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# Comparison of Upper Lip Bite Test (A New Simple Technique) With Mallampati Test for Predicting Difficulty in Endotracheal Intubation in Pakistani Population

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## ABSTRACT

### Objective:

To determine the diagnostic accuracy of upper lip bite test for predicting difficulty in endotracheal intubation by taking Cormack Lehane classification as gold standard.

### Material and Methods:

It was a cross sectional validational study conducted on 212 patients that underwent general anesthesia from 1st July 2015 to 31st December 2015 at Indus Hospital. Upper lip bite test was performed prior to surgery and then Cormack and Lehane classification was used to predict difficult intubation on induction of general anesthesia during conventional laryngoscopy.

### Results:

Overall area under the ROC curve (AUC) of upper lip bite test (ULBT) was 71.8% with diagnostic accuracy of 85% inferring that ULBT is a fair test. However, the sensitivity of ULBT was found to be 51.3% suggesting that the test is not good enough to correctly identify patients with difficult intubation

### Conclusion:

It is therefore concluded from our study that upper lip bite test may be a good predictor for easy intubation but alone it cannot be used as a sole predictor for difficult intubation rather it should be used in combination with other bedside technique to increase accuracy of prediction difficult intubation.

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**Key words**: Upper lip bite test, Cormack – Lehane Classification, mallampati, endotracheal, intubation, laryngoscopy.

## INTRODUCTION

Airway maintenance is an important task in anesthesia practice while doing general anesthesia (GA). Endotracheal intubation with direct laryngoscopy is the most preferred method used to secure airway. Therefore, in order to maintain an intact airway various important measures need to be done including examination of upper airway and are always done prior to any surgery where GA along with tracheal tube intubation is required.Difficult laryngoscopy or endotracheal intubation has been identified as one of the most common causes of anesthesia related morbidity and mortality which is termed difficult if either more than 3 attempts or more than 10 min for a successful endotracheal intubation is required by anesthesiolgist[1].

Airway difficulties in direct laryngoscopy were identified in 2.8% to 27% and in Upper lip bite test (ULBT) in 2% to 21%[2]. Difficult intubation can increase risk of complications like airway trauma to oral mucosa as well as bleeding. Around 85% of the mistakes regarding airway management result in permanent cerebral damage and difficult airway management can be attributed to up to 30% of anesthetic deaths[3].Different studies show different incidence of difficult intubation depending on anthropomorphic features among population. A study conducted at Tehran University showed incidence of difficult intubation around 5.7 % [4] whereas a study conducted in Karachi estimated it to be 17.3%[5].

The gold standard of assessing an ability to intubate is done under anesthesia using the Cormack and Lehane classification[6]. However, anesthesiologists also like to assess the airway prior to surgery as a preparatory measure. Several methods exist but the most frequently used ones are the Mallampati test (MP), the modified Mallampati test, chin protrusion, as well as the ULBT. The Mallampati classification is one of the most common methods used to assess difficulty of intubation and it is based on the structures that can be visualized on wide angled open mouth and protruded tongue in sitting position[7] whereas the ULBT, a more recent and less commonly used test, evaluates the possibility of a patient to bite the upper lip above the vermilion line Mucosa of the upper lip with the lower incisors. [8]

The ability of these bedside tests to predict difficult intubation is important. A study done in Germany reported low discriminating power of both ULBT and MT (60% and 66% respectively) with sensitivities 28.2% and 70.2% respectively and concluded that both tests were poor predictors as a single screening test [9]. However, a study conducted at Karachi assessed that the ULBT showed significantly higher accuracy, with a sensitivity of 87.5% and specificity of 92.9% in comparison to the MP test which had a sensitivity of 19.6% and specificity of 91.2% [10].

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Difficult intubation can also be predicted on the basis of other tests such as measuring thyromental distance, sternomental distance, neck circumference and Wilson scoring system have been found to have high false positive values which can minimize their usefulness as a predictor of difficult intubation [11,12]. A study concluded high sensitivities for ULBT, mandibulohyoid distance and thyromental distance [13].

In daily practice MP test is usually used to predict difficult intubation so ULBT needs to be evaluated as an important predictor of difficult intubation in day to day practice.
As mentioned above, studies shows variation in results among different population group depending upon anthropomorphic features so it was detrimental to see whether ULBT shows more accurate result for predicting difficulty in endotracheal intubation in our population of a metropolitan city of Pakistan. If ULBT remains successful in predicting difficulty then this diagnostic modality can be recommended as a better diagnostic tool in future. This study was conductedto determine the diagnostic accuracy of ULBT for predicting difficulty in endotracheal tube intubation by taking Cormack – Lehane classification as gold standard.

## OPERATIONAL DEFINITIONS:

**Upper lip bite test (ULBT):**

- Class I: lower incisors can bite upper lip above vermilion line.
- Class II: lower incisors can bite upper lip below vermilion line.
- Class III: lower incisors cannot bite upper lip.

**Cormack and Lehane Grade I-IVclassification**

- Grade I full view of glottis
- Grade II glottis partly exposed, anterior commissure not seen.
- Grade III only epiglottis seen
- Grade IV epiglottis not seen[6].

**Difficult intubation for ULBT:**

- Grade III for ULBT

**Difficult intubation:** Grades III and IV Cormack and Lehane Grade is difficult intubation

**True Positive:** a difficult laryngoscopy that had been predicted to be difficult (A).
**False Positive:** an easy laryngoscopy that had been predicted to be difficult (B).

**False Negative:** a difficult laryngoscopy that had been predicted to be easy (C).

**True Negative:** an easy laryngoscopy that had been predicted to be easy (D).

**Sensitivity:** The percentage of correctly predicted difficult laryngoscopies as a proportion of all laryngoscopies that were truly difficult (A/A+C).

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**Specificity:** The percentage of correctly predicted easy laryngoscopies as a proportion of all laryngoscopies that were truly easy (D/B+D).

**Accuracy:** Percentage of correctly predicted easy or difficult laryngoscopies as a proportion of all laryngoscopies (A+D/A+B+C+D).

## MATERIAL AND METHODS:

It was a single centered, cross sectional validational study, conducted atthe Indus Hospital, Karachi. Sample size was 210, calculated using sample size calculator for sensitivity and specificity studies [14]with parameters as Alpha (significance level) = 5%, Prevalence of difficult intubation = 17.3% [5], Sensitivity % of upper lip bite = 87.5%[5], Specificity % of upper lip bite = 92.9%[5], D for Sensitivity = 9% and D for Specificity = 6%.

After ethical approval, data was collected from 1st July 2015 to 31st December 2015, using non-probability consecutive sampling, from all the patients aged 18-60 years planned for surgery under general anesthesia having American Society of Anesthesiologists Classification (ASA) status I and II. Cases who were either edentulous, unable to open mouth, had cervical spine injuries, upper airway tumors or undergone lip surgery were excluded.

### Data Collection procedure:

Informed consent was taken from all patients meeting eligibility criteria requiring endotracheal intubation in general anesthesia for an elective surgery. Preoperatively ULBT assessment was made by the on-call duty doctor in the pre-op clinic. All eligible patients were asked to bite their upper lip with the lower incisors as high as they can. Classification of the ULBT was based on how high the lower incisors can touch the upper lip and noted in the proforma.

On the day of surgery, Inj.propofol,nalbuphine and atracurium (neuromuscular blocking agent) was given to induce general anesthesia (GA) and pre-oxygenation was done for 3-5 minutes with 100% oxygen in preparation for intubation. Once the patient was ready, endotracheal intubation was done by a trained anesthesiologist having minimum of 2 years of experience in clinical anesthesia and who was unaware of the results of the ULBT done preoperatively. Patient head and neck was kept in optimal intubating position i.e. sniffing position (extension at atlanto-occipital joint and flexion at neck). Laryngoscopy was done using appropriate size Macintosh blade (usually size 3 in adults). The glottic views wereclassified according to Cormack and Lehane grading. Patients were intubated using appropriate size endotracheal tube. At this point, patients were classified as easy or difficult depending on the Cormack and Lehane classification as mentioned in the operational definitions.

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**Data Analysis:**

Data was entered and analyzed using SPSS version 21. Mean and SD were computed for age, height and weight. Frequency and percentage were calculated for gender, grades of ULBT and Cormack and Lehane grading. The sensitivity, specificity, negative predictive value (NPV) and positive predictive values (PPV) as well as accuracy with gold standard werecomputed for ULBT. PPV was calculated as the percentage of correctly predicted difficult laryngoscopies as a proportion of all predicted difficult laryngoscopies (A)/ (A+B). NPV was calculated as the percentage of all correctly predicted easy laryngoscopies as a proportion of all predicted easy laryngoscopies (D)/(C+D). Accuracy is the percentage of correctly predicted easy or difficult laryngoscopies as a proportion of all laryngoscopies (A+D)/ (A+B+C+D).

## RESULTS

Total 212 patients were enrolled in the study. Out of which 54.7% (n=116) were females, 44.3% (n=94) were males and 0.9% (n=2) had missing information regarding gender. Mean (SD) age, height and weight were 38.53 (13.71) years, 1.68 (0.13) meters and 63.86 (11.51) kg respectively. According to ULBT grades and Cormack Lehane grading difficult intubation was found in 15.6% and 17.5% respectively. Majority of the patients (47.2%) had general surgery (Table 1).

The diagnostic accuracy as calculated by the following (A+D/A+B+C+D) was found out to be 85%.

Overall area under the curve (AUC) of ULBT was 71.8% inferring that ULBT is a fair test(Table 2). However, the sensitivity and positive predictive value of ULBT was found to be 51.3% and 57.6% respectively, suggesting that the test is not good enough to correctly identify patients with difficult intubation. Specificity of test was found to be 92% with Negative Predictive value (NPV) of 90.0%.

**Table 1: Status Of Intubation Assessed In Studied Population**

| | | Frequency (n) | Percent (%) |
|---|---|---|---|
| **ULBT* GRADES** | | | |
| | Grade I | 113 | 53.3 |
| | Grade II | 66 | 31.1 |
| | Grade III (Difficult Intubation) | 33 | 15.6 |
| | | | |
| **ORIGINAL CORMACK AND LEHANE SYSTEM** | | | |
| | Full View of the Glottis | 122 | 57.5 |
| | Partial View of the Glottis of Arytenoids | 53 | 25.0 |

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| | | | |
|---|---|---|---|
| | Only Epiglottis Visible | 26 | 12.3 |
| | Neither Glottis nor Epiglottis Visible | 11 | 5.2 |
| | | | |
| **CORMACK AND LEHANE GRADING** | | | |
| | Easy Intubation | 175 | 82.5 |
| | Difficult Intubation | 37 | 17.5 |
| | | | |
| **TOTAL** | | 212 | 100.0 |

*ULBT= Upper Lip Bite Test

**Table 2: Accuracy of ULBT**

| | **UPPER LIP BITE TEST (ULBT)** | **CORMACK LEHANE** | | **TOTAL** | **AUC*** |
|---|---|---|---|---|---|
| | | **Easy intubation** | **Difficult intubation** | | |
| | | **n (%)** | **n (%)** | **n (%)** | |
| Easy Intubation | | 161 (76.0) | 18 (8.5) | 179 (84.4) | 71.8% |
| Difficult Intubation | | 14 (6.6) | 19 (8.9) | 33 (15.6) | |
| Total | | 175 (82.2) | 37 (17.8) | 212 (100) | |

*AUC= Area under the Curve

**DISCUSSION:**

Airway management is an important challenge in daily practice of general anesthesia. Therefore preoperative assessment facilities must be adequate and appropriate preparation must be done prior to start of surgery or before induction of general anesthesia to deal with difficult intubation when it is anticipated by performing different bedside tests.

There are many preoperative tests which are used to be done as preoperative assessment test to predict difficult intubation but no one has proved to be an ideal as an isolated test with high specificity andsensitivity that can easily be performed as a bedside technique. Although Mallampati classification is most popular bedside technique, but ULBT is also very simple bedside test without any need of additional measures like use of torch lite or without saying 'Ahh' which sometimes produces bias in Mallampati classification. Khan and his colleagues proposed ULBT as an alternative to most widely used Modified Mallampati test and they found out it as convenient test which can be easily performed bedside [4]. Therefore, in order to determine diagnostic accuracy of ULBT for difficult intubation we carried out this study in our population.

Total 212 patients those meeting eligibility criteria undergoing elective surgery under general anesthesia were considered to perform ULBTin order to predict difficult intubation during conventional laryngoscopy by taking Cormack and Lehane classification as gold standard.

The incidence of difficult intubation in our study was found to be 17.5% which is similar to a study done by Ali and colleagues [5] while having no reported failed intubation in our study.

As compared to our study, Lee et al [15]had similar sensitivity (51.3% vs. 31.9%), specificity (92% vs. 92%), positive predictive value (57.6% vs. 40.5%), negative predictive value (90% vs. 88.7%) and accuracies (85% vs. 83.2%) for ULBT, thereby suggesting that ULBT is more accurate for predicting easy intubation. But best result could be achieved when Facial Angle is used in combination with either the Modified Mallampati Score or ULBT. [16]

Unlike to our study, Azmat and colleagues [17] concluded that ULBT as highly accurate, sensitive and specific for predicting difficult intubation and which were also similar to study done by Ali and colleagues [5] and the study conducted at Lahore [18] in which calculated accuracy of ULBT for predicting difficult airway was found to be 91.2%.

A recent study done by Badheka and colleagues [19], concluded that ULBT has high sensitivity and specificity 96.64% and 82.35%.

ULBT alone may be a good predictor for easy intubation but for difficult intubation no one test is accurate enough.

The high specificity and negative predictive value in our study therefore makes ULBT a good predictor for easy intubation rather than to predict difficult intubation.

## CONCLUSION:

ULBT is not a good predictor of difficult intubation when used as a single bedside test in Pakistan. Therefore multiple bed-side tests such as Mallampati Classification, thyromental distance and ratio of patient's height to thyromental distance should be used for predicting difficult intubation.

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