

Comparison of Upper Lip Bite Test and Thyromental Distance with Other Airway (Mallampatti and Inter Incisor Distance) Assessment Tests for Predicting Difficult Endotracheal Intubation

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ABSTRACT

Objective: To study the ability of upper lip bite test and thyromental distance to predict difficult endotracheal intubation when compared to standard assessment tests such as Mallampatti and inter incisor distance.

Study Design: Cross-sectional validation study.

Place and Duration of Study: Department of Anesthesiology, Pak-Emirates Military Hospital, Rawalpindi, Pakistan, Sep 2020 to Mar 2021.

Methodology: We studied a total of 50 patients who reported for the administration of general anesthesia. All patients underwent evaluation with modified Mallampatti test, upper lip bite test and thyromental distance test. All participants underwent subsequent intubation according to a standard protocol. The researcher documented difficult intubations.

Results: We found the upper lip bite test to have a sensitivity of 75.7%, a specificity of 84.2%, and a diagnostic accuracy of 78.6%. Thyromental distance had a sensitivity, specificity, and diagnostic accuracy of 51.4%, 78.9% and 60.7%, respectively while the modified Mallampatti had a sensitivity of 64.9%, 89.5%, specificity and a diagnostic accuracy of 73.2%.

Conclusion: Upper lip bite test is a useful bedside assessment tool with which to predict the probability of a difficult endotracheal intubation. Height to thyromental distance ratio test is also acceptable for rapid assessment.

Keywords: Endotracheal intubation, Mallampatti grading, Thyromental distance, Upper lip bite test.

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INTRODUCTION

Patient airway assessment is of paramount importance in the pre-anesthesia workup before surgery as difficult intubation/airway management is the single most important cause of anesthesia associated morbidity and mortality.¹ The estimated incidence of difficult intubation is between 0.43- 0.52%, and more common in those between ages of 45 and 75 years.² Thus, pre-anesthesia airway assessment must be able to predict difficulties during endotracheal intubation before any problems occur.³ Improper assessment of the airway to identify potential problems may result in lethal consequences.⁴ Airway assessment methods include tests such as, inter-incisor gap, modified Mallampatti test, sterno-mental and thyro-mental distance, and upper lip bite test, but all of these have variable predictive values.⁵ The upper lip bite test is a useful measure as it takes into account the importance of the range of anterior mandibular motion

as well as the anatomy of dentition.⁶ Patients are graded into three grades according to the degree to which they can bite their upper lip with their lower incisors, with Grade III predicting difficult intubation.⁷ Thyromental distance is the distance, in centimeters, between the thyroid notch and the tip of the mandible with the head held in full extension, with greater possibility of difficult endotracheal intubation if this distance is less than 7.0 cm.^{8,9} The Mallampatti assessment of airway for intubation has remained a criterion standard for pre-operative workup, however, the test is known to have a low sensitivity, such that its use has been advocated only as a part of a larger clinical picture with other supportive assessments.¹⁰ The upper lip bite test and thyromental distance provide a rapid method for airway assessment which may be especially useful in the emergency setting. The aim of this study was to establish the diagnostic accuracy of these two aforementioned tests when compared to modified Mallampatti in predicting the possibility of a difficult intubation, which can help to establish whether these tests can be employed as standard practice.

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METHODOLOGY

We conducted a cross-sectional validation study from September 2020 to March 2021 in the Department of Anesthesiology, Pak-Emirates Hospital (PEMH), Rawalpindi, Pakistan, after obtaining approval from Institutional Ethical Review Board . We enrolled 56 consenting patients via non-probability consecutive sampling, who reported for general anesthesia for various indications. The sensitivity and specificity sample size calculator was used to calculate the sample size keeping expected sensitivity of 66.7%, expected specificity of 99.1%, an expected prevalence of 11.5% and a desired precision of 8.0.¹¹

Inclusion Criteria: Patients of either gender, aged 18-65 years, American Society of Anesthesiologists (ASA) I and II, undergoing elective surgeries with general anesthesia were included.

Exclusion Criteria: Patients who were unwilling, with defects in mobility of the lower jaw and neck, history of trauma, surgery or burns of the head and neck, pregnant women, and morbidly obese patients with a body mass index ≥ 35 , were excluded.

Pre-operative airway assessment was conducted by a consultant anesthesiologist for all patients.

Height, weight, and body mass index (BMI) for all patients was recorded on a data collection tool. All patients underwent grading using the Modified Mallampati Test, the thyromental distance and the upper lip bite test. Laryngoscopy was performed by a consultant anesthetist with a size 3 or 4 blade, keeping patient’s head and neck in the neutral position. Any intubation which required more than three attempts or lasted more than ten minutes was classified as difficult.

Data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Quantitative variables were measured by mean and standard deviation. Qualitative variables were measured as frequency and percentage. We constructed 2 x 2 tables to calculate the prevalence, sensitivity, specificity, positive predictive value and negative predictive value and diagnostic accuracy for all three tests.

RESULTS

Data for a total of 56 patients was analyzed with a mean age of 26.59 ± 6.98 years. The patients were mostly males (32, 57.1%). Difficult intubation was seen in 33.9% patients. The upper lip bite test was compared to the difficult intubation at the time of surgery where the upper lip bite test had a sensitivity of 75.7%, a specificity of 84.2%, and a diagnostic accuracy of 78.6%

Table-I: Upper Lip Bite Test (n=50)

Upper Lip Bite Test	Difficult Intubation		
	Status	Positive	Negative
	Positive	28 (50.0%)	3(5.4%)
Negative	9 (16.1%)	16(28.5%)	
Outcomes			
Sensitivity	75.7%	Specificity	84.2%
Positive Predictive Value	90.3%	Negative Predictive Value	64%
Diagnostic Accuracy	78.6%		

Table-II: Thyromental Distance (n=50)

Thyromental Distance	Difficult Intubation		
	Status	Positive	Negative
	Positive	19 (33.9%)	4 (7.1%)
Negative	18 (32.2%)	15 (26.8%)	
Outcomes			
Sensitivity	51.4%	Specificity	78.9%
Positive Predictive Value	82.6%	Negative Predictive Value	45.4%
Diagnostic Accuracy	60.7%		

Table-III: Modified Mallampati (n=50)

Modified Mallampati	Difficult Intubation		
	Status	Positive	Negative
	Positive	24 (42.9%)	2 (3.6%)
Negative	13 (23.2%)	17 (30.3%)	
Outcomes			
Sensitivity	64.9%	Specificity	89.5%
Positive Predictive Value	92.3%	Negative Predictive Value	56.7%
Diagnostic Accuracy	73.2%		

(Table-I). Thyromental distance was assessed in the same manner where Thyromental distance had a sensitivity of 51.4%, a specificity of 78.9% and a diagnostic accuracy of 60.7% in our study (Table-II). Lastly, we assessed the results of the modified Mallampati test in our study and found it to have a sensitivity of 64.9%, a specificity of 89.5%, and a diagnostic accuracy of 73.2% (Table-III).

DISCUSSION

The modified Mallampati test has been a standard in airway assessment,^{12,13} and in our study, it had a sensitivity of 64.9%, a specificity of 89.5%, and a diagnostic accuracy of 73.2%. While the test is highly specific, its sensitivity leaves much to be desired, as demonstrated in Patel *et al.* which showed a sensitivity of 28.6% while the specificity remained a solid 93%.¹⁴ Ittichaikulthol *et al.* also showed a similar trend in sensitivity and specificity: 41.7% and 95.5%, respectively.¹⁵ These two studies showed figures that were overall in agreement with the general trends that were seen in our study, however it was Merah *et al.* who was in closer agreement with our results with a sensitivity and specificity of 61.5% and 98.4%, respectively.¹⁶ In our study, the thyromental distance was an even less effective test than the modified Mallampati test, with a sensitivity of 51.4%, a specificity of 78.9% and a diagnostic accuracy of 60.7%. Panjiar *et al.*¹⁷ showed a similarly low sensitivity of 20% but a much higher specificity of 94.55% when compared to our study. The upper lip bite test had a sensitivity of 75.7%, a specificity of 84.2%, and a diagnostic accuracy of 78.6% in our study, and we found it to be the best single test in our study. Salimi *et al.* showed that the upper lip bite test had a sensitivity of 70% and a specificity of 93.3%,¹⁸ while Badheka *et al.*¹⁹ showed a similarly high sensitivity and specificity of 96.64% and 82.35%, respectively. It is important to note that while the general trends in sensitivity and specificity are similar for each test, there is a significant degree of variation as to the individual percentages. We account for these differences via a variation in anthropometric measures between differences, an observation that has been validated by Safavi *et al.*²⁰ The strength of our study lies in the fact that we compared multiple modalities of airway assessment on the same set of patients, establishing a more effective comparison.

LIMITATIONS OF STUDY

Our study was limited by a small sample size, which was not randomized. In addition, the operators were not

blinded to the study. Further research is required to ascertain the role of adjunctive tests like upper lip bite test and thyromental distance with relation to standard airway evaluation to better understand their role in airway management.

CONCLUSION

Upper lip bite test is useful for predicting whether an intubation will be difficult or not. It can be rapidly performed in the conscious patient at the bedside, with minimal effort, and has good diagnostic accuracy. The thyromental distance is a less sensitive alternative that has the added benefit of not requiring the patient to be conscious and thus can be used to perform a rapid assessment in case of emergencies. Both tests are useful and should be employed in standard assessment of airway pre-intubation.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MTS & AR: Data acquisition, critical review, approval of the final version to be published.

MNS & TA: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

AR & HA: Conception, Study design, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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