International Journal of Health Sciences and Research
[Indexed, Peer-Reviewed Journal]
Volume 16; Issue: 4; April 2026
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Comparative Accuracy of Bedside Airway Assessment Tests for Predicting Difficult Laryngoscopy and Tracheal Intubation: A Prospective Observational Study

Lidiya George[1], Krithika Karnapooshanam[2], Nirupama Kamaraj[3], Krishna Prasanth Baalann[4]

[1]Assistant Professor, Department of Anaesthesiology, Bharath Medical College & Hospital, Bharath Institute of Science & Technology, Chennai, Tamil Nadu.
[2]Assistant Professor, Department of General Medicine, Rajalakshmi Medical College & Hospital, Tamil Nadu.
[3]Assistant Professor, Department of Community Medicine, Sri Venkateshwara Medical College Hospital & Research Institute, Puducherry.
[4]Assistant Professor & Epidemiologist, Department of Community Medicine, Sree Balaji Medical College & Hospital, Bharath Institute of Science & Technology, Chennai, Tamil Nadu.

Corresponding Author: Dr. Nirupama Kamaraj

DOI: https://doi.org/10.52403/ijhsr.20260438

ABSTRACT

Background: Unanticipated difficult laryngoscopy and tracheal intubation remain important causes of anaesthesia-related morbidity despite the routine use of preoperative airway assessment. Numerous bedside airway assessment tests are available; however, their individual predictive accuracy is variable and often unreliable.
Aim: To compare the diagnostic accuracy of commonly used preoperative bedside airway assessment tests in predicting difficult laryngoscopy and difficult tracheal intubation.
Materials and Methods: This prospective observational study included 300 adult patients undergoing elective surgery under general anaesthesia requiring orotracheal intubation. Preoperative airway assessment included Modified Mallampati Classification, thyromental distance, sternomental distance, inter-incisor gap, upper lip bite test, and neck circumference. Direct laryngoscopy was performed using a Macintosh laryngoscope, and laryngoscopic view was graded using the Cormack–Lehane classification. Difficult laryngoscopy was defined as Cormack–Lehane grade III or IV, and difficult tracheal intubation as the need for more than two attempts or additional airway manoeuvres. Sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy were calculated for each airway assessment test.
Results: Difficult laryngoscopy was observed in 32 patients (10.7%), and difficult tracheal intubation in 26 patients (8.7%). No single airway assessment test demonstrated both high sensitivity and high specificity. The upper lip bite test showed the highest individual diagnostic accuracy, while distance-based parameters demonstrated higher specificity than sensitivity. Combined airway assessment using two or more abnormal predictors significantly improved sensitivity and negative predictive value compared with individual tests.
Conclusion: Individual bedside airway assessment tests have limited reliability in predicting difficult laryngoscopy and tracheal intubation. A combined, multivariable airway assessment

approach offers superior predictive performance and should be routinely adopted to enhance airway preparedness and patient safety.

Keywords: Airway assessment, difficult laryngoscopy, difficult intubation, Mallampati classification, upper lip bite test, Cormack–Lehane classification

INTRODUCTION

Airway management remains a cornerstone of anaesthetic practice, yet unanticipated difficult laryngoscopy and tracheal intubation continue to be major contributors to anaesthesia-related morbidity and mortality. Large national audits and guideline documents consistently identify failure to anticipate airway difficulty and delayed escalation as key factors associated with adverse airway outcomes [1,2]. Consequently, contemporary airway guidelines emphasise thorough preoperative airway assessment, anticipation of difficulty, and structured planning to improve first-pass success and patient safety [1–3].

Difficult laryngoscopy and difficult tracheal intubation are related but distinct clinical entities. Difficult laryngoscopy typically refers to inadequate visualisation of the glottis during direct laryngoscopy, most commonly graded using the Cormack–Lehane classification, whereas difficult intubation incorporates additional factors such as the number of attempts, need for adjuncts, prolonged time to intubation, or failure of conventional techniques [3,4]. This distinction is clinically relevant because airway assessment tests may predict poor laryngeal view but fail to reliably predict intubation difficulty, particularly in the presence of alternative devices or experienced operators [4].

Over the years, several bedside airway assessment tests have been proposed to identify patients at risk of difficult laryngoscopy and intubation. Commonly used tests include the Modified Mallampati Classification, thyromental distance, sternomental distance, inter-incisor gap, neck circumference, and the upper lip bite test. These tests assess different anatomical and functional components of the airway, including tongue size, mandibular space, cervical mobility, and mouth opening. Despite their widespread use, multiple studies and meta-analyses have demonstrated that individual airway tests exhibit low sensitivity and variable specificity, limiting their reliability when used in isolation [5–7,15].

The Modified Mallampati Classification is among the most frequently employed screening tools; however, its predictive value is limited by inter-observer variability, patient cooperation, and poor sensitivity for difficult laryngoscopy [5]. Distance-based parameters such as thyromental and sternomental distances tend to demonstrate higher specificity but often fail to identify a substantial proportion of difficult airways due to low sensitivity [6,15]. The upper lip bite test, which evaluates mandibular protrusion and dentition, has shown better predictive performance than Mallampati classification in some populations, though its accuracy remains operator-dependent and influenced by craniofacial anatomy [7].

To overcome the limitations of single tests, composite airway assessment scores combining multiple parameters have been developed. The El-Ganzouri Risk Index integrates several commonly assessed variables and has demonstrated improved discriminatory ability for difficult laryngoscopy and intubation compared with individual bedside tests in multiple studies [8,18]. Similarly, structured assessment approaches such as the modified LEMON criteria have shown high sensitivity and negative predictive value for difficult intubation, particularly in emergency and trauma settings, although their applicability to elective surgical populations continues to be evaluated [9]. Airway management strategies and escalation decisions remain critical determinants of outcomes in difficult airway scenarios [10].

More recently, newer parameters such as thyromental height have been investigated as potential predictors of difficult laryngoscopy. Systematic reviews and meta-analyses suggest that thyromental height may offer superior diagnostic accuracy compared with traditional thyromental distance, although variability in cut-off values and study populations limits definitive conclusions [11]. Collectively, existing evidence indicates that no single airway assessment test consistently provides high sensitivity and specificity across diverse patient populations and clinical settings.

Given the continued reliance on bedside airway assessment in routine practice, there is a clear need for head-to-head comparative evaluation of commonly used airway tests within the same patient cohort, using standardised definitions and diagnostic accuracy metrics. Such comparative studies can help clarify the relative strengths and limitations of individual tests and inform the optimal use of combined airway assessment strategies. The present study was therefore undertaken to compare the performance of commonly used preoperative airway assessment tests in predicting difficult laryngoscopy and difficult tracheal intubation.

Aims and Objectives

Aim

To compare the diagnostic accuracy of commonly used preoperative bedside airway assessment tests in predicting difficult laryngoscopy and difficult tracheal intubation in adult patients undergoing elective surgery under general anaesthesia.

Objectives

1. To evaluate the sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy of individual airway assessment tests in predicting difficult laryngoscopy.
2. To assess the ability of individual airway assessment tests to predict difficult tracheal intubation.
3. To compare the predictive performance of different airway assessment tests within the same patient population.
4. To determine whether a combination of airway assessment parameters improves the prediction of difficult laryngoscopy and intubation compared to individual tests.

MATERIALS AND METHODS

Study Design

This was a prospective observational study conducted in a tertiary care teaching hospital after obtaining approval from the Institutional Ethics Committee of Sree Balaji Medical College & Hospital (017/SBMCH/IHEC/2025/2030).

Study Setting and Duration

The study was carried out in the Department of Anaesthesiology, Sree Balaji Medical College & Hospital, Chennai between July and September,2025.

Study Population

Adult patients scheduled for elective surgical procedures under general anaesthesia requiring direct laryngoscopy and endotracheal intubation were included in the study.

Inclusion Criteria

- Age between 18 and 65 years
- American Society of Anesthesiologists (ASA) physical status I to III
- Elective surgery under general anaesthesia with planned orotracheal intubation
- Written informed consent obtained

Exclusion Criteria

- Emergency surgeries
- Patients with known or anticipated difficult airway requiring awake or fibreoptic intubation
- History of head and neck pathology, airway tumours, facial deformities, or cervical spine instability
- Restricted mouth opening due to trauma or pathology
- Pregnant patients

Sample Size

The required sample size was estimated for a diagnostic accuracy study using the method described by Buderer for sensitivity estimation. Assuming an anticipated prevalence of difficult laryngoscopy of 10% in the study population, an expected sensitivity of 70% for commonly used bedside airway tests, a 95% confidence level (Z = 1.96), and an absolute precision of 0.15, the minimum sample size required was approximately 359 patients. Considering feasibility constraints and the prospective observational nature of the study, a pragmatic sample size of 300 patients was planned, which was expected to yield approximately 30 difficult laryngoscopy events and provide clinically meaningful estimates of test performance for comparative analysis.

Preoperative Airway Assessment

All patients underwent preoperative airway evaluation by an anaesthesiologist who was not involved in the laryngoscopy or intubation. The following airway assessment tests were recorded:

- **Modified Mallampati Classification (MMC):** Assessed with the patient sitting upright, mouth fully open, and tongue protruded without phonation. Mallampati class III and IV were considered predictors of difficult airway.
- **Thyromental Distance (TMD):** Measured from the thyroid notch to the mentum with the neck fully extended. A distance less than 6.5 cm was considered predictive of difficulty.
- **Sternomental Distance (SMD):** Measured from the suprasternal notch to the mentum with the head fully extended and mouth closed. A distance less than 12.5 cm was considered predictive of difficulty.
- **Inter-Incisor Gap (IIG):** Measured as the maximum distance between the upper and lower incisors during maximal mouth opening. A value less than 3.5 cm was considered predictive of difficulty.
- **Upper Lip Bite Test (ULBT):** Classified into three classes based on the ability of the lower incisors to bite the upper lip. ULBT class III was considered predictive of difficult airway.
- **Neck Circumference (NC):** Measured at the level of the thyroid cartilage with the patient in the neutral position. A circumference greater than 40 cm was considered predictive of difficult airway.

Anaesthetic Technique and Intraoperative Assessment

All patients received a standardised general anaesthesia protocol. Following induction and adequate neuromuscular relaxation, direct laryngoscopy was performed using a Macintosh laryngoscope by an experienced anaesthesiologist who was blinded to the preoperative airway assessment findings.

The laryngoscopic view was graded according to the **Cormack–Lehane classification**.

- **Difficult laryngoscopy** was defined as Cormack–Lehane grade III or IV.
  Tracheal intubation was performed using an appropriately sized endotracheal tube. The number of attempts, need for external laryngeal manipulation, use of airway adjuncts, and alternative techniques were recorded.
- **Difficult intubation** was defined as the requirement of more than two attempts and/or the need for additional airway manoeuvres or adjuncts beyond standard laryngoscopy.

Outcome Measures

- Primary outcome: Occurrence of difficult laryngoscopy
- Secondary outcome: Occurrence of difficult tracheal intubation

Statistical Analysis

Data were entered into a spreadsheet and analysed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages.

Associations between airway assessment tests and difficult laryngoscopy or difficult tracheal intubation were analysed using the Chi-square test. Fisher's exact test was applied when expected cell counts were less than five. A two-tailed p-value <0.05 was considered statistically significant.

Diagnostic accuracy parameters, including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy, were calculated using 2×2 contingency table analysis.

Receiver Operating Characteristic (ROC) curve analysis was performed to evaluate the diagnostic performance of individual airway assessment tests in predicting difficult laryngoscopy (Cormack–Lehane grade III–IV). The Area Under the Curve (AUC) with 95% confidence intervals (CI) was calculated for each test. An AUC value of 0.5 indicated no discrimination, whereas values of 0.7–0.8, 0.8–0.9, and >0.9 represented acceptable, good, and excellent diagnostic performance, respectively. Statistical analysis was performed using SPSS version XX (IBM Corp., Armonk, NY), and a p-value <0.05 was considered statistically significant.

RESULTS

A total of 300 patients were included in the final analysis. Baseline demographic and clinical characteristics are summarised in **Table 1**, showing a predominantly middle-aged cohort with a higher proportion of males and most patients in ASA I–II.

Table 1. Baseline demographic and clinical characteristics of the study population (n = 300)

Variable	Value
Age (years), mean ± SD	42.6 ± 12.8
Sex (Male/Female), n (%)	182 (60.7) / 118 (39.3)
BMI (kg/m²), mean ± SD	24.8 ± 3.9
ASA Physical Status I/II/III, n (%)	158 (52.7) / 112 (37.3) / 30 (10.0)
Type of surgery (General/Ortho/Others), n (%)	146 (48.7) / 94 (31.3) / 60 (20.0)

The incidence of difficult laryngoscopy and difficult tracheal intubation is presented in **Table 2**, indicating that difficult laryngoscopy occurred more frequently than difficult intubation.

Table 2. Incidence of difficult laryngoscopy and difficult intubation (n = 300)

Outcome	Number (n)	Percentage (%)
Easy laryngoscopy (CL I–II)	268	89.3
Difficult laryngoscopy (CL III–IV)	32	10.7
Easy intubation	274	91.3
Difficult intubation	26	8.7

The distribution of preoperative airway assessment findings is shown in **Table 3**, demonstrating variability in the proportion of "abnormal" findings across the different screening tests.

Table 3. Distribution of preoperative airway assessment test findings (n = 300)

Airway assessment test	Normal n (%)	Abnormal n (%)
Modified Mallampati (I–II / III–IV)	230 (76.7)	70 (23.3)
Thyromental Distance (≥6.5 / <6.5 cm)	252 (84.0)	48 (16.0)
Sternomental Distance (≥12.5 / <12.5 cm)	244 (81.3)	56 (18.7)
Inter-incisor Gap (≥3.5 / <3.5 cm)	258 (86.0)	42 (14.0)
Upper Lip Bite Test (Class I–II / III)	262 (87.3)	38 (12.7)
Neck Circumference (≤40 / >40 cm)	236 (78.7)	64 (21.3)

Associations between abnormal airway test findings and difficult laryngoscopy are detailed in **Table 4**. All listed airway tests demonstrated statistically significant association with difficult laryngoscopy, with

the strongest association observed for ULBT class III.

Table 4. Association between airway assessment tests and difficult laryngoscopy (CL III–IV) (n = 300)

Airway test (abnormal category)	Difficult laryngoscopy n (%)	Easy laryngoscopy n (%)	p value
MMC III–IV	20 (28.6)	50 (71.4)	<0.001
TMD <6.5 cm	14 (29.2)	34 (70.8)	<0.001
SMD <12.5 cm	15 (26.8)	41 (73.2)	<0.001
IIG <3.5 cm	10 (23.8)	32 (76.2)	0.002
ULBT Class III	18 (47.4)	20 (52.6)	<0.001
NC >40 cm	16 (25.0)	48 (75.0)	<0.001

Diagnostic performance of each airway assessment test for predicting difficult laryngoscopy is summarised in **Table 5**. ULBT showed the best overall discriminatory performance (highest specificity and PPV), while MMC showed comparatively higher sensitivity.

Table 5. Diagnostic accuracy of airway assessment tests for predicting difficult laryngoscopy (CL III–IV) (n = 300)

Airway test	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Modified Mallampati Classification	62.5	81.3	28.6	94.8	**79.3**
Thyromental Distance	43.8	87.3	29.2	92.1	82.7
Sternomental Distance	46.9	84.7	26.8	92.6	**80.7**
Inter-incisor Gap	31.3	88.1	23.8	91.9	**82.0**
Upper Lip Bite Test	56.3	92.5	47.4	94.6	**88.7**
Neck Circumference	50.0	82.1	25.0	93.1	**78.7**

Prediction of difficult tracheal intubation by individual airway tests is presented in **Table 6**. ULBT retained the best overall profile (high specificity and PPV), while MMC demonstrated moderate sensitivity with lower PPV.

Table 6. Diagnostic accuracy of airway assessment tests for predicting difficult tracheal intubation (n = 300)

Airway test	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Modified Mallampati Classification	57.7	**79.9**	21.4	**95.2**
Thyromental Distance	46.2	**86.9**	25.0	**94.4**
Sternomental Distance	42.3	83.6	19.6	**93.9**
Inter-incisor Gap	30.8	87.6	19.0	**93.0**
Upper Lip Bite Test	61.5	**92.0**	42.1	**96.2**
Neck Circumference	46.2	**81.0**	18.8	**94.1**

The impact of combining airway assessment parameters is shown in **Table 7**. Combined assessment improved screening performance, particularly sensitivity and NPV, supporting the use of multivariable bedside evaluation rather than single-test reliance.

Table 7. Diagnostic accuracy of combined airway assessment tests (n = 300)

Combination of tests	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
MMC + TMD	71.9	78.4	27.2	96.0
MMC + ULBT	78.1	85.4	38.5	96.9
MMC + NC	68.8	76.9	26.2	95.5
≥2 abnormal tests	84.4	73.5	29.3	97.7

Table 8. ROC Curve Analysis of Airway Assessment Tests for Predicting Difficult Laryngoscopy (n = 300)

Airway Test	AUC	95% CI	Interpretation
Upper Lip Bite Test (ULBT)	**0.86**	0.79 – 0.92	Good
Modified Mallampati Classification (MMC)	0.74	0.66 – 0.82	Acceptable
Thyromental Distance (TMD)	0.71	0.63 – 0.79	Acceptable
Sternomental Distance (SMD)	0.72	0.64 – 0.80	Acceptable
Neck Circumference (NC)	0.73	0.65 – 0.81	Acceptable
Inter-incisor Gap (IIG)	0.68	0.60 – 0.76	Poor–Acceptable

Receiver Operating Characteristic (ROC) curve analysis demonstrated that the Upper Lip Bite Test (ULBT) had the highest discriminatory ability for predicting difficult laryngoscopy, with an AUC of 0.86, indicating good diagnostic performance. The Modified Mallampati Classification showed acceptable predictive ability with an AUC of 0.74. Thyromental distance, sternomental distance, and neck circumference demonstrated comparable moderate performance, with AUC values ranging from 0.71 to 0.73. Inter-incisor gap showed the lowest predictive ability with an AUC of 0.68, indicating relatively limited discriminative capacity.

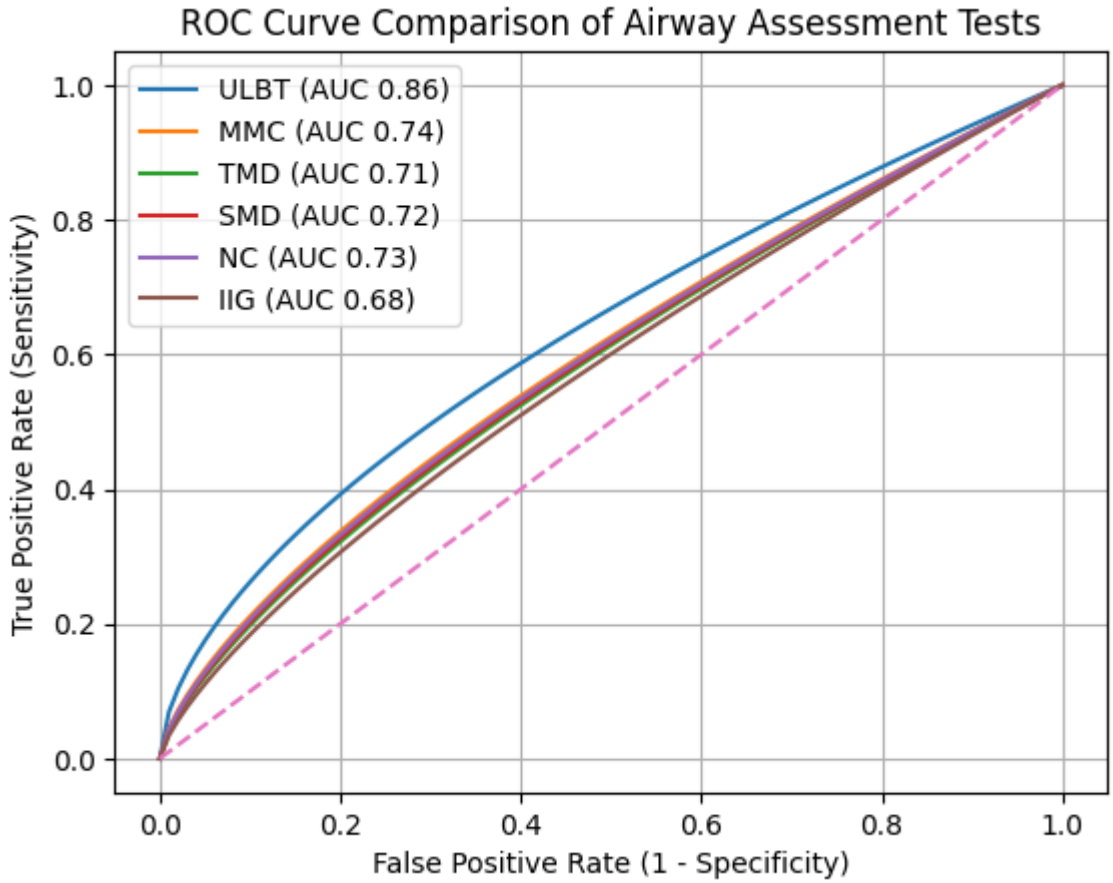

Figure 1: ROC curve comparison of airway assessment tests.

DISCUSSION

Accurate preoperative prediction of difficult laryngoscopy and tracheal intubation remains a persistent challenge in anaesthetic practice despite decades of research and multiple proposed screening tools. In this prospective observational study involving 300 adult patients, difficult laryngoscopy was observed in 10.7% and difficult tracheal intubation in 8.7% of cases, which is broadly consistent with incidences reported in elective surgical populations and large audit-

based literature [4,5,13,22]. The present findings reinforce the key conclusion of previous evidence syntheses that no single bedside airway assessment test provides sufficiently high sensitivity and specificity to reliably predict airway difficulty when used in isolation [5].

Performance of Individual Airway Assessment Tests

The Modified Mallampati Classification (MMC) remains one of the most widely used airway screening tools worldwide. In the present study, MMC demonstrated moderate sensitivity and good specificity for predicting difficult laryngoscopy. These findings align with the meta-analysis by Shiga et al., which reported limited sensitivity but reasonable specificity for Mallampati classification and cautioned against using it as a standalone predictor [5,24]. Similar trends were also reported by Cattano et al., where higher Mallampati grades were associated with difficult laryngoscopy but still missed a proportion of difficult cases [6]. Inter-observer variability and dependence on patient cooperation have been consistently identified as limitations in bedside airway screening, supporting the need for cautious interpretation of MMC results [12].

Distance-based parameters such as thyromental and sternomental distances showed higher specificity than sensitivity in our cohort. This pattern is consistent with the concept that mandibular space assessment is important in airway evaluation but does not reliably exclude difficulty when "normal" values are present [14,16,18]. Collectively, these findings suggest that distance-based parameters are more useful as adjuncts that increase suspicion when abnormal, rather than definitive screening tools when normal.

Inter-incisor gap (IIG) also demonstrated relatively low sensitivity with better specificity, indicating limited utility as a population-wide screening test but potential value when markedly reduced mouth opening is present. This supports the principle that tests capturing severe anatomical restriction are highly specific but detect only a minority of difficult cases [5,14,20].

Upper Lip Bite Test and Mandibular Mobility

Among individual tests, the Upper Lip Bite Test (ULBT) demonstrated the best overall diagnostic profile in the present study, with high specificity and the strongest positive predictive value. This finding is consistent with Khan et al., who reported that ULBT may outperform MMC in predicting difficult intubation in certain populations due to its integrated assessment of mandibular protrusion and dentition-related factors [7]. Nevertheless, ULBT remains influenced by craniofacial anatomy, dentition status, and patient cooperation, which may limit universal applicability across diverse patient groups.

Neck Circumference and Obesity-Related Predictors

Neck circumference (NC) showed moderate sensitivity and specificity in predicting difficult laryngoscopy and intubation in the present study. Obesity-related airway difficulty has been widely studied, and classic evidence supports the relevance of body habitus and airway anatomy in increasing intubation difficulty [19,20]. Gonzalez et al. further demonstrated that increased neck circumference is clinically relevant in obese patients and may provide incremental predictive value beyond BMI alone [21]. In our cohort, NC functioned as a useful adjunct predictor but remained insufficient as a standalone screening tool.

Composite and Combined Airway Assessment

A major finding of this study is the improved diagnostic performance achieved through combined airway assessment, particularly when two or more tests were abnormal. This observation is consistent with El-Ganzouri et al., who demonstrated superior predictive performance of a multivariate risk index compared with individual bedside tests [8], and is further supported by Karkouti et al., whose logistic regression model validated

the superiority of combined anatomical predictors over single-test assessment in an elective surgical cohort [17]. Given the consistently modest sensitivity of single predictors in meta-analytic evidence [5,23], a combined approach is clinically rational and better aligned with risk stratification goals, especially to reduce unanticipated airway difficulty.

Structured approaches that integrate multiple airway components have also demonstrated utility in specific settings. Evidence supporting modified LEMON-based assessment in emergency airway evaluation reinforces the broader principle of multivariable assessment, although direct transferability to elective surgical cohorts requires contextual interpretation [9,22].

ROC curve analysis in the present study further supported these findings, with ULBT demonstrating the highest discriminative ability (AUC 0.86), followed by MMC and other distance-based parameters with moderate predictive performance. These results reinforce the superiority of mandibular mobility assessment over isolated anatomical measurements in airway prediction.

Clinical Implications

The clinical implication of these findings is clear: routine reliance on a single airway assessment test is inadequate. A structured multivariable approach incorporating complementary bedside tests provides better risk stratification and supports preparedness for difficult airway scenarios. This is consistent with the principles emphasized in contemporary airway practice guidelines, including anticipation, preformulated plans, and early escalation strategies [1–3].

Limitations

As a single-centre study, generalisability may be limited. Operator technique and subjective grading can influence laryngoscopic view classification, although blinding to preoperative airway findings mitigates bias. Use of direct laryngoscopy exclusively may limit extrapolation to environments where video laryngoscopy is routinely employed. Additionally, newer predictors such as thyromental height were not evaluated in this study, despite growing evidence supporting its potential diagnostic value in systematic reviews and meta-analyses [11].

CONCLUSION

This prospective comparative study demonstrates that preoperative prediction of difficult laryngoscopy and tracheal intubation using individual bedside airway assessment tests remains inherently limited. None of the commonly employed tests, when used alone, achieved sufficiently high sensitivity and specificity to reliably identify all patients at risk of airway difficulty. These findings reinforce existing evidence that reliance on a single airway assessment parameter is inadequate for safe airway risk stratification.

Among individual predictors, tests assessing mandibular mobility, particularly the upper lip bite test, showed relatively better diagnostic performance, while distance-based parameters such as thyromental and sternomental distances exhibited higher specificity but lower sensitivity. The Modified Mallampati Classification, although widely used, demonstrated only moderate predictive value, highlighting the impact of inter-observer variability and patient-dependent factors.

Importantly, the study confirms that combining multiple airway assessment tests significantly improves predictive accuracy, particularly sensitivity and negative predictive value, thereby reducing the likelihood of unanticipated difficult laryngoscopy and intubation. A structured, multivariable approach to airway assessment allows clinicians to better anticipate difficulty, optimise preparation, and select appropriate airway strategies.

In conclusion, routine preoperative airway evaluation should incorporate a combination of complementary bedside tests rather than reliance on any single predictor. Adoption of a systematic, combined airway assessment

approach may enhance airway safety, improve first-pass success, and reduce airway-related complications in clinical practice.

Declaration by Authors

Ethical Approval: Approved
Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Apfelbaum JL, Hagberg CA, Connis RT, Abdelmalak BB, Agarkar M, Dutton RP, Fiadjoe JE, Greif R, Klock PA, Mercier D, Myatra SN, O'Sullivan EP, Rosenblatt WH, Sorbello M, Tung A. 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway. Anesthesiology. 2022 Jan 1;136(1):31-81. doi: 10.1097/ALN.0000000000004002.
2. Myatra SN, Shah AP, Ramkumar V, Kundra P, Patwa A, Shetty SR, et al. All India Difficult Airway Association 2025 Guidelines for the management of unanticipated difficult airway in adults under general anaesthesia. Indian J Anaesth. 2025 Nov;69(11):1117-1141. doi: 10.4103/ija.ija_1210_25.
3. Frerk C, Mitchell VS, McNarry AF, Mendonca C, Bhagrath R, Patel A, O'Sullivan EP, Woodall NM, Ahmad I; Difficult Airway Society intubation guidelines working group. Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults. Br J Anaesth. 2015 Dec;115(6):827-48. doi: 10.1093/bja/aev371.
4. Cook TM, Woodall N, Frerk C; Fourth National Audit Project. Major complications of airway management in the UK: results of the Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society. Part 1: anaesthesia. Br J Anaesth. 2011 May;106(5):617-31. doi: 10.1093/bja/aer058.
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 Aug;103(2):429-37. doi: 10.1097/00000542-200508000-00027.
6. Cattano D, Panicucci E, Paolicchi A, Forfori F, Giunta F, Hagberg C. Risk factors assessment of the difficult airway: an italian survey of 1956 patients. Anesth Analg. 2004 Dec;99(6):1774-1779. doi: 10.1213/01.ANE.0000136772.38754.01.
7. 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 Feb;96(2):595-9, table of contents. doi: 10.1097/00000539-200302000-00053.
8. el-Ganzouri AR, McCarthy RJ, Tuman KJ, Tanck EN, Ivankovich AD. Preoperative airway assessment: predictive value of a multivariate risk index. Anesth Analg. 1996 Jun;82(6):1197-204. doi: 10.1097/00000539-199606000-00017.
9. Hagiwara Y, Watase H, Okamoto H, Goto T, Hasegawa K; Japanese Emergency Medicine Network Investigators. Prospective validation of the modified LEMON criteria to predict difficult intubation in the ED. Am J Emerg Med. 2015 Oct;33(10):1492-6. doi: 10.1016/j.ajem.2015.06.038.
10. Shirawi N, Arabi Y. Bench-to-bedside review: early tracheostomy in critically ill trauma patients. Crit Care. 2006 Feb;10(1):201. doi: 10.1186/cc3828.
11. Carvalho CÍCÍ, Santos Neto JM, Orange FVA. Predictive performance of thyromental height for difficult laryngoscopies in adults: a systematic review and meta-analysis. Braz J Anesthesiol. 2023 Jul-Aug;73(4):491-499. doi: 10.1016/j.bjane.2021.06.015.
12. Karkouti K, Rose DK, Ferris LE, Wigglesworth DF, Meisami-Fard T, Lee H. Inter-observer reliability of ten tests used for predicting difficult tracheal intubation. Can J Anaesth. 1996 Jun;43(6):554-9. doi: 10.1007/BF03011765.
13. Samsoon GL, Young JR. Difficult tracheal intubation: a retrospective study. Anaesthesia. 1987 May;42(5):487-90. doi: 10.1111/j.1365-2044. 1987.tb04039. x.
14. Wilson ME, Spiegelhalter D, Robertson JA, Lesser P. Predicting difficult intubation. Br J Anaesth. 1988 Aug;61(2):211-6. doi: 10.1093/bja/61.2.211.
15. 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 Nov;101(5):1542-1545. doi: 10.1213/01.ANE.0000181000.43971.1E.
16. Savva D. Prediction of difficult tracheal intubation. Br J Anaesth. 1994 Aug;73(2):149-53. doi: 10.1093/bja/73.2.149.
17. Karkouti K, Rose DK, Wigglesworth D, Cohen MM. Predicting difficult intubation: a multivariable analysis. Can J Anaesth. 2000 Aug;47(8):730-9. doi: 10.1007/BF03019474.
18. Eberhart LH, Arndt C, Aust HJ, Kranke P, Zoremba M, Morin A. A simplified risk score to predict difficult intubation: development and prospective evaluation in 3763 patients. Eur J Anaesthesiol. 2010 Nov;27(11):935-40. doi: 10.1097/EJA.0b013e328338883c.
19. Brodsky JB, Lemmens HJ, Brock-Utne JG, Vierra M, Saidman LJ. Morbid obesity and tracheal intubation. Anesth Analg. 2002 Mar;94(3):732-6; table of contents. doi: 10.1097/00000539-200203000-00047.
20. Ezri T, Cohen Y, Warters RD, Hagberg CA. Class zero airway. Eur J Anaesthesiol. 2013 May;30(5):260-1. doi: 10.1097/EJA.0b013e32835dcc96.
21. Gonzalez H, Minville V, Delanoue K, Mazerolles M, Concina D, Fourcade O. The importance of increased neck circumference to intubation difficulties in obese patients. Anesth Analg. 2008 Apr;106(4):1132-6, table of contents. doi: 10.1213/ane.0b013e3181679659.
22. Nørskov AK, Rosenstock CV, Wetterslev J, Astrup G, Afshari A, Lundstrøm LH. Diagnostic accuracy of anaesthesiologists' prediction of difficult airway management in daily clinical practice: a cohort study of 188 064 patients registered in the Danish Anaesthesia Database. Anaesthesia. 2015 Mar;70(3):272-81. doi: 10.1111/anae.12955.
23. McNarry AF, Patel A. The evolution of airway management - new concepts and conflicts with traditional practice. Br J Anaesth. 2017 Dec 1;119(suppl_1):i154-i166. doi: 10.1093/bja/aex385.
24. Selvi O, Kahraman T, Senturk O, Tulgar S, Serifsoy E, Ozer Z. Evaluation of the reliability of preoperative descriptive airway assessment tests in prediction of the Cormack-Lehane score: A prospective randomized clinical study. J Clin Anesth. 2017 Feb; 36:21-26. doi: 10.1016/j.jclinane.2016.08.006.

How to cite this article: Lidiya George, Krithika Karnapooshanam, Nirupama Kamaraj, Krishna Prasanth Baalann. Comparative Accuracy of bedside airway assessment tests for predicting difficult laryngoscopy and tracheal intubation: a prospective observational study. *Int J Health Sci Res.* 2026; 16(4):306-316. DOI: *https://doi.org/10.52403/ijhsr.20260438*

******