Journal of Current Medical Research and Opinion

CMRO 02 (12), 383–387 (2019) ISSN (O) 2589-8779 | (P) 2589-8760

Diagnostic Value of Upper Lip Bite Test with Hyomental Distance Ratio in Assessing the Airway

Dr Hally Thankamony*,†,[1], Dr Harikrishnan S[2], Dr Rajani Gandha Venkitachalam[3]

[1]*Senior Resident, Regional Cancer Center, Thiruvananthapuram, Kerala.*
[2]*Additional professor Medical college Thiruvanthapuram*
[3]*Associate professor,Medical college, Kottayam*

DOI: https://doi.org/10.15520/jcmro.v2i12.241

Accepted 15-12-2019; Received 14-11-2019; Publish Online 17-12-2019

Reviewed By:
Dr. Diana Ferraro
Department:
Reviewer/CMRO

ABSTRACT

Introduction:
Airway assessment before any type of anesthesia is mandatory. Upper lip bite test (ULBT) is a relatively new test for assessing the airway. Range of freedom of mandible and dental architecture has a significant role in facilitating intubation, both of which are assessed by this single test. ULBT with good neck movements are sufficient criteria for assessing the airway. Hyomental distance ratio (HMDR) assesses the range of neck movements. So by combining these two tests we expect an increase in reliability and validity.

Methods:
Preoperatively we assessed the airway using ULBT, HMDR, and Mallampati (MP) tests of 300 patients. The anesthesiologist doing laryngoscopy is blinded to the results of pre op airway evaluation. Direct laryngoscopies are graded using the modified Cormack and Lehane scale. Difficult laryngoscopy was defined as Grade 3 or 4 view. ULBT class 3, and HMDR with optimal cutoff point 1.2 are considered as difficult intubation predictors. Sensitivity, Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and Accuracy of both ULBT and HMDR separately and then both in combination are calculated and compared with those of MP.

Results:
ULBT:-Sensitivity - 88.2%, Specificity - 99.62%, PPV - 96.77%, NPV - 98.51%, Accuracy - 98.33%
HMDR: - Sensitivity - 88.2%, Specificity – 99.25%, PPV - 93.75%, NPV - 98.50%, Accuracy - 98.00%
MP: - Sensitivity - 17.65%, specificity - 88.72%, PPV - 16.67%, NPV - 89.39%, Accuracy - 80.66%
ULBT+HMDR: - Sensitivity - 82.35%, specificity-100%, PPV100%, NPV97.75%, Accuracy - 98.00 %

Conclusion:
Upper Lip Bite test is good screening test for assessing the airway. ULBT in combination with HMDR increased the specificity and positive predictive value.

Key words: ULBT–HMDR–Difficult Airway–Mallampati–Cormack and Lehane scale

1 INTRODUCTION:

Airway assessment before any type of anesthesia is mandatory. Unanticipated difficult airway is a nightmare for every anesthesiologist. Usually we use a group of tests for assessing the airway such as Mallampati criteria, thyro mental distance, mouth opening etc. All these tests are not totally reliable. The incidence of a difficult laryngoscopy or intubation varies from 1.5% to 13% [1]. Failure to maintain a patent airway after induction of anaesthesia leads to irrevocable catastrophic sequelae such as brain damage or death. In an updated report by the American Society of Anaesthe-

* Corresponding author.
† Email: hallysharon@gmail.com

siologists (ASA) task force on management of the difficult airway, a difficult airway is defined as the clinical situation in which a conventionally trained anaesthesiologist experiences difficulty with face mask ventilation of upper airway, difficult tracheal intubation or both [2–5] .

Upper Lip Bite Test (ULBT) is a relatively new test for assessing the airway. Range of freedom of mandible and dental architecture has a significant role in facilitating intubation. ULBT, a single test which simultaneously assess both dental architecture and mandibular movement, serves as a good predictor of difficult intubation. ULBT also assess the relationship between upper and lower dental arches, which gives us an idea about the airway of the patient [6]. ULBT with good neck movements are sufficient criteria for assessing the airway [7, 8].

Hyomental Distance Ratio (HMDR) assess the range of neck movements. It is an important predictor of submandibular space, which is needed to push the tongue during intubation [9]. So by combining these two tests the expected reliability and validity should increase.

The aim of this study was to determine the diagnostic value of Upper Lip Bite Test (ULBT) combined with Hyomental Distance Ratio (HMDR).

2 METHODOLOGY:

The study was approved by an institutional human ethics committee and research committee, IEC NO 01/69/2014/MCTand informed consent was obtained from each patient. Assuming 70% prediction rate as per reference [6] precision 10% and 95% confidence level, sample size needed was calculated as 300.

Consecutive male and female, 300 patients, aged 15-60 yrs, scheduled to undergo surgery under general anesthesia and endotracheal intubation, between March 2014 and February 2015, were considered for enrollment. Edentulous patients, those unable to open the mouth, with big oral tumours, or cervical spine pathology were excluded from the study.

Preoperative assessment of the airway is done using Mallampati criteria, Upper Lip Bite Test (ULBT) and Hyomental distance ratio (Hyomental distance at extreme extension devided by Hyomental distance at neutral position), taken with the patient in supine position. General anaesthesia induced as per institutional protocol. Laryngeoscopy is done by an experienced person who does not know Upper Lip Bite Test class and Hyomental distance ratio (HMDR). Statistical analysis was done using SPSS version 11. Catagorical variables are analysed using chi squire test and continuous variables are analysed using student's t test. Cormack Lehane grading of laryngosopy was taken as the gold standard. Difficult laryngoscopy was defined as a Grade 3 or 4 laryngoscopic view. ULBT class 3, and HMDR with optimal cutoff point 1.2 are considered as difficult intubation predictors [8, 10] . Stastistical parameters of ULBT are Upper lip bite test class3 is considered as a predictor of difficult intubation. Upper lip bite test class 1&2 are considered as predictors of easy intubation. True positive - Cormack lehane grade 3&4 + upper lip bite test class 3. True negative - Cormack lehane 1&2 + upper lip bite test class 1&2. False negative - Cormack lehane 1&2 + upper lip bite test class 3. False positive - Cormack lehane 3&4 + upper lip bite test class 1&2. Statistical parameters of HMDR are true positive - Cormack lehane 3&4+HMDR less than 1.2. True negatives- Cormack lehane 1&2 +HMDR more than 1.2. False negatives- Cormack lehane 1&2+HMDR less than 1.2.False positives Cormack lehane 1&2 +HMDR greater than 1.2.

Sensitivity, Specificity, Positive Predictive Vale (PPV), Negative Predictive Value (NPV) and Accuracy of both ULBT and HMDR separately and then both in combination are calculated and compared with those of MP.

Table 1. Demographic data of patients enrolled

Category	Value
Female	84.7 %
Male	15.3 %
Age	44 ± 12 yrs
ASA Class	58.7% 41.3%
I II	

3 RESULTS:

Out of 300 patients recruited in this study, 84.7% were females. The mean age was 44 ± 12 years (mean ± SD). Difficult laryngoscopy (C–L grades III) was seen in 34 (11.33%) patients. Out of 300 patients recruited in this study, 254 (84.7%) were females.

Table 1 shows the demographic data of the enrolled cases. Table 2 reveals the statistical indices of the different diagnostic tests.

4 DISCUSSION:

This study was designed to evaluate the efficacy of ULBT, MP, HMDR and HMDR+ULBT in forecasting a difficult intubation, and to draw a possible correlation between the tests and C–L grades.

We have taken more number of females in this study so the results are more applicable to females. 84.7% of study population are females. The incidence of difficult airway in this study is 11.33% which is consistent with a meta-analysis of nine studies that included 14,438 patients and a DVL incidence of 6%–27% .

The wide variations in the incidence of DVL may be related to factors such as age [11] [21] and ethnic differences among patients [12, 13] or types of laryngoscope blade used [10]. The incidence of difficult intubation is 1.3%, 15%, 1.8%, 3.5%, 4%, 45%, 4.9%, 7%, 8%, and 13% [7, 11, 14–16] depending on the criteria used to define it.

In this study 4% of patients under the age group 15-20 yrs. There are 12.7 % of patients under the age group 20-30

Table 2. Statistical Indices

Test	TP	TN	FP	FN	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
ULBT	30	265	1	4	88.24	99.62	96.77	98.51	98.33
MP	6	236	30	28	17.65	88.72	16.67	89.39	80.66
HMDR	30	264	2	4	88.24	99.25	93.75	98.50	98
ULBT+HMDR	28	266	0	6	82.35	100	100	97.75	98

yrs. There are 23.3% and 27.3% under the age group 30-40 and 40-50 respectively. There are 32.7% under the age group 50-60yrs. There are 84.3% patients are under the age group 30-60yrs. Hence this study is more applicable in the age group 30 -60 yrs.

Total thyroidectomy patients constitutes 54% of the total number enrolled in this study. Chances of difficult airway in thyroid patients are higher, therefore in consideration to this we have included more number of thyroidectomy cases. Voyagis et al [17] had described that goiter, when accompanied by airway deformity, constitutes an aggravating factor for difficult intubation. Many articles have been published suggesting that goiter, when accompanied by tracheal compression, constitutes an aggravating factor for difficult airway [18–20].

Upper lip bite test is relatively new and easy test to predict the airway pre operatively. The new ULBT, was performed according to the following criteria: 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 [8]. ULBT class1 and 2 are considered as easy intubation and class 3 is difficult intubation. Hence there are 10% incidence of difficult intubations are predicted by this test. There are 76.7% patients having ULBT (Upper Lip Bite Test) class1 and 13.3% of patients are coming under class 2 Upper lip bite test in this study.

Classification of patients based on the ULBT is of a qualitative nature, making differentiation of classes easy and precise. In brief, the differences between the ULBT and the other tests are those between continuous and discrete variables. Thus, the ULBT is associated with the least inter observer variability, which adds to its advantage as an airway assessment test [21].

A test to predict difficult intubation should have high sensitivity, so that it will identify most patients in whom intubation will truly be difficult [22]. It should also have a high PPV, so that only few patients with airways actually easy to intubate are subjected to the protocol for management of a difficult airway [17, 23].

Oates et al predicted MMC as bedside test with higher predictive value but had multiple problems like inter-observer variation and phonation [21]. In this study MP has only 17.65% sensitivity; 88.72% specificity, 16.67% positive predictive value, 89.39% NPV and 80.66% accuracy. These results are almost in consistent with a study conducted in a tertiary hospital of Pakistan which showed sensitivity 19.6%, (95% CI 10.9%-33.4%), specificity 91.8% (95%CI 87.6%-94.6%), PPV3 3.3%(95% CI 18.6%-51.6%), NPV 84.3% (95% CI 80%-88.6%) [24]. Our results are against the finding of Oates et al maybe due to inter observer variability and ethnic differences [12, 16] [25] . In a study accuracy of ULBT 93% is much higher than that of Modified Mallampati alone 81.6% [26] which are 98%, 33% and 80.66% in our study. The specificity of ULBT was 99.1% which is similar to this study 99.25%. But they got low sensitivity for ULBT because of low incidence of class 3 group in their study [26].

Upper lip bite test class of 1 coupled with good neck extension and flexion of 90° were sufficient criteria for us to predict with confidence that the intubation would be easy and thus proceeded with the rapid sequence protocol [8] .

These findings are consistent with a previous report by Eberhart et al. [27] which showed that the inter observer reliability of the ULBT is higher than the Mallampati classification. The discriminating power of ULBT was high 0.90 (95% confidence interval, 0.84-0.95) than MP 0.55 (95% confidence interval, 0.47-0.64) indicating that ULBT is a good predictor of difficult intubation [27].

Sensitivity, specificity and NPV of ULBT in our study is comparable to an earlier study [28] (88.24%, 99, 62% and 98.51% versus 88%, 88.7% and 98.4% respectively), and some other studies [27, 29] . Sensitivity (87.5% versus 88.72%.) and PPV (96.77% versus 28.9%) of ULBT was higher in our study compared to earlier studies [8, 29–31] .

The probable reasons are lack of inter observer variance in our study as well as ethnic difference in a study. Comparison of six methods for predicting difficult intubation in obstetric patients, they got sensitivity, specificity, PPV, NPV of ULBT are 94.6%, 97.6%, 89.7%, 98.8% these results are almost similar to this study [38]. In this study, it is 88.24% sensitivity, 99.62% specificity, 96.77% positive predictive value, 98.51% negative predictive value and accuracy 98.33% for ULBT.

The hyomental distance (HMD) has been used to estimate the mandibular space, but the HMD alone was shown to have only a modest degree of diagnostic value [14]. Takenaka et al defined the ratio of HMD in extreme of head extension to neutral position and as the hyomental distance ratio (HMDR) and demonstrated that it was a good predictor of a reduced occipito-atlantoaxial (OAA) complex extension capacity [32].

The angle required to expose the glottis during direct laryngoscopy was previously reported to be at least 12°, and the corresponding HMDR was calculated as 1.25 [13] . HMDR showed 88.24% sensitivity, 99.25% specificity, 93.75% positive predictive value, 98.5% negative predictive value and 98% accuracy in this study. The sensitivity of HMDR in this study is comparable to Takanaka et al (88.2% versus 88%) [33] Limitations of the study are ULBT cannot

be performed in edentulous patients, patients with low intellectual coefficient small children .The risk score requires further validation in larger study population. [34–40]

By combining ULBT and HMDR, the results showed sensitivity 82.35%, specificity100%, positive predictive value 100%, negative predictive value 97.79% and accuracy 98%. Observed improvement in positive predictive value, specificity and sensitivity, while there is slight decrease in negative predictive value in combination with ULBT and HMDR. Results show this is an excellent combination of airway assessment.

5 ACKNOWLEDGEMENT:

I would like to thank the patients who enrolled in the study. I sincerely thank the other contributor, Dr Harikrishnan S. and Dr Rejani Gandha for their support. There is no conflict of interest present and no external funding for this study.

REFERENCES

[1] Randell T. Prediction of difficult intubation. Acta Anaesthesiol Scand. 1996;40:1016–1039.
[2] Khan SZH, Arbabi. Diagnostic value of the upper lip bite test in predicting difficulty in intubation with head and neck landmarks obtained from lateral neck X-ray. Indian Journal of Anaesthesia |. 2013;57.
[3] Apfelbaum JL, Hagberg CA, Caplan RA, Blitt CD, Connis RT, Nickinovich DG. Practice guidelines for management of the difficult airway: An updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology. 2013;118:251–70.
[4] Schwartz DE, Matthay MA, Cohen NH. Death and other complications of emergency airway management in critically ill adults. A prospective investigation of 297 tracheal intubations. Anesthesiology. 1995;82:367–76.
[5] Caplan RA, Posner KL, Ward RJ, Cheney FW. Adverse respiratory events in anesthesia: A closed claims analysis. Anesthesiology. 1990;72:828–861.
[6] Khan MSH, Gharadaghil F, Nilli M, Ghiamat M, Mohammadi. Easy Endotracheal Intubation of a patient Suffering from Both Cushings and Nelsons syndromes predicted by the Upper lip bite test Despite a Mallampati Class 4 airway. Anesth Analg. 2007;105(3):786–793.
[7] Wilson ME, Spiegeihalter D, Robertson JA, Leasser P. Predicting the Difficult Airway. BJA Education. 2015;15(5):253–257.
[8] Khan ZH, Kashfi A, Ebrahimkhani E. A comparison of the upper lip bite test (a simple new technique) with modified Mallampati classification in predicting difficulty in endotracheal intubation: a prospective blinded study. Anesth Analg. 2003;96(2):595–604.
[9] Asai T, Matsumoto S, Fujise K, Johmura S, Shingu K. Comparison of two Macintosh laryngoscope blades in 300 patients. Br J Anaesth. 2003;90:457–60.
[10] Elberhart LH, Arndt C, Cierpka T, Schwanekamp J, Wulf H, Putzke C. The reliability and validity of the upper lip bite test with Mallampati classification to predict difficult laryngoscopy: an external prospective evaluation. Anesth Analg. 2005;101:284–293.
[11] Ezri T, Warters RD, Szmuk P, Saad-Eddin H, Geva D, Katz J, et al. The incidence of class "zero" airway and the impact of Mallampati score, age, sex, and body mass index on prediction of laryngoscopy grade. Anesth Analg. 2001;93:1073–1078.
[12] Wong SH, Hung CT. Prevalence and prediction of difficult intubation in Chinese women. Anaesth Intensive Care. 1999;27:49–52.
[13] Cooke MS, Wei SH. A comparative study of southern Chinese and British Caucasian cephalometric standards. Angle Orthod. 1989;59:131–139.
[14] Mohamed, La, Rocke DA. StemomentaI distance as the sole predictor of difficult laryngoscopy in obstetric anaesthesia. Br J Anaesth. 1996;5:312–318.
[15] Yamamoto K, Tsubokawa T, Shibata K. Predicting difficult intubation with indirect laryngoscopy. Anesthesiology. 1997;86:316–316.
[16] Tseie RE, Hussain A. Predicting difficult endotracheal intubation in surgical patients scheduled for general anesthesia: a prospective blind study. Anesth Analg. 1995;81:254–262.
[17] Gregory S, Voyagis KP, Kyriakis. The Effect of Goiter on Endotracheal Intubation. Anesth Analg. 1997;84:611–613.
[18] Ghai S, Hooda R, Wadhera N, Garg. Gross TrachealDeviation : Airway Challenges And Concerns - Two Case Reports. A Acta Anaesth Belg. 2011;62:203–206.
[19] Souza JW, Williams JT, Ayoub MM, Jerles ML, Dalton ML. Bilateral recurrent nerve paralysis associated with multinodular substernal goiter: a case report. Am Surg. 1999;65:456–465.
[20] Shaha AR. Airway management in anaplastic thyroid carcinoma. Laryngoscope. 2008;118(7):1195–1203.
[21] Khan ZH, Mohammadi M, Rasouli MR, Farrokhnia F, Khan RH. The diagnostic value of the upper lip bite test combined with sternomental distance, thyromental distance, and interincisor distance for prediction of easy laryngoscopy and intubation: a prospective study. Anesth Analg. 2009;109(3):822–826.
[22] Arne J, Descoins P, Fusciardi J, Ingrand P, Ferrier B, Boudigues D, et al. Preoperative assessment for difficult intubation in general and ENT surgery: predictive value of a clinical multivariate risk index. Br J Anaesth. 1998;80:140–146.
[23] Merah NA, Wong DT, Foulkes-Crabbe DJ, Kushimo OT, Bode CO. Modified Mallampati test, thyromental distance and interincisor gap are the best predictors of difficult laryngoscopy in West Africans. Can J Anaesth. 2005;52:291–297.
[24] Ali M, Qamar-Ul-Hoda M, Samad K. Comparison of upper lip bite test with Mallampati test in the prediction of difficult intubation at a tertiary care hospital of Pakistan. J Pak Med Assoc. 2012;62(10):1012–1017.
[25] Eberhart LHJ, Arndt C. The Reliability and Validity of the Upper Lip Bite Test Compared with the Mallampati Classification to Predict Difficult Laryngoscopy: An external Prospective Evaluation. Anesth Analg. 2005;101:284–293.
[26] Bhat R, Mishra, Badhe. Comparison Of Upper Lip Bite Test And Modified Mallampati Classification In Predicting Difficult Intubation. The Internet Journal of Anesthesiology. 2006;13(1).
[27] Türkan S, Ateş Y, Cuhruk H, Tekdemir I. Should we reevaluate the variables for predicting the difficult airway in anesthesiology? Anesth Analg. 2002;94(5):1340–1344. table of contents.
[28] Lee A, Fan LT, Gin T, Karmakar MK, Kee N, WD. A systemic review (meta-analysis) of the accuracy of the Mallampati tests to predict the difficult airway. Anesth Analg. 2006;102:1867–78.
[29] Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, et al. A clinical sign to predict difficult

tracheal intubation: a prospective study. Can Anaesth Soc J. 1985;32(4):429–463.
[30] Sawin PD, Todd MM, Traynelis VC, Farrell SB, Nader A, Sato Y, et al. Cervical spine motion with direct laryngoscopy and orotracheal intubation. An in vivo cinefluoroscopic study of subjects without cervical abnormality. Anesthesiology. 1996;85(1):26–36.
[31] Oates J, Macleod AD, Oates PD, Pearsall FJ, Howie JC, Murray GD. Comparison of two methods for predicting difficult intubation. British Journal of Anaesthesia. 1991;66:305–309.
[32] Rocke DA, Murray WB, Rout CC, Gouws E. Relative risk analysis of factors associated with difficult intubation in obstetric anesthesia. Anesthesiology (hagerstown);1992(1):67–73.
[33] Tse JC, Rimm EB, Hussain A. Predicting difficult endotracheal intubation in surgical patients scheduled for general anesthesia: a prospective blind study. Anesth Analg. 1995;81:254–262.
[34] Horton WA, Fahy L, Charters P. Defining a standard intubating position using Angle Finder. British Journal of Anaesthesia. 1989;62:6–12.
[35] Myneni N, O'leary AM, Sandison M, Roberts K. Evaluation of the upper lip bite test in predicting difficult laryngoscopy. J Clin Anesth. 2010;22:174–182.
[36] Salimi A, Farzanegan B, Rastegarpour A, Kolahi AA. Comparison of the upper lip bite test with measurement of thyromental distance for prediction of difficult intubations. Acta Anaesthesiol Taiwan. 2008;46:61–66.
[37] Takenaka I, Iwagaki T, Aoyama K, Ishimura H, Kadoya T. Preoperative evaluation of extension capacity of the occipitoatlantoaxial complex in patients with rheumatoid arthritis: comparison between the Bellhouse test and a new method, hyomental distance ratio. Anesthesiology. 2006;104(4):680–685.
[38] Huh J, Shin HY, Kim SH, Yoon TK, Kim DK. Diagnostic predictor of difficult laryngoscopy: the hyomental distance ratio. Anesth Analg. 2009;108(2):544–552.
[39] Hagberg CA, Robert GM, Krohner S, Ramanathan;.
[40] Allahyary E, Ghaemei SR, Azemati S. Comparison of six methods for predicting difficult intubation in obstetric patients. Shiraz, Iran;.