

## COMPARISON OF UPPER LIP BITE TEST WITH OTHER FOUR PREDICTORS FOR PREDICTING DIFFICULTY IN INTUBATION

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**ABSTRACT:** Unanticipated difficult tracheal intubation remains a primary concern for anaesthesiologists, endangering the life of patients at the crucial moment. The aim of the present study is to compare Upper lip bite test (ULBT) with other four predictors (Modified Mallampati test MMT, Thyromental distance TMD, Sternomental distance SMD, Inter incisor distance IID) for predicting difficulty in intubation. Upper lip Bite test, if proven to be effective, is very helpful to even the junior most Anaesthetist to evaluate the difficulty in tracheal intubation, and thus being ready with all the armamentarium, needed for the difficulty likely to be faced. Hence, leading to better safety of the patient and comfort of the anaesthetist. **AIM OF THE STUDY:** This prospective study was undertaken at Sri Venkateswara Medical College, Tirupati and S.V.R.R.G.G. Hospital, Tirupati, to determine the ability of Upper Lip bite test, to predict difficult/easy visualization of larynx and intubation and comparing upper lip bite test with four different tests i.e., Modified Mallampati test, sternomental distance, thyromental distance and inter incisor distance.

**KEYWORDS:** Prediction, Difficulty, Tracheal Intubation, Upper Lip Bite Test.

**INTRODUCTION:** The prime responsibility of an anesthesiologist is to maintain good airway for adequate gas exchange in the patient. To achieve this, the patient's airway must be managed well to be continuously patent. Failure to maintain a patent airway for more than few minutes results in brain damage or death. Intubation difficulties and problems with airway management during emergence remain among the leading causes of serious intraoperative problems.<sup>1</sup>

There are three common ways to maintain airway patency and gas exchange. First, inspired gas is delivered to the patient through a face mask. Second, inspired gas is delivered through supraglottic airways. Third, the airway is kept open to inspired gas by a tube passed into the trachea through the vocal cords.

Difficult mask ventilation is a condition in which it is not possible for the anaesthesiologist to provide adequate face mask ventilation.

El-Ganzouri and associates,<sup>2</sup> defined difficult ventilation as "Inability to obtain chest excursion sufficient to maintain a clinically acceptable capnogram waveform despite optimal head and neck positioning and use of muscle paralysis, use of an oral airway, and optimal application of a face mask by anaesthesia personnel."

Difficult laryngoscopy is described as not being able to visualize any portion of the vocal cords after multiple attempts at conventional laryngoscopy, and many investigators included grades III and IV or grade IV alone, according to the Cormack-Lehane,<sup>3</sup> original grading of the rigid laryngoscopic view. The components of best performance of laryngoscopy consist of morning sniff position, good complete muscle relaxation and firm forward lift of the mandible.

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Difficult laryngoscopy (A grade III or IV view),<sup>3,4</sup> is synonymous with Difficult Intubation (DI) in the majority of patients. However, endotracheal intubation depends slightly more on the skill of the individual than does laryngoscopy, and therefore the degrees of difficulty with laryngoscopy and endotracheal intubation may be inconsistent.

### PREDICTORS OF DIFFICULT AIRWAY<sup>5</sup>:

1. Modified Mallampati test. (MMT)
2. Thyromental distance. (TMD)
3. Sterno-mental distance. (SMD)
4. Inter-incisor distance. (IID)
5. Upper lip bite test<sup>6</sup> (ULBT): A modification of the temporomandibular displacement test.

**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 and,

**Class III:** Lower incisors cannot bite the upper lip.

### RADIOGRAPHIC ASSESSMENT:

#### 1. From skeletal films:

Mandibulo-hyoid distance.

Atlanto-occipital gap.

Relation of mandibular angle and hyoid bone with cervical vertebra and laryngoscopy grading.

Anterior/Posterior depth of the mandible.

C1-C2 gap.

The present study is designed to determine the ability to predict difficult / easy visualization of larynx in study population by comparing upper lip bite test with four different tests i.e., modified Mallampati test, sternomental distance, thyromental distance and inter incisor distance.

**METHODOLOGY:** The present study "Comparison of Upper Lip Bite Test with Other Four Predictors for Predicting Difficulty in Intubation, was undertaken at Sri Venkateswara Medical College and SVRR Government General Hospital, Tirupati, Andhra Pradesh, during the period of January 2013 to May 2014. Written informed consent was obtained from all the participants.

**Patient Selection:** 200 ASA grade I and II (18-60 yrs of age group) adult patients scheduled to receive general anaesthesia with endotracheal intubation. Patients with Airway malformations, Edentulous patients, Pregnancy and lactating mothers and patients with cranio facial anomalies were excluded from the study. Preoperative airway examination was performed using multiple screening tests to predict difficult airway. The following screening tests were used in present study.

**Recording of Patient's:** Height and Weight, Pathologies associated with difficulty in aryngoscopy or intubation.

### Modified Mallampati Test:

- |  |   |           |
|--|---|-----------|
| <b>Class 1:</b> Soft palate, <u>faucus</u> , uvula and pillars seen. | } | Easy      |
| <b>Class 2:</b> Soft palate, <u>faucus</u> , uvula seen.             |   |           |
| <b>Class 3:</b> Soft palate and base of uvula seen.                  | } | Difficult |
| <b>Class 4:</b> Soft palate not visible at all.                      |   |           |

**Upper Lip Bite test:**

- Class I: Lower incisors can bite the upper lip above the vermilion line. } Easy  
 Class II: Lower incisors can bite the upper lip below the vermilion line. }  
 Class III: Lower incisors cannot bite the upper lip. } Difficult

**Sternomental Distance:**

- Class I:  $\geq 11$ cm – Easy.  
 Class II:  $< 11$  cm- Difficult.

**Thyromental Distance:**

- Class I:  $\geq 6$  cm – Easy.  
 Class II:  $< 6$  cm- Difficult.

**Inter incisor Distance:**

- Class I:  $\geq 3.5$  cm- Easy.  
 Class II:  $< 3.5$ cm- Difficult.

Glottic visualization was assessed using Cormack and Lehane grading. After evaluation intubation was performed and then subjected to anaesthetic management for the surgical procedure. Endotracheal intubation was considered truly difficult, if any of the following were positive. 1) Cormack and Lehane grade III and IV. 2) Three attempts at tracheal intubation or duration longer than ten minutes 3) Failure to intubate. Rest of the patients were considered to have truly easy endotracheal intubation.

**OBSERVATIONS AND RESULTS:** In the present study a total number of 200 cases were recruited. Chi-square test and Fischer's Exact test was performed to test the differences in frequency between groups of different methods in comparison to gold standard method. Sensitivity, Specificity, Positive predictive value and Negative predictive value for different methods were calculated with the help of IBM SPSS Statistics. Study findings were documented as follows.

Variable	Mean $\pm$ SD	p-value
Age (years)	39.48 $\pm$ 11.22	-
Sex:		
Male (%): Female (%)	25(41.7): 35(58.3)	
Height (cm)	157.97 $\pm$ 7.22	-
Weight (kg)	57.78 $\pm$ 9.04	-
BMI (kg/m <sup>2</sup> )	23.17 $\pm$ 3.30	-
SMD (cm)	15.84 $\pm$ 1.19	-
TMD (cm)	7.17 $\pm$ 0.89	-
IID (cm)	4.53 $\pm$ 0.59	-

Table 1: Demographic characteristics of study population

Data expressed as mean ( $\pm$ Standard deviation).

The mean age of the study population was 39.48 $\pm$ 11.22 years. Among the study population 42% were males, 58% were females. Mean weight of the study group was 57.78 $\pm$ 9.04 Kgs and BMI was 23.17 $\pm$ 3.30 Kg/m<sup>2</sup>. Mean sternomental distance (SMD), thyromental distance (TMD) and interincisor distance (IID) were 15.84 $\pm$ 1.19 cm, 7.17 $\pm$ 0.89 cm and 4.53 $\pm$ 0.59 cm respectively.

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Type of Test	Class / Grade	No. of Patients (%) (n=200)
Upper-lip bite test (ULBT)	Class-I	30(15%)
	Class-II	164(82%)
	Class-III	6(3%)
Modified Mallampati Test(MMT)	Class-1	40(20%)
	Class-2	126(63%)
	Class-3	34(17%)
	Class-4	0
Sternomental distance(SMD )	Class-I( $\geq 11$ cm)	200(100%)
	Class-II( $< 11$ cm)	0(0%)
Thyromental distance(TMD)	Class-1( $\geq 6$ cm)	192(96%)
	Class-2( $< 6$ cm)	8(4%)
Inter Incisor distance:(IID)	Class-1( $\geq 3.5$ cm)	196(98%)
	Class-2( $< 3.5$ cm)	4(2%)
CML grading: (Cormack and Lehane)	Class-I	70(35%)
	Class-II	76(38%)
	Class-III	54(27%)
	Class - IV	0

Table 2: Distribution of different classes of ULBT, MMT, SMD, TMD, IID and CML tests in study group

Predictive tests	Laryngoscopic view(n=200)		Kappa Coefficient	p- value
	I/II - Easy(n=147)	III/IV - Difficult(n=53)		
<b>Upper-lip bite test:</b> Class-I/II(Easy) Class-III(Difficult)	144(72%) 03(1.5%)	50(25%) 03(1.5%)	0.05	0.957
<b>Modified Mallampati Test:</b> Class-1/2(Easy) Class-3(Difficult)	127(63.5%) 20(10%)	40(20%) 13(6.5%)	0.13	0.514
<b>Sternomental Distance:</b> Class-I( $\geq 11$ cm) -Easy Class-II( $< 11$ cm) -Difficult	147(73.5%) 0(0%)	53(26.5%) 0(0%)	0.00	NA
<b>Thyromental Distance:</b> Class-1( $\geq 6$ cm) - Easy Class-2( $< 6$ cm) -Difficult	144(71.66%) 03(1.5%)	50(25%) 03(1.5%)	0.05	0.957
<b>Interincisor Distance:</b> Class-1( $\geq 3.5$ cm) - Easy Class-2( $< 3.5$ cm) - Difficult	144(72%) 03(1.5%)	53(26.5%) 0(0%)	0.03	0.595

Table 3: Kappa coefficient of different tests in predicting difficult intubation

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When compared to other predictive tests, ULBT has fair agreement, with laryngoscopic view, in predicting difficulty in intubation.

Test Method	Outcome			
	True positive	False negative	False positive	True negative
ULBT	03	50	03	144
MMT	13	40	20	127
SMD	0	53	0	147
TMD	03	50	03	144
IID	0	53	03	144

**Table 4: Outcome distribution of various methods in predicting difficult intubation: Laryngoscopic view VS ULBT, MMT, SMD, TMD, IID**

Number of True Positives and True Negatives, when compared to laryngoscopic view, are fairly good in Upper lip bite test.

**DISCUSSION:** Predicting difficult intubation can reduce anaesthesia associated morbidity and mortality. In order to be clinically useful, a test predicting difficult intubation must be easily applicable at the bedside and must give reliable results. No test has 100% sensitivity and there will always be some patients with unpredicted difficult intubation are desirable. 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 who can be actually intubated easily and subjected to the protocol for management of a difficult intubation.

Although there are many preoperative tests to predict difficult airway, they are far from being ideal i.e., one which is easy to perform, highly sensitive, highly specific and which possess high predictive value with few false positive prediction.

In the present study, the sensitivity of Upper lip bite test (ULBT) is only 5.66% that means in about 94.3% could not identify possibility of difficult intubation. This is in contrast to the results obtained by Khan et al,<sup>6</sup> Azmat ali et al, Ali et al,<sup>7</sup> and Eberhart et al,<sup>8</sup> wherein they found a sensitivity of 76.5%, 91.5%, 87.5%, and 26.2% respectively. Our study is in concordance with the study done by Karci et al,<sup>9</sup> wherein they found sensitivity of 13%. The lower sensitivity of ULBT in our study can be explained due to low incidence of ULBT Class III in our study (1 out of 60 patients) .We found that repeated demonstration were required for the patients to perform ULBT and a few still failed to understand the procedure In spite of our efforts. Also in some, there was a reflex movement of upper lip in the reverse direction over the upper teeth which may alter the point of meeting of vermilion line with lower incisors. In the same individual measured, the ULBT may vary according to the effort applied by the patient.

The specificity of ULBT in our study was 97.9%, which correlates with the studies done by Khan et al,<sup>6</sup> (88.7%), Eberhart et al,<sup>7</sup> (92.5%), Hester et al,<sup>10</sup> (97%). The specificity of Modified Mallampati test (MMT) was 86.36% in our study. This is in contrary to the results obtained by Khan et al,<sup>6</sup> Eberhart et al,<sup>8</sup> and Hester et al,<sup>10</sup> wherein they reported specificity of MMT as 66.8%, 61.0%, and 75% respectively. This discrepancy may be explained by the fact that in our study both the preoperative evaluation of airway predictors and intubation was done by the same person.

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So the chances of inter observer bias as reported by many authors may not be an issue here. Also this difference may also be explained on the different racial characteristics of the people observed.

The negative predictive value of ULBT, MMT, SMD, TMD and inter incisor distance (IID) are almost similar in our study (74.14%, 76%, 73.3%, 74.14 and 72.88%) respectively. Naithani et al observed NPV for above said airway parameters as 98.3%, 96.7%, 90.5%, 91.7% and 94.7 respectively. In contrast Khan et al reported NPVs for ULBT, SMD, TMD and IID as 98.8%, 98.8%, 98.3% and 97.8% respectively. This discrepancy in the results obtained by us may be due to different yardsticks defined by us as the cut off points for predicting difficult intubation.

In the present study, kappa coefficient for ULBT, MMT, SMD, TMD and IID were 0.05, 0.13, 0, 0.05, 0.03 respectively and there was no statistically significant difference ( $p > 0.05$ ) in predicting difficulty in intubation with respect to Cormack and Lehane laryngoscopic grading,<sup>3</sup> III/IV. This is in contrast to results obtained by Eberhart et al,<sup>8</sup> who observed better interobserver reliability for ULBT when compared to MMT (0.79 vs 0.59;  $p < 0.01$ ). This difference in the results obtained may be explained due to different ethnicity of study population.

**CONCLUSION:** Upper lip bite test had low sensitivity and high specificity in predicting difficulty in intubation. As the test is simple and can be evaluated even by the junior most resident, it is likely to be of help in predicting airway difficulty, especially when used in conjunction with other predictors.

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