



Comparison of upper lip bite test with thyromental distance for predicting difficulty in endotracheal intubation: A prospective study

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ABSTRACT

The present study has aimed to compare the upper lip bite test (ULBT) and thyromental distance (TMD) in predicting difficulty in intubation. 140 consecutive patients aged 18 – 60 years were included in the study. Each patient was evaluated regarding ULBT, TMD. Laryngoscopy was assessed by an attending anesthesiologist blinded to the study. In our study we found both the tests have a negative predictive value more than 90%, thus stressing the fact that, these tests can be good predictors of easy intubation, rather as positive predictors of difficult intubation which has a very low incidence. But out of the two tests, positive predictive value of ULBT is more and statistically significant, so better than TMD.

KEYWORDS: Difficulty intubation, Predictive airway test, endotracheal intubation, upper lip bit test, thyromental distance.

1. INTRODUCTION:

Airway management is of prime importance to the anesthesiologist. In airway management, tracheal intubation using direct laryngoscopy remains the gold standard till date. No anesthetic is safe unless conscious efforts are made to secure and maintain a patent airway. The reported incidence of difficult laryngoscopy and tracheal intubation occurs in 1.5 % to 8 % of patients of general anaesthesia. ^[1] Difficult laryngoscopy and intubation cause increased risk of complications to the patient ranging from sore throat to airway trauma. In some cases, if anesthesiologist is not able to maintain a patent airway, it may lead to serious complications like hypoxic brain damage or death. Of all the anesthetic deaths 30 % to 40 % are attributed to the inability to manage a difficult airway. ^[2] Of the overall claims against

anesthetist in closed claims project, 17% involved difficult or impossible intubation. ^[3]

To aid the anesthesiologist in identifying these patients, several preoperative airway assessment tests have been proposed. ^[4-8] There are many tests to predict difficult intubation like Patil's measurement of Thyromental distance, the Mallampati test and the Wilson scoring system which have been shown to have high false positive rates, which detract their usefulness. ^[9, 10] So predicting a difficult intubation employing a multitude of measurements and observations has not demonstrated it to be practicable or even reliable.

A new, simple bed side test, Upper lip bite test (ULBT) was found to have higher accuracy (88%), specificity (88.7%), positive predictive value (28.9%) than Thyromental

Distance (TMD).^[11] In day to day practice, we use TMD to predict the difficult endotracheal intubation, whereas ULBT is not as popular as that. So usefulness of ULBT as a predictor of difficult intubation needs to be evaluated and established. Hence, we proposed this study to compare ULBT with TMD in predicting difficulty in endotracheal intubation, in patients who are undergoing surgery under general anaesthesia.

2. MATERIALS AND METHODS

A study was undertaken in Sri Sathya sai medical college & research institute during the year February 2011 to January 2012. The study design was approved by Institutional human ethical committee and informed consent obtained from all the patients prior to the experiment. One hundred and forty (140) patients were included in the study. Patients having any significant disorders such as edentulous patients, patients unable to open the mouth, patients with cervical spine fractures and deformities, patients with upper airway tumors, patients with loose incisors, patients who has undergone lip surgeries were excluded from the study.

Preoperatively all the patient’s airway was evaluated using TMD and ULBT. The thyromental distance was taken by making the patient to be seated upright and asked to extend their head and neck as far as possible with mouth closed. The straight distance on the exterior surface from the inside of the mentum to thyroid notch was measured.^[11] Grade I - >6.5 cm, Grade II- <6.0 cm.

The ULBT was performed according to the following criteria;

Class I – lower incisors can bite upper lip above the vermilion line

Class II – lower incisors can bite upper lip below the vermilion line

Class III – lower incisors cannot bite the upper lip

On the day of surgery i.v line was secured prior to surgery in the pre operative room , once the patient was shifted to the operating theatre, patients were monitored with an electrocardiogram, non-invasive blood pressure and pulse oximeter. Patients were premedicated with Glycopyrrolate 0.005 mg Kg⁻¹ i.v, midazolam 0.05 mg kg⁻¹ i.v and fentanyl 1.5 mcg kg⁻¹ i.v. After pre oxygenation with 100% oxygen for 5 minutes, patients were induced with IV thiopentone 5 mg Kg⁻¹ and the endotracheal intubation was accomplished with suxamethonium 1.5 to 2 mg Kg⁻¹ by a senior anesthesiologist having minimum three years of experience in clinical anaesthesia.

The patients’ head and neck were kept in optimal intubating position with a pillow under the occiput during intubation (sniffing position), laryngoscopy was done using appropriate sized Macintosh blade and glottic view was graded according to the Modified Cormack and Lehane grading.

Grade1 – Visualization of entire laryngeal aperture.

Grade2a - Visualization of only posterior commissure of laryngeal aperture.

Grade2b - Visualization of arytenoids only.

Grade 3 - Visualization of only epiglottis.

Grade 4 -Visualization of just the soft palate.

Patients were intubated with appropriate sized endotracheal tube. Patient’s vital signs were monitored throughout the procedure. At the end of surgery patients were adequately reversed with inj. Glycopyrrolate 0.01 mg / kg and inj. Neostigmine 0.05 mg / kg. Patients were extubated after through oral suctioning. After stabilization, patients were shifted to post operative recovery room.

The pre operative airway assessment data and the findings during intubation were used to determine the sensitivity, specificity, positive and negative predictive values for each test. Fisher exact test and McNemar’s test will be used to calculate statistically significant difference in sensitivity and specificity between these tests respectively.

3. RESULTS

In our study 128 patients had thyromental distance more than 6.5 cm, out of which 114 belonged to modified Cormack and Lehane (MCL) class 1, 2a and 2b and the rest of 14 patients belonged to MCL class 3 and 4. 12 patients belonged to thyromental distance less than 6.5 cm, out of which 7 were in MCL 1,2a and 2b and the rest of 5 were in MCL 2b, 3 and 4 as shown in table 1.

As shown in table 2, there were 131 patients belonged to ULBT class I and II out of whom, 122 patients belonged to MCL 1 and 2a and the rest 9 belonged to MCL 2b, 3 and 4. 9 patients were in ULBT class III out of which 3 belonged to MCL 1 and 2a and rest of 6 belonged to MCL 2b, 3 and 4.

Prevailing test	MCL 1,2a and 2b	MCL 3 and 4	Total
Thyromental distance > 6.5 cm	114	14	128
Thyromental distance < 6.5 cm	07	05	12

Table 1: Relation between Thyromental distance and laryngoscopic view

	MCL 1,2aand 2b	MCL 3 and 4	Total
ULBT I,II	122	09	131
ULBT III	03	06	09

Table 2: Relationship between Upper lip bite test (ULBT) and Laryngoscopic view

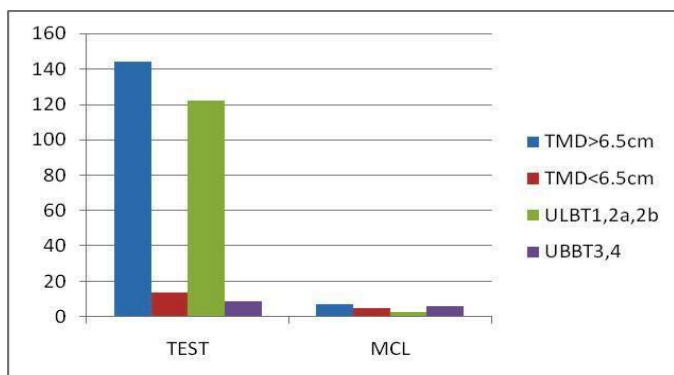


Figure 1: Comparison of TMD and ULBT in predicting difficult intubation.

4. DISCUSSION

Airway management remains an important challenge in the contemporary practice of anaesthesia and preoperative airway assessment facilitates appropriate preparation when difficulty with intubation or ventilation is anticipated prior to induction of anaesthesia. 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 possesses high positive predictive value with few false positive predictions. Khan and his colleagues, Upper Lip Bite test (ULBT) was such an attempt,^[11] they proposed jaw subluxation and buck teeth as alternative to the most widely used Thyromental distance. They found out that ULBT was easy to perform within seconds of demonstrating it to the patients and very convenient to perform as a bedside test. The classes are clearly demarcated and delineated making inter observer variability highly unlikely while using this test. The current study therefore, was undertaken to compare Upper Lip Bite Test (ULBT) with Thyromental distance (TMD) for predicting difficulty during endotracheal intubation in 140 participants undergoing elective surgery under general anaesthesia.

In our study, incidence of difficult intubation was found to be 10% (fifteen cases of difficult intubation out of one hundred and forty participants) which is comparable to the results obtained by Evan Hester et al (18%)^[40]. However the reported incidence of difficult intubation is 1.3%, 1.5%, 1.8%, 3.5%, 4%, 4.5%, 4.9%, 7%, 8%, and 13%^[12,13,14,15,16], depending on the criteria used to define the difficult intubation and different anthropometric features among populations. There were no failures to intubate the trachea in any of the participants of our study. Thyromental distance is being used nearly since three decades and over the years many limitations have been pointed out by various authors. Measurement of TMD originated as a quantitative assessment of "receding jaw," yet we have found no correlation between receding jaw and the mechanism of difficult laryngoscopy.^[17] It has

been previously shown that in patients with a caudally positioned larynx, the mandibulo-hyoid distance (MHD) is long and the tongue is largely contained in the hypopharynx, causing difficult ventilation, difficult intubation, or sleep apnea.^[18] Although MHD is measured vertically and TMD obliquely, patients who have a long MHD/caudal larynx/large hypopharyngeal tongue will also have a long TMD. These patients are candidates for difficult intubation, yet their long TMDs will indicate easy intubation. Such cases may account for the large false negatives associated with the use of TMD in prediction^[19].

The sensitivity of TMD is 33.33%, is more in our study than Freda Richa et, al.,^[20] (21.8%) and less than Salimi et, al.,^[21] (55%). The wide variations in reported sensitivity in various studies may be because of incorrect evaluation of the measurement from inner or outer mentum. The specificity of TMD in our study is 94.4 % which is similar to Salimi A et, al.,^[21] (93.3%) and A K Gupta et, al.,^[22] (96.5%). The positive predictive value of TMD in our study was 41.6% which is quite high when compared to Salimi A et, al.,^[21] (22%). The negative predictive value of TMD was 92.1%, which is comparable to the study done by Freda Richa et, al.,^[20] (94%). This can be explained by the fact that, all the patients' airway was evaluated by a single resident, unlike in other studies where in two or more than two anaesthesiologists were being involved in assessing the airway, which might have contributed to the inter observer variability in their study leading to variable positivity. The experience of the anaesthesiologist performing the intubation also might have caused variation in results. In our study, anaesthesiologist with minimum five years of experience in clinical anaesthesia was involved, thereby further reducing the false positivity and hence high predictive value.

The sensitivity of ULBT in our study was 40% which is well below Khan et, al.,^[11] had got in their study (76.5%), but it was nearer to the value obtained by Hester et, al.,^[23] (55%). This means that several patients who present with difficult intubation will not be identified by ULBT (larger number of patients with false negative test). Lower sensitivity of the ULBT can be explained due to low incidence of ULBT class III in our study. The specificity of ULBT in our study was 97.6% well above the original trial by Khan et, al.^[11] This is because of the lesser number of false negative results obtained in our study with ULBT. The PPV of ULBT in our study was 66.7% which comparable to study done by S K Mishra et, al.,^[24] (52.3%). The NPV was 93.12 % which is comparable to original study by Khan et, al.,^[11] (98.4%).

In our study comparing both the tests, we found that, TMD is as sensitive (33.3%) as ULBT (40%), but both tests had high specificity and NPV. Difference in the sensitivity

between the two tests was not found to be statistically significant. Although ULBT has higher positive predictive value, which is statistically significant ($p < 0.05$), it has a very poor sensitivity, making it an unreliable test to screen the patients for difficult intubations.

Both the tests have a negative predictive value more than 90%, thus stressing the fact that all these tests can be good predictors of easy intubation, rather as positive predictors of difficult intubation which has a very low incidence. But out of the two tests, positive predictive value of ULBT is more and statistically significant, so better than TMD.

Incidentally, during the study, we found that repeated demonstrations were required for patients to perform ULBT and a few failed to understand the procedure inspite of our efforts. We went on to exclude these patients from our study which numbered to only three. Another interesting observation was the reflex movement of the upper lip in the reverse direction over the upper teeth. This movement may alter the point of meeting of vermilion line with the lower incisors. It might be different in different age groups and also in males and females. In the same individual, this may also vary according to the effort applied. However the distinct advantage of ULBT as we found out, included less or no chance for inter observer variability because of clear demarcation of the different classes and the appreciation of buck teeth during assessment which is one of the important factor predicting difficult intubation.

Further future studies are required with larger sample size and also using these tests in conjunction with other tests of airway assessment viz. sternomental distance, hyomental distance, ratio of patient height to thyromental distance, neck circumference to predict difficult airway may prove to be better to predict difficult intubation.

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