



THE RATIO OF HEIGHT TO THYROMENTAL DISTANCE AS A PREDICTOR OF DIFFICULT LARYNGOSCOPY; A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT **Background:** The term air way in its day-to-day usage refers to the upper airway which may be defined as the extra pulmonary air passage consisting of the nasal & oral cavities, pharynx, larynx, trachea and large bronchi. "Difficult Airway" is one in which there is a problem in establishing or maintaining gas exchange via a mask, an artificial airway, or both. Recognizing the potential for a difficult airway allows time for optional preparation, proper selection of equipment & technique, and participation of personal experienced in difficult airway management. For securing the airways, tracheal intubation remains the method of choice in most cases. However difficult laryngoscope tracheal intubation occurs in 1.5-8% general anesthesia. Difficulty in airways management is a major cause of morbidity & mortality in anesthetic practice. Difficult laryngoscopy is considered as a surrogate indicator of difficult intubation. The ability to identify patients at risk of difficult tracheal intubation is important especially in patients with apparently normal airways. The diagnostic accuracy of the screening tests varies between different studies. This is attributed to the difference in incidence of difficult laryngoscopy and intubation, inadequate statistical power and difference in patient characteristics. SMD, RHTMD, ULBT etc., are the mostly cited pre-operative tests to predict the absence or presence of difficult laryngoscopy grade. These tests are very cheap, simple and easily applicable in clinical practice by any level of anesthesia professionals. In this study we could determine the predictive value of RHTMD as a pre-operative screening test in assessing difficult airway.

KEYWORDS :

INTRODUCTION

The anesthesiologists are very concerned with airway control. Tracheal intubation difficulty, which may result in intubation failure or delay, greatly raises the morbidity and mortality of general anaesthesia.¹

Maintaining the airway patent is every anesthesiologist's first priority since failing to do so and failing to oxygenate will have disastrous consequences. A significant contributor to anesthesia-related morbidity, death, and legal disputes are occurrences involving the airway.² Inability to foresee a difficult airway continues to be one of the primary causes of difficult or unsuccessful intubation.³

The cornerstone of effective airway management is a comprehensive preoperative airway examination since an unexpectedly difficult airway often results in a poorer outcome. To provide accurate predictors for a problematic airway, several investigations have been carried out. Bedside tests that are quick, simple, and don't need specialized equipment have been the subject of several research, however each of these tests has its flaws and isn't fully comprehensive.¹

Despite the existence of several predictors and clinical tests, not a single test is capable of accurately predicting every instance of difficult laryngoscopy. Only 50 percent of the challenging airways we encountered can be accurately anticipated before surgery.⁴ (Baker) High sensitivity, specificity, and PPV are desirable characteristics in an airway predictor. Low false negative prediction is more significant since a false negative prediction might be fatal. False positive results are crucial because other procedures to managing problematic airways may entail more time and money at the expense of patient pain.⁵

For predicting problematic airways, a number of preoperative airway assessment tests have been utilized, including the modified Mallampati test (MMT), thyromental distance (TMD),

Sternomental distance (SMD), and ratio of height to thyromental distance (RHTMD).^{6,7} Nevertheless, no single test or set of tests has been shown to be the most accurate predictor of a problematic airway.

Thyromental height test (TMHT), a novel airway predictor, was recently shown by Etezadi et al. to have a higher predictive value than MMT, TMD, and SMD.⁸ In comparison to MMT, TMD, and SMD, RHTMD has been repeatedly found to be a superior predictor of difficult airway.^{9,10} More difficult laryngoscopy is correlated with shorter thyromental height. In order to enhance the laryngoscopic vision in patients with anterior larynx, rearward, upward, and rightward pressure is applied. This raises the thyromental height.¹¹

As a result, the RHTMD has become one of the most effective techniques for identifying the problematic airway. However, there aren't many studies on the topic in India, and none were discovered in our context. As a result, we carried out the following study in Government Medical College Thrissur, Kerala.

METHOD

The ratio of height to thyromental distance of the study subjects was measured during pre-anaesthetic check up in the OPD after obtaining their informed consent. During elective surgery the anaesthesiologist, documented the Cormack and Lehane laryngoscopy grading during endotracheal intubation, after performing the routine intubation protocol.

Operational definitions: ASA Physical status I and II, ASA - I Healthy patients, ASA - II Mild to moderate systemic disease caused by the surgical Condition or by other pathological processes, but medically well controlled.

Thyromental distance – Distance from the mentum to thyroid notch, while patients' neck is fully extended. A value of less than 6 cm predicts difficult laryngoscopy

Study design: A prospective single blinded observational study

Study setting: Department of Anaesthesiology, Government Medical College, Thrissur.

Study population: Patients in the age group of 18-60 years undergoing elective surgery in Government Medical College, Thrissur

Study period: One year after getting Institutional Research and Ethics Committee approval

Eligibility criteria

Inclusion criteria: Adult patients of either gender in 18-60 years age group of American Society of Anesthesiology (ASA) physical status I and II scheduled for elective surgery under general anesthesia with endotracheal intubation.

RESULTS

The study was done in Govt. Medical College, Thrissur on 173 patients undergoing elective surgery under general anesthesia. Height, thyromental distance, sternomental distance and BMI of the patients were assessed during pre-anesthetic checkup Cormack Lehane Grading was assessed during Direct laryngoscopy.

Data was entered in Microsoft Excel software and analyzed using R Software version 4.0.1.

The continuous variable like age, height, weight, BMI, Thyromental distance, RHTMO, SMD etc. were Summarized as mean and standard derivation. Categorical variables like MPC difficult airway were summarized as frequencies and percentages ROC (Receiver Operating Characteristic Curve) analysis was done to detect the cut off of RHTMD to identify difficult intubation. Sensitivity, Specificity, Positive and negative predictive values were calculated. MMPC and ULBT grand cut off identified in ROC analysis was used to predict difficult laryngoscopic view.

Sex

Frequency			Percent
	male	87	50.3
	female	86	49.7
	Total	173	100.0

MMPC Class

Frequency			Percent
	1	43	24.9
	2	94	54.3
	3	24	13.9
	4	12	6.9
	Total	173	100.0

Incidence of difficult airway was 20.8%. MMPC Difficult airway

Frequency			Percent
	Yes	36	20.8
	No	137	79.2
	Total	173	100.0

ULBT Class

Frequency			Percent
	1	35	20.2
	2	99	57.2
	3	29	16.8
	4	10	5.8
	Total	173	100.0

ULBT Difficult Airway

Frequency			Percent
	Yes	39	22.5
	No	134	77.5
	Total	173	100.0

	Mean	SD	Median	IQR
Age	44.8	11	46	38,55
Height	159.5	6	159	155,164
Weight	63.6	8.1	62	58,68
BMI	25	2.7	24.6	23.3,26
TMD	7.1	0.5	7.2	6.8,7.5
RHTMD	22.5	1.4	22.5	21.4,23.1
SMD	12.5	0.2	12.4	12.4,12.5

Patients with difficult airway were significantly shorter than the patients without difficult airway ($p<0.05$)

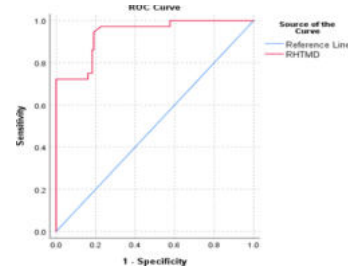
	MMPC Difficult airway	N	Mean Rank	p value
Age	Yes	36	74.88	0.102
	No	137	90.19	
	Total	173		
Patients Height (cm)	Yes	36	60.35	<0.001
	No	137	94.00	
	Total	173		
Weight (Kg)	Yes	36	77.08	0.181
	No	137	89.61	
	Total	173		
BMI	Yes	36	86.46	0.942
	No	137	87.14	
	Total	173		

Patients with difficult airway had significantly shorter Thyromental Distance than the patients without difficult airway ($p<0.05$)

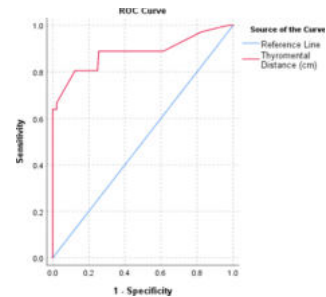
Patients with difficult airway had significantly higher RHTMD than the patients without difficult airway ($p<0.05$)

Patients with difficult airway had significantly shorter Sternomental Distance than the patients without difficult airway ($p<0.05$)

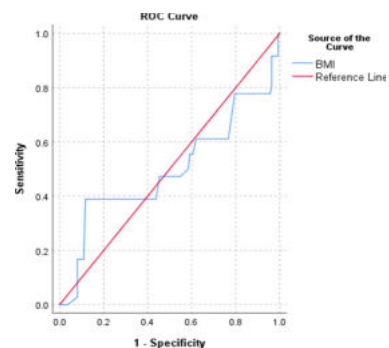
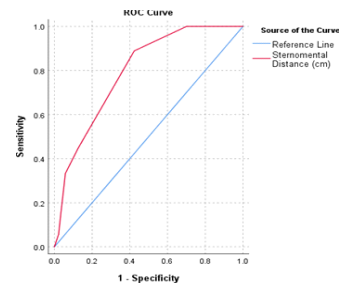
The AUC for RHTMD to predict difficult airway was 0.938 ($p<0.001$). RHTMD is a significant predictor of difficult airway. The ideal cut off is 22.64



The AUC for TMD to predict difficult airway was 0.883 ($p<0.001$). TMD is a significant predictor of difficult airway. The ideal cut off is 6.9



The AUC for SMD to predict difficult airway was 0.794 ($p<0.001$). SMD is a significant predictor of difficult airway. The ideal cut off is 12.45. The AUC for BMI to predict difficult airway was 0.496 ($p=0.950$).



Diagnostic values of the various parameters

	Sensitivity	Specificity	PPV	NPV
RHTMD	94.4	81	56.7	98.2
TMD	80.6	87.6	63	94.5
SMD	88.9	57.7	35.6	95.2

BMI	38.9	88.3	46.7	84.6
ULBT	100	97.8	92.3	100

The accuracy of TMD in our study was found to be 86.1%, higher than RHTMD. This is similar to the findings of Shobha et al (86.2%), but lower than the findings of Kaniyil et al (95%) and Panjiar et al (87.1%).1,3,5

CONCLUSION

The incidence of difficult laryngoscopy was found to be 20.8% among the patients who were included in the study. RHTMD had the highest sensitivity in predicting difficult laryngoscopy in our settings. TMD and ULBT had better accuracy. SMD has the lowest accuracy among the studied parameters. This may be because metacentric studies are to be conducted by including other potential predictors like lower lip to chin distance and neck circumference to validate and expand our findings.

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