

International Journal of Medical Science and Current Research (IJMSCR) Available online at: www.ijmscr.com Volume3, Issue 3, Page No: 259-263 May-June 2020



# Diagnostic significance of Ratio of height to thyromental distance (RHTMD) of difficult airway for endotracheal intubation

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Type of Publication: Original Research Paper Conflicts of Interest: Nil

#### ABSTRACT

**Objective:** To evaluate the diagnostic significance of ratio of height to thyromental distance (RHTMD) of difficult airway for endotracheal intubation in north Indian population.

**Methods:** This was a prospective blinded study conducted in 249 patients. The demographic data was collected from patient's attendant. Laryngoscopy and grading was performed by an experienced anesthesiologist who was not aware of the recorded pre-operative airway evaluation.

**Results:** The RHTMD score of all patients ranged from 14.0-33.8 with mean ( $\pm$  SD) 21.46  $\pm$  2.90. The prevalence of difficult airway for endotracheal intubation was 17.7%. Cormack Lehane score 1 was among more than half of patients (59.8%). The diagnostic of RHTMD was significant (AUC=0.681, Z=3.80, p<0.001) and had low sensitivity 61.36% (95% CI=45.5-75.6) but high specificity 71.71% (95% CI=65.0-77.8). The positive likelihood ratio (+LR), negative likelihood ratio (-LR), positive predictive value (+PV) and negative predictive value (-PV) were found to be 2.17%, 0.54%, 31.8% and 89.6% respectively

Conclusion: RHTMD is a low sensitive, high specific with low positive and high negative predictive value.

Keywords: Difficult airway, Endotracheal intubation, Diagnostic significance, RHTMD

# **INTRODUCTION**

The preoperative prediction of a difficult airway is important. Majority of all the mistakes (85%) for airway management consequences in the permanent cerebral damage. However, up to 30% of all anesthetic deaths can be recognized in managing difficult airways.<sup>1,2</sup>

Difficult laryngoscopy is synonymous with the difficult laryngoscopy among most of patients. Difficult laryngoscopy is reported in 1.5%–13% of patients. The ability in predicting the difficult tracheal intubation allows the anesthesiologists to take protections to decrease the risk.<sup>3,4</sup> Preoperative

assessment is important for the risk of difficult airway management. But which clinical factors are the best predictors are controversial.<sup>5,6</sup>

Many investigations describe the prediction rules by applying a single risk factor or a multifactorial index.<sup>3,7</sup> One of the tests for difficult laryngoscopy is upper-lip-bite test (ULBT). This test assesses the likelihood of a patient to cover the mucosa of the upper lip with the lower incisors.<sup>8</sup>

Another available test for difficult laryngoscopy is thyromental distance (TMD). This test is different as per the patient size. Nevertheless, many of the studies Dr. Lokendra Gupta et al International Journal of Medical Science and Current Research (IJMSCR)

questioned about this test that the TMD is either sensitive or specific as the only predictor of difficult laryngoscopy.<sup>9</sup> Schmitt *et al* found that RHTMD test had better predictive values than TMD test.<sup>10</sup>

The present study was conducted with the objective to study the diagnostic significance of RHTMD test of difficult airway for endotracheal intubation.

# MATERIAL AND METHODS

After approval from the Institutional Review Board, this prospective blinded study was conducted in 249 patients. The demographic data was collected from patient's attendant. Patients were evaluated for RHTMD before surgery. Patients undergoing elective surgery under general anesthesia with endotracheal intubation aged 15-80 years were included in the study. All patients belonged to ASA grade I and II. Emergency cases, history of previous surgery, edentulous patients, patients requiring a rapid sequence induction and patients with requiring cricoid pressure during intubation were excluded from the study.

Laryngoscopy and grading was performed by an experienced anesthesiologist who was not aware of the recorded pre-operative airway evaluation. Laryngoscopy and grading was performed as per Cormack and Lehane's classification.<sup>11</sup>

**RHTMD:** TMD was measured from the bony point of the mentum. During this, head was fully extended and the mouth closed.<sup>12</sup> Then the RHTMD was calculated.

The view was graded as follows:<sup>13</sup>

- Class 1-Soft palate, fauces, uvula, pillars are seen
- Class 2-Soft palate, fauces, uvula are seen
- Class 3-Soft palate, base of uvula seen
- Class 4-Soft palate not visible at all.

The patient was allowed to relax for a minute and test was repeated to confirm the Grading.

# Statistical analysis

Continuous data were summarized as Mean  $\pm$  SD (standard deviation) while discrete (categorical) in %. The discrete groups were compared by chi-square ( $\chi^2$ ) test. Diagnostic significance of predictors of difficult airway for endotracheal intubation was

assessed by ROC (receiver operating characteristic) curve analysis. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and likelihood ratios were calculated. A two-sided p<0.05 was considered statistically significant. SPSS (version 16.0) software was used for the analyses.

# RESULTS

Among patients, mostly were males (57.0%). The age of all patients ranged from 15-80 yrs with mean ( $\pm$  SD) 41.79  $\pm$  14.51 yrs. The weight, height and BMI of all patients ranged from 29-98 kg, 144-186 cm and 11.77-38.75 kg/m<sup>2</sup>, respectively with mean ( $\pm$  SD) 59.90  $\pm$  12.17 kg, 160.04  $\pm$  7.65 cm and 23.35  $\pm$  4.47 kg/m<sup>2</sup>, respectively (Table-1).

The RHTMD score of all patients ranged from 14.0-33.8 with mean ( $\pm$  SD) 21.46  $\pm$  2.90. The prevalence of difficult airway for endotracheal intubation was 17.7%. Cormack and Lehane score 1 was among more than half of patients (59.8%) (Table-2).

The diagnostic of RHTMD was significant (AUC=0.681, Z=3.80, p<0.001) and had low sensitivity 61.36% (95% CI=45.5-75.6) but high specificity 71.71% (95% CI=65.0-77.8). The positive likelihood ratio (+LR), negative likelihood ratio (-LR), positive predictive value (+PV) and negative predictive value (-PV) were found to be 2.17%, 0.54%, 31.8% and 89.6% respectively (Table-3).

# DISCUSSION

This study showed the incidence of difficult intubation to be 17.7%. In the present study, the RHTMD score of all patients ranged from 14.0-33.8 with mean ( $\pm$  SD) 21.46  $\pm$  2.90. Kaniyil et al reported lower incidence (5.3%) of difficult intubation in their study.<sup>14</sup> Other studies reported incidence of difficult intubation between 1.5%-13%.<sup>15-17</sup> The reason for the wide range of incidence reported in the studies are the lack of uniformity in the practice of laryngoscopy and intubation as in head and neck positioning, application of sellick manoeuvre, external laryngeal manipulation, multiple attempts, type of blade used and varving skill of anesthesiologists.18

The RHTMD which was introduced by Schmitt et alis a better predictor of difficult laryngoscopy as compared to TMD.<sup>19</sup> RHTMD focuses the body

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proportions of patients. Therefore, it is a better index than TMD. The reported cutoff value of 23.5 was considered a risk factor for difficult laryngoscopy.<sup>20,21</sup>

This study had low sensitivity 61.36% (95% CI=45.5-75.6) but high specificity 71.71% (95% CI=65.0-77.8) for RHTMD cutoff >21.9. Contrast to this study, Kaniyil et al reported that RHTMD had higher sensitivity and accuracy, better specificity, and highest NPV.<sup>14</sup> The sensitivity of RHTMD in their study was 62.5% but similar with some other studies.<sup>20,20</sup>

The ROC curve which is a measure of accuracy and discriminative power, was also found to be little higher for RHTMD (0.68). Higher AUC denotes more reliability and discriminative power. The optimal cutoff value for the study population obtained was 21.9 with a sensitivity of 61.36% and specificity of 71.71%. Different (23.5 and 25) cutoff value for RHTMD in the studies have been reported. The calculated statistical values also differ which may be because of demographic differences.<sup>23,19</sup> A study in south Indian population has reported a cutoff value of 17.1.<sup>24</sup> This might be due to the higher mean TMD value being 9.03 cms reported in the study. The study was able not to provide the optimum measurements for the predictive tests. Their best outcome ROC curve was 0.64 for RHTMD and all other indices giving a value  $\geq 0.7.^{8}$ 

Further studies are required to find any significance of ethnicity on difficult airway prediction. A systematic review has reported the limited and inconsistent capacity of bedside predictors to discriminate between difficult and easy airways with few studies having AUC values in clinically relevant ranges.<sup>25</sup>

# CONCLUSION

RHTMD is a low sensitive, high specific with low positive and high negative predictive value.

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Table-1: Demographic characteristics (Mean  $\pm$  SD, n=249) of study population patients.

Characteristics	Statistics
Gender:	
Females	107 (43.0%)
Males	142 (57.0%)
Age (yrs)	$41.79 \pm 14.51$
	(15-80)
Weight (kg)	59.90 ± 12.17
	(29-98)
Height (cm)	$160.04 \pm 7.65$
	(144-186)
BMI (kg/m <sup>2</sup> )	$23.35 \pm 4.47$
	(11.77-38.75)

Numbers in parenthesis indicates the range (minmax)

# Table-2: Frequency distribution of RHTMD andintubation of difficult airway for endotrachealintubation

	N (%)
RHTMD score	
RHTMD: Mean ± SD	$21.46 \pm 2.90$
(range)	(14.0-33.8)
Intubation:	
Easy	205 (82.3%)
Difficult	44 (17.7%)

Table-3: Diagnostic significance of RHTMD fordifficult intubation

<b>RHTMD &gt;21.9</b>	Predictive value,
Sensitivity, % (95%CI)	61.36 (45.5-75.6)
Specificity, % (95%CI)	71.71 (65.0-77.8)
+PV	31.8
-PV	89.6

+LR	2.17
-LR	0.54
AUC	0.68
p-value	0.0001*

+LR: Positive likelihood ratio, -LR: Negative likelihood ratio, +PV: Positive predictive value, -PV: Negative predictive value, \*Significant