Comparison Of Upper Lip Bite Test And Modified Mallampati Classification In Predicting Difficult Intubation

R Bhat, S Mishra, A Badhe

Citation

Abstract
Background and methods: Five hundred ASA 1/2 patients admitted for elective surgical procedure requiring endotracheal intubation were prospectively studied to predict difficult intubation. All the patients were assessed preoperatively using the Modified Mallampati Classification and Upper Lip Bite Test.

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy were calculated. The accuracy of the tests was further assessed using Likelihood ratio and Odds ratio. The discriminating power of the tests was calculated using Area under a Receiver Operating Curve (AuC of a ROC-curve)

Conclusion: A combination of Upper Lip Bite Test and Modified Mallampati Test in parallel is more sensitive, specific and has a higher discriminative power which is clinically relevant than Modified Mallampati Test or ULBT alone. Upper Lip Bite Test and Modified Mallampati Test alone, in parallel and series are good predictors of possible easy intubation rather than difficult intubation.

INTRODUCTION
Endotracheal intubation may be rendered difficult or impossible due to coexisting diseases or abnormal physical features like restricted neck movements, restricted jaw movements, or restricted mouth opening.

Unanticipated difficulty in intubation in patients for elective surgical procedures can occur in 1.5 to 13 percent cases with none of the above mentioned abnormalities resulting in both morbidity and mortality.

Mallampati et,a, proposed a grading system (Classes 1 to 3) to anticipate such cases , which considers the pre-operative ability to visualize the faucial pillars, soft palate and base of uvula which was later modified by Samsoon and Young 2 to four classes. During intubation this was compared with the degree of laryngeal exposure according to Cormack and Lehane Classification .

Other clinical predictors of difficult intubation include thyromental distance, sterno-mental distance, receding mandible, buck teeth, and obesity. Several studies have however cast doubts on these pre-op predictors including Modified Mallampati Classification to reliably predict unanticipated difficult intubation.

In 2003, Khan et al 4 proposed and studied a new test the Upper Lip Bite Test (a simple bed side technique) which involves the assessment of jaw subluxation, and presence of buck teeth in a single test which they concluded would improve its reliability and reduce inter-observer variability.

AIMS AND OBJECTIVES
- To assess the ability of Upper Lip Bite Test (ULBT) to predict difficult intubation.
- To compare the sensitivity, specificity, accuracy, positive predictive value and negative predictive value of Upper Lip Bite Test and Modified Mallampati Classification.
- To assess the combined accuracy of Upper Lip Bite Test and Modified Mallampati Classification.

MATERIAL AND METHODS
After obtaining institutional approval and informed consent obtained from the patients Five hundred ASA-1/2 patients were assessed. Included in study are, Age above 16 years
undergoing elective surgical procedure requiring endotracheal intubation for providing anesthesia.

Excluded from the study are edentulous patients, restricted mouth opening, Restricted cervical movement Presence of oropharyngeal / laryngeal pathology

PARAMETERS STUDIED

Modified Mallampati Classification.
Upper Lip Bite Test
Cormack and Lehane grading of laryngeal exposure.

MODIFIED MALLAMPATI CLASSIFICATION

Classification of oropharyngeal view was assessed with the patient in sitting position with the neck in neutral position and tongue fully protruded without phonation (fig 1).

Soft palate, fauces, uvula and pillars seen, class 1
Soft palate, fauces and uvula seen, class 2
Soft palate and base of uvula seen, class 3
Soft palate not seen, class 4.

Figure 1
Figure 1 : Modified Mallampati classification of oropharyngeal visibility

UPPER LIP BITE TEST

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 (fig 2).

- Lower incisors can bite upper lip above the vermilion line.
- Lower incisors can bite below the vermilion line.
- Cannot bite upper lip.

This assessment was done by the candidate and these findings were not disclosed to the anaesthesiologist intubating the patient.

MODIFIED MALLAMPATI CLASSIFICATION

Classification of oropharyngeal view was assessed with the patient in sitting position with the neck in neutral position and tongue fully protruded without phonation (fig 1).

Soft palate, fauces, uvula and pillars seen, class 1
Soft palate, fauces and uvula seen, class 2
Soft palate and base of uvula seen, class 3
Soft palate not seen, class 4.

Figure 1
Figure 1 : Modified Mallampati classification of oropharyngeal visibility

CORMACK AND LEHANE CLASSIFICATION

The anaesthesiologist conducting the case recorded the degree of laryngoscopic evaluation according to fig 3.

Full view of glottis, only posterior commissure visible, only epiglottis visible.

No glottic structure visible.

Direct laryngoscopy was done using Macintosh blade by an anaesthesiologist with at least two years of experience. Induction was done with inj. Thiopentone 5 mg/kg iv and intubation was done after giving suxamethonium 1.5mg/kg. The grade of glottic visualization and number of attempts was noted down on the proforma by the intubator after intubation. Grade 1 and 2 were considered as easy and grade 3 and 4 were considered as difficult intubation.

Figure 3
Figure 3: Cormack & Lehane's classification of glottic exposure

OBSERVATION

Data was collected from 500 patients scheduled to receive general anesthesia and endotracheal intubation.

The age group of patients in the study was 16 to 67. Females comprised 286(57.2%) of the study population where as 214(42.8%) were males. Most of the females were in the age group 28-48 years and males in the age group 26 -55, (Graph 1).
Figure 4
Graph 1: age and sex distribution

HEIGHT DISTRIBUTION
The patients in the study were in the height range of 140 to 184cm. Most of the men were in the range of 162 to 172cm, whereas women were in the range of 148 to 158cm, (Graph 2).

Figure 5
Graph 2: Distribution of height

The patients in the study were in the weight range of 28 to 92kgs. Most of the men were in the range of 44 to 62kgs whereas females were in the 42-58kgs range, (Graph 3).

Figure 6
Graph 3: weight distribution

The BMI ranged from 13 to 42kgm-2. Most of the females had BMI ranging from 18-24kgm-2, whereas males had a range of 16 to 22kgm-2, (Graph 3).

Figure 7
Graph 4: Distribution of body mass index

Modified Mallampati Class (MMP)
The number of patients in each class of Modified Mallampati Class was as given in Table 13 & Graph 5.

Figure 8
Table 13: Modified Mallampati class distribution

<table>
<thead>
<tr>
<th>MODIFIED MALLAMPATI CLASS</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>164</td>
<td>32.8</td>
</tr>
<tr>
<td>Class 2</td>
<td>238</td>
<td>47.6</td>
</tr>
<tr>
<td>Class 3</td>
<td>83</td>
<td>16.6</td>
</tr>
<tr>
<td>Class 4</td>
<td>15</td>
<td>3.0</td>
</tr>
<tr>
<td>Total</td>
<td>500</td>
<td>100</td>
</tr>
</tbody>
</table>

Figure 9
Graph 5: Distribution of patients among different classes of modified mallampati classification

The number of patients in class 1&2(164+238) predicted easy intubation is 402 (80.4%) whereas class 3&4(83+15) predicted difficult intubation was 98 (19.6%).

The number of patients in each class of Upper Lip Bite Test was as given in the Table 14 & Graph 6.

UPPER LIP BITE TEST DISTRIBUTION
Comparison Of Upper Lip Bite Test And Modified Mallampati Classification In Predicting Difficult Intubation

Figure 10
Table 14: upper lip bite test distribution

<table>
<thead>
<tr>
<th>ULBT</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>382</td>
<td>76.4</td>
</tr>
<tr>
<td>Class 2</td>
<td>106</td>
<td>21.2</td>
</tr>
<tr>
<td>Class 3</td>
<td>12</td>
<td>2.4</td>
</tr>
<tr>
<td>Total</td>
<td>500</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 11
Graph 6: Distribution of patients among different classes of Upper Lip Bite Test Score

The table and graph above show that 12 cases have class 3 ULBT class hence predicted as difficult intubation.

The number of patients in each class of Cormack and Lehane classification of glottic exposure is as given in the Table 15. It shows that only 39 patients were grade 3 i.e. difficult intubation and there were no cases of grade 4 visualization.

Figure 12
DISTRIBUTION OF CORMACK & LEHANE'S GRADES OF GLOTTIC EXPOSURE

<table>
<thead>
<tr>
<th>Cormack &amp; Lehane's</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>353</td>
<td>70.6</td>
</tr>
<tr>
<td>Grade 2</td>
<td>108</td>
<td>21.6</td>
</tr>
<tr>
<td>Grade 3</td>
<td>39</td>
<td>7.8</td>
</tr>
<tr>
<td>Total</td>
<td>500</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 13
Graph 7: Distribution of patients among different grades of glottic exposure

EFFECT OF EXTERNAL LARYNGEAL MANOuVRE

Figure 15
Table 16: Cormack & Lehane's classification of glottic exposure with ELM

<table>
<thead>
<tr>
<th>CL with ELM</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>109</td>
<td>21.8</td>
</tr>
<tr>
<td>Grade 2</td>
<td>38</td>
<td>7.6</td>
</tr>
<tr>
<td>Grade 3</td>
<td>1</td>
<td>.2</td>
</tr>
<tr>
<td>Total</td>
<td>148</td>
<td>29.6</td>
</tr>
</tbody>
</table>

The table above shows that in 148 cases belonging to grade 2 and grade 3 glottic exposure, external laryngeal maneuver was applied and it improved the visualization to grade 1 in 109 cases, grade 2 in 38 cases and remained grade 3 in one case.
Comparison Of Upper Lip Bite Test And Modified Mallampati Classification In Predicting Difficult Intubation

Figure 16
Table 17: Number of attempts for successful intubation

<table>
<thead>
<tr>
<th>Number of attempts</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>479</td>
<td>95.8</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>3.4</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>0.8</td>
</tr>
<tr>
<td>Total</td>
<td>500</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The table above shows that 479 cases were intubated in first attempt, 17 cases required 2nd attempt and 4 cases required 3rd attempt. There were no cases of failed intubation.

Figure 17
Graph 8

Figure 18
Table 18: Modified Mallampati Classification Vs Cormack & Lehane's Classification of glottic exposure

<table>
<thead>
<tr>
<th>Modified Mallampati</th>
<th>Cormack &amp; Lehane's classification of glottic exposure</th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td></td>
<td>140</td>
<td>21</td>
<td>3</td>
<td>164</td>
</tr>
<tr>
<td>Class 2</td>
<td></td>
<td>188</td>
<td>56</td>
<td>14</td>
<td>258</td>
</tr>
<tr>
<td>Class 3</td>
<td></td>
<td>40</td>
<td>24</td>
<td>19</td>
<td>85</td>
</tr>
<tr>
<td>Class 4</td>
<td></td>
<td>5</td>
<td>7</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>total</td>
<td></td>
<td>353</td>
<td>108</td>
<td>39</td>
<td>500</td>
</tr>
</tbody>
</table>

Figure 19
Graph 9: Distribution of patients among different classes of Modified Mallampati Class and glottic exposure grades

The above graph and table shows that 3 patients with class 1 exposure out of 164 patients, 14 patients with class 2 out of 238 patients, 19 patients with class 3 out of 83 patients and 3 patients with class 4 out of 15 patients had difficult intubation.

Figure 20
Table 19: Upper Lip Bite Test Vs Cormack & Lehane's classification of glottic exposure

<table>
<thead>
<tr>
<th>ULBT</th>
<th>Cormack &amp; Lehane's classification of glottic exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>Grade 2</td>
</tr>
<tr>
<td>Class 1</td>
<td>312</td>
</tr>
<tr>
<td>Class 2</td>
<td>39</td>
</tr>
<tr>
<td>Class 3</td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 21
Graph 10: Distribution of patients among different classes of ULBT class and glottic exposure grades

The table and graph show that 9 patients out of 382 class 1 ULBT patients had grade 3 Cormack and Lehane’s, 22 out of 106 patients with class 2 ULBT had grade 3 Cormack and Lehane’s and 8 patients out of 12 with class 3 ULBT had grade 3 glottic exposure.

RESULTS

Figure 22

The table and graph show that 9 patients out of 382 class 1 ULBT patients had grade 3 Cormack and Lehane’s, 22 out of 106 patients with class 2 ULBT had grade 3 Cormack and Lehane’s and 8 patients out of 12 with class 3 ULBT had grade 3 glottic exposure.

RESULTS

Modified Mallampati Vs Cormack Lehane's
Comparison Of Upper Lip Bite Test And Modified Mallampati Classification In Predicting Difficult Intubation

**Figure 23**

Table: 20

<table>
<thead>
<tr>
<th>Predicted Easy</th>
<th>Cormack &amp; Lehane's</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easy Grade 162</td>
<td>Difficulty Grade 364</td>
</tr>
<tr>
<td>Predicted Easy Class 162</td>
<td></td>
<td></td>
</tr>
<tr>
<td>True Negative 50</td>
<td>False Negative 35</td>
<td>85</td>
</tr>
<tr>
<td>Predicted Difficult Class 364</td>
<td></td>
<td></td>
</tr>
<tr>
<td>False Positive 1</td>
<td>True Positive 23</td>
<td>24</td>
</tr>
<tr>
<td>Total 51</td>
<td>88</td>
<td>139</td>
</tr>
</tbody>
</table>

**Figure 24**

Table 21: ULBT VS CORMACK LEHANE'S

<table>
<thead>
<tr>
<th>Predicted Easy</th>
<th>Cormack &amp; Lehane's</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easy Grade 162</td>
<td>Difficulty Grade 364</td>
</tr>
<tr>
<td>Predicted Easy Class 162</td>
<td></td>
<td></td>
</tr>
<tr>
<td>True Negative 68</td>
<td>False Negative 49</td>
<td>117</td>
</tr>
<tr>
<td>Predicted Difficult Class 364</td>
<td></td>
<td></td>
</tr>
<tr>
<td>False Positive 4</td>
<td>True Positive 23</td>
<td>27</td>
</tr>
<tr>
<td>Total 72</td>
<td>92</td>
<td>164</td>
</tr>
</tbody>
</table>

**Figure 25**

Table 22: Modified Mallampati Or Ulbt Vs Cormack Lehane's

<table>
<thead>
<tr>
<th>Predicted Easy</th>
<th>Cormack &amp; Lehane's</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easy Grade 162</td>
<td>Difficulty Grade 364</td>
</tr>
<tr>
<td>Predicted Easy Class 162</td>
<td></td>
<td></td>
</tr>
<tr>
<td>True Negative 38</td>
<td>False Negative 37</td>
<td>75</td>
</tr>
<tr>
<td>Predicted Difficult Class 364</td>
<td></td>
<td></td>
</tr>
<tr>
<td>False Positive 1</td>
<td>True Positive 23</td>
<td>24</td>
</tr>
<tr>
<td>Total 39</td>
<td>88</td>
<td>127</td>
</tr>
</tbody>
</table>

**Figure 26**

Table 23: Modified Mallampati &Ulbt Vs Cormack Lehane's

<table>
<thead>
<tr>
<th>Predicted Easy</th>
<th>Cormack &amp; Lehane's</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easy Grade 162</td>
<td>Difficulty Grade 364</td>
</tr>
<tr>
<td>Predicted Easy Class 162</td>
<td></td>
<td></td>
</tr>
<tr>
<td>True Negative 5</td>
<td>False Negative 3</td>
<td>8</td>
</tr>
<tr>
<td>Predicted Difficult Class 364</td>
<td></td>
<td></td>
</tr>
<tr>
<td>False Positive 1</td>
<td>True Positive 23</td>
<td>24</td>
</tr>
<tr>
<td>Total 24</td>
<td>88</td>
<td>112</td>
</tr>
</tbody>
</table>

**Figure 27**

Table 24: comparison of sensitivity and specificity of ULBT &MMP; using McNemar test

The p value of 0.004 for sensitivity and 0.000 for specificity show that the difference in sensitivity and specificity between MMP &AMP; ULBT is significant

**Figure 28**

Table 25: comparison of sensitivity and specificity of MMP & MMP AND ULBT in series using McNemar test

The p value of 0.000 for sensitivity and 0.000 for specificity show that the difference in sensitivity and specificity between MMP &AMP; MMP AND ULBT in series using McNemar test is significant

**Figure 29**

Table 26: comparison of sensitivity and specificity of ULBT and MMP& ULBT in series using McNemar test

The p value of 0.063 for sensitivity and 0.500 for specificity show that the difference in sensitivity and specificity between ULBT and MMP &ULBT in series using McNemar test is not significant
Comparison Of Upper Lip Bite Test And Modified Mallampati Classification In Predicting Difficult Intubation

Table 27: comparison of sensitivity and specificity of MMP AND MMP or ULBT in parallel using McNemar test

<table>
<thead>
<tr>
<th></th>
<th>MMP</th>
<th>MMP or ULBT</th>
<th>P VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SENSITIVITY</td>
<td>50%</td>
<td>71.1%</td>
<td>0.063</td>
</tr>
<tr>
<td>SPECIFICITY</td>
<td>83.9%</td>
<td>81.9%</td>
<td>0.688</td>
</tr>
</tbody>
</table>

The p value of 0.063 for sensitivity and 0.688 for specificity show that the difference in sensitivity and specificity between MMP &AMP; MMP or ULBT in parallel using McNemar test is not significant.

The p value of 0.000 for sensitivity and 0.000 for specificity show that the difference in sensitivity and specificity between ULBT and MMP &ULBT in parallel using McNemar test is significant.

The p value of 0.000 for sensitivity and 0.000 for specificity show that the difference in sensitivity and specificity between MMP & ULBT in series and MMP &ULBT in parallel using McNemar test is significant.

### LIKELIHOOD RATIO

The likelihood ratio incorporates both the sensitivity and specificity of the test and provides a direct estimate of how much a test result will change the odds of having a disease. The likelihood ratio for a positive result (LR+) tells you how much the odds of the disease increase when a test is positive.

The AUC of ROC curve for Modified Mallampati class is 0.712 with a 95% confidence interval 0.618 to 0.807.

The AUC of ROC curve for ULBT class is 0.598 with a 95% confidence interval 0.494 to 0.703.

The AUC of ROC curve for MMP or ULBT class in parallel is 0.779 with a 95% confidence interval 0.694 to 0.863.

The AUC of ROC curve for MMP & ULBT class in series is 0.536 with a 95% confidence interval 0.437 to 0.636.

### DISCUSSION

The incidence of unanticipated difficult intubation varies between 1.3% to 13% in various studies and the search for predictive tests that has ease of applicability, reliability and accuracy continues.

Khan et al's Upper Lip Bite Test was such an attempt. They proposed this test a combination of jaw subluxation and buck teeth as an alternative to the widely used test the Modified Mallampati Test. ULBT is easy to perform within seconds by demonstrating it to the patient. It does not require any equipment hence very easy to perform as a bedside test. The classes of ULBT are clearly demarcated and delineated making inter observer variability highly unlikely when using this test. We found that repeated demonstrations were required for the patients to perform the upper lip bite test.

The Leopold trial also has brought out some limitations of this test like its inability to assess edentulous patients; 11% of patients in Leopold's study had to be excluded as they were edentulous.

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. The absence of a definite demarcation between class2 & class 3 and between class3 & class 4 group and effect of phonation on the oropharyngeal classification lead to high inter observer variability and decreased reliability. Another limitation includes the fact that it does not assess neck mobility which is another important factor in predicting difficult intubation; this is true for ULBT also.

The incidence of difficult intubation in our trial was 7.8% i.e. 39 out of the total 500 people assessed turned out to have difficult intubation, of these only 23 were correctly predicted as difficult by Modified Mallampati test where as only 8 were predicted as difficult by ULBT. The incidence of difficult intubation in Khan's trial was 5.7% where as in Leopold's trial it was 12%.

In our study we found the sensitivity of Modified Mallampati Class was 59% which was less than the study conducted by Khan et al (82.4%) , but this was comparable with many other studies like that of Savva et al (64%).

The specificity of Modified Mallampati class in our study is 83.5% which is more than that of Khan et al (66.8%) and
Comparison Of Upper Lip Bite Test And Modified Mallampati Classification In Predicting Difficult Intubation

Leopold et al (61%). Higher specificity similar to our study been reported by Oates et al (82%) and Freck (84%)

The wide variation in reported specificity and sensitivity in various studies may be because of incorrect evaluation of the test because of inter observer variability seen in Modified Mallampati class assessment as was found by Leopold et al, especially change in class of visualization with phonation which usually occurs involuntarily and poor demarcation between the various classes.

The sensitivity of ULBT was 20.5% which is comparable to that of Leopold et al trial 28.2%. The original study by Khan et al had a sensitivity of 76.5% we were unable to replicate the high sensitivity of the original study, the cause of which may be the low incidence of ULBT 3 class in our study.

The specificity of ULBT was 99.1% in our study and much higher compared to Leopold et al 92.5% and Khan et al 88.7% trials.

When ULBT and Modified Mallampati Class were done in parallel that is, if any one of the tests predicted difficult intubation they were considered as predicted difficult intubation the sensitivity increased to 71%. The specificity for this group is 83.9% which is less than that for ULBT alone but comparable to specificity of Modified Mallampati Class.

When Modified Mallampati and ULBT were done in series i.e. if one test predicted positive then only the other test was performed and if it also predicted positive for difficult intubation then only the person will be considered as predicted difficult intubation. The sensitivity for this group was very low 7.7% where as the specificity was 99.6%.

We used McNemar test to find out whether the difference sensitivity and specificities in various groups was significant.

The difference in sensitivity was significant when MMP and ULBT were compared (p=0.004), when MMP and MMP&ULBT in series were compared (p=0.000), when ULBT and MMP or ULBT were compared in series (p=0.000) and when MMP or ULBT in parallel is compared with MMP &ULBT in series (p=0.000).

The positive predictive value of Modified Mallampati Class (23.2%) in our study is less than that for ULBT (66.6%) and almost similar to that of Leopold et al trial (19.5%) and much higher than that found by Khan et al (13%).

The positive predictive value of ULBT is higher in our study (66.6%) as compared to Leopold et al trial (33.6%) and Khan et al trial (28.9%.) this may be because of low number of ULBT class 3 cases in our study.

When ULBT and Modified Mallampati class were done in parallel (27.5%) the positive predictive value was more than that for modified mallampati class alone (23.2%) and this increased to 60% when ULBT and modified mallampati class were done in series.

The negative predicted value was more than 90% for both the tests individually (96% - MMP, 93.7% - ULBT) and also when considered in parallel and series (ULBT or MMP-97.2%, ULBT & MMP – 92.7%) thus stressing upon the fact that all these tests can be good predictors of easy intubation rather than as positive predictors of difficult intubation which has a very low incidence. This was one of the conclusions made by Leopold et al.

The accuracy of prediction was frequent in the original study describing the ULBT by Khan et al. The accuracy of ULBT was (88%) compared to modified mallampati class (67.7% )this was almost replicated in the trial by Leopold et al (84.9%) for ULBT and (62.1% )for modified mallampati class. In our study the ULBT had higher accuracy of 93% compared to that of MMP (81.6%), MMP or ULBT in parallel (83%) and MMP & ULBT in series (92.4%).

We have further tried to analyse the accuracy using likelihood ratio. The likelihood ratio for a positive test result may be useful measure to judge the usefulness of a predictive tool. This measure is the number of times more likely that a patient with a positive test result will present with difficult intubation.

In our study the likelihood ratio for ULBT was 22.7 followed by ULBT and modified mallampati class in series 19.25 followed by ULBT and modified mallampati class in parallel 4.45. The least value was for modified mallampati class 3.57. This value for Modified Mallampati class (3.57) in our study is high compared to Leopold et al (1.8) and
khan et al (2.48). We found a high likelihood ratio for ULBT 22.77 compared to Leopold et al (3.78) and khan et al (6.76).

We calculated the Odds ratio for all the groups. The Odds ratio for MMP alone is 7.282 with a 95% confidence interval (3.675-14.429). The Odds ratio for ULBT alone is higher 29.484(8.412-103.336) the odds ratio of MMP or ULBT in parallel group 13.312(6.349-27.94) and odds ratio for MMP & ULBT in series 19.25(3.095-118.163).The wide variation in 95% confidence intervals seen in ULBT group and MMP & ULBT in series show their lack of accuracy.

We also calculated area under curve of receiver operating characteristics (AUCofROC) for all the four groups as a measure of discriminating power of a predictive test because it is independent from incidence of difficult intubation. Other measures used to describe accuracy of prediction are prone to be biased by differing incidences of the event that is predicted i.e. if an event is extremely rare than a test forecasting it will appear in no patient can have an accuracy near 100%

AUCofROC curve with confidence level of 95% was 0.598(0.494—0.703) for ULBT in the present study which was less than 0.826 (calculated by Leopold et al for) Khan et al and almost same to that for ULBT in Leopold's trial. The AUCofROC curve thus reveals that the pre–hoc probability of correct prediction is improved from 50% (random guess) to 59.8% when applying the ULBT, an improvement that is far from being of clinical relevance. This disappointing result may be caused by the low sensitivity of the test due to large proportion of false negatives

AUCofROC curve with confidence level of 95% for modified mallampati class was 0.743 (0.663-0.822) which was similar to Khan et al trial (0.746) but more than that calculated for Modified Mallampati class in Leopold's trial (0.656),which again is more compared to ULBT in our study . AUC value more than 0.7 is considered to be clinically relevant.

AUCofROC curve with confidence level of 95% for MMP or ULBT in parallel is 0.779(0.694-0.863). A combination of ULBT and Modified Mallampati in combination improves the predictive ability.

AUCofROC curve with confidence level of 95% for MMP and ULBT in series is 0.536 (0.437-0.636). This combination has poor predictive value.

Thus in our study we found that sensitivity of ULBT 20.5% was much low compared to Modified Mallampati Test 59%. It increased when both the tests were used in parallel 71.8%. ULBT had a higher specificity of 99.1% and positive predictive value 66.6% compared to Modified Mallampati Test 23.2% and ULBT and modified Mallampati class in parallel 27.5%. The negative predictive value for all the groups was more than 90% proving that these tests are better used for their prediction of easy intubation, this may be because difficult intubation may not be that common.

The accuracy of ULBT 93% is much higher than that of Modified Mallampati alone 81.6% or Modified Mallampati and ULBT in series 92.4% or in parallel 83%. The discriminative power of the tests when evaluated using AUCofROC a combination of MMP and ULBT in parallel that is if either of the tests predicted difficulty the patient would be considered predicted difficult had a better discriminative power of 0.779 compared to MMP alone (0.743), ULBT alone (0.598) and ULBT and MMP in series, that is patient would be considered difficult only if both the tests predicted difficult.

CONCLUSION

- Upper Lip Bite Test cannot be used as a single bed side test for predicting unanticipated difficult intubation.
- A combination of Upper Lip Bite Test and Modified Mallampati Test in parallel is more sensitive, specific and has a higher discriminative power which is clinically relevant than Modified Mallampati Test or ULBT alone.
- The high negative predictive values of both the tests alone and in parallel and series indicate that they are good predictors of possible easy intubation rather than difficult intubation.

References
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