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ORIGINAL ARTICLE

Comparative Assessment of Difficult Intubation: Role of Modified Mallampati Test Versus Thyromental Height Test

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Abstract

Background: Challenging intubation presents a frequent and significant obstacle for anesthesiologists, frequently playing a role in anesthesia-related mortality. The Modified Mallampati test (MMT) assesses oropharyngeal structures and provides a simple approach for anticipating possible airway challenges during endotracheal intubation. Recently, the thyromental height test (TMHT) has emerged as a dependable indicator of challenging intubation.

Objective: The goal of this study was to find out which of these preoperative airway assessment techniques TMHT or MMT is better at finding patients who are likely to have trouble with intubation.

Methods: This observational study was carried out in the Medical College for Women & Hospital, Uttara, Dhaka from July 2024 to June 2025, spanning a duration of 12 months. A total of 148 patients with various surgical issues were selected for the study, all undergoing different procedures under general anaesthesia in various operating theatres at Medical College for Women & Hospital, Uttara, Dhaka. Following the acquisition of written consent from each patient or their attendant, a detailed history of the illness was gathered, thorough clinical examinations were conducted, and pertinent laboratory investigations were carried out. MMT and TMHT was done for all patients. All data was meticulously documented in a structured data sheet, and statistical analysis was conducted using SPSS version 22.0.

Results: For the purpose of predicting intubation difficulty, TMHT showed a sensitivity of 94.9%, specificity of 93.3%, positive predictive value of 90.3%, negative predictive value of 96.5%, and accuracy of 93.9%. On the other hand, MMT got a sensitivity of 74.6%, specificity of 88.8%, PPV of 81.5%, NPV of 84.0%, and accuracy of 93.1%.

Conclusion: With higher sensitivity, specificity, positive predictive value, negative predictive value, and accuracy than MMT, this study demonstrates that TMHT is the most pertinent predictive test for difficult intubation.

Key words: Modified Mallampati Test, Thyromental Height Test, Intubation.

Introduction

Anesthesiologists often face the critical obstacle of difficult intubation. Pathak and Sah1 characterize this circumstance as one in which intubation surpasses ten minutes, necessitates more than three attempts by a proficient anesthesiologist, or fails despite the application of ideal laryngoscopic technique.[1] Such circumstances substantially increase perioperative problems and constitute a primary source of anesthesia-related morbidity and mortality.[2] Insufficient airway care may result in grave consequences, such as mortality or irreversible neurological impairment.[2,3] Airway-related complications are estimated to constitute around 32% of anesthesia-related mortality (Pascal et al., 2021).[4] Mallhi et al.[3] (2018) report that the incidences of difficult intubation, failed intubation, and difficult laryngoscopy are 9%, 0.005%, and 12.3%, respectively.[3] These findings underscore the imperative for highly

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dependable preoperative airway evaluations to identify patients susceptible to airway management challenges.[5]

Unanticipated difficult laryngoscopy (DL) or difficult intubation (DI) may lead to severe airway complications, including airway trauma, esophageal intubation, and pulmonary aspiration, which are recognized as major contributors to anesthesia-related perioperative morbidity and mortality (Honarmand et al., 2014; Apfelbaum et al., 2013).[6,7] Difficult laryngoscopy, while not synonymous with difficult intubation, serves as a dependable clinical indicator that frequently suggests a heightened chance of intubation difficulties. Consequently, the existence of a precise and reliable airway assessment tool is essential for safeguarding patient safety during anesthesia. Several bedside assessments have been suggested for the preoperative prediction of difficult laryngoscopy, including the upper lip bite test (ULBT), the modified Mallampati test (MMT), and the measurement of thyromental distance (TMD). Recent investigations consistently illustrate that no single test has adequate sensitivity and specificity for accurately predicting difficult laryngoscopy.[8-11]Ongoing investigation into efficient airway assessment techniques is essential.Etezadi et al.[12] introduced the thyromental height test (TMHT) as a simple, single-parameter preoperative screening method aimed at detecting challenging airways.[12] This assessment involves measuring the vertical distance from the front margin of the mentum to the thyroid cartilage, with the patient in a supine position and the mouth closed. The preliminary study, despite being based on a limited sample, indicated that a threshold of 5 cm yielded an unexpectedly high predictive value for difficult laryngoscopy. Etezadiet al.[12] define thyromental height (TMH) as the vertical distance from the anterior aspect of the thyroid cartilage (located at the thyroid notch between the laminae) to the anterior edge of the mentum (on the mental protuberance), measured with the patient in a supine position and the mouth closed. Subsequent studies have evaluated the effectiveness of TMHT as an independent predictor of difficult laryngoscopy in various populations.[12-16] In order to lessen the complications related to airway management, a study within the local population is necessary to ascertain whether TMHT or MMT is a more reliable and accurate predictor of difficult intubation, given the paucity of locally available published data.

Methods

This observational study was carried out at the Medical College for Women & Hospital, Uttara, Dhaka, over a 12-month duration from July 2024 to June 2025. Ethical approval was obtained from the institutional review board, and written informed consent was collected from all participants before enrollment. A total of 148 patients, aged 18 to 55 years and classified as American Society of Anesthesiologists (ASA) physical status I or II, were included, encompassing both sexes. All patients were scheduled for elective surgeries under general anesthesia necessitating endotracheal intubation. The exclusion criteria included patients with congenital or acquired airway anomalies, neck burn contractures, midline neck masses, edentulous conditions, or those necessitating awake intubation. The pre-anesthetic evaluation encompassed the documentation of demographic and clinical characteristics, including age, sex, weight, height, ASA physical status, and body mass index (BMI). The attending anesthesiologist conducted an airway evaluation, assessing the following predictors:

Modified Mallampati Test (MMT)

The assessment was conducted by directing the patient to adopt an upright posture, fully open their mouth, and protrude their tongue silently. Visibility was categorized as follows: Class I – visibility of the soft palate, fauces, uvula, and both anterior and posterior tonsillar pillars; Class II – visibility of the soft palate, fauces, and uvula; Class III – visibility of the soft palate and the base of the uvula; Class IV – visibility of just the hard palate. MMT scores for Class III and IV were considered symptomatic of difficult laryngoscopy.[17]

The Thyromental Height Test (TMHT) is a procedure that entails measuring the vertical distance from the anterior aspect of the thyroid cartilage, particularly at the thyroid notch located between the laminae, to the anterior edge of the mentum (the mental protuberance of the mandible). This measurement is taken with the patient lying supine and the mouth closed, utilizing a caliper for accuracy. A measurement below 5 cm has been recognized as a potential sign of difficult intubation.[12]

All patients abstained from food for a minimum of eight hours before surgery. Upon entering the operating theatre and documenting baseline vital signs, anesthesia was initiated with intravenous thiopental sodium at a dosage of 3–5 mg/kg of body weight,

subsequently followed by the intravenous administration of the muscle relaxant suxamethonium at 1.5 mg/kg. Following a three-minute pause, a seasoned anesthesiologist—who had not been involved in the preoperative airway assessment—conducted direct laryngoscopy utilizing Macintosh blades sizes #3 and #4, with the patient positioned in the sniffing posture. The ideal intubation position was attained by positioning an 8 cm pillow beneath the patient's head.[18] Tracheal intubation was performed, with accurate placement verified with bilateral lung auscultation and capnographic confirmation.The laryngeal view was evaluated using the modified Cormack–Lehane (CL) grading system, categorized as follows: Grade I – full glottic exposure; Grade II – visualization limited to the posterior commissure of the glottis; GradeIII – visualization restricted to the epiglottis; and Grade IV – epiglottis not visible.[19] For analysis, CL Grades I and II were considered easy laryngoscopy, whereas CL Grades III and IV were classified as difficult laryngoscopy.

Endotracheal intubation was deemed successful upon confirmation by bilateral chest auscultation and capnography. The number of attempts, failed intubations, and any use of adjunctive airway techniques or equipment were systematically documented. Intraoperative monitoring included continuous assessment of pulse rate, non-invasive blood pressure (NIBP), and oxygen saturation (SpO_2), recorded at baseline, following premedication, post induction, and post-intubation.

All data were prospectively collected using a structured proforma, verified for completeness, and entered into a database. Quantitative variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Statistical analyses were performed using SPSS (version 22.0; IBM Corp., Armonk, NY, USA), and a p-value of <0.05 was considered statistically significant. Results were summarized in descriptive and inferential tables as appropriate.

Results

The observational study aimed to evaluate the effectiveness of preoperative anaesthetic airway assessment methods, specifically the Thyromental Height Test (TMHT) and the Modified Mallampati Test (MMT), in predicting challenges related to intubation. The findings are presented below:

Table-I: Baseline characteristics of the study subjects (N=148)

Gender	Frequency (n)	Percentage (%)
Male	59	39.9
Female	89	60.1
	Mean ± SD	Min - max
Age (years)	40.33 ± 13.94	15.00 - 72.00
BMI (kg/m2)	29.51 ± 7.55	20.67 - 107.96
Systolic BP (mmHg)	114.47 ± 6.11	100.00 - 130.00
Diastolic BP (mmHg)	77.70 ± 4.39	65.00 - 89.00
Heart rate (b/min)	80.94 ± 7.26	68.00 - 100.00
SpO2 (%)	98.16 ± 1.06	93.00 - 100.00
Respiratory Rate (breath/min)	12.90 ± 1.00	12.00 - 15.00

Mean age of the study subjects was40.33 ± 13.94 years. Females (60.1%) were enrolled more than males (39.9%). Mean BMI was 29.51 ± 7.55 kg/m^2, systolic BP was 114.47 ± 6.11 mmHg, diastolic BP was 77.70 ± 4.39 mmHg, heart rate was 80.94 ± 7.26 beats/min, SpO_2 was 98.16 ± 1.06% and respiratory rate was 12.90 ± 1.00 breaths/min.

Table-II: Clinical and respiratory parameters after intubation (N=148)

	Mean ± SD	Min - max
Systolic BP (mmHg)	118.45 ± 6.89	100.00 - 135.00
Diastolic BP (mmHg)	78.86 ± 6.73	55.00 - 100.00
Heart rate (b/min)	89.47 ± 12.83	70.00 - 120.00
SpO2 (%)	98.43 ± 1.87	90.00 - 100.00
Respiratory Rate (breath/min)	13.82 ± 1.04	12.00 - 16.00

Unpaired t test was done

Mean systolic BP was 118.45 ± 6.89 mmHg, diastolic BP was 78.86 ± 6.73 mmHg, heart rate was 89.47 ± 12.83 beats/min, SpO2 was 98.43 ± 1.87% and respiratory rate was 13.82 ± 1.04 breaths/min after intubation.

Table-III: Validity of thyromental height test

TMHT	Cormack and Lehane (CL)		p-value
	Difficult	Not difficult	
Difficult intubation	56 (94.9) (TP)	6 (6.7) (FP)	<0.001
No difficult intubation	3 (5.1) (FN)	83 (93.3) (TN)	

Chi-Square test was done

Table-IV: Validity of modified Mallampati test

MMT	Cormack and Lehane (CL)		p-value
	Difficult	Not difficult	
Difficult intubation	44 (74.6) (TP)	10 (11.2) (FP)	<0.001
No difficult intubation	15 (25.4) (FN)	79 (88.8) (TN)	

Chi-Square test was done

Table-V: Diagnostic efficacy parameters of different test for predicting intubation difficulty

	Sensitivity	Specificity	PPV	NPV	Accuracy
TMHT	94.9	93.3	90.3	96.5	93.9
MMT	74.6	88.8	81.5	84.0	83.1

TMHT had a sensitivity of 94.9%, a specificity of 93.3%, a PPV of 90.3%, an NPV of 96.5%, and an accuracy of 93.9% for predicting intubation difficulty. On the other hand, MMT showed 74.6% sensitivity, 88.8% specificity, 81.5% PPV, 84.0% NPV, and 93.1% accuracy.

Discussion

Airway management poses a considerable challenge in contemporary anaesthesia practice, making preoperative airway assessment crucial for proper preparation in anticipated difficult cases. Various approaches are available for predicting challenging intubation scenarios. This investigation evaluates the precision of the TMHT and MMT techniques in predicting challenging intubation situations.

Mean age of the study subjects was 40.33 ± 13.94 years. Females were enrolled more than males. BMI was 29.51 ±7.55 kg/m^2. In the study of Majigoudar and Revappa,[13] mean age of the patients was 39.8 years, mean BMI was 21.3 kg/m^2 and males were more than females. Similar age was observed in the study of Chhatrapati et al.[20] In the study of Jain et al.[21], mean age of the chosen patients was 56.7 years; with mean BMI of 24.72 kg/m^2.

This present study revealed that the thyromental height test (TMHT) was 93.9% accurate in predicting difficult intubation, with a sensitivity of 94.9%, specificity of 93.3%, PPV of 90.3%, NPV of 96.5%, and overall accuracy of 93.9%. The findings presented here resonate strongly with the data provided by Chhatrapati et al.[20], who noted a sensitivity of 93.3%, specificity of 91.4%, PPV of 82.4%, NPV of 97.0%, and an accuracy of 92.0%. In contrast to their findings, our study revealed a slight enhancement in sensitivity, specificity, PPV, and accuracy, whereas the NPV stayed almost unchanged. In a comparable way, Nurullahet al.[14] reported a sensitivity of 92.7%, specificity of 93.5%, PPV of 85.4%, NPV of 97.8%, and an accuracy of 93.5%, thereby reinforcing the dependability of TMHT. Conversely, Etezadiet al.[12] noted a slightly reduced PPV (61.1%), although their sensitivity (91.7%) and specificity (92.1%) were comparable. They also achieved an impressively high NPV (98.8%) and accuracy (98.1%). In a recent study, Ashebir et al. (2024)[22] observed a decline in sensitivity to 78.8% and a positive predictive value of 54.2%. However, the specificity was reported at 89.7% and the negative predictive value at 96.5%, aligning with findings from previous studies.

The sensitivity measured using MMT was found to be 74.6%. This aligns with the findings of Chhatrapati et al.[20] (77.78%), Ezri et al.[23] (76%), Schmitt et al.[24] (76%), and Kaul et al.[25] (74%). The specificity recorded was 88.8%, which aligns closely with the findings of Cattanoet al.[26] (91%), Kaul et al.[25] (95%), and Adamus et al.[27] (82.4%). The significant variation observed in specificity and sensitivity for MMT across different studies may be attributed to considerable inter observer variance. In our study, MMT demonstrated a positive predictive value of 81.5%, surpassing the results reported by Chhatrapati et al.[20] (64.81%) and Kaul et al.[25] (56.36%). The negative predictive value in our study was 84.0, which is lower than the values reported by Chhatrapati et al.[20] (89.58%), Eberhart et al.[28] (93.8%), and Khan et al.[29] (98.4%). The study revealed a negative predictive value of 93.1%. A comparable result was observed by Eberhart et al.[28], who determined that MMT exhibited a negative predictive value of 93.8%.[28]

Conclusion

This study clarifies that TMHT is a more accurate predictive test for difficult intubation, showcasing improved sensitivity, specificity, positive predictive value, negative predictive value, and accuracy in comparison to MMT.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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References

1. Pathak L, Sah PK. Prediction of difficult intubation in apparently normal patients by combining modified Mallampati test and thyromental distance: A prospective observational study. International Journal of Anesthesiology Sciences. 2020;2(1): 16–20.
2. Joffe AM, Aziz MF, Posner KL, Duggan LV, Mincer SL, Domino KB. Management of difficult tracheal intubation: A closed claims analysis. Anesthesiology. 2019;131(4):818–29.
3. Mallhi AI, Abbas N, Naqvi SM, Murtaza G, Rafique M, Alam SS. A comparison of Mallampati classification,

thyromental distance and a combination of both to predict difficult intubation. Anaesthesia, Pain & Intensive Care. 2018;22(4):468–73.

4. Pascal FN, Malisawa A, Barratt-Due A, Namboya F, Pollach G. General anaesthesia related mortality in a limited resource settings region: A retrospective study in two teaching hospitals of Butembo. BMC Anesthesiology. 2021;21(1):1–3.
5. El-Radaideh K, Dheeb E, Shbool H, Garaibeh S, Bataineh A, Khraise W, et al. Valuation of different airway tests to determine difficult intubation in apparently normal adult patients undergoing surgical procedures. Patient Safety in Surgery. 2020;14(1):1–8.
6. Honarmand A, Safavi M, Ansari N. A comparison between hyomental distance ratios, ratio of height to thyromental, modified Mallampati classification test and upper lip bite test in predicting difficult laryngoscopy. Advances in Biomedical Research. 2014;3:166.
7. Apfelbaum JL, Hagberg CA, Caplan RA, Blitt CD, Connis RT, Nickinovich DG, et al. Practice guidelines for management of the difficult airway: An updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology. 2013;118(2):251–70.
8. Chhina AK, Jain R, Gautam PL, Garg J, Singh N, Grewal A. Formulation of a multivariate predictive model for difficult intubation: A double blinded prospective study. Journal of Anaesthesiology Clinical Pharmacology. 2018;34(1):62–7.
9. Roth D, Pace NL, Lee A, Hovhannisyan K, Warenits AM, Arrich J, et al. Bedside tests for predicting difficult airways: An abridged Cochrane diagnostic test accuracy systematic review. Anaesthesia. 2019;74(7):915–28.
10. Vannucci A, Cavallone LF. Bedside predictors of difficult intubation: A systematic review. Minerva Anestesiologica. 2016;82(1):69–83.
11. Detsky ME, Jivraj N, Adhikari NK, Friedrich JO, Pinto R, Simel DL, et al. Will this patient be difficult to intubate? The Rational Clinical Examination systematic review. Journal of the American Medical Association. 2019;321(5): 493–503.
12. Etezadi F, Ahangari A, Shokri H, Najafi A, Khajavi MR, Daghigh M, et al. Thyromental height: A new clinical test for prediction of difficult laryngoscopy. Anesthesia and Analgesia. 2013;117(6):1347–51.
13. Majigoudar SS, Revappa KB. Comparison of thyromental height test (TMH) with modified Mallampati test and thyromental distance for prediction of difficult laryngoscopy: A prospective study. Indian Journal of Clinical Anaesthesia. 2017;4(2):238–41.
14. Nurullah M, Alam MS, Hossen M, Shahnawaz M. Prediction of difficult airway by thyromental height test – a comparison with modified Mallampati test. Bangladesh Journal of Medical Science. 2018;17(3):455–61.
15. Panjiar P, Kochhar A, Bhat KM, Bhat MA. Comparison of thyromental height test with ratio of height to thyromental distance, thyromental distance, and modified Mallampati test in predicting difficult laryngoscopy: A prospective study. Journal of Anaesthesiology Clinical Pharmacology. 2019;35(3):390–5.
16. Rawal P, Shrestha SM. The evaluation of thyromental height test as a sin- gle, accurate predictor of difficult laryngoscopy. J Nepal Health Res Counc . 2020;18:271–276
17. Samsoon GL, Young JR. Difficult tracheal intubation: A retrospective study. Anaesthesia. 1987;42(5):487–90.
18. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia. 1984;39(11): 1105–11.
19. Mohammad EO, Harvey W, Ramez SM. Head and neck position for direct laryngoscopy. Anesthesia and Analgesia. 2011;113(1):103–9.
20. Chhatrapati S, Bloria S, Singh N, Paul S, Luthra A, Kataria KK, et al. Comparison of modified Mallampati test and thyromental height test for preoperative airway assessment: A prospective observational study. Indian Anaesthetists' Forum. 2021;22(2):47–52.
21. Jain N, Das S, Kanchi M. Thyromental height test for prediction of difficult laryngoscopy in patients undergoing coronary artery bypass graft surgical procedure. Annals of Cardiac Anaesthesia. 2017;20(2):207–11.

22. Ashebir Z, Fentie F, Mohammed Z. Assessment of predictive value of thyromental height in predicting difficult laryngoscopy compared with Mallampati, and thyromental distance among surgical patients: Ethiopia, 2022. Annals of Medicine and Surgery. 2024;86(9):5112–9.

23. Ezri T, Medalion B, Weisenberg M, Szmuk P, Warters RD, Charuzi I. Increased body mass index per se is not a predictor of difficult laryngoscopy. Canadian Journal of Anaesthesia. 2003;50(2):179–83.

24. Schmitt H, Buchfelder M, Radespiel-Tröger M, Fahlbusch R. Difficult intubation in acromegalic patients: Incidence and predictability. Anesthesiology. 2000;93(1):110–4.

25. Kaul TK, Deepika PG, Singh A, Bansal M. Prediction of difficult intubation: Analysis in 500 adult patients. Journal of Anaesthesiology Clinical Pharmacology. 1998;14:323–8.

26. 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. Anesthesia and Analgesia. 2004;99(6):1774–9.

27. Adamus M, Fritscherova S, Hrabalek L, Gabrhelik T, Zapletalova J, Janout V. Mallampati test as a predictor of laryngoscopic view. Biomedical Papers of the Medical Faculty of the University Palacky, Olomouc, Czechoslovakia. 2010;154(4): 339–43.

28. Eberhart LH, Arndt C, Cierpka T, Schwanekamp J, Wulf H, Putzke C. The reliability and validity of the Upper Lip Bite Test compared with the Mallampaticlassification to predict difficult laryngoscopy: An external prospective evaluation. Anesthesia and Analgesia. 2005;101(1):284–9.

29. 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. Anesthesia and Analgesia. 2003;96(2): 595–9.