

# A Prospective Comparative Study of Upper Lip Bite Test, Thyromental Distance, Sternomental Distance and Modified Mallampati with Cormack Lehane Grading for Predicting Difficulty During Endotracheal Intubation

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## Abstract

**Background:** Numerous tests for predicting difficult laryngoscopy and intubation have been incorporated in our routine anaesthesia practice. Failure to predict a Difficult laryngoscopy and intubation can cause increased risk of complications to patient ranging from sore throat to airway trauma, it may also lead to serious complications like hypoxic brain damage and death. Our study aimed at assessing the efficacy of preoperative airway assessment for predicting a difficulty airway with regard to Cormack Lehane grading on direct laryngoscopy. **Objective:** To predict difficulty in larngoscopy and intubation using upperlip bite test, thyromental distance, sternomental distance and modified Mallampati with regard to Cormack lehane grading. **Subjects and Methods:** Hospital based prospective study. **Study area:** Department of Anaesthesia, at YASHODA HOSPITAL, Malakpet branch, Hyderabad, Telangana. Study Period: April 2022 – March 2023. **Study design:** 100 patients aged between 18-70 years were included in the study. After obtaining informed consent, information was collected from patients who fulfilled our selection criteria. Relevant history and systemic conditions of the patients were noted. Malampatti Grading (MPG), Sternomental Distance (SMD), Thyromental Distance(TMD) And Upper Lip Bite Test(ULBT) were performed in every patient and their efficacy in predicting a difficult airway was assessed by comparing the Cormack – lehane grading on direct laryngoscopy view. **Results:** According to our study ULBT and MPG were better in predicting a difficult airway on laryngoscopy with had sensitivity 88.9% & 83.3% and specificity of 97.6% & 90.2% respectively. TMD and SMD had poor PPV of 47.8% and 48.1% respectively. **Conclusion:** Our study found that ULBT and MPG were were good predictors for both easy and difficult airways. However, SMD and TMD could predict an easy intubation accurately but failed in predicting a difficult laryngoscopy.

**Keywords:** Mallampati grading, Sternomental Distance, Upper Lip Bite Test, Thyromental Distance, Cormack- Lehane Grading.

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**Received:** 05 January 2023

**Revised:** 01 February 2023

**Accepted:** 12 February 2023

**Published:** 11 April 2023

## Introduction

Managing a difficult airway is one of the most relevant issues and core competency for practicing Anaesthesiologists.<sup>[1]</sup> poor airway management can result in range of complications from minor such as oral trauma up to an increased risk of aspiration, hypoxia, cerebral damage and death from inability to oxygenate.<sup>[2]</sup> A Failure to assess for potential difficulties, or the application of poor judgment in planning and management of the airway, may contribute to a poor outcomes.<sup>[3,4]</sup> According to American Society of anesthesiologists, the incidence of difficult and failed intubation in operating room is 1.2- 3.8% and 0.13 – 0.30% respectively while incidence of difficult intubation in ICU or emergency dept. is 20%.<sup>[5]</sup> Airway assessment is the first and foremost step in formulating an appropriate airway plan,

and also incorporate steps to manage an unexpected difficult airway. The role of airway assessment is to identify potential problems with the maintenance of oxygenation and ventilation during airway management.<sup>[6]</sup> Airway assessment should be done for all patients irrespective of the type of anaesthesia planned. Various tests like upper lip bite test, mallampatti grading, neck distances etc have been incorporated in the routine anaesthesia practice but no single test has an adequate accuracy in predicting a difficult airway. Our study aimed at assessing the efficacy of these parameters for predicting a difficulty airway with regard to Cormack Lehane grading on direct laryngoscopy.

## Subjects and Methods

The study was conducted in Yashoda hospital, malakpet,

Hyderabad. After obtaining the ethics committee approval 100 patients between 18-70 years undergoing elective surgeries were included in the study. Exclusion criteria: 1. Edentulous patients 2. Those unable to open mouth 3. Patients with cervical spine fractures and deformities 4. Patients with airway tumors 5. Patients with facial bone injuries. The detailed pre anaesthetic check-up was done. Routine investigations were noted. Airway assessment was done and study parameters were noted on a separate sheet. To reduce the bias airway assessment was done by the same observer for all patients. For mallampatti grading, the patient was put in the sitting position with the head in the neutral position, and the mouth was opened and as widely as possible and tongue protruded out. The patient stuck his/her tongue out of his/her mouth if possible. The observer used a penlight to observe the pharyngeal structure. Second, the thyromental distance was measured when the patient extended his neck, the distance from the thyroid notch to the end of the chin was measured using 3 knuckles (approximately 6-6.5 cm). Sterno-mental distance was measured from the suprasternal notch to the mentum and measured with the head fully extended on the neck with the mouth closed (difficult airway <12cm). Lastly, the ULBT was done in the upright sitting position with the jaw protruded, and the ability of the lower teeth to bite the upper lip was recorded as 3 classes. Class I was when the lower teeth was able to bite the upper vermilion line and completely cover the upper lip membrane. Class II was when the lower teeth bit below the upper vermilion line so that only some of the membrane was covered. Class III was when the lower teeth could not bite the upper lip.

**Table 1: Airway Assessment Grading**

AIRWAY	SCORE		
	0	1	2
MALLAMPATTI GRADING	I	II	III-IV
TMD (cm)	>6.5	6.5	<6.5
SMD (cm)	>12	12	<12
UPLBT	I	II	III

Laryngoscopy was graded as easy, borderline and difficult for 0,1 and 2 score respectively

Inside the operating theatre, ASA standard monitoring devices were attached. Before anaesthetic induction preoxygenation was done for 3 minutes. patients were premedicated with 0.2 mg glycopyrrolate IV, midazolam 1mg. Anaesthesia induction was done with 2mcg/kg Fentanyl and iv propfol 1-2 mg/kg. After checking for loss of consciousness and adequate mask ventilation, 0.8 mg/kg rocuronium was administered intravenously. For laryngoscopy and intubation, the patient was put into the sniffing position, and endotracheal intubation was performed using a Macintosh blade 3 or 4 size blade. Cormack- Lehane grading of 1 - 2 were considered easy and 3 - 4 difficult laryngoscopy respectively. To eliminate interobserver bias a single doctor performed the laryngoscopy. The patients were intubated with 7 and 8 sized cuffed endotracheal tubes for females and males respectively. Anaesthesia was maintained with sevoflurane and at the end of surgery patients were extubated after recovery of neuromuscular blockade. A maximum of three

attempts were allowed with conventional laryngoscope. In case of failure of first two attempts, third attempt was by another senior experienced anesthesiologist. If there was failure to intubate at third attempt, alternate measures such as use of supraglottic device, bougie was done as per the discretion of attending anesthesiologist. External laryngeal manipulation was used to improve visualization after first attempt. Use of additional gadgets/manoeuvres during intubation was noted. Oxygenation was ensured in between attempts at intubation. Confirmation of intubation was done by bilateral auscultation of lung fields and capnography. The number of intubation attempts, the number of additional procedures, the use of different intubation skills, Cormack and Lehane's classification of laryngeal view, the lifting force when laryngoscopy used, external laryngeal pressure manoeuvre were noted.

### Statistical Analysis:

Data were entered in MS-Excel and analyzed in SPSS V25. Descriptive statistics were represented with percentages. Kappa statistics was applied to find the agreement. Multivariate logistic regression with Backward LR method was applied. ROC curve was drawn. Area under the curve was calculated. Sensitivity and specificity were calculated. P<0.05 was considered as statistically significant. Diagnostic statistics such as Sensitivity, Specificity, PPV, NPV, and Accuracy will be obtained to prediction of difficulty

## Results

Out of 100 patients, majority of patients belonged to 21-50 years of age (79%), 64% were females and 36% males. Out of total 100 patients studies 81 patients (81%) were of ASA Grade I, 17 patients (17%) were of ASA Grade II and 2 patients (2%) were of ASA grade III.

Out of total 100 patients studied 18 patients (18%) were of MMC grade I, 59 patients (59%) were of grade II, 18 patients (18%) were of grade III and 5 patients (5%) were of MMC grade IV. 67 patients (67%) were of ULBT grade I, 15 patients (15%) were of ULBT grade II, 18 patients (18%) were of ULBT grade III. Out of 100 patients studies 34 patients (34%) were of TMD grade I (>6.5cms), 43 patients (43%) were of TMD grade II (6-6.5cms), 23 patients (23%) were of TMD grade III (<6cms). 73 patients (73%) were of SMD grade I (>12.5cms), 27 patients (27%) were of SMD grade II (<12.5cms).

**Table 1: Sensitivity, Specificity, PPV, NPV and Accuracy of the Study Parameters**

	SENSITIVITY	SPECIFICITY	PPV	NPV	ACCURACY
MPG	83.3%	90.2%	65.2 %	96.1 %	89%
TMD	61.1%	85.4%	47.8 %	90.9 %	81%
SMD	72.2%	82.9%	48.1 %	93.2 %	81%
ULBT	88.9%	97.6%	88.9 %	97.6 %	96%

In our study amongst the 100 patients examined, 18 patients

had difficult laryngoscopy of Cormack Lehane grade 3 and 4, of which 10 patients were intubated in the first laryngoscopic attempt. These 10 patients were successfully intubated with an external laryngeal manipulation, which improved the glottis view by at least one grade.

Upper lip bite test had high sensitivity and specificity compared to other parameters and reflected the same on ROC curve.

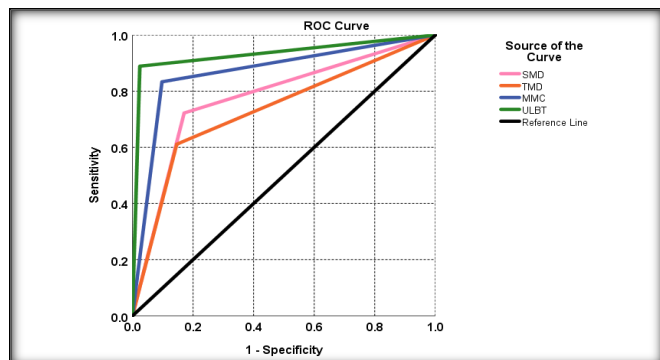


Figure 1: ROC Curve for Various parameters

## Discussion

According to the definition provided by American society of anesthesiologists (ASA), a difficult airway is the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with face mask ventilation, difficulty with tracheal intubation or both.<sup>[7]</sup> Many airway assessment tools have been formulated to predict the difficulty in mask ventilation and difficult laryngoscopy. In our study we assessed 4 parameters namely mallampatti grading, thyromental distance, sternomental distance and upper lip bite test and compared it with Cormack – lehane grading on direct laryngoscopy to predict the ease for intubation.

According to the present study ROC curve MMC and SMD accuracy was better than ULBT and TMD when compared with CL grading. Of all the parameters assessed upper lip bite test had better sensitivity and specificity. A higher score of Sternomental distance and thyromental distance were poor in predicting a difficult airway on laryngoscopy. MPG and ULBT were the best parameters to predict a difficult laryngoscopy and intubation.

A study conducted by Badheka Jigisha prahladrai et al.<sup>[5]</sup> in 2016 showed that ULBT and ratio of height to thyromental distance (RHTMD) had highest sensitivity (96.64%,90.72%) specificity (82.35%,80.39%) PPV of (92.74%, 91.53%) and NPV (91.3%, 78.8%) respectively. Hence ULBT can be used as a single bedside screening test for prediction of difficult intubation, but it should be combined with other airway assessment tests for better airway predictability. Various studies conducted by Hemanth N et al.<sup>[8]</sup>, Arun Kr Gupta et al.<sup>[9]</sup>, R.Bhat et al.<sup>[10]</sup>, El Radaideh et al.<sup>[11]</sup> have observed that ULBT and MPG were better in predicting a difficult laryngoscopy. Bhavdip Patel.<sup>[12]</sup> found that the combination of MMC, TMD, and SMD increases the sensitivity and specificity to 100% and 92.7% respectively. Varghese A et al.<sup>[13]</sup> found that specificities for modified Mallampati, upper lip bite test and sternomental distance were 65.6, 98.9 and 94% respectively. All the tests had a

NPV more than 90%, indicating that, these tests can be good predictors of easy intubation.

A good predictive test should be simple to perform and reproducible in varied group of patients with high accuracy but no single study has been found to be accurate. A combination of these bedside tests should be done to predict a difficult airway. In general, our study found that ULBT and MPG were good predictors for both easy and difficult airways. However, SMD and TMD could predict an easy intubation accurately but failed in predicting a difficult laryngoscopy.

## Conclusion

We conclude that MPG and ULBT are better compared to SMD and TMD in predicting a difficulty in laryngoscopy and intubation. A combination of all 4 parameters is required to accurately predicting the difficult airway.

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**How to cite this article:** Ashwini. U, Vikram Reddy. V, A L Narsimha Reddy, Krishna. S R. A Prospective Comparative Study of Upper Lip Bite Test, Thyromental Distance, Sternomental Distance and Modified Mallampati with Cormack Lehane Grading for Predicting Difficulty During Endotracheal Intubation. *Anaesthesia. Acad. Anesthesiol. Int.* 2023;8(1):1-4.

DOI: [dx.doi.org/10.21276/aan.2023.8.1.1](https://doi.org/10.21276/aan.2023.8.1.1)

**Source of Support:** Nil, **Conflict of Interest:** None declared.