RESEARCH

Comparison of Upper Lip Bite Test with Modified Mallampati Classfication for Prediction of Difficult Endotracheal Intubation

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ABSTRACT

Background:
Prediction of difficult airway and its management are fundamental skills for the safe conduct of anesthesia. Failure in recognizing difficult airway before induction of anesthesia can lead to disastrous complications ranging from sore throat to serious airway trauma to hypoxic brain damage or death. This study was conducted to compare upper lip bite (ULBT) and modified Mallampati (MMC) tests in prediction of difficult endotracheal intubation.

Methods:
One hundred ASA I and II patients scheduled for elective surgical procedure requiring endotracheal intubation were prospec-tively recruited in this study. All the patients airway were assessed pre-operatively with ULBT and MMC tests and laryngeal view grading by Cormack-Lehane's classification was recorded by anesthesiologist blind to preoperative airway assessment. Sensitivity, specificity, positive and negative predictive values; and accuracy of ULBT and MMC were calculated; and Z test for statistical difference between them was used.

Results:
The incidence of difficult intubation in our study was 6% (n=6). The specificity and accuracy of ULBT (98.9% and 95% respectively) were significantly higher than MMC (77.6% and 76% respectively), each with P value < 0.001. However,there was no significant difference in sensitivity and negative predictive value between the two tests. The difference of positive predictive value for ULBT (66.6%) and MMC (12.5%) was though insignificant with p-value 0.053, but could not be ignored.

Conclusion:
Our study concluded that ULBT serves as a good predictor in predicting difficult laryngoscopic intubation than MMC.

Keywords:
Airway assessment, Difficult intubation, Modified Mallampati Classification, Upper lip bite test

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INTRODUCTION

Difficult airway is the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with face mask ventilation of the upper airway, difficulty with tracheal intubation, or both.[1] Failure in maintaining a patent airway following the induction of general anesthesia places patients at increased risk of complications ranging from sore throat to serious airway trauma to brain damage or death. [2-4] In 1% - 4% of patients, it is found to be difficult with direct

laryngoscopic intubation and impossible in 0.05% - 0.35% who have seemingly normal airway.[5] Of all anesthetic deaths, 30% to 40% are attributed to the inability to manage a difficult airway.[6]

In order to avoid potential problems in airway management, airway assessment remains the most important aspect of anesthesia practice in predicting difficult intubation. There are several non-invasive clinical pre-operative airway measures have been described that possesses significant association with difficult intubation like modified Mallampati classification (MMC), upper lip bite test (ULBT), thyromental distance, sternomental distance, inter incisor gap, protrusion of mandible, Wilson risk score etc. Modified Mallampati classification (MMC) is one of the most commonly used predictor in general as well as obstetric population despite its limitation in predicting difficult intubation.[7-9] MMC assessment determines the size of the tongue in relation to the oropharynx and the ability to open mouth.

In 2003, Khan et al introduced a simple bedside test the upper lip bite test (ULBT) in predicting difficult intubation, which involves the assessment of jaw subluxation and presence of buck teeth in single test.[10] Therefore, this study is conducted to compare the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy of ULBT with MMC in prediction of difficult intubation.

MATERIAL AND METHODS

After approval of institutional ethical committee, this prospective, observa-tional, comparative, single blind study was done on one hundred patients undergoing elective surgical procedure of American Society of Anesthesiologist (ASA) Grade I and II.The study was conducted at King Edward Medical University, Mayo Hospital, Lahore, Pakistan between September 2011 and March 2012. Obesity, edentulous, restricted neck movement, tumor in oropharynx and requiring rapid sequence induction were excluded.

The patient's airway was assessed pre-operatively using the MMC and ULBT tests simultaneously by the principle investigator after demonstration.

MMC was performed with the patient in sitting position at eye level to investigator with the mouth maximally open and tongue maximally protruded without phonation with the help of flashlight. Class I: soft palate, fauces, uvula and pillars; Class II: soft palate, fauces and uvula; Class III: soft palate and base of uvula; Class IV:soft palate was not visualised.

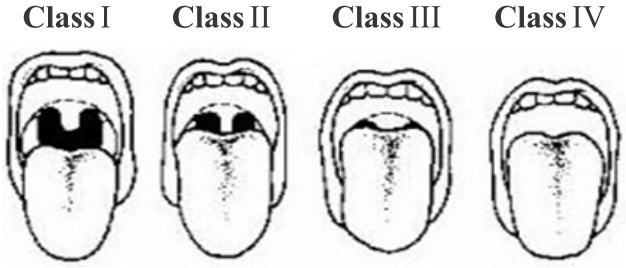

Fig. 1. Modified Mallampati classification of oropharyngeal visibility

Likewise, ULBT was performed by asking the patient to bite their upper lip with lower incisors as high as they can. Class I – lower incisors can bite the upper lip above the vermilion line; Class II – lower incisors can bite the upper lip below the vermilion line; Class III– lower incisors cannot bite the upper lip.

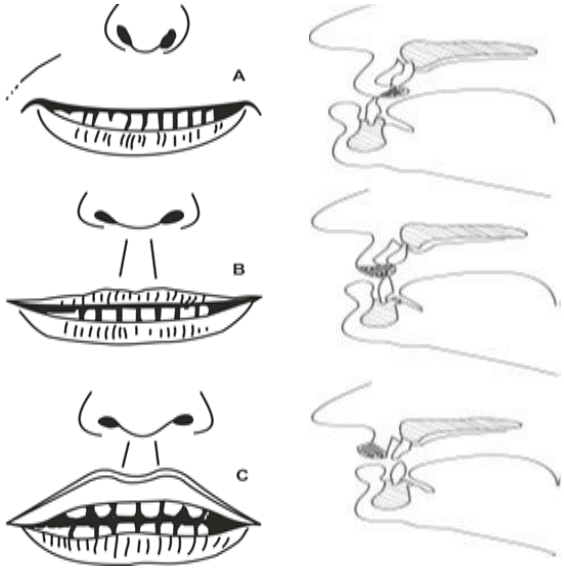

Fig. 2(I) **Fig. 2(II)**

Fig. 2. Upper Lip Bite Test: Fig. 2(I) anterior view and 2 (II) lateral view

In the operation theater, all the enrolled patients were anesthetized with standard technique with inj. Nalbuphine 0.1 mg/kg, inj. Thiopentone sodium 4-5 mg/kg or inj. Propofol 1.5-2.5 mg/kg; and to facilitate endotracheal intubation, inj. Suxamethonium chloride 1.5 mg/kg was adminis-

tered. After disappearance of fasciculations, patient's head was placed in the sniffing position or atlanto-occipital joint extension and direct laryngoscopy was performed with a Macintosh blade No. 3 or 4 depending upon the personal preferences. The grade of glottic view according to Cormack- Lehane's classification without applying external laryngeal pressure (BURP-maneuver)[11] was obtained and recorded in the proforma. An experienced anesthesiologist of at least two years of experience in anesthesia, who was blind to pre-operative airway assessment of that patient, performed the laryngoscopy. Grade I – full view of the glottis; Grade II – glottis partially exposed, anterior commissure not seen; Grade III – only epiglottis seen;Grade IV – epiglottis not seen.[12]

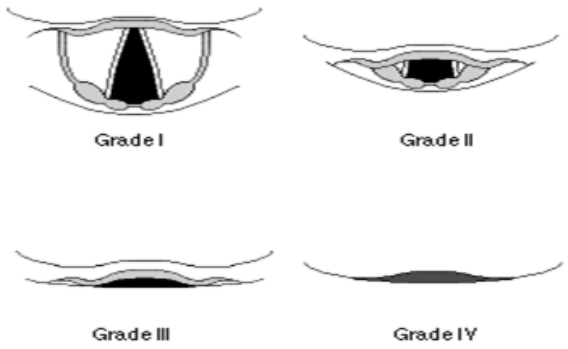

Fig. 3. Cormack-Lehane clasification of glottic exposure

Easy Intubation:It was taken as

Class I and Class II of MMC

Class I and Class II of ULBT

Grade I and Grade II of C-L classification

Difficult Intubation:It was taken as

Class III and Class IV of MMC

Class III of ULBT

Grade III and Grade IV of C-L classification

Data were collected and analyzed by SPSS version 11.5. Sensitivity, specificity, PPV, NPV and accuracy were calculated and Z test for proportions was used to compare the sensitivity, specificity, PPV, NPV and accuracy between the two tests.

RESULTS

Out of 100 enrolled patients, 30 were females and 70 were males.The age group of patients in the study was from 18 to 55 years with mean of 33.06. The BMI ranged from 18.6 to 29.5 kg/m^2 with mean of 23.36.

Six patients were found to have difficult airways to intubate with laryngoscopy grade of III and grade IV was not detected in our study. In some patients, BURP maneuver was performed to facilitate intubation. None of the patients in the study had failed endotracheal intubation.

In this study, out of 100 patients, 76 were class I and II of MMC, and 24 patients were class III and IV; whereas 97 patients were assessed to have class I and II of ULBT, and 3 patients were class III as shown in Tabe 1. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy of MMC and ULBT were shown in Table 2.

Table 1: Relationship Between the Results of Two Predicting Tests and Laryngoscopy Grades in 100 Patients

	Laryngoscopic View	
Predicting Tests	Easy I & II	Difficult III & IV
Modified Mallampati		
Class I and II	73	3
Class III and IV	21	3
Upper Lip Bite		
Class I and II	93	4
Class III	12	

Table 2: Statistical Terms Used for Modified Mallampati and Upper Lip Bite as Predicting Tests

Outcome Calculations	ULBT (n = 100)	MMC (n = 100)	P value
True Positive	2	3	
False Positive	1	21	
True Negative	93	73	
False Negative	4	3	
Sensitivity (%)	33.3	50	0.552
Specificity (%)	98.9	77.6	<0.001
PPV (%)	66.6	12.5	0.053
NPV (%)	95.8	96	0.947
Accuracy (%)	95	76	<0.001

Using the Z test for statistical differences, we observed specificity and accuracy of ULBT to be significantly higher than MMC with p value <0.001. Sensitivity and negative predictive values could not be considered significant difference between the two tests (33.3% and 95.8% of ULBT; and 50% and 96% of MMC respectively) with p-values of 0.552 and 0.947 respectively. The difference of positive predictive value for ULBT and MMC was though insignificant with p-value 0.053, but could not be ignored.

DISCUSSION

Difficult intubation is one of the most common difficulties experienced by anesthesiologists in their practice and one of the most common cause of anesthesia related morbidity and mortality.[13] Therefore, airway assessment and its management are fundamental skills for the safe conduct of anesthesia. As difficult intubation often arises unexpectedly, all anesthesiologist should have a pre-formed strategy for intubation of the difficult airway.

The modified Mallampati classification, one of the most frequently used clinical test to predict difficult intubation since two decades and a new test, upper lip bite introduced by Khan in 2003 were compared in predicting difficult intubation by many anesthesiologists. There have been conflicting results among different studies.

The incidence of difficult intubation in the operating room has been reported to range from 1%-18%.[14] In our study, we found a 6% incidence of difficult intubation and there was no failed intubation. Out of 6 difficult intubation from 100 patients, only 3 were correctly predicted as difficult by MMC and only 2 were predicted as difficult by ULBT. The incidence of difficult intubation in Khan et al,[10] Bhat et al[15]and Mittal et al[16] were almost similar of 5.7%, 7.8% and 7% respectively. However, it was higher in study conducted by Hester et al[17], Ali MA et al[18] and Shah et al[19] of 18 %, 17.3% and 13.95% respectively. This differences could have been due to the variations in experience of the anesthesiologist performing laryngoscopy and anthropometric differences of populations that were involved in study.

In our study, we found the sensitivity of ULBT (33.3%) lower than the original study conducted by Khan et al of 76.5% and other studies.[18-20] However, it was comparable to Eberhart et al[21] (28.2%) and Mittal et al[16] (28.6%). Specificity of ULBT in our study was 98.9%, which correlates with the studies done by Khan et al[10], Hester et al[17]and Mittal et al[16] of 88.7%, 97% and 97.85 % respectively. The lower sensitivity of ULBT in our study compared to other studies could be due to lower incidence of class III of ULBT in our study. Higher specificity in our and many other studies signify that this test predict easy intubation rather than difficult intubation and found out that the majorityof airways are easy to intubate.

The sensitivity of MMT in our study was 50% which was comparable to study done by Bhat et al[15](59%) but lower when compared to Khanet al[10] (82.4%), and quite higher than study conducted by Hester et al [17](11%) and Ali et al [18](19%). The specificity of MMT was 77.6% in our study which was higher than in Khan's study [10](66.8%). However, it was comparable with studies done by Bhat et al [15](83.5%) and Hester et al [17](75%) but lower than Orarat et al[22](91.6%), Aliet al[18](91.8%) and Mittal et al [16] (89.25%). This differences in values in different studies could be due to different racial characteristics; and significant alteration of MMT score with phonation and accessory muscles use; and the impact of the interobserver variations in administering, evaluating and interpreting the test.[17]

The positive predictive value (PPV) of ULBT (66.8%) in our study was comparable to Bhat et al[15](66.6%) and Ali et al[18](71.6%) but higher than in Khan's study[10](28.9%). The PPV of MMC(12.5%) in our study correlates with studies done by Khan et al[10] (13%) and Hester et al[17](9%). Likewise, the negative predictive value (NPV) of both the tests in our study were 95.5% and 96% for ULBT and MMC respectively which was comparable to many studies done previously. These higher value of specificity and NPV in our and many other studies indicate that these tests are good predictors of easy intubation.

In our study, the accuracy of ULBT was 95% whereas in MMC was 76% which was significantly lower ($p< 0.001$). The accuracy of ULBT that we obtained was comparable to Khan et al[10](88%), Bhat et al[15](93%) and Ali et al[18](91.9%). And the accuracy of MMC in our study was comparable to study by Bhat et al[15] (81.6%) and Ali et al[18] (79.3%).

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The great difference does occur in results if tests are not performed properly and a clinician doing laryngoscopy is not experienced. The three classes of ULBT are clearly demarcated and delineated that makes this test the least rate of

inter-observer variations, and easy to memorize and interpret where as this is unlikely with MMC in which numerous inter observer variations exits due to the absence of definite demarcation between classes II, III and IV.

In some studies, author mentioned about performing ULBT difficult in some patients after demonstrating multiple times and even had to exclude those patients from the study due to not performed correctly. In our study, we also found it difficulty in few patients to perform this test after multiple demonstration. However, there were no patients who were unable to do it and had to exclude from the study.

Many authors have done studies in these two tests. Some concluded that both these tests are not good predictor if used alone, but instead will be a good predictor if used both and some studies failed to agree that ULBT is superior to MMC.[16,22,23] However, majority of studies showed that ULBT is superior to MMC both in obstetric[24] and non obstetric patients.10,15 Our study also showed ULBT superior to MMC.

Limitations of our study

- ULBT is limited in edentulous patients as they were unable to perform the test.
- These two tests are unable to assess the neck mobility as range of neck movement is one of the important predictor of difficult intubation.
- Both tests are inapplicable to individuals who can't follow commands.

CONCLUSION:

This study concluded that in comparison with two bed side tests in predicting difficult laryngoscopic intubation, upper lip bite test serves as a good predictor than modified Mallampati classification. Although our study showed ULBT superior to MMC, it is always better to perform more than one test to have more accuracy due tosome limitationsof the tests.

Conflict of Interest: None

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