The Professional Medical Journal
www.theprofesional.com

DOI: 10.29309/TPMJ/18.496

ORIGINAL PROF-496

UPPER LIP BITE TEST;
ACCURACY OF UPPER LIP BITE TEST IN PREDICTING DIFFICULT AIRWAY

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Article received on:
01/11/2018
Accepted for publication:
30/11/2018
Received after proof reading:
04/12/2018

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ABSTRACT… Introduction: Various anatomical measurements and non–invasive clinical tests can be performed to predict difficult intubation. Recently introduced "Upper lip bite test" (ULBT) is claimed to have a high predictability. However, limited data exists to support its high predictability both nationally and internationally. **Objectives:** To determine the diagnostic accuracy of upper lip bite test in the prediction of difficult airway. **Study Design:** Cross sectional study. **Setting:** Operation theatres of Sheikh Zayed Hospital Lahore. **Period:** From March 2014 to Sept 2014. **Methodology:** A sample of 283 patients was calculated by using WHO sample size calculator and sampling was done by non-probability consecutive sampling. All the selected patients were assessed for upper lip bite test and Cormack and Lehane laryngoscopy grade separately. Data was collected on pre-designed proforma. Accuracy of ULBT was calculated based on the acquired data. **Results:** The calculated accuracy of ULBT for predicting difficult airway was found to be 91.2%. **Conclusion:** ULBT is a reliable bedside technique with a high accuracy for predicting a difficult airway.

Key words: Upper Lip Bite Test, Cormack and Lehane Scale, Difficult Airway.

Article Citation: Bukhari S, Niazi AK, Shuja H. Upper lip bite test; Accuracy of upper lip bite test in predicting difficult airway. Professional Med J 2018; 25(12):1966-1971. **DOI:** 10.29309/TPMJ/18.496

INTRODUCTION

The safety of anesthesia is predicated on anticipating difficulties in advance instead of reacting to them when they occur. Maintaining a patent airway is essential for adequate oxygenation and ventilation and failure to do so, even for a brief period of time, can be life threatening.[1]

Respiratory compromise accounts for the single largest class of adverse outcomes in the American Society of Anesthesiologists' Closed Claim Project.[2] According to Robert Caplan, the three commonest causes of respiratory related injuries are inadequate ventilation, esophageal intubation and difficult intubation.[3]

Difficult tracheal intubation accounts for 17% of the respiratory related injuries and results in significant morbidity and mortality. In fact up to 28% of all anesthesia related deaths are secondary to the inability to mask ventilate or intubate.[4] Closed claim analysis found that under anesthesia the vast majority of the airway related events, especially inability to maintain patent airway, involve brain damage or death.[5] The incidence of Cormack and Lehane grade III and IV requiring multiple attempts or blades or both is relatively high (1-18%). The incidence of failed endotracheal intubation is 0.05-0.35%, whereas the incidence of cannot ventilate, cannot intubate is around 0.0001-0.02%.[6-8]

Prediction of potentially difficult airway management during the pre-operative period is determined by the anatomy of the oropharyngeal structures, architecture, and range of movement of the oropharynx and the neck.[9] Therefore, all patients undergoing general anesthesia should have a basic evaluation of the airway consisting of history, general physical examination and a few specific tests. History should always include any previous anesthetic records. After taking a careful history, several preoperative airway assessment tests have been proposed.[10-14]

These preoperative airway assessment tests [Mouth opening or Inter-Incisor gap (IIG), Head

and neck movement (HNM), Modified Mallampati Test (MMT), Wilson risk score (WS), horizontal length of mandible (HLM), sterno-mental distance (SMD), thyro-mental distance (TMD)] may be used to predict difficult intubations but sensitivity and positive predictive value of these individual signs are low (33%-71%) while false positive results are high.[7,12,15]

Recently, a new simple bedside test to predict difficult laryngoscopy was found to be superior to the Mallampati classification with respect to positive predictive value and specificity and thus accuracy.[16] The studies done on ULBT so far show promising and encouraging results. However discrepancy exists between the results of various studies e.g. study done by Safavi et al.,[17] concluded that ULBT has a sensitivity of 66.01% and specificity of 73.17%, whereas Myneni et al.,[18] showed that ULBT has a poor sensitivity of 8.1%. Furthermore conflict exists in studies done in Pakistan e.g. Ali et al.,[19] proved the higher sensitivity and specificity of ULBT i.e. 87.5% and 92.9% respectively, whereas Atif et al., concluded their study on ULBT with a sensitivity of 25% and specificity of 99.2%.[16] The rationale of this study is to resolve the conflict which exists between the various studies done on ULBT both at national and international level.

OBJECTIVE

To determine the diagnostic accuracy of upper lip bite test in the prediction of difficult airway.

MATERIAL AND METHODS

Study Design

Cross sectional study

Setting

Operation theatres of Sheikh Zayed Hospital Lahore.

Duration

From March 2014 to Sept 2014.

Sample Size

By using WHO sample size calculator, sample size was estimated as 283 cases using 95% confidence level, with an expected sensitivity of 87.5% with 8% margin of error, 92.9% specificity with 6% margin of error, taking frequency of difficult airway as 17.3%.[19]

Sampling Technique

Non-probability consecutive sampling technique.

SELECTION CRITERIA

Inclusion

Patients (both male and female) aged 18-45 years, having a BMI <30, undergoing elective abdominal, orthopedic, urological and vascular surgeries

Exclusion

Patients with history of cleft palate, neurological or psychological disorder, epilepsy patients

Data Collection

After approval from hospital ethical committee, patients scheduled to receive general anesthesia requiring endotracheal intubation and having difficult airway on ULBT were selected (a scale indicating the range of motion and bite of the lower teeth onto the upper lip: 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. Class III will be considered a difficult airway on ULBT.). Benefits of the study were explained to all patients and they were assured that the study was purely done for research publication and data review and if agreed upon, a written informed consent was obtained. Before surgery each patient received a clinical physical evaluation including anatomical features of the mouth, face and neck, with a special emphasis on ULBT. Assessment for upper lip bite test was done with the participant in sitting position at eye level to the investigator. ULBT was demonstrated by the investigator, followed by the participant and then graded accordingly. Anesthesia was induced with Nalbuphine (0.1mg/kg), propofol (2mg/kg), and atracurium (0.5mg/kg) with the head in sniffing position, laryngoscopy with a Macintosh 3 blade was attempted by an anesthetist and the view determined using Cormack-Lehane grading system to detect grade III or IV which was considered as difficult airway. A scale indicating

the glottic view obtained with direct 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. All the ULBT and C&L scale detection were performed. According to Cormack and Lehane grading system "laryngoscopic view of grade III and IV defines a difficult airway". All the above mentioned information including age, gender and weight were recorded in a pre-designed proforma.

Data Analysis

The collected data was entered in SPSS version 17 and analyzed through it. Quantitative data like age was described as mean ± SD. Frequency and percentage were calculated for gender, ULBT and Cormack and Lehane Scale. Sensitivity, specificity, PPV, NPV and accuracy of ULBT were calculated and represented as 2×2 tables.

RESULTS

The mean age was 34.63±9.12years (range = 18-45). Of the 283 patients we studied, 148 (52.3%) were males and 135 (47.7%) were females. Table-I.

n	283
Age (years)	34.63±9.12
Male	148 (52.3%)
Female	135 (47.7%)

Table-I. Demographics of patients

Among the 32 patients with difficult intubation 9 had been predicted as difficult on ULBT (true positives) and 23 were predicted as easy on ULBT (False negative). Among the 251 patients with easy intubation, 4 were predicted as difficult on ULBT (False positive) and 247 were predicted as easy on ULBT (True negative). The calculated accuracy, sensitivity, specificity, positive predictive value and negative predictive value of ULBT were 90.45%, 28.1%, 98.4%, 62.9%, and 91.5% respectively. Tables-II.

		Cormack & Lehane scale		Total
		Difficult	Easy	
ULBT	Difficult	9	4	13
	Easy	23	247	270
Total		32	251	283

Table-II. Accuracy of ULBT against Cormack & Lehane scale

Sensitivity: 28.1% **Specificity:** 98.4%
PPV: 69.2% **NPV:** 91.5% **Accuracy:** 90.45%

DISCUSSION

The failure of the anesthesiologist to maintain a patent airway after the induction of general anesthesia is one of the most common causes of anesthesia-related morbidity and mortality. Wilson et al.,[20] described five risk factors that are important in predicting difficult intubation, including weight (p = 0.05), head and neck movement (P = 0.001), jaw movement (P = 0.001), receding mandible (P = 0.001), and buck teeth (P = 0.001). Our technique, the ULBT, assesses a combination of jaw movement and the presence of buck teeth simultaneously, obviously enhancing its predictive value and reliability.

The search for a predictive test for difficult airway that has ease of applicability, reliability, and accuracy of prediction (discriminating power) continues. The ULBT seems to meet all of these quality factors. Obviously, it is easy to perform within seconds as a bedside test because it can be determined without the use of any equipment. The instructions required for both the observer and the patients are extremely easy, and thus, there is less probability of misinterpretation while performing the test compared with the Mallampati test in which a different manner of performing the test may be used (e.g., performing the test with or without phonation). Increased interobserver reliability compared with the Mallampati score may be another major advantage of the ULBT.

We used the Cormack-Lehane system as the gold standard for testing the validity of ULBT. The Cormack-Lehane system classifies views obtained by direct laryngoscopy based on the structures seen. It was initially described by R.S. Cormack and J. Lehane in 1984 as a way of simulating potential scenarios that trainee anesthetists might face.[21]

The incidence of difficult intubations in our study was 11.3% which is similar to the frequency in recent published data. The incidence of unanticipated difficult intubation varies between 1.3% to 17% in various studies. This variation

might be due to the different reference standard used for difficult intubation among studies which were based on Cormack and Lehane intubation grades,[21] number of laryngoscopic attempts[22] and use of Backward Upward Rightward Pressure (BURP) manoeuvre.[17] The incidence of difficult intubation was 5.7% in the study by Khan et al.,[16] 7.8% in study by Bhatt et al.,[23] 8% in the study by Aswar et al.,[24] 8.1% in the study by Karci et al.,[25] and 17.3% in the study by Hoda et al.[19]

The results of our study can be compared to the results of study by Khan et al., where ULBT was found to have accuracy, sensitivity, specificity, PPV and NPV of 88%, 76.5%, 88.7%, 28.9% and 98.4% respectively. This study compared it with MMT and found that the specificity and accuracy of the ULBT to be better than the MMT and that ULBT could correctly predict 76.5% of difficult intubations and 88.7% of easy intubations.[16]

In contrast to the study by Khan et al.,[16] most of the studies done internationally show similar results i.e. poor sensitivity with a good specificity and accuracy e.g. study by Karci et al.,[25] concluded with sensitivity, specificity and accuracy of the ULBT of 13%, 97.6% and 90.8% respectively. In this study the test was found to have high specificity and negative predictive value, making it useful in identifying easy tracheal intubation. Similarly other studies were done internationally which resulted in poor sensitivity of ULBT e.g. In the trial by Bhatt et al., the sensitivity of ULBT was 20.5% and in the Aswar et al trial., it had a sensitivity of 25%.[23,24]

Similar to the above mentioned studies; our study found ULBT to have a higher specificity (98.4%) and accuracy (90.45%).

Contrasting the international studies, the studies done at the national level show much higher sensitivity, specificity and positive predictive value. For example study done by Shah et al.,[26] resulted with sensitivity, specificity, positive predictive value and negative predictive value of 91.5%, 96%, 72.8% and 98.9% respectively. Similarly the study done by Ali et al., resulted in a high accuracy, sensitivity, specificity, PPV and NPV of 91.9%, 87.5%, 92.9%, 71.6% and 97.3% respectively.[19]

In our study the specificity and NPV (98.4%, 91.5% respectively) were comparable to the studies done nationally and internationally.[16,19,24-26] On the other hand, the sensitivity and positive predictive value (i.e. 28.1%, 69.2% respectively) were lower than the studies done nationally[16] and comparable to the study done by Khan et al.,[16] and Jadeh et al.[27] The probable reasons are lack of inter observer variance in our study.

The positive predictive value of ULBT in Khan et al.,[16] was 28.9% ,in Aswar et al.,[24] was 30.77% in Jadeh et al.,[27] was 37.9% and in Bhatt et al.,[23] was 66.6%. Similarly our study had PPV of 69.2%. Hence ULBT has a low PPV in most studies so quite a good proportion of patients with airways actually easy to intubate will be subjected to the protocol for management of a difficult airway using ULBT. ULBT however has obvious ease of applicability and has a high accuracy of around 90%.[28]

ULBT has many obvious advantages. Firstly, It is a simple bedside method that involves the assessment of jaw subluxation and presence of buck teeth. Secondly, the three classes ULBT are clearly demarcated and delineated, making inter observer variations highly unlikely and its use is not dependent on skill or experience level. Thirdly, ULBT takes into account some of the limitations associated with traditional airway evaluation methods. Our study had certain limitations. We did not include pediatric and geriatric population. We used the original Cormack-Lehane classification however a modified version that subdivided Grade 2 was described in 1998.[29] In class II a partial view of glottis is seen and the likelihood of difficult intubation is only 4.3%. While in II b only posterior extremity of glottis is seen or only the arytenoid cartilages and the likelihood of difficult intubation is 67.4%.[16] We did not use this subdivision of class II and this might have affected our results.

The possible limitation of this study, and any clinical or bedside study, is that patients do not

completely understand the instructions. We suggest that the anesthesiologist demonstrate the test, thereby enabling patient compliance. The other limitations of ULBT is that it can't be performed in edentulous, patients with restricted mouth-opening as well in non-cooperative patients.

Although, ULBT has very high accuracy, specificity and negative predictive value and reasonably good positive predictive value, it has been suggested by many previous studies that detection of difficult intubation becomes more accurate when multiple clinical tests are used. Perhaps for the current status ULBT should be used in combination with other tests for airway assessment to make a decision.[30,31]

CONCLUSION

It is concluded that although the ULBT has high specificity and accuracy but sensitivity was ow in predicting difficult airway during in patients. ULBT is a reliable bedside technique with a high accuracy for predicting a difficult airway.

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