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Prediction of Difficult Airway-Ratio of Patient's Height to Thyromental Distance

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ABSTRACT

Preoperative evaluation is important in the detection of patients at risk for difficult tracheal intubation. Thyromental distance (TMD) is often used for these purposes, The purpose of the present study was to evaluate and compare the accuracies of the ratio of patient's height to TMD (ratio of height to TMD = RHTMD) in the prediction of difficult tracheal intubation. Four hundred patients were evaluated preoperatively using the TMD ,Modified Mallampati test(MP),and RHTMD. The three tests were compared analyzing the area under the receiver operating characteristic curves (AUC). Difficult laryngoscopy occurred in 13 patients (3.3%). The AUC of RHTMD was significantly greater ($P<0.001$) when compared to TMD, indicating a more accurate prediction by the RHTMD. RHTMD has shown to be highly specific(97.1%) and also sensitive(76.9%) with accuracy(96.5%) in predicting difficult intubation. The study is more sensitive and specific in comparison with MP. Based on our results, we recommend that the RHTMD should be used instead of the TMD.

Key Words: *Difficult Airway,Modified Mallampati test, Thyromental distance, Ratio of patient's Height to Thyromental Distence*

INTRODUCTION

There are many methods have been used to predict the difficult airway. But all the tests have a good failure rates in predicting the difficult intubation. Failure in managing airway is the most significant cause of mortality and morbidity in anaesthetized patients. Incidence is 1.5% - 13% of patients undergoing surgery, however it still accounts for significant proportion of adverse anesthetic outcomes in clinical practice.* The single largest source of unfavorable outcome in the ASA (American Society of Anesthesiologists') closed claim study was for adverse respiratory episodes which accounted for 34% liability claims, of which difficult tracheal intubation was culprit in 50%.* So, preoperative evaluation is important in the detection of patients at risk for difficult airway management.

Although, many advances have been made and many methods have been used to overcome unanticipated difficult airway, the existing bedside tests such as Patils measurment of Thyromental distance (TMD), Mallampatti test, Wilson scoring system have been shown in various studies to have high false+verates,which detracts from their usefulness. So, there is a need for a test, which is quick and easy to perform, which is highly Sensitive (so that majority of difficult cases can be identified) and highly Specific (so that false+ rate will be low when the test is used routinely).

However, one of the tests proposed to predict difficult airway TMD, varies with patients size. TMD has been adjusted for patient's height for

predicting difficult airway. We in our prospective study, tried to evaluate the capability of the RATIO OF PATIENTS HEIGHT TO THYROMENTAL DISTANCE (RHTMD) compared to THYROMENTAL DISTANCE for predicting ease or difficult intubation.

METHODS

The institutional ethics committee approved this study and all patients gave written informed consent. We studied 400 patients above the age of 18 years ASA I, II requiring general anaesthesia with tracheal intubation are included in the study. Patients with Mouth opening <3cm, Midline neck swellings, Pregnant patients, adentuous were excluded from the study. Each patient underwent a preoperative general physical examination and a detailed systemic examination.

TMD was measured as straight distance between the thyroid notch and the lower border of mental prominence, with the head is fully extended and the mouth closed, using a rigid ruler. The distance was rounded to the nearest 0.5cm. Height of patient was measured in centimetres with the patient standing straight by side of wall ,with heel touching wall and was rounded to nearest 1cm. RHTMD was calculated. In addition to these tests, Mallampatti test, interincisor distance , head and neck mobility also assessed.

After preoxygenation all patients were induced using standard agents and paralysed using neuromuscular blocking agents to facilitate orotracheal intubation. Laryngoscopy was performed after full relaxation. The head placed in sniffing position on a head ring or pillow and an

appropriate Macintosh blade was used, by consultant anesthesiologist.

Glottic visualisation was assessed by using modified Cormack and Lehane classification without external laryngeal manipulation. Cormack and Lehane grades 3 and 4 were defined as difficult intubation in this study.

The preoperative assessment data and laryngoscope findings will be used together to evaluate the accuracy of two tests (TMD, RHTMD) in predicting difficult intubation. The sensitivity, specificity and positive and negative predictive values of each test will be calculated according to standard formula.

RESULTS

The measurement of thyromental distance revealed that 306

Patients (23.5%) had a thyromental distance \geq 6.5cm.

On calculating ratio of height to thyromental distance, we observed that 378 patients (94.5%) had RHTMD $<$ 25 , while 22 (5.5%) patients had RHTMD \geq 25 .

The Cormack-Lehane (CL) grading showed that 329 (82.3%) patients had a CL grade I ,58 (14.5%) patients had a CL grade II, 13(3.3%) patients had a CL grade III.

The sensitivity of modified Mallampati test was 53.8% and specificity was 91.4%. The test has a positive predictive value of 17.5% , Negative

predictive value of 98.5% and overall accuracy of 90.1%.

The sensitivity of TMD was 84.6% and specificity was 78.6%. The test has a positive predictive value of 11.8% , Negative predictive value of 99.3% and overall accuracy of 78.8%.

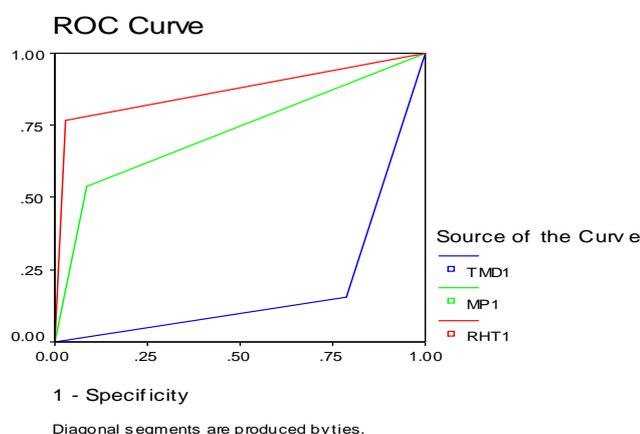
Out of 376 patients with RHTMD of $<$ 25, 324 patients had CL grade I, while 49 patients had CL grade II. 3 patients had CL grade III. Out of 21 the patients with RHTMD of \geq 25, 3 patients had CL grade I, while 8 patients had CL grade II. 10 patients had CL grade III. Out of the 21 patients predicted to be difficult intubation with RHTMD of \geq 25, 11 were easy intubations as they had a CL grade I or II. Thus , the high degree of false positivity of this test exposed.

The sensitivity of RHTMD was 76.9% and specificity was 97.1%. The test has a positive predictive value of 47.6%, Negative predictive value of 99.2% and overall accuracy of 96.5%.

	MP	TMD	RHTMD
Sensitivity	53.8	84.6	76.9
Specificity	91.4	78.6	97.1
Positive predictive value	17.5	11.8	47.6
Negative predictive value	98.3	99.3	99.2
Accuracy	90.1	78.8	96.5

For predicting a difficult airway the optimum cut-off values selected were 25.0 (sensitivity 76.9%; specificity 97.1%) for RHTMD and 6.5 cm

(84.6%; 78.6%) for TMD. MP had sensitivity of 53.8% and specificity of 91.4%.



DISCUSSION

The RHTMD was introduced to allow for the individual's proportions, which are not allowed for in these of the TMD. Identical TMD measurements in a woman with a height of 160 cm and a 190 cm man would be expected to be associated with quite different jaw proportions in relation to the surrounding structures. The length of the neck and mandible as well as the volume of the tongue and soft tissue may vary with the size and proportion of the body¹⁴,

We used the analysis of ROC curves to assess and compare the overall performance of the predictive

tests. This methodology is widely used to evaluate the performance of diagnostic tests. The results clearly demonstrated that the RHTMD has a higher predictive value compared to the TMD. This result is not unexpected, since the RHTMD takes individual proportions into account.

In this study, incidence of difficult airway was 3.3%. 11 out of 13 patients who had difficult airway, had RHTMD ≥ 25 and TMD ≤ 6.5 cm. 9 out of 13 patients had Modified Mallampati grade III. Thus, RHTMD is more sensitive than Modified Mallampati grading (53.8%). Sensitivity of TMD and RHTMD is comparable.

Out of 387 easy intubation, 378 were predicted to be easy by RHTMD, 304 patients by TMD and 359 by Modified Mallampati test. Thus, RHTMD (97.1%) was more specific than Modified Mallampati test (91.4%) and TMD (78.6%).

CONCLUSION

This study highlights the importance of a new, simple, yet very useful and important test involving measurement of external anatomic structures in predicting a difficult intubation. The test was performed on a reasonably large population and wide age. RHTMD has shown to be highly specific (97.1%) and also sensitive (76.9%) with accuracy(96.5%) in predicting difficult intubation. The study is more sensitive and specific in comparison with modified Mallampati test. This test is more specific than thyromental distance, but less sensitive. *The study is more sensitive and specific in comparison with MP. Based on our results, we recommend that the RHTMD should be used instead of the TMD for better prediction of difficult airway*

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