Diagnostic Significance of Upper Lip Bite Test of Difficult Airway for Endotracheal Intubation in North Indian Population

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Abstract		Original Research Article

Objective: To evaluate the diagnostic significance of upper lip bite test (ULBT) of difficult airway for endotracheal intubation in north Indian population. *Methods:* This was a prospective blinded study conducted in 249 patients. The demographic data was collected from patient's attendant. Patients were evaluated for ULBT before surgery. An experienced anesthesiologist, not aware of the recorded pre-operative airway evaluation, performed the laryngoscopy and grading as per Cormack and Lehane's classification. *Results:* Among study population, ULBT score 1 was among more than half of patients (69.1%). The prevalence of difficult airway for endotracheal intubation was 17.7%. Cormack Lehane score 1 was among more than half of patients (59.8%). The diagnostic value of ULBT was significant (AUC=0.887, Z=11.53, p<0.001) but had high sensitivity 72.73% (95% CI=57.2-85.0) and high specificity 95.61% (95% CI=91.8-98.0). The positive likelihood ratio (+LR), negative likelihood ratio (-LR), positive predictive value (+PV) and negative predictive value (-PV) were found to be 16.57%, 0.29%, 78.0% and 94.2%, respectively. *Conclusion:* ULBT is a highly sensitive, specific, with high positive and negative predictive value.
Key words: Difficult airway, endotracheal intubation, Diagnostic significance, ULBT.

INTRODUCTION

Difficult laryngoscopy and difficult tracheal intubation occur in 1.5% to 13% of patients undergoing general anesthesia and have always been a concern for anesthesiologists [1]. Different method has been introduced by physician for management of difficult airway. However, the important note is the early and accurate detection of difficult airway for its safe management because failed intubation can have serious consequences and lead to high morbidity and mortality of the patients [2, 3]. Various bedside tests have been used for prediction of difficult laryngoscopy and intubation; of which, upper lip bite test (ULBT) has been proposed by Khan *et al*. [4] as a good predictor for difficult laryngoscopic intubation. However, its usefulness is not still very clear, as various studies have demonstrated different results regarding its diagnostic accuracy. In a prospective blinded study comparing the ULBT with modified Mallampati test (MMT), ULBT significantly showed higher accuracy and specificity than MMT (*P* < 0.001). However, there were no significant differences in sensitivity, positive and negative predictive values between two tests (P>0.05). In another study, comparing ULBT with measurement of sternomental distance (SMD),

thyromental distance (TMD), and interincisor distance (IID), it was revealed that the specificity and accuracy of the ULBT is significantly higher than the older tests. Also, ULBT, when combined with SMD, showed the highest sensitivity [5].

A study evaluated the role of ULBT, MMT and TMD individually and also in various combinations in prediction of difficult laryngoscopy. Unlike the previous studies, this study showed that none of these three tests is a suitable predictive test when it is used alone. However, higher diagnostic value is achieved when they are combined together [6]. Furthermore, the accuracy and reliability of the ULBT may vary according to patients' sex and ethnic group; as lip size varies among different ethnicities. In addition, patients with collagen lip injections might show false positives or false negative results [7].

The aim of this study was to evaluate the diagnostic significance of upper lip bite test of difficult airway for endotracheal intubation in north Indian population.

MATERIAL AND METHODS

After approval from the Institutional Review Board, this prospective blinded study was conducted in 249 patients. The demographic data was collected from patient's attendant. Patients were evaluated for ULBT before surgery. Patients undergoing elective surgery under general anesthesia with endotracheal intubation aged 15-80 years belonging to ASA grade I and II were included in the study. Emergency cases, history of previous surgery, edentulous patients, patients requiring a rapid sequence induction and patients with requiring cricoid pressure during intubation were excluded from the study.

An experienced anesthesiologist, not aware of the recorded pre-operative airway evaluation, performed the laryngoscopy and grading as per Cormack and Lehane's classification [8].

The ULBT was performed in all patients according to the following criteria:[4]

Class 1-lower incisors can bite the upper lip above the vermilion line
Class 2-lower incisors can bite the upper lip below the vermilion line
Class 3-lower incisors cannot bite the upper lip.

STATISTICAL ANALYSIS

Continuous data were summarized as Mean ± SD (standard deviation) while discrete (categorical) in %. The discrete groups were compared by chi-square (χ^2) test. Diagnostic significance of predictors of difficult airway for endotracheal intubation was assessed by ROC (receiver operating characteristic) curve analysis. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and likelihood ratios were calculated. A two-sided $p<0.05$ was considered statistically significant. SPSS (version 16.0) software was used for the analyses.

RESULTS

Among patients, mostly were males (57.0%). The age of all patients ranged from 15-80 yrs with mean (± SD) 41.79 ± 14.51 yrs. The weight, height and BMI of all patients ranged from 29-98 kg, 144-186 cm and 11.77-38.75 kg/m^2, respectively with mean (± SD) 59.90 ± 12.17 kg, 160.04 ± 7.65 cm and 23.35 ± 4.47 kg/m^2, respectively (Table-1).

Among study population, ULBT score 1 was among more than half of patients (69.1%). The prevalence of difficult airway for endotracheal intubation was 17.7%. Cormack Lehane score 1 was among more than half of patients (59.8%) (Table-2).

The diagnostic value of ULBT was significant (AUC=0.887, Z=11.53, p<0.001) but had high sensitivity 72.73% (95% CI=57.2-85.0) and high specificity 95.61% (95% CI=91.8-98.0). The positive

likelihood ratio (+LR), negative likelihood ratio (-LR), positive predictive value (+PV) and negative predictive value (-PV) were found to be 16.57%, 0.29%, 78.0% and 94.2%, respectively (Table-3 & Fig.1).

Table-1: Demographic characteristics (Mean ± SD, n=249) of study population patients

| Characteristics	Statistics
Gender:	
Females	107 (43.0%)
Males	142 (57.0%)
Age (yrs)	41.79 ± 14.51 (15-80)
Weight (kg)	59.90 ± 12.17 (29-98)
Height (cm)	160.04 ± 7.65 (144-186)
BMI (kg/m^2)	23.35 ± 4.47 (11.77-38.75)

Numbers in parenthesis indicates the range (min-max)

Table-2: Frequency distribution of ULBT and intubation of difficult airway for endotracheal intubation

	N (%)
ULBT score	
1	172 (69.1%)
2	36 (14.5%)
3	41 (16.5%)
Intubation:	
Easy	205 (82.3%)
Difficult	44 (17.7%)

Table-3: Diagnostic significance of ULBT for difficult intubation

ULBT>2	Predictive value,
Sensitivity, % (95%CI)	72.73 (57.2-85.0)
Specificity, % (95%CI)	95.61 (91.8-98.0)
+PV	78.0
-PV	94.2
+LR	16.57
-LR	0.29
AUC	0.88
p-value	0.0001*

+LR: Positive likelihood ratio, -LR: Negative likelihood ratio, +PV: Positive predictive value, -PV: Negative predictive value, *Significant
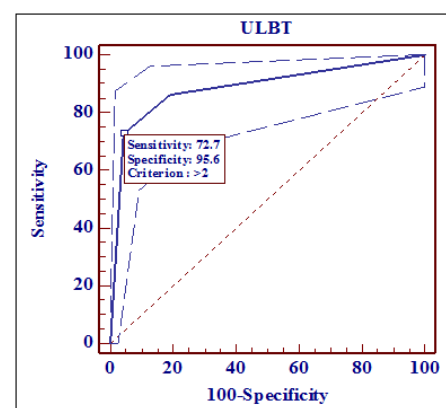
Fig-1: ROC curve showing diagnostic significance of ULBT for difficult intubation

DISCUSSION

The incidence of difficult intubation in this study was 17.7% and there were no failures to intubate the trachea. The incidence of difficult intubation varies between 0.5 to 18% in various studies [4, 9, 10]. Kolarkar *et al.* [11] in their study found that the incidence of unanticipated difficult intubation was 13.3%. Some authors blame different anthropomorphic features among populations as the cause of the discrepancies in the incidence of difficult intubation in different studies.

The ULBT was proposed by Khan *et al.* in a hope that combining two important factors affecting intubation like jaw subluxation and presence of buck teeth which interfere with intubation [4]. There have been varying reports of the predictive value of this test since its introduction. Khan *et al.* [4] compared it with the modified Mallampati and found it to be more specific (88.7%) and accurate (88.0%) than the Mallampati with an equally good sensitivity (76.5%). The sensitivity, specificity, PPV and NPV of the ULBT in this study were 72.73%, 95.61%, 78% and 94.2% respectively. This was comparable to some previous studies [12-14]. A highly specific but not sensitive test is of little value for evaluation; although when results are negative, there is a high probability that intubation is easy. The ULBT was claimed to be more reliable and easy to interpret than the Mallampati with its clear demarcation between the classes. Even with this feature, the problem encountered was that, the patients could not understand the test in spite of the demonstrations made by the investigator.

CONCLUSION

ULBT is a highly sensitive, specific, with high positive and negative predictive value.

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