CAN DIFFICULT INTUBATION BE ACCURATELY PREDICTED USING UPPER LIP BITE TEST?

Azmat Ali Shah[1], Khalid Rafique[2], Mujahid Islam[3]

[1] Department of Anesthesia, Aga Khan Hospital, Dar es Salaam - Tanzania.
2 Department of Anesthesia, Islamabad Medical and Dental College, Islamabad - Pakistan.
[3] Department of Anesthesia, Rehman Medical Institute (RMI), Hayatabad, Peshawar - Pakistan.

Address for correspondence:
Dr. Khalid Rafique
Assistant Professor, Anesthesia, Islamabad Medical and Dental College, Islamabad - Pakistan.
E-mail: khalidrafiquechib@yahoo.com
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ABSTRACT

Objective: To determine the diagnostic accuracy of Upper Lip Bite Test (ULBT) in the diagnosis of difficult intubation taking Cormack-Lehane's classification as the gold standard.

Methodology: This cross-sectional validation study was carried out at Ayub Teaching Hospital, Abbotabad, Hospital from February to December 2012. 450 patients aged ≥16 yr, scheduled to undergo surgery under general anesthesia were included in the study. Preoperatively, two anesthesiologists not involved in intubating the airways of the patients evaluated the patients using ULBT. Anesthesiologists, who were not informed of the preoperative upper lip bite classes, assessed difficulty of laryngoscopy at intubation according to the method described by Cormack and Lehane. The preoperative assessment data and the intubation findings were used to determine the accuracy of the above mentioned tests in predicting difficult intubation. Accuracy, Sensitivity, specificity, accuracy, and positive and negative predictive values were calculated for ULBT.

Results: The mean age of the patients was 38.8±14.09 years and 196 (43.6%) were males. Forty seven (10.4%) of them were found at laryngoscopy to have airways that were difficult to intubate, exhibiting laryngoscopy grade III or IV. There were no failed intubations. The calculated accuracy, sensitivity, specificity, positive predictive value and negative predictive value of ULBT were 95.5%, 91.5%, 96%, 72.8% and 98.9% respectively.

Conclusion: ULBT is a highly accurate, sensitive and specific for predicting difficult intubations.

Key Words: Difficult intubation, difficult laryngoscopy, endotracheal intubation, predictive airway tests, upper lip bite test.

INTRODUCTION

The incidence of difficult intubation is reported to be 10-18%, depending on the criteria used to define it and that of failure to intubate is 0.05%-0.35%.[1] Because failed endotracheal intubation is the principal cause of morbidity and mortality in anesthetized patients,[2] there is a need for accurate tests to predict difficult intubation. When a difficult intubation occurs unexpectedly in a patient after general anesthesia has been induced, there might be an unfavorable outcome if the patient's lungs cannot be adequately ventilated by mask or if an endotracheal tube cannot be properly inserted with use of other techniques. Unexpected difficult intubations are probably the result of a lack of accurate predictive tests for difficult intubation and inadequate preoperative examinations of the airway.

Different preoperative tests for assessing a patient's airway for difficult intubation have been proposed including oropharyngeal class[3] (an assessment of the size of the tongue in relation to the size of the oral cavity); measurement of the thyromental distance[4] an indicator of the mandibular space anterior to the larynx; and measurement of the head extension.[5] Jimson et al found that these tests for forecasting intubation type had inadequate sensitivity (10-66%) and positive predictive values (18%-38%) in predicting difficult intubation. Modified Mallampati classification has been in use for more than 2 decades and over the years many of its limitations have been pointed out by various trials.[6] Many similar studies supported the finding that these screening evaluations have little value in predicting difficult intubation, although when their results are negative there is a high probability that intubation will be easy.

A test to predict difficult intubation should have high sensitivity, so that it will identify most patients in whom intubation will truly be difficult. It should also have a high positive predictive value, so that only a few patients with airways actually easy to intubate are subjected to the protocol for management of a difficult airway. The search for predictive tests that has ease of applicability, reliability and accuracy continues. Development of Upper Lip Bite Test was such an attempt in this direction.

The upper lip bite test (ULBT) was developed by Khan et al[7] in an effort to produce a simple, single test that could be used preoperatively to evaluate for a difficult airway. The test is classified according to the ability to bite the upper lip with the lower teeth. Although this technique shows much promise, limited data exists to support its widespread adoption as the method of choice for preoperative airway assessment.

METHODOLOGY

This cross sectional validation study was carried out at department of Anaesthesiology, Ayub Teaching Hospital, Abbotabad, from February to December 2012 after approval of the hospital ethics committee. 450 patients aged ≥16 yr, scheduled to undergo surgery under general anesthesia were included in the study using non-probability consecutive sampling. Edentulous patients, those unable to open the mouth, those with laryngeal masses, those having large goiters or with limitation of cervical movements were excluded from the study. Pre-operatively, two anesthesiologists not involved in intubating the airways of the patients evaluated the patients using ULBT. Upper lip bite test was assessed with patient sitting, head in neutral position. Ability of the patient to bite his / her upper lip was assessed and graded by the investigator after a proper demonstration of the test to the patient according to the following criteria; class I = Lower incisors can bite upper lip above the vermilion line; class II = Lower incisors can bite below the vermilion line and class III = Cannot bite upper lip. (Figure 1). Class I and II was taken as predictor of easy intubation and class III was taken as a predictor of difficult intubation.

Anesthesiologists, who were not informed of the preoperative upper lip bite classes, assessed difficulty of laryngoscopy at intubation, which was performed with the patient adequately anesthetized and fully relaxed on the operating room table. The induction of anesthesia was done with propofol and suxamethonium and intubation was performed. The maintenance was done with nitrous oxide and volatile gases including isoflurane with muscle relaxation achieved by using atracurium besylate. For intubation the head was placed in the sniffing position, and initial laryngoscopy was performed with a Macintosh No. 3 blade (Welch Allyn Inc., Skaneatills Falls, NY). However, if difficulty was encountered and the first attempt failed to provide a laryngoscopic view, a Miller laryngoscope blade (Welch Allyn) was used coupled with external laryngeal pressure and adjustment of head position as the situation demanded. The laryngeal view was graded according to the method described by Cormack and Lehane as grade I (full view of the glottis), grade II (glottis partly exposed, anterior commissure not seen), grade III (only epiglottis seen), or grade IV (epiglottis not seen); no external laryngeal pressure was applied while reporting the laryngeal view. (Figure 2)

The criteria for difficult intubation with the optimal position of the head (the so-called sniffing position), applying external pressure to the cricoid cartilage (Sellick's maneuver) and after calling in an experienced anesthesiologist were as follows:

- The patient cannot be intubated despite more than three attempts at direct laryngoscopy or more than three attempts at tracheal tube insertion.

- Tracheal intubation attempts lasting more than ten minutes with direct laryngoscopy.

- A grade of III or IV on Cormack-Lehane's classification.

The preoperative assessment data and the intubation findings were used to determine the accuracy of the above mentioned tests in predicting difficult intubation. Accuracy, Sensitivity, specificity, accuracy, and positive and negative predictive values were calculated for ULBT.

RESULTS

The study included 450 patients. The age of the patients ranged from 16-65 years. The mean age of the patients was 38.8±14.09 years. 196 (43.6%) were males and 254 (56.4%) were females. The mean BMI was 29.8±3.59. (Table 1)

Forty seven (10.4%) of them were found at laryngoscopy to have airways that were difficult to intubate, exhibiting laryngoscopy grade III or IV. There were no failed intubations. The mean age, gender and BMI were not significantly different between easy and difficult intubations (p>0.05, Table 1).

Among the 47 patients with difficult intubation 43 had been predicted as difficult on ULBT (true positives) and 4 were predicted as easy on ULBT (False negative). Among the 403 patients with easy intubation, 16 were predicted as difficult on ULBT (False positive) and 387 were predicted as easy on ULBT (True negative). The cal-

Table 1: Demographic data

	Variable	Overall	Difficult (Cormack and Lehane)	Easy (Cormack and Lehane)	P value (comparing difficult and easy groups)
1	Age in years; mean±SD	38.8±14.09	35.38±12.66	39.2±14.2	0.079∗
2	Gender males; n (%)	196 (43.6%) males	17 (36.2%) males	179 (44.4%) males	0.281♠
3	BMI; mean±SD	29.8±3.59	29.52±2.91	29.86±3.66	0.536∗

∗ Calculated using independent sample t test
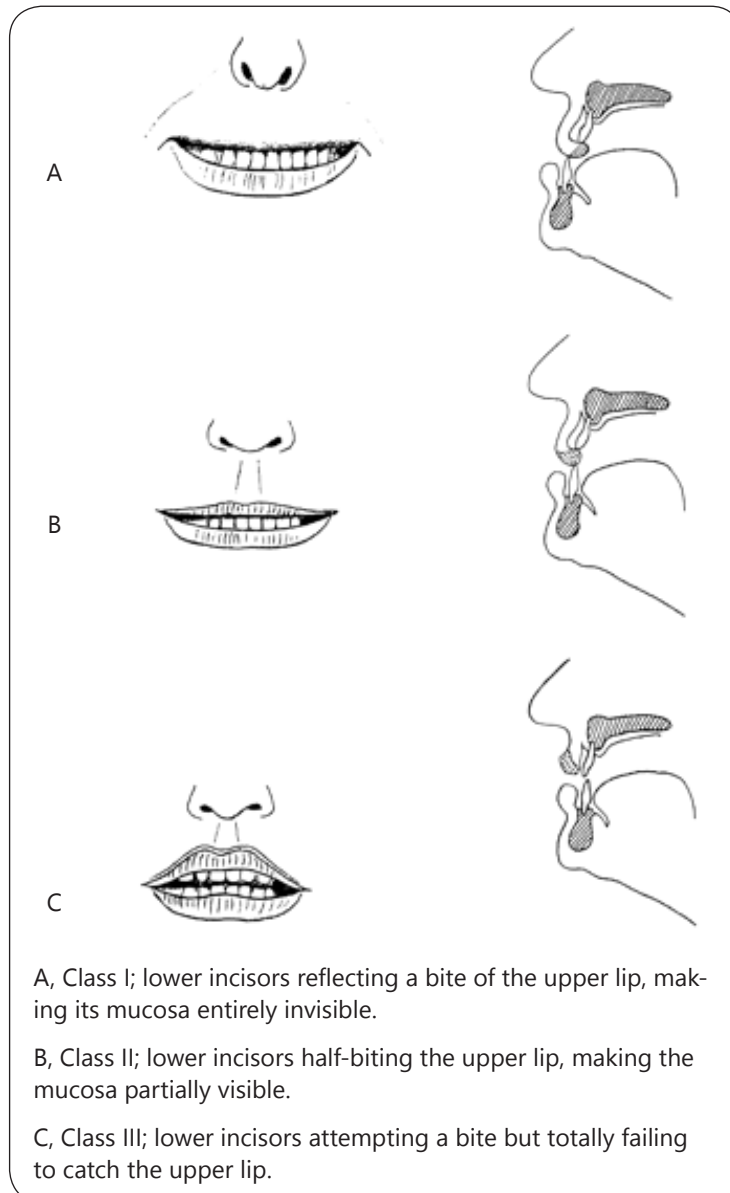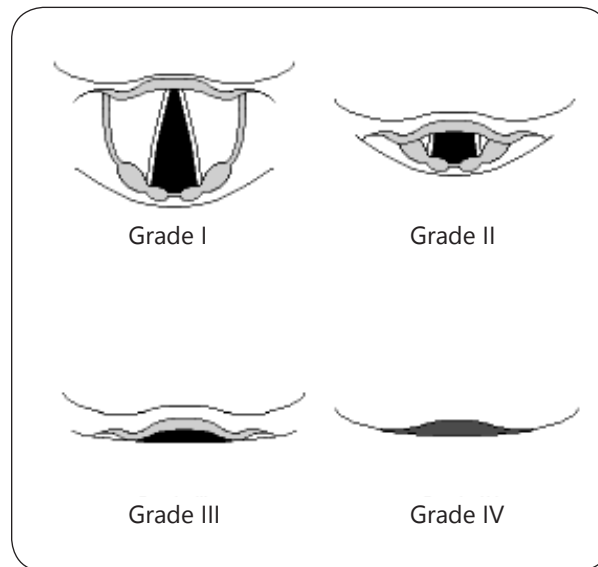♠ Calculated using chi square test

Figure 1: The upper lip bite test

A, Class I; lower incisors reflecting a bite of the upper lip, making its mucosa entirely invisible.

B, Class II; lower incisors half-biting the upper lip, making the mucosa partially visible.

C, Class III; lower incisors attempting a bite but totally failing to catch the upper lip.

Figure 2: The Cormack-Lehane classification

Grade I   Grade II

Grade III   Grade IV

Figure 3: Relationship between the results of ULBT and intubation findings in 450 patients
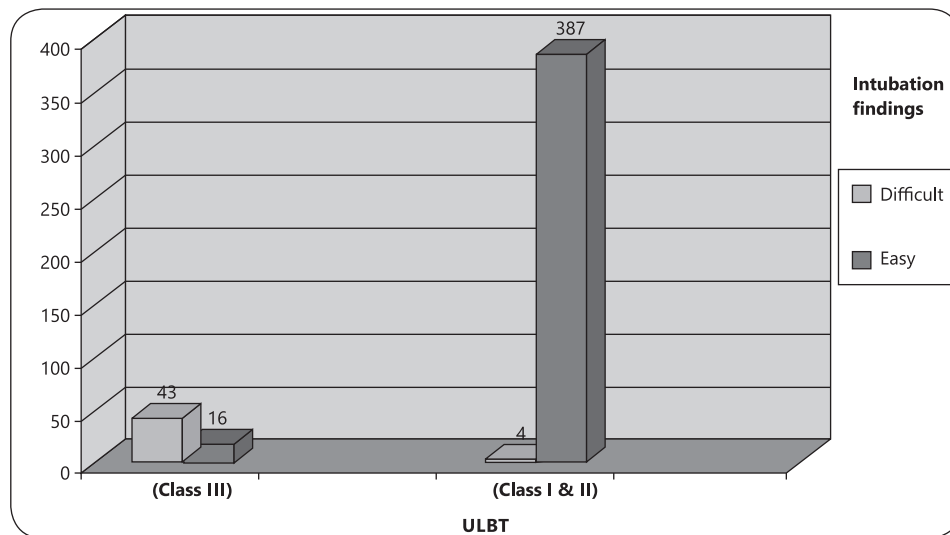
culated accuracy, sensitivity, specificity, positive predictive value and negative predictive value of ULBT were 95.5%, 91.5%, 96%, 72.8% and 98.9% respectively. (Figure 3)

DISCUSSION

Our study was intended to know the validity of the ULBT in airway assessment. 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 (Figure 2). It was initially described by R.S. Cormack and J. Lehane in 1984 as a way of simulating potential scenarios that trainee anaesthetists might face.[8] In our study ULBT had high sensitivity, so it is likely to identify most patients in whom intubation will truly be difficult. It however had a positive predictive value of only 72.8%, so about one third patients with airways actually easy to intubate will be subjected to the protocol for management of a difficult airway if ULBT will be used for preoperative airway assessment. ULBT however has obvious ease of applicability and has a high accuracy of 95.5%.

The incidence of difficult intubations in our study was 10.4% which is similar to the frequency in recent published data. The incidence of unanticipated difficult intubation varies between 1.3% to 13% in various stud-

ies. The incidence of difficult intubation was 5.7% in the study by Khan et al,[7] 7.8% in study by Bhatt et al,[9] 8.1% in the study by Karci et al,[10] 12% in Leopold's trial[11] and 17.3% in the study by Hoda et al.[12]

The results of our study were quite different from the results of study by Khan et al[7] 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. In the study by Karci et al[12] the sensitivity, specificity and accuracy of the ULBT were 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. In the trial by Bhatt et al[11] the sensitivity of ULBT was 20.5% and in the Leopold et al trial[13] it had a sensitivity of 28.2%. In contrast to all the above mentioned studies; our study found ULBT to be highly sensitive (91.5%) and hence it is also likely to identify most patients in whom intubation will be difficult. A recent local study by Ali et al[13] also showed a relatively higher sensitivity of 87.5% for the ULBT. In another local study by Hoda et al[14] ULBT showed significantly higher accuracy, positive predictive valve and negative predictive valve than MT. The negative predictive value of ULBT in our study and the above trial were all more than 90.0%. The specificity of ULBT was 99.1% in the study by Bhatt et al[11] and 92.5% in the study by Leopold et al.[13] The positive predictive value of ULBT in Leopold et al trial[13] was 33.6%, in Khan et al trial[7] was 28.9% and in Bhatt et al trial[11] it was 66.6%. 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 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.[14]

Our study had certain limitations. We did not include paediatric and geriatric population. . We used the original Cormack-Lehane classification however a modified version that subdivided Grade 2 was described in 1998.[15] In class IIa partial view of glottis is seen and the likelihood of difficult intubation is only 4.3%. While in IIb only posterior extremity of glottis is seen or only the ar-ytenoid cartilages and the likelihood of difficult intubation is 67.4%.[17] We did not use this subdivision of class II and this might have affected our results. ULBT should also have been compared with the other prevailing tests like MMT.

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.

CONCLUSION

ULBT is a highly accurate, sensitive and specific for predicting easy and difficult intubation. This could be a good rationale for its routine application in the prediction of difficulty or easiness of intubation. Upper lip bite test however should be used in combination with other airway assessment methods to predict difficult airway till further studies on a larger scale prove its validity beyond doubt.

REFERENCES

1. Frerk CM. Predicting difficult intubation. Anaesthesia 1991;46:1005-8.

2. Rosenblatt WH. The airway approach algorithm: a decision tree for organizing preoperative airway information. J Clin Anesth 2004;16:312-6.

3. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, et al. A clinical sign topredict difficult tracheal intubation: a prospective study. Can Anaesth Soc J 1985;32:429-34.

4. Patil VU, Stehling LC, Zaunder HL. Fiberoptic endoscopy inanesthesia. Chicago: Year Book Medical Publishers; 1983.

5. Bellhouse C, Dare C. Criteria for estimating likelihood of difficultyof endotracheal intubation with the Macintosh laryngoscope. Anaesth Intensive Care 1988;16:329-37.

6. Lee A, Fan LT, Gin T, Karmakar MK, NganKee WD. A systematic review (meta-analysis) of the accuracy of the Mallampati tests to predict the difficult airway. Anesth Analg 2006;102:1867-78.

7. 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. Anesth Analg 2003;96:595-9.

8. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia1984;39:1105-11.

9. Bhat RR, Mishra SK, Badhe AS. Comparison of upper

lip bite test and modified Mallampati classification in predicting difficult intubation. Internet J Anesthesiol 2007;13:248-52.

10. Karci A, Karagöz S, Girgin P, Bozdogan DG. Comparison of modified Mallampati classification, upper lip bite test and neck circumference in prediction of difficult intubation: 19AP5-5. Eur J Anaesthesiol 2011;28:236.

11. 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 Mallampati classification to predict difficult laryngoscopy: an external prospective evaluation. Anesth Analg 2005;101:284-9.

12. Hoda, QM, Asghar A, Samad K. Comparison of upper lip bite test with Mallampati test in prediction of difficult intubation in tertiary care hospital of a developing country: 19AP4-7. Eur J Anaesthesiol 2010;27:254.

13. Ali MA, Hoda QM, Samad K. Comparison of upper lip bite test with Mallampati test in the prediction of difficult intubation at a tertiary care hospital of Pakistan. J Pak Med Assoc 2012;62:1012-5.

14. Oates JD, Macleod AD, Oates PD. Comparison of two methods for predicting difficult intubation. Br J Anaesth1991;66:305-9.

15. Yentis SM, Lee DJ. Evaluation of an improved scoring system for the grading of direct laryngoscopy. Anaesthesia 1998;53:1041-4.

CONTRIBUTORS