



A COMPARATIVE STUDY OF UPPER LIP BITE TEST WITH OTHER PREDICTOR TESTS FOR PREDICTING DIFFICULTY IN INTUBATION AT A RURAL TERTIARY CARE HOSPITAL

Dr. Swathy Reghunandanan¹, Dr. Amol D Bhalerao², Dr. Pallavi Dnyandev Kamble³

¹Junior Resident Department of Anaesthesiology and Critical Care, Dr Balasaheb Vikhe Patil Rural Medical College, Loni, Maharashtra, India

²Professor Department of Anaesthesiology and Critical Care, Dr Balasaheb Vikhe Patil Rural Medical College, Loni, Maharashtra, India

³Assistant Professor Department of Anaesthesiology and Critical Care, Dr Balasaheb Vikhe Patil Rural Medical College, Loni, Maharashtra, India



Correspondence:

Dr. Swathy Reghunandanan

Received: January 02, 2026

Revised: January 27, 2026

Accepted: February 10, 2026

Published: February 16, 2026

Abstract

Background: Unanticipated difficult airway remains a major contributor to anaesthesia-related morbidity and mortality. Several bedside airway assessment tests are available to predict difficult laryngoscopy and intubation; however, no single test has proven completely reliable. The Upper Lip Bite Test (ULBT) is a simple and rapid assessment tool that evaluates mandibular mobility and dentition. This study aimed to compare the predictive accuracy of ULBT with other commonly used airway assessment tests in a rural tertiary care hospital. **Methods:** This prospective, observational, single-blind study was conducted in 320 adult patients (ASA I-II) undergoing elective surgery under general anaesthesia with endotracheal intubation. Preoperative airway assessment included ULBT, Modified Mallampati Score, Ratio of Height to Thyromental Distance, and various distance-based measurements. Laryngoscopy was performed by a blinded senior anaesthesiologist, and laryngeal view was graded using the Cormack-Lehane classification. Difficult laryngoscopy was defined as Cormack-Lehane grade III or IV. **Results:** The incidence of difficult laryngoscopy was 10%. ULBT demonstrated high specificity (98.6%) and overall diagnostic accuracy (95.9%) in predicting difficult laryngoscopy. Compared with other airway predictors, ULBT showed superior specificity and comparable sensitivity, making it a reliable bedside screening tool. **Conclusion:** ULBT is a simple, reliable, and highly specific predictor of difficult intubation and can be effectively incorporated into routine preanaesthetic airway assessment, particularly in resource-limited rural settings.

Keywords: Upper Lip Bite Test; Difficult Intubation; Airway Assessment



This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).

INTRODUCTION

Airway management is a critical responsibility of the anesthesiologist, and failure to anticipate a difficult airway remains a major cause of anesthesia-related morbidity and mortality. (1) Endotracheal intubation, though routinely performed, can become challenging in the presence of anatomical or functional variations of the airway. (2,3) Early and accurate prediction of difficult intubation allows appropriate planning, availability of alternative airway devices, and skilled personnel, thereby reducing complications such as hypoxia, airway trauma, and aspiration. (4)

Several bedside screening tests have been described to predict difficult laryngoscopy and intubation, including the Modified Mallampati classification, thyromental distance, inter-incisor gap, neck mobility, and the Wilson risk score. However, no single test has demonstrated high sensitivity and specificity when used

alone. The Upper Lip Bite Test (ULBT) is a simple, quick, and noninvasive assessment that evaluates mandibular mobility and dentition, and has been proposed as a reliable predictor of difficult intubation. (5,6,7)

In rural tertiary care hospitals, limited resources, high patient load, and variable access to advanced airway equipment underscore the need for an effective and easily applicable predictive test. (8) Our study aims to compare the diagnostic accuracy of the Upper Lip Bite Test with other commonly used airway assessment methods in predicting difficult intubation, with the goal of identifying a practical and reliable tool suitable for routine pre-anesthetic evaluation in rural healthcare settings.

MATERIALS AND METHODS

Citation: Reghunandanan S, Bhalerao AD, Kamble PD A COMPARATIVE STUDY OF UPPER LIP BITE TEST WITH OTHER PREDICTOR TESTS FOR PREDICTING DIFFICULTY IN INTUBATION AT A RURAL TERTIARY CARE HOSPITAL. *Int. J. Med.*, 2026;8(2):225-228.

Study Methodology

This prospective, observational, single-blind study was conducted after obtaining approval from the Institutional Ethics Committee. A total of 320 patients of either sex, aged between 18 and 60 years, belonging to ASA physical status I and II, and scheduled for elective surgery under general anaesthesia with endotracheal intubation, were included in the study over a period of one year.

Written informed consent was obtained from all participants. Patients who were edentulous, had restricted mouth opening, pharyngolaryngeal pathology, history of thyroid or neck surgery, temporomandibular or atlanto-axial joint limitation, congenital facial deformity, or refused consent were excluded from the study.

Preoperative airway assessment was performed by an anaesthesiologist who was not involved in laryngoscopy or intubation.

Each patient underwent evaluation using multiple airway predictive tests including Upper Lip Bite Test (ULBT), Modified Mallampati Score (MMS), Ratio of Height to Thyromental Distance (RHTMD), Hyomental Distance (HMD), Thyromental Distance (TMD), Thyrosternal Distance (TSD), Sternomental Distance (SMD), and Mandibular Length (ML). All measurements were obtained using a standardized measuring tape by a single observer to minimize inter-observer variability. Based on predefined cut-off values from previous studies, ULBT Class III, HMD <3.5 cm,

TSD <6.5 cm, and ML <9 cm were considered predictors of potentially difficult intubation.

All patients were kept nil per oral for 8–10 hours prior to surgery and standard monitoring including ECG, pulse oximetry, and non-invasive blood pressure was applied in the operating theatre.

After premedication and preoxygenation, general anaesthesia was induced using standard anaesthetic agents, followed by neuromuscular blockade. Direct laryngoscopy was performed in the sniffing position using a Macintosh blade (size 3 or 4) by a senior anaesthesiologist with a minimum of three years of experience, who was blinded to the preoperative airway assessment. The laryngoscopic view was graded according to the Cormack–Lehane grading system without the application of external laryngeal pressure during the first attempt.

Cormack–Lehane grades I and II were considered easy visualization, while grades III and IV were considered difficult. Endotracheal intubation was defined as difficult if there was a Cormack–Lehane grade III or IV view, more than three attempts or duration exceeding ten minutes, or failure to intubate. External laryngeal manipulation and adjuncts such as bougie or supraglottic airway devices were used if required and were documented. Confirmation of intubation was done by bilateral chest auscultation and capnography. Data were recorded and later analyzed to determine the correlation between preoperative airway predictors and difficult laryngoscopy and intubation.

RESULTS

Table 1: Demographic Profile and Incidence of Difficult Intubation (n = 320)

Variable	Category	Number (%)
Age (years)	18–40	182 (56.9)
	41–60	138 (43.1)
Sex	Male	176 (55.0)
	Female	144 (45.0)
ASA Grade	I	198 (61.9)
	II	122 (38.1)
Cormack–Lehane Grade	I–II (Easy)	288 (90.0)
	III–IV (Difficult)	32 (10.0)

Table 2: Distribution of Airway Predictive Tests

Airway Test	Easy (%)	Difficult (%)
ULBT	Class I–II: 290 (90.6)	Class III: 30 (9.4)
Modified Mallampati	Class I–II: 262 (81.9)	Class III–IV: 58 (18.1)
RHTMD	<23.5: 250 (78.1)	≥23.5: 70 (21.9)
Hyomental Distance	≥3.5 cm: 286 (89.4)	<3.5 cm: 34 (10.6)
Thyromental Distance	≥6 cm: 270 (84.4)	<6 cm: 50 (15.6)
Thyrosternal Distance	≥6.5 cm: 292 (91.3)	<6.5 cm: 28 (8.7)
Sternomental Distance	≥11 cm: 276 (86.3)	<11 cm: 44 (13.7)
Mandibular Length	≥9 cm: 289 (90.3)	<9 cm: 31 (9.7)

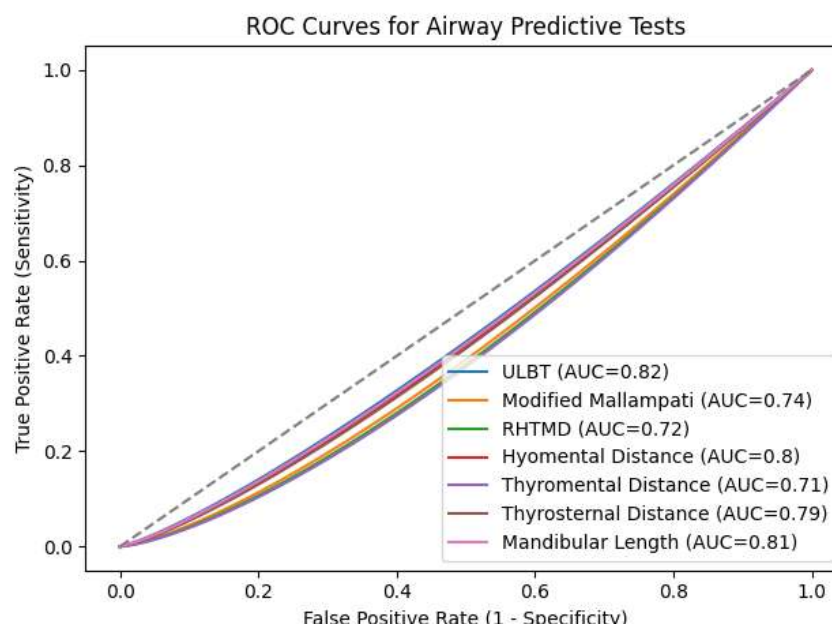
Citation: Reghunandanan S, Bhalarao AD, Kamble PD A COMPARATIVE STUDY OF UPPER LIP BITE TEST WITH OTHER PREDICTOR TESTS FOR PREDICTING DIFFICULTY IN INTUBATION AT A RURAL TERTIARY CARE HOSPITAL. *Int. J. Med.*, 2026;8(2):225-228.

Table 3: Correlation of Airway Predictors with Difficult Laryngoscopy (C-L Grade III-IV)

Airway Test	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
ULBT	65.6	98.6	70.0	97.9
Modified Mallampati	75.0	85.1	41.4	96.0
RHTMD	71.9	82.3	32.9	96.1
Hyomental Distance	68.8	97.2	64.7	96.5
Thyromental Distance	62.5	88.5	40.0	95.0
Thyrosternal Distance	59.4	98.3	67.9	95.6
Mandibular Length	65.6	97.6	67.7	96.7

Table 4: Diagnostic Accuracy of ULBT Compared with Other Airway Tests

Airway Test	Accuracy (%)	Area Under ROC Curve (AUC)
ULBT	95.9	0.82
Modified Mallampati	84.7	0.74
RHTMD	83.1	0.72
Hyomental Distance	94.4	0.80
Thyromental Distance	85.0	0.71
Thyrosternal Distance	95.0	0.79
Mandibular Length	95.3	0.81



Graph – ROC curves for airway predictive tests

DISCUSSION

Anticipation of a difficult airway remains a cornerstone of safe anaesthetic practice, particularly in settings where advanced airway equipment and subspecialty support may be limited. The present prospective observational study evaluated and compared the Upper Lip Bite Test (ULBT) with other commonly used bedside airway assessment tests for predicting difficult laryngoscopy and endotracheal intubation in a rural tertiary care hospital. The overall incidence of difficult laryngoscopy, defined as Cormack–Lehane (C-L) grade III or IV, was 10%, which is consistent with the incidence reported in previous studies, thereby

validating the representativeness of the study population. (8,9,10)

In the present study, ULBT demonstrated a sensitivity of 65.6% and a remarkably high specificity of 98.6%, with an overall diagnostic accuracy of 95.9%. These findings suggest that although ULBT may miss a small proportion of difficult airways, a positive ULBT (Class III) is highly predictive of difficult laryngoscopy. This high specificity makes ULBT particularly useful as a screening tool to “rule in” difficult intubation, which is clinically valuable for planning airway management

Citation: Reghunandanan S, Bhalerao AD, Kamble PD A COMPARATIVE STUDY OF UPPER LIP BITE TEST WITH OTHER PREDICTOR TESTS FOR PREDICTING DIFFICULTY IN INTUBATION AT A RURAL TERTIARY CARE HOSPITAL. *Int. J. Med.*, 2026;8(2):225-228.

strategies. The high negative predictive value further indicates that patients classified as ULBT Class I or II are unlikely to pose difficulty during intubation.

When compared with other airway predictors, Modified Mallampati Score (MMS) showed higher sensitivity but significantly lower specificity. While MMS identified a larger proportion of difficult cases, it also falsely labeled many patients as difficult, reducing its positive predictive value. This limitation of MMS has been widely reported and may be attributed to interobserver variability, patient cooperation, and alteration of pharyngeal anatomy during phonation. In contrast, ULBT is less dependent on patient compliance and observer interpretation, contributing to its consistency and reliability. (11, 12)

Among the distance-based parameters, hyomental distance, thyrosternal distance, and mandibular length demonstrated high specificity and good overall accuracy, comparable to ULBT. These parameters reflect mandibular space, laryngeal position, and submandibular compliance, which are key anatomical determinants of laryngoscopic view. However, their practical applicability may be limited in routine clinical practice due to the need for precise measurement and patient positioning. ULBT, being a quick and equipment-free test, offers a practical advantage without compromising diagnostic performance.

The ratio of height to thyromental distance (RHTMD) showed moderate sensitivity and specificity in the present study. Although it incorporates patient anthropometry, its predictive ability was inferior to ULBT and certain distance-based measurements. Thyromental and sternomental distances also showed moderate diagnostic accuracy, reinforcing the concept that no single airway assessment test is sufficient to predict difficult intubation with absolute certainty.

The findings of this study support the concept that combining airway assessment tests may improve predictive accuracy. However, in resource-limited rural settings, reliance on a simple, rapid, and highly specific test such as ULBT may be particularly beneficial. The study reinforces ULBT as a valuable bedside tool that can be easily incorporated into routine preanaesthetic evaluation.

CONCLUSION

In conclusion, ULBT demonstrated superior specificity and high diagnostic accuracy compared to other

commonly used airway predictors. Its simplicity, reproducibility, and reliability make it a useful screening test for anticipating difficult intubation, especially in rural tertiary care hospitals where early identification and preparedness are critical for patient safety.

REFERENCES

1. Khan ZH, Kashfi A, Ebrahimkhani E. A comparison of the upper lip bite test (a simple new technique) with modified Mallampati classification in predicting difficulty in endotracheal intubation: A prospective blinded study. *Anesth Analg.* 2003;96(2):595–9.
2. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, et al. A clinical sign to predict difficult tracheal intubation: A prospective study. *Can Anaesth Soc J.* 1985;32(4):429–34.
3. Samsoon GLT, Young JRB. Difficult tracheal intubation: A retrospective study. *Anaesthesia.* 1987;42(5):487–90.
4. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. *Anaesthesia.* 1984;39(11):1105–11.
5. Shiga T, Wajima Z, Inoue T, Sakamoto A. Predicting difficult intubation in apparently normal patients: A meta-analysis of bedside screening test performance. *Anesthesiology.* 2005;103(2):429–37.
6. Wilson ME, Spiegelhalter D, Robertson JA, Lesser P. Predicting difficult intubation. *Br J Anaesth.* 1988;61(2):211–6.
7. Krobbuaban B, Diregpoke S, Kumkeaw S, Tanomsat M. The predictive value of the height ratio and thyromental distance: Four predictive tests for difficult laryngoscopy. *Anesth Analg.* 2005;101(5):1542–5.
8. Savva D. Prediction of difficult tracheal intubation. *Br J Anaesth.* 1994;73(2):149–53.
9. Eberhart LH, Arndt C, Aust H, Kranke P, Zoremba N, Wulf H, et al. A simplified risk score to predict difficult intubation. *Anesth Analg.* 2010;111(3):742–7.
10. Huh J, Shin HY, Kim SH, Yoon TK, Kim DK. Diagnostic predictor of difficult laryngoscopy: The hyomental distance ratio. *Anesth Analg.* 2009;108(2):544–8.
11. Yildiz TS, Korkmaz F, Solak M, Toker K, Erciyes N, Bayrak F. Prediction of difficult tracheal intubation in adults: A comparison of preoperative airway assessment tests. *J Clin Anesth.* 2007;19(2):109–15.
12. Adhikari S, Zeger W, Schmier C, Crum T, Harker L, Wang H, et al. Pilot study to determine the utility of point-of-care ultrasound in predicting difficult laryngoscopy. *Acad Emerg Med.* 2011;18(7):754–8.