ORIGINAL ARTICLE

Comparison of Upper Lip Bite Test with Modified Mallampati Test and Thyromental Distance for Prediction of Difficult Intubation.

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How to cite this article:
Koirala S, Shakya BM, Marhatta MN et al. Comparison of Upper Lip Bite Test with Modified Mallampati Test and Thyromental Distance for Prediction of Difficult Intubation.*Nepal Journal of Medical Sciences* 2020;5(1):2-9

ABSTRACT

Introduction: The prediction of difficult intubation using simple bedside test is of great importance to prevent mismanagement of airway. This study was conducted to compare Upper Lip Bite Test (ULBT) with Modified Mallampati Test (MMT) and Thyromental Distance (TMD) for the prediction of difficult intubation.

Methods: This was descriptive cross-sectional study conducted in 121 patients of American Society of Anaesthesiologists Physical Status (ASA PS) I and II patients scheduled for elective surgery requiring general anaesthesia with endotracheal tube . The airway assessment of the patients was done one day prior to the surgery using Upper Lip Bite Test (ULBT), Modified Mallampati Test (MMT) and measurement of Thyromental Distance (TMD) . On the day of surgery during laryngoscopy ,Cormack-Lehane (CL) grading was recorded. The CL grading of III and IV was labeled as difficult intubation. The Sensitivity, Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), Likelihood Ratio (LR) of ULBT, MMT and TMD were calculated and compared.

Results: The total percentage of difficult intubation, defined by Cormack-Lehane (CL) III and IV was 16.52 %. The sensitivity, specificity, PPV, NPV and accuracy of Upper Lip Bite Test (ULBT) was 50%, 100%, 100%, 91% and 91.74% respectively. ULBT had a significantly higher sensitivity, specificity and PPV when compared to MMT or TMD or MMT and TMD when combined together.

Conclusions: Upper Lip Bite Test (ULBT) is better predictor of difficult intubation and it should be used along with other test during airway assessment.

Key words: *Airway management; Endotracheal intubation.*

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INTRODUCTION

 A difficult intubation is defined by the American Society of Anaesthesiologists (ASA) as tracheal intubation requiring more than three attempts, in the presence or absence of tracheal pathology.[1]The incidence of difficult airway in general population undergoing surgery was found to be 5.8% in meta analysis.[2] The mistakes concerning airway management can result in irreversible cerebral damage and up to 30% of all anaesthetic related deaths can be attributed to the mismanagement of difficult airway.[3,4] Inspite of various clinical tests ,there is not a single test which can accurately predict difficult airway and endotracheal intubation.[5] Upper lip bite test which was introduced in 2003 expected to offer a higher predictive value for assessment of difficult airway.[6]

  Hence the aim of the study was to compare the Upper Lip Bite Test (ULBT) with Modified Mallampati Test (MMT) and Thyromental Distance (TMD) to predict difficult intubation .

METHODS

This was descriptive cross sectional study done over period of six months from October 2012 to March 2012 in Tribhuvan University Teaching hospital after taking approval from Institutional Review Board , Institute of Medicine (IOM). The protocol approval number was 63 c6-11-D^2/069-70. The inclusion criteria was male and female patients, age more than 16 years of American Society of Anaesthesiologists (ASA) I and II who were scheduled to undergo elective surgery under General Anaesthesia (GA) with Endotracheal Tube (ETT). The exclusion criteria was ASA III and IV, emergency cases where Rapid Sequence Induction (RSI) was required, edentulous patients or patients with absent incisors, patients with history of trauma, burn or previous surgery to facial, cervical, or anterior neck region, patients with mass or tumor in neck or facial region, patients with intra-oral or laryngeal mass, patients requiring awake intubation, patients with restricted mobility of neck and mandible and patients with difficult Bag and Mask Ventilation. Total 121 patients were enrolled for study. This was calculated based on formula n= z^2pq/d^2 where n= sample size, z= 1.96, p=0.09, q=1-p and d=0.05.The prevalence of difficult intubation was 9% in study done by Iohom G et al .[7] Written informed consent was taken from all the patients. Pre-anaesthetic evaluation and preoperative airway assessment was done by the investigator one day prior to the surgery. Age, gender, weight and height of the patient were recorded. The preoperative airway assessment was done with Upper Lip Bite Test (ULBT), Modified Mallampati Test (MMT) and Thyromental Distance (TMD). For the assessment of Upper Lip Bite Test (ULBT), patient were asked to bite the upper lip with the lower incisors. Based on how high the lower incisors could bite the upper lip, Upper Lip Bite Test (ULBT) was classified into three classes as follows and recorded: Class I: patient could bite upper lip above the vermilion border, Class II: patient could bite upper lip below the vermilion border, Class III: patient could not bite upper lip.

While seated and head in neutral position, each patient was asked to open his/hermouth maximally and to protrude the tongue without phonation. Based on the view of the oropharyngeal structures, Modified Mallampati Test (MMT) was done as follows and recorded:

Class I: soft palate, uvula and tonsillar pillars visible,Class II: soft palate and uvula visible,Class III: soft palate and only base of uvula visible, Class IV: soft palate not visible.While seated, each patient was asked to fully extend his/her neck and close the mouth. Thyromental Distance (TMD) was measured from the tip of mentum to the thyroid notch with a measuring tape and was classified as follows and recorded:>6.5 cm , 6-6.5 cm, <6 cm.

Upper lip bite test of class III, Modified Mallampati of class III and IV and Thyromental distance < 6 cm were selected as indicator for difficult intubation.

Patients were kept nil per oral (NPO) for eight hours before the surgery. On the day ofsurgery, in the pre-anaesthetic preparation room, intravenous (IV) access wasestablished with an 18 G cannula. Patient was shifted to the operating room (OR)and placed supine on the operating table (neutral position). The height of the table was adjusted such that the airway of the patient was at the level of xiphisternum of the laryngoscopist (consultant anaesthesiologist). The head of the patient waselevated from the level of the table with the help of a 10 cm high block. Monitors:Electrocardiography (ECG), Non-Invasive Blood Pressure (NIBP) and Pulse Oximeter were attached, and monitoring was done. Analgesia was provided with Inj.Pethidine 0.75 mg/kg IV. Induction of anaesthesia was done with Inj. Propofol IV(titrated dose). After induction of anaesthesia (indicated by loss of eyelash reflex and inability to open eyes on verbal command), adequacy of bag and mask ventilation was checked. If bag and mask ventilation was adequate, Inj. Vecuronium 0.1 mg/kg IV was administered to achieve adequate muscle relaxation (indicated by no body movement on Jaw Thrust). If bag and mask ventilation was not adequate then the case was excluded. Till the achievement of adequate muscle relaxation, patient was maintained on 100% oxygen and ventilation was assisted with bagging. After achievement of adequate muscle relaxation, direct laryngoscopy was performed by the consultant anaesthesiologist who was unaware of the pre-anaesthetic airway assessment. Macintosh No. 3 blade was used for performing direct laryngoscopy. The view of the larynx, without external laryngeal manipulation, was classified using Cormack-Lehane (CL) Grading and recorded as follows: 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.

If needed external laryngeal manipulation was done before intubation. Confirmation of successful endotracheal intubation was done by capnography and bilateral auscultation over the lung fields. If intubation were difficult, ASA Difficult Airway Algorithm would have been followed for management of difficult airway. After successful intubation, General Anesthesia was maintained. The difficult intubation in our study was defined as CL grading of Grade III and IV without use of external laryngeal manipulation.

The preoperative airway assessment and the laryngoscopic findings were collected in a preformed data sheet. Statistical Package for Social Sciences (SPSS) software was used for statistical analysis. The Sensitivity, Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), Likelihood Ratio (LR) and Accuracy of the different tests were calculated .

RESULTS

The total sample of the study was 121. The baseline characteristics of this study population regarding sex-wise distribution and distributions according to American Society of Anesthesiologist's (ASA) Physical Status are listed in Table 1. The mean age was 39.93±13.85 years and mean weight was 57.83±10.10 kg.

Table 1: Demographic profile

Characteristics	Number	Percentage (%)
Gender		
Male	50	41.32
Female	71	58.67
ASA physical status		
I	82	67.76
II	39	32.23

Table 2 represents the results of pre-operative airway evaluation.

Table 2:   Distribution of tests

Airway Examination	Number (%)			
Modified Mallampati Test (MMT)	Class I	Class II	Class III	Class IV
	66 (54.54%)	45 (37.19%)	10(8.26%)	0
Upper lip bite Test (ULBT)	Class I	Class II	Class III	
	90 (74.38%)	21 (17.35%)	10(8.26%)	
Thyromental Distance (TMD)	>6.5cm	6-6.5cm	<6 cm	
	103 (85.12%)	18 (14.87%)	0	
Cormack Lehane (CL) grading	Grade I	Grade II	Grade III	Grade IV
	86 (71.07%)	15 (12.39%)	20(16.52%)	0

Prediction of Difficult Intubation :

The sensitivities, specificities, accuracy, positive predictive values (PPV), negative predictive values (NPV), and likelihood ratios of the various tests for the prediction of difficult intubation are listed in Table 3.

Table 3. Comparative Table of Various Tests for Prediction of Difficult Intubation

Tests	Sensitivity (95%CI)	Specificity (95%CI)	Accuracy	+Likelihood Ratio	-Likelihood Ratio	PPV	NPV
MMT	5%	91.1%	76.86%	0.56	1.04	10%	82.88%
	(0.08-0.25)	(0.84-0.96)		(0.08-4.19)	(0.93-1.17)	(0.02-.45)	(0.75-0.89)
ULBT	50%	100%	91.74%	Infinite	0.5	100%	91%
	(0.27-0.73)	(0.96-1)			(0.32-0.78)	(0.69-1)	(0.84-0.96)
TMD	25%	87.12%	76.86%	1.94	0.86	27.77%	85.43%
	(0.09-.49)	(0.78-.92)		(0.77-4.84)	(0.66-.11)	(0.10-0.53)	(0.76-0.91)
MMT and TMD	30%	80.2%	71.90%	1.52	0.87	23.08%	85.26
	(0.12-0.54)	(0.71-0.87)		(0.70-3.29)	(0.64-1.18)	(0.09-0.44)	(0.77-0.92)

DISCUSSION

This was descriptive cross sectional study in which the pre operative airway assessment tools were investigated to predict difficult intubation. The commonly used tools like modified Mallampati (MMT) ,thyromental distance(TMD) and upper lip bite test (ULBT) were chosen as they were simple bed side tests. Any clinical tests for prediction of difficult intubation should have high sensitivity, specificity, and should have a high positive predictive value (PPV) with few negative predictions.

The percentage of difficult laryngoscopy was 16.52% as measured by CL grading of III or more during the intubation without external laryngeal manipulation. In our study, both Modified Mallampati test and Thyromental distance had low sensitivity and PPV. Thus they are very poor in identifying difficult intubation. This was consistent with previous studies, reflecting that TMD is a poor predictor of difficult intubations. In 2005, the study by Merah et al showed that the sensitivity, specificity, and PPV of TMD were 15.4%, 98.1%, and 22.2%,respectively.[8] But in 1994, the study by Savva et al reported that the TMD had a sensitivityof 64.7% and a specificity of 81.4%.[9] Merah et al suggested that the relatively low sensitivity in their study might be due to anthropometric peculiarities in the study population. [8] Many patients involuntarily phonate during assessment of MMT score, which may considerably alter the Mallampati classification. Bilgin et al showed that a low prediction value of MMT was due to involuntary phonation during test, which probably alters the Mallampati classification.[10] Tham et al confirmed that prevention of phonation was a critical factor in accomplishing a reliable MMT score.[11] MMT in evaluating oropharyngeal view has had poor reliability in the study by Karkouti and colleagues, which could be due to the technicalities involved in the demonstration, and incongruity in evaluating and interpreting the observations.[12]Oates and colleagues showed that one critical factor in doing a reliable Mallampati classification was maximal extrusion of tongue and opening of the mouth.[13] Failure to employ these maneuvers strictly is a chief drawback when performing the evaluation.

The ULBT, evaluates a combination of jawsubluxation and the presence of buck tooth concurrently .In the present study, the sensitivity, specificity, PPV, and NPV of the ULBT were demonstrated to be 50%, 100%, 100%, and 91%, respectively . These values were 76.5%, 88.7%, 28.9% and 98.4%, respectively, in the original study by Khan et al. [6]The difference in PPV in these two studies may be due to the fact that PPV depends upon the prevalence of difficult intubation in the study population. Eberhart LH et al reassessed the ULBT in their study published in 2005; the sensitivity, specificity, PPV and NPV they obtained were 28.2%, 92.5%, 33.6%, and90.6%, respectively.[14] In 2007, Hester et al presented a study that determined a sensitivity of 55%, a specificity of 97%, PPV of 83% and NPV 90% for the ULBT.[15] All the above three studies measured the ULBT with the Modified Mallampati Test as a comparison. From the results of the investigations by Khan et al and Hester et al , a conclusion could be obtained that the ULBT was superior to the modified Mallampati Test in

almost every aspect for difficult airway prediction.[6,15] In our study ,the ULBT had a higher sensitivity , higher specificity and higher PPV when compared with the   MMT, TMD and even combination of MMT and TMD.

Considering that the ULBT is a simple objective evaluation that is not dependent on particular circumstances or specific instruments, it is of utmost importance to evaluate and re-evaluate it in various conditions and make comparisons with alternative tests.

Moreover, the likelihood ratio (+LR) for a positive test result may be a usefulmeasure to judge the efficacy of a predictive tool in daily practice. This measure is the number of times more likely that a patient with a positive test result will presentwith a difficult laryngoscopy. The +LR was   infinite for ULBT whereas it was 0.56 and 1.94 for MMT and TMD, respectively. The ULBT score of predicting difficult laryngoscopy has also some limitations. It is not appropriate for edentulous patients. Due to racial variation in morphology and anthropometry of human mandible and maxillary bones, ULBT may not be applicable in some populations. So the study with larger sample size involving heterogeneous group of population is required to further investigate the prediction ability of Upper lip bite test for difficult intubation. Safe anesthesia continues to be an important goal for every anaesthesiologist. Unfortunately, there is still no test that can predict 100% of difficult airway.

CONCLUSION

ULBT is better than other bedside screening test for prediction of difficult laryngoscopy and intubation and it should be used along with other routine tests.

CONFLICT OF INTEREST

None

SOURCES OF FUNDING

None

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