RESULTS

The study included 320 patients (131 males and 189 females). The youngest patient being 18 years and the oldest being 65 years. The mean age was 36.975 and the standard deviation was 12.5895. Out of all cases 271 were easy intubation (CL grade 1,2) and 49 were difficult (CL grade 3,4)

Table 1: Cormack And Lehane Grading in study population

| Cormack And Lehane Grading | N | % |
|----------------------------|-----|--------|
| Grade I | 159 | 49.7% |
| Grade II | 112 | 35.0% |
| Grade III | 44 | 13.8% |
| Grade IV | 5 | 1.6% |
| Total | 320 | 100.0% |

A Thyromental distance of less than 7.5 cm was considered to be predictive of difficult laryngoscopy and intubation. Out of 320 patients, 145 patients were predicted to be easy intubation and 175 were predicted to be difficult intubation.

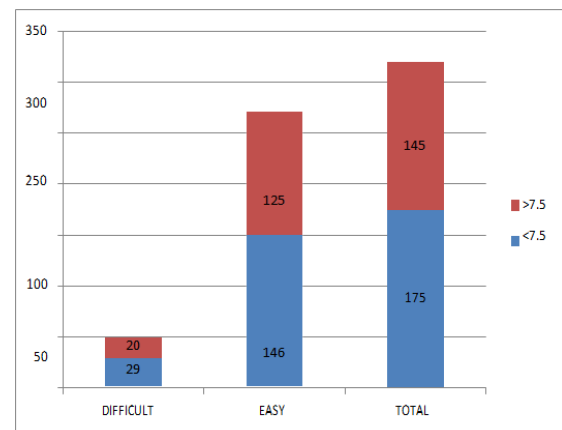


Figure 1: Prediction of ease of laryngoscopy with thyromental distance

A Ratio of height to thyromental distance of greater than 18.4 was considered to be predictive of difficult laryngoscopy and intubation. Out of 320 patients, 154 patients were predicted to be easy intubation and 166 were predicted to be difficult intubation.

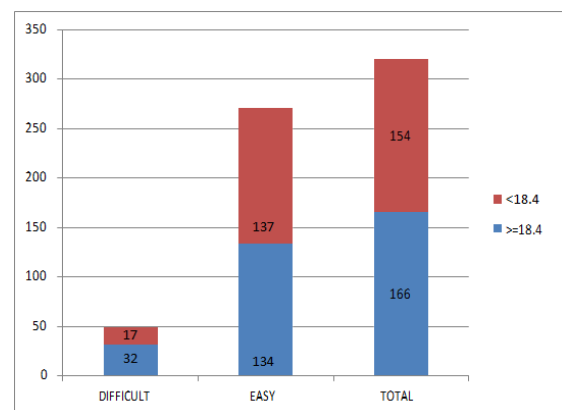


Figure 2: Prediction of ease of laryngoscopy with RHTMD

Table 2: A Comparison Of The Two Parameters

| Parameter | TMD | RHTMD |
|-------------|-------|-------|
| Sensitivity | 59.2% | 65.3% |
| Specificity | 45.8% | 50.6% |
| PPV | 16.5% | 19.3% |
| NPV | 86.1% | 89.0% |
| Accuracy | 47.8% | 52.8% |

The accuracy of RHTMD for prediction of difficult laryngoscopy came out to be 52.8% as compared to 47.8% for TMD.

DISCUSSION

Designing a good predictive test for difficult intubation is problematic because many factors may affect visualization of the larynx at intubation, such as the maximum mouth-opening distance, the circumference and length of the neck, and several characteristics that cannot be quantified accurately which include the compressibility of the tongue and soft tissues of the floor of the mouth and the extent of subluxation of the temporomandibular joint during laryngoscopy.^[4,9-11] In addition, the ability of the person performing the intubation cannot be easily incorporated into a standardized assessment.

Schmitt et al,^[8] compared the diagnostic accuracy of thyromental distance and ratio of height to thyromental distance. The two tests were compared analyzing the area under the receiver operating characteristic curves (AUC). The AUC of RHTMD was significantly greater ($P < 0.007$) when compared to TMD, indicating a more accurate prediction by the RHTMD. The sensitivity of both tests was 0.81, the RHTMD had significantly greater specificity (0.91) than the TMD (0.73). This study recommended RHTMD to be a better predictor of difficult laryngoscopy. Our study confirmed these findings. RHTMD is a height dependent parameter and there exists significant differences in height among races, which probably accounts for the different values reported in the literature with regard to diagnostic accuracy.

Chara L et al¹² found RHTMD to be a more accurate predictor of difficult laryngoscopy in comparison to TMD and Sternomental distance with a sensitivity of 88.4% and a specificity of 33.2%. Our findings are in agreement with this study.

A limitation of the study was that laryngoscopy was undertaken by different anaesthesiologists. However, the incidence of difficult laryngoscopies was comparable among them. Another limitation of the study was that it could vary with anthropometric variations among different populations,^[13-15] however our results can be interpreted with appropriate modification to populations with significantly different morphological characteristics. Another drawback was that prediction of easy laryngoscopy doesn't imply an easy tracheal intubation as there are other factors influencing it.

CONCLUSION

Ratio of height to thyromental distance proved to be more accurate test for predicting difficulty laryngoscopy than thyromental distance. However, None of the tests could predict all the incidences of difficult intubations which goes on to show that although a number of screening tests are available

for prediction of difficult laryngoscopy, the search for a single ideal test or composite score is an unending process.

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