



Original Research Article

Predicting difficult intubation: A comparison between upper lip bite test (ULBT) and Modified Mallampati test (MMT)

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ABSTRACT

Introduction: No anaesthesiologist like to face scenario of unanticipated difficult intubation, as it may cost patients life. Many tests are there to predict difficult intubation, amongst those tests Modified Mallampati test [MMT] is a gold standard test. Upper lip bite test [ULBT] is an acceptable option for predicting difficult intubation. Our study aimed to compare both the tests to predict difficult intubation.

Objectives: To analyse positive predictive value (PPV), negative predictive value (NPV), sensitivity, specificity and accuracy of ULBT and MMT. To compare the results of both the tests to predict difficult intubation.

Aim: To ascertain whether ULBT can be incorporated in standard protocol of airway assessment along with other tests to increase predictive accuracy of difficult endotracheal intubation

Materials and Methods: It was prospective randomised comparative observational study carried out at single centre. Three hundred patients of either sex, aged between 16-60 yrs scheduled for elective surgery under general anaesthesia with endotracheal intubation were enrolled in the study. Preoperative evaluation of airway was done with ULBT and MMT and findings were documented. MMT class III, IV and ULBT class III were considered as predictors of difficult intubation. On the day of the surgery after direct laryngoscopy laryngeal view was noted and was classified according to Cormack and Lehane classification. Patients with Cormack Lehane class III, IV considered as difficult to intubate. Cormack Lehane classification (C & L class) readings were compared with ULBT and MMT.

Observations and Results: Demographic data and ASA grade was same for both the groups as participants were same. By comparing ULBT with Cormack and Lehane score we got 88.46% sensitivity, 92.74% specificity, 71.87% Positive predictive value (PPV), 97.45% negative predictive value (NPV) and 92% accuracy. For MMT we got 19.23% sensitivity, 91.93% specificity, 33.33% PPV, 84.44% NPV and 79.33% accuracy. Thus results showed accuracy, sensitivity, PPV and NPV of ULBT were superior than MMT while specificity of both the tests was similar.

Conclusion: With higher level of sensitivity, PPV, NPV and accuracy ULBT is a better choice for predicting difficult airway than that of MMT. ULBT should be incorporated in standard airway assessment protocol along with other tests.

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1. Introduction

In this new era of supraglottic devices to manage airway under anaesthesia endotracheal intubation has its irreplaceable place in situations like protection of airway in full stomach patient, in emergency situations, in head- neck surgeries, when operative position is not supine, when one

has no easy access to patients airway etc.

Delayed or failed endotracheal intubation is a major complication of general anaesthesia which may lead to permanent brain damage.¹ Incidence of difficult and failed intubation varies from 1.5%-13% and 0.05%- 0.3% respectively.² In patients receiving general anaesthesia most common cause of morbidity and mortality is failure to maintain airway patency.^{3,4}

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By accurately predicting difficult intubation preoperatively incidence of unanticipated difficult intubation or failed intubation can be significantly reduced.⁵ 17% of claims against the anaesthetists where airway mishap happened mentions that there was no preoperative assessment documented.⁶

The anatomy of oropharyngeal structure, size of tongue, extent of mouth opening, position of larynx, circumference of neck, range and degree of neck movement, teeth alignment these all factors contribute to determine the difficult airway. Clinical evaluation of these anatomical structures is done by noting atlanto-occipital joint extension, thyromental distance and modified mallampati test.⁷ Many tests are used to predict difficult intubation few of them are not very reliable.⁸ By definition poor glottis view on direct laryngoscopy is considered as difficult laryngoscopy and is synonymous with difficult tracheal intubation in most of the patients. Difficulty in intubation is graded according Cormack Lehane classification. In clinical settings test to predict difficult intubation should be simple, convenient, easy to perform, quick and should have high predictive power. Most commonly used test is modified Mallampati test i.e MMT (modification of original Mallampati by Samssoon and Young).^{9,10} MMT has been considered as gold standard for many years to predict difficulty in intubation.¹¹ However many large group studies evaluated its limitations in accuracy of prediction.¹²⁻¹⁴ On the other hand in 2002 Khan et al described a new and easy method called upper lip bite test (ULBT). This test was claimed to be simple easy acceptable option with more accuracy. We aim our study to compare these to tests for predicting difficult intubation

2. Materials and Methods

2.1. Study design

This was single centre prospective randomised single blind comparative observational study which was carried out in Dr. D Y Patil medical college Kolhapur in period July 16-July17.

After ethics committee cleared our project, three hundred patients of ASA grade I,II in age group of 16-60yrs of either sex scheduled for elective surgery under general anaesthesia with endotracheal intubation were randomly selected and were enrolled in the study. Written consent was obtained from selected patients after explaining them the purpose of the study. Patients with BMI > 30 kg/m², with neck circumference > 50 cm, with thyromental distance < 6.5 cm, trauma or mass in airway or cervico - facial region, edentulous patients, patients with restricted mouth opening of less than two fingers and limited neck mobility were excluded from the study.

In preoperative assessment along with general and systemic examination patients were thoroughly examined

and assessed for difficult intubation. In all patients ULBT and MMT was carried out and result documented.

On the day of surgery patient was taken inside the operation theatre, intravenous line was secured and multipara monitor was attached and basal parameters were noted. Patients was premedicated with inj Ranitidine 1.2 mg/kg, inj ondansetron 0.08 mg/kg and glycopyrrolate 0.04 mg/kg intravenously. Sedation was given with inj midazolam 0.05 mg/kg and inj pentazocine.6mg /kg intravenously slowly. Patients were preoxygenated with 10 L oxygen for three min and induced with injection propofol 2mg/kg. After checking mask ventilation inj succinylcholin was given in dose of 1.5 mg/kg intravenously, after full relaxation sniffing position was given and laryngoscopy was done by senior resident who was not involved in study, with curved Macintosh blade no. 3 or 4 and glottis view without applying external laryngeal pressure was documented according to Cormack and Lehane Classification.

Intubation with appropriate ETT was done in routine manner, and if required external laryngeal pressure was applied. In difficult cases where glottis view was III or IV McCoy blade was used to facilitate endotracheal intubation. Rest of the case was continued and finished in routine manner.

All patients were successfully intubated and no complication was observed during study.

2.2. Observations

In preopevaluation ULBT and MMT was graded as follows

ULBT: It assesses ability of patient to bite upper lip with lower incisors in sitting position, and examiner observes at eye level and documents as follows^{15,16}



Fig. 1: Upper lip bite test

Class I: Lower incisor can bite the upper lip above the vermilion line

Class II: Lower incisor can bite the upper lip below the vermilion line

Class III: Lower incisors can not bite upper lip

Class I & II are considered as predictors of easy intubation and Class III is of difficult intubation

MMT: Patient was asked to open his mouth maximally and to protrude the tongue without phonation in sitting position. With the help of flash light view of posterior pharynx through open mouth was noted at the eye level of examiner, and documented as follows [1]

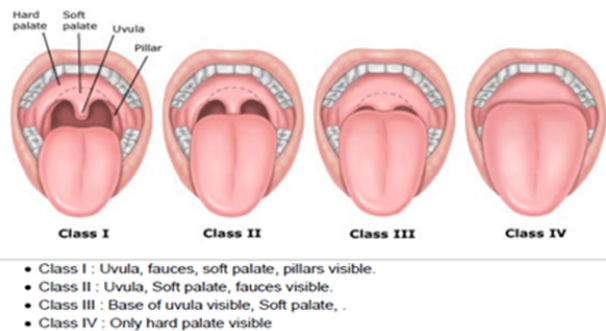


Fig. 2: Modified Mallampati test:

Class I: soft palate, fauces, uvula and pillars are seen

Class II: soft palate, fauces and uvula seen

Class III: Soft palate and base of uvula seen

Class IV: Soft palate no visible

I & II are considered as predictors of easy intubation.

II & IV are considered as predictors of difficult intubation.

On direct laryngoscopy glottis view was classified according to Cormack and Lehane¹⁷

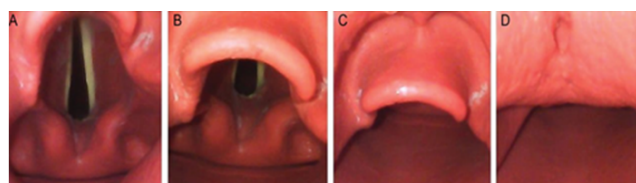


Fig. 3: Cormack And Lehane classification(C & L class)

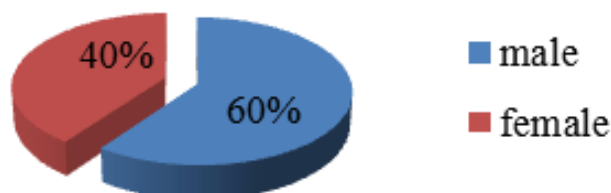
Grade I: full view of glottis, A in Figure 3 Grade II: Glottis partly exposed, only posterior commissure is seen, B in fig 3 Grade III: Only epiglottis is seen, C in Figure 3 Grade IV: Epiglottis not seen, D in Figure 3 Grade I and II are considered as easy intubation and III and IV as difficult intubation.

3. Statistical Analysis and Results

Demographic data is showed in Table 1 , Graph 1 and 2. Both the test groups share same sample of population. Number of difficult cases predicted according to ULBT, MMT are shown Table 2. We predicted 21.3% and 10% difficult intubation cases by ULBT and MMT respectively. We actually faced difficulty in 17.4% of the patients according to Cormack and Lehane classification and this is showed in Tables 3, 4 and 5. shows calculated values of

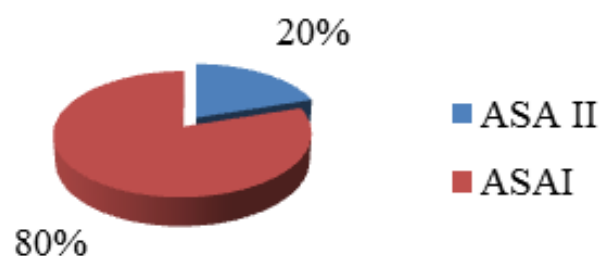
false positive (FP), false negative (FN), true positive (TP) and true negative (TN) for ULBT and MMT respectively by comparing it with Cormack Lehane classification. Table 6 compares analytical test results of ULBT and MMT. From Table 6 it is clear that ULBT definitely has high sensitivity, PPV, NPV and accuracy and specificity of both the tests is similar.

Sex distribution



Graph 1: Sex distribution

Asa physical status



Graph 2: ASA physical status

TN: true negative, TP: true positive, FN: False negative, FP: false positive Sensitivity : $TP / (TP + FN) = 88.46\%$: Specificity: $TN / (TN + FP) = 92.74\%$ Positive predictive value PPV: $TP / (TP + FP) = 71.87\%$ Negative predictive value NPV: $TN / (TN + FN) = 97.45\%$ Accuracy : $TP + TN / TP + TN + FP + FN = 92.0\%$

TN: true negative, TP: true positive, FN: False negative, FP: false positive Sensitivity : $TP / (TP + FN) = 19.23\%$: Specificity: $TN / (TN + FP) = 91.93\%$ Positive predictive value PPV: $TP / (TP + FP) = 33.33\%$ Negative predictive value NPV: $TN / (TN + FN) = 84.44\%$ Accuracy : $TP + TN / TP + TN + FP + FN = 79.33\%$

Table 1: Demographic data of study population

ASA Physical status ASA I : number (%) ASA II: number (%)	240 (80%) 60 (20%)
SEX Male: number (%) Female: number (%)	120 (40%) 180 (60%)
AGE in years (Mean + Standard Deviation)	28 + 3.28
Height in cms (Mean + Standard Deviation)	154.6+ 5.4
Weight in kilograms (Mean + Standard Deviation)	61.5+ 3.9

Table 2: Prediction of difficult intubation by ULBT, MMT

Test	Grade i	Grade ii	Grade iii	Grade iv	Prediction of difficulty
Ulbt	116(38.7%)	120(40%)	64(21.3%)	Na	21.3% (grade iii)
Mmt	75 (25%)	195(65%)	25(8.3%)	5(1.7%)	10% (grade iii+iv)

Table 3: Actual difficult cases by Cormack and Lehane

Test	Grade i	Grade ii	Grade iii	Grade iv	Actual difficult intubations
Cormack & lehane	130(43.3%)	118(39.3%)	44(14.7%)	8(2.7%)	17.4% (iii+iv)

Table 4: Comparison of ULBT with C and L classification

ULBT	Total	Actual Easy on C & L	Actual difficult on C & L
Predicted Easy (I & II)	236 (78.7%) a+b	230 (a) TN	06 (b) FN
Predicted Difficult (III)	64(21.3%) c+d	18(c) FP	46 (d) TP
Total	300 a+b+c+d	248 (a+c) [82.7%]	52 (b+d) [17.3%]

Table 5: Comparison of gradings between MMT and Laryngeal view

MMT	Total	Actual Easy on C & L	Actual Difficult on C & L
Predicted Easy (I,II)	270 (78.7%) a+b	228 (a) TN	42 (b) FN
Predicted Difficult (III, IV)	30(21.3%) c+d	20(c) FP	10 (d) TP
Total	300 a+b+c+d	248 (a+c) [82.7%]	52 (b+d) [17.3%]

Table 6: Comparison of analytical result of ULBT and MMT

Outcome	ULBT	MMT
TP	46	10
FP	18	20
TN	230	228
FN	06	42
Sensitivity (%)	88.46	19.23
Specificity (%)	92.74	91.93
PPV (%)	71.87	33.33
NPV (%)	97.45	84.44
Accuracy (%)	92%	79.33

4. Discussion

Failed tracheal intubation may have potentially serious consequences such as hypoxemia and cardiopulmonary arrest and morbidity and mortality associated with it.^{18–20} It is important to predict difficulty in laryngoscopy and intubation so that we should be prepared with advanced gadgets or new alternative technique to secure airway. Many factors contribute in difficult intubation that is why so many predictive tests are available either alone or in combination⁶. Ideally predictive test should be quick, easy, reliable, and accurate. It should detect almost all

difficult cases, it should predict all easy cases correctly. It should have high PPV with few negative prediction so that difficult cases are not missed and deleterious life threatening consequences are avoided. Of all available tests no single screening test is 100% specific or 100% sensitive, so even with so many predictive test we face unanticipated difficult intubation. So combination of such test may give us high predictive value for difficult intubation.

Mallampati test is worldwide used scoring system since its introduction in 1985 by Mallampati et al. Later in 1987 it was modified by retrospective study and analysis by

Sanson and Young et al and named as Modified Mallampati Test (MMT). It basically addresses mouth opening and size of base of the tongue in relation to oropharynx.²¹ Accuracy of MMT has been questioned number of times and there is controversy about its value^{8,22–24}. In an extensive systemic review on 34,513 patients in 42 studies Lee et al found poor to good accuracy of MMT²³. When test was primarily formulated there were 22 data collectors, also MMT score is altered with phonation and use of accessory muscles in the neck thus the impact of inter observer variation was significant that might be the reason MMT was not found reliable in number of studies.^{25,26} ULBT assesses jaw movement, presence or absence of bucked teeth, and ability to protrude lower jaw. It also gives us idea about mouth opening as protrusion of jaw and mouth opening both are the function of T-M joint so if one is affected other is also affected. In our study we have achieved uniformity by conducting all tests by primary investigator and doing all laryngoscopies by senior resident so as to avoid inter-observer variation. Objective of our study was to compare MMT and ULBT with regard to accuracy, PPV, NPV, specificity and sensitivity against laryngoscopic visualization by using gold standard CL grading. The results showed that the accuracy (92%), sensitivity (88.46%), PPV (71.87%) and NPV (97.45%) of ULBT were higher than MMT. While specificity of both the tests was similar. Our results are comparable to other studies^{9,24–26}. Some studies found that ULBT is more accurate than MMT while PPV, NPV and sensitivity of the both is comparable.¹⁵ Sensitivity in our study is higher than many previous studies^{27–30} the reason for this may be lack of inter-observer variation as well as ethnic differences. The anthropological literature described that craniofacial and dental alignment varies from race to race^{31–33}

As both the tests were assessed by primary investigator it has reduced the risk of inter-observer variation to significant extent and this is the main strength of our study. Limitation of our study is we can not perform test on patients who are not co-operative or mentally challenged. Also results of edentulous patients are not reliable.

5. Conclusion

By the results of our study we conclude that ULBT is better test in predicting difficult intubation cases as it has more accuracy, PPV, NPV and sensitivity than MMT. ULBT should be incorporated in standard airway assessment protocol.

6. Source of Funding

None.

7. Conflict of Interest

None.

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