



EVALUATION OF UPPER LIP BITE TEST AND MODIFIED MALLAMPATI CLASSIFICATION TO PREDICT DIFFICULT LARYNGOSCOPY AND CONFIRMATION BY CORMACK & LEHANE GRADING

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ABSTRACT

To secure an intact airway is an important goal for the safety of patient. Sometime unrecognized or unanticipated difficult airway may lead to unexpected bad outcome like hypoxic brain damage or death. The aim and objective of this study is to predict difficult laryngoscopy using Modified Mallampati classification and Upper lip bite test as methods of airway assessment and to confirm the above findings with Cormack and Lehane grading. These tests will be used in combination to assess their sensitivity and specificity in order to determine their positive predictive value and negative predictive value.

Material and methodology: The preoperative airway assessment was conducted using both the screening tests, Modified Mallampatti test and the Upper lip bite test. Modified Mallampatti test grade III or IV and Upper lip bite test grade III were considered as predictors of difficult intubation. Intubation was considered difficult if the view on laryngoscopy was Cormack and Lehane grade III or IV. The results were evaluated on the basis of sensitivity, specificity, positive and negative predictive value of these tests.

Results: The Modified Mallampati test has higher sensitivity of 71.43% and negative predictive value 97.65% resulting as better individual test for predicting difficulty for intubation than by Upper lip bite test with sensitivity of 28.57% and negative predictive value of 94.79%. This means that several patients with difficult intubation will not be identified by Upper lip bite test.

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INTRODUCTION

Expertise in airway management is important and is a life line for the anaesthesiologist. It is the concern of the anaesthesiologist to secure the airway of the patient. Respiratory compromise accounts for the single largest class of adverse outcomes¹. The ability to predict a difficult tracheal intubation authorizes the anaesthesiologist to take precautions to decrease the risk². Preoperative assessment is essential for the risk of difficult airway management³. Several clinical tests have been proposed for preoperatively identifying patients who may have difficult laryngoscopy but unfortunately at present, there is still no single test or group of tests that can accurately predict difficult laryngoscopy.⁴

Research is ongoing to device a simple bedside test, to anticipate difficult tracheal intubation, which has high specificity, sensitivity, positive predictive value (PPV), negative predictive value (NPV), likelihood ratio (LR) with minimal false negative (FN) and false positive (FP) values.⁴

In day to day practice, we use Modified Mallampati Test to predict the difficult endotracheal intubation whereas upper lip bite test is not as popular as that. So upper lip bite test needs to be evaluated as a useful test to predict difficult intubation in day to day cases.

Hence, we proposed this study to compare upper lip bite test with Modified Mallampati Test in predicting difficulty in endotracheal intubation and then to confirm above findings with Cormack and Lehane grading in patients who are undergoing surgery under general anaesthesia.

METHODS AND MATERIALS

After obtaining clearance from institutional ethical committee and written informed consent from all the patients, the study was conducted in 100 patients, male and female, aged between 20-50 years at Maharishi Markandeshwar Institute of Medical Science and Research, Mullana, Ambala. A thorough pre anaesthetic evaluation was carried out in all the patients and the procedure was explained in detail to the patients to undergo elective surgery under general anaesthesia of ASA grade I and II.

Preoperatively all the patients' airway was evaluated using MMT and ULBT.

Modified Mallampati classification.: Samssoon and Young's modification of Mallampati test recorded oropharyngeal structures visible upon maximal mouth opening. Each patient when seated was asked to open mouth maximally and to

protrude the tongue without phonation. The view is classified as -

Grade I - Good visualization of palate, fauces, uvula and tonsillar pillars.

Grade II - Pillars obscured by the base of the tongue but the soft palate, fauces and uvula visible.

Grade III - Soft palate and base of the uvula visible.

Grade IV - Soft palate not visible.

Upper Lip Bite Test: It is done by assessing the ability of the patient to cover the mucosa of the upper lip with lower incisors. This test is rated as -

Class 1: If the lower incisors could bite the upper lip above the vermilion line.

Class 2: If the lower incisors could bite the upper lip below the vermilion line.

Class 3: If the lower incisors could not bite the upper lip.

MMT class III and IV, ULBT class III were considered as predictors of difficult intubation.

Preoperative investigations were done based on surgical procedure, physical status and age of the patients. Patients were kept nil per oral for eight hours prior to the surgery and were given alprazolam 0.5 mg at night. After arrival in the operation theatre monitors were attached and NIBP, ECG and Pulse Oximetry were monitored. All the patients were pre-medicated prior to surgery with intravenous Inj Midazolam 0.03mg/kg, Inj Glycopyrolate 0.2 mg and Inj. Nalbuphine 0.1mg/kg.

Table I MMT vs. Cormack Lehane Grading

Statistical Test	Value	95%CI
True Positive	5	
False Negative	2	
False Positive	10	
True Negative	83	
Incidence	7%	
Sensitivity	71.43%	29.04%-96.33%
Specificity	89.25%	81.11%-94.72%
Positive Predictive Value	33.33%	11.82%-61.62%
Negative Predictive Value	97.65%	91.76%-99.71%

Table II ULBT vs. Cormack Lehane Grading

Statistical Test	Value	95%CI
True Positive	2	
False Negative	5	
False Positive	2	
True Negative	91	
Sensitivity	28.57%	3.67%-70.96%
Specificity	97.85%	92.45%-99.74%
Positive Predictive Value	50.00%	6.76%-93.24%
Negative Predictive Value	94.79%	88.26%-98.29%

Table III Comparison of difficult intubation

Grades	MMT	ULBT	Cormack Lehane Grading
I & II	85	96	93
III & IV	15	4	7

Easy: Grades I and II, Difficult: Grades III and IV

Following pre oxygenation for three minutes, the standard induction technique was applied to all the patients which included Propofol 2mg/kg IV titrated to loss of response to verbal commands and Succinylcholine 1.5mg/kg IV was given.

Laryngoscopy was performed in all the patients using size 3 Macintosh laryngoscope blade to ensure the consistency of the technique. Glottic visualization during laryngoscopy was assessed using Cormack and Lehane grades:

- Grade 1: Most of the glottis (with or without epiglottis) visible.
- Grade 2: Only the posterior extremity of the glottis seen.
- Grade 3: No glottis visible, but the larynx (such as the epiglottis) can be seen.
- Grade 4: No glottis and the larynx can be seen.

After noting the grade of laryngoscopy, tracheal intubation was performed. Difficult laryngoscopy was defined as not being able to visualise any portion of the vocal cords with conventional laryngoscope. Difficult intubation was defined as proper insertion of tracheal tube with conventional laryngoscope requiring more than 3 attempts or more than 10 minutes. Easy intubation was taken as Cormack- Lehane Grade I & II and difficult intubation was taken as Cormack-Lehane Grade III & IV on direct laryngoscopic visualization. Rest of the anaesthesia was continued as per standard protocol.

RESULTS

DISCUSSION

The failure of the anaesthesiologist to maintain a patent airway after the induction of general anaesthesia is one of the most common causes of anaesthesia related morbidity and mortality. Current practice of anaesthesia and preoperative airway assessment facilitates appropriate preparation when difficulty with intubation or ventilation is anticipated prior to induction of anaesthesia.

The current study therefore, was undertaken to compare Upper Lip Bite Test (ULBT) with Modified Mallampati Test (MMT) for predicting difficulty during endotracheal intubation in 100 patients of both sexes, aged between 20 years to 50 years of age undergoing elective surgery under general anaesthesia.

In our study, incidence of difficult intubation was found to be around 7% which is comparable to the results obtained by Frerk and Savva^{5, 6}. However the reported incidence of difficult laryngoscopy or intubation is 1.5% 44 to 8%⁷. This wide variation in incidence is due to the criteria that are used to define the difficult intubation and different anthropometric features among populations. There were no failures to intubate the trachea in any of the patients of our study.

In this study we found the sensitivity of MMT to be 71.43% which was almost near to the study conducted by Erzi *et al* (76%). The specificity of MMT in our study is 89.25% which is more than of Khan *et al* (66.8%) and Eberhart *et al* (61%). A higher specificity similar to our study has also been reported by Cattano *et al*.⁸ The wide variations in reported specificity and sensitivity in various studies may be because of incorrect evaluation of the test and inter observer variability seen in MMT as was also found by Eberhart *et al*.⁹

The positive predictive value of MMT in our study was 33.33% which is quite high when compared to other studies. This can be explained by the fact that, all the patients' airway was evaluated by a single resident, unlike in other studies where in two or more than two Anaesthesiologists were being involved in assessing the airway, which might have contributed to the inter observer variability in their study

leading to high false positivity. The experience of the Anaesthesiologist performing the intubation also might have caused variation in results. The negative predictive value of MMT was 97.65%, which is comparable to the study done by Eberhart *et al.*⁹

Upper Lip Bite Test

On comparing both the MMT and ULBT, we found out that the sensitivity of ULBT in our study was 28.57% which is well below what Khan *et al* had got in their study (76.5%),¹⁰ but it was nearer to the value obtained by Eberhart *et al* (28%) and Myneni *et al* (8.1%)^{9,11}. This means that several patients who present with difficult intubation will not be identified by ULBT (larger number of patients with false negative test). Lower sensitivity of the ULBT can be explained due to low incidence of ULBT class III in our study. The specificity of ULBT in our study was 97.85% which is well above the original trial by Khan *et al*. This is because of the lesser number of false negative results obtained in our study with ULBT.

The PPV of ULBT in our study was 50% which was comparable to the study done by Eberhart *et al*. The NPV was 94.79% which is comparable to original study by Khan *et al*.

In another study done by Salimi *et al*, it was found out that ULBT was 70% sensitive which is way above our result (28.57%) but specificity was somewhat comparable. Their study showed the specificity to be 93.3% which is comparable to our study (97.85%). The positive predictive value was found out to be 39% in the above study which is again comparable to our study i.e. 50%. The negative predictive value was very close viz. 98.1% in the above study vs. 94.79% in our study.⁴⁰ Z.H.Khan and ShahriarArbabi in a recent study conducted in 2013 aimed to check the utility of lateral neck X-Ray measurements in improving the diagnostic value of the upper lip bite test. The specificity of ULBT in this study came out to be 91.4% which was close to our study (97.85%). The PPV and NPV was found out to be 37.5% and 98.7% respectively which was found out to be comparable with our study in which it came out to be 50% and 94.79% respectively but the difference in sensitivities between the two studies was high i.e. 81.5% in this study and 28.57% in our study. The high NPV meant that the test adequately removed patients with difficult intubation and thus, difficult laryngoscopic view or difficult intubation was not encountered. Moreover, the low PPVs implied that the test lacked utility to forecast difficulty in intubation.¹³

The probable reasons for the difference in results of our study might be due to lack of inter observer variance in our study as well as ethnic difference. The anthropological literature well documents human ethnic craniofacial variation, and the dental literature confirms significant racial variation in mandibular and maxillary morphology and morphometry¹⁴.

On comparing both the tests, we found that, MMT is more sensitive (71.43%) than ULBT (28.57%), but both tests had high specificity and NPV. Difference in the sensitivity between the two tests was found to be statistically significant using McNemar test. Although ULBT has higher specificity, which is statistically significant ($p < 0.05$), it has a very poor sensitivity. Thus, as a sole test, it is an unreliable test to screen the patients for difficult intubations.

Both the tests have a negative predictive value more than 90%, thus stressing the fact that all these tests can be good predictors of easy intubation, rather as positive predictors of difficult intubation which has a very low incidence.

The difficulty we faced during the study was that repeated demonstrations were required for patients to perform ULBT and few patients failed to understand the procedure in spite of our efforts. The use of ULBT in our study was further hampered in clinical practice by the problems of evaluating edentulous patients. However the discrete advantage of ULBT as we found out, included less or no chance for inter observer variability because of clear demarcation of the different classes and the appreciation of buck teeth during assessment which is one of the important factor predicting difficult intubation.

In future study, these tests can be used in combination with other tests of airway assessment such as thyromental distance, inter incisor distance, hyomental distance etc. to predict difficult airway may prove to be better to predict difficult intubation and a larger sample size can be taken.

CONCLUSION

From our study we conclude that:

1. Both the tests have a negative predictive value more than 90%, thus stressing the fact that both these tests can be good predictors of easy intubation, rather as positive predictors of difficult intubation which has a very low incidence.
2. MMT is a better test at predicting difficult endotracheal intubation when compared to ULBT.

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