Journal of Cardiovascular Disease Research

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 08, 2023

Orginal research article

PREDICTING DIFFICULT AIRWAY BY EVALUATION OF MAXIMUM CONDYLE TRAGUS DISTANCE WITHOUT EXPOSING UPPER RESPIRATORY TRACT IN PATIENTS UNDERGOING SURGERY WITH ENDOTRACHEAL INTUBATION UNDER GENERAL ANAESTHESIA

AUTHORS:

First author **: Dr Nikitha Somanayaka** senior resident in SIMS shivamogga

Second **: Dr Adharsh shivanna** BMCRI Bangalore

Third : **Dr Deeksha R Malkhedkar** BMCRI Banalore

CORRESPONDING AUTHOR : **Dr Nikitha Somanayaka** senior resident in SIMS shivamogga

Mail: srgal61@gmail.com

Abstract :

Background: Predictive tests like modified mallampatti test, interincisordistance(IID), upper lip bite test(ULBT) are routinely done to anticipate difficult airway requiring exposure of upper airway to the assessor and environment. Condyle tragus maximal distance(CTMD) measurement can be used to predict difficult airway without exposing upper airway

Objectives:To compare above tests to predict difficult airway and predictive value of CTMD test **Methods and study design** :Eighty adult patients undergoing surgery with endotracheal intubation under general anaesthesia, aged between 18-60 years, ASA physical status I and II are enrolled. Mallampatti grading, IID,ULBT and CTMD are evaluated one day prior to surgery. During procedure CL grading, time to intubation and attempts at intubation were noted .

Results: The study included 80 patients. 25 patients were identified as difficult airway. In patients where intubation was successful in first and second attempts belong to CTMD >1 finger and third and fourth attempts belonged to CTMD <1 finger. The mean and standard deviation of time to intubation in CTMD test was 109.38 and 17.75 in <1 finger and 51.63 and 9.47 in >1 finger which was statistically significant.

Interpretation and conclusion :CTMD evaluation can be used as an alternative to other predictive tests for predicting difficult airway without exposing upper respiratory tract to the assesser and environment, which is safe considering the present pandemic situation.

Keywords: Difficult airway, predictive tests, CTMD test, Mallampatti grading

Introduction:

The unanticipated difficult airway is a potentially life threatening event during anaesthesia which will be associated with mortality and morbidity. It can account for 28% of anaesthesia-related deaths[1], with complications including hypoxia, arterial hypertension, dental lesions, admission to an intensive care unit and problems during extubation.About 50-75% of cardiac arrests during general anesthesia are because of difficult intubation[5]

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 08, 2023

The anaesthesia preoperative evaluation is the clinical foundation and framework of perioperative management and enhance patient outcome[2].Predictive tests, including the modified Mallampati test, interincisor distance (IID), upper lip bite test (ULBT) are conducted during pre operative evaluation with the aim of establishing safe strategies that may facilitate adequate airway access. All these tests helps us to evaluate temporomandibular mobility(TMJ) as it plays a significant role in the grading of laryngoscopic exposure and the prediction of difficult laryngoscopy. However, none of the predictors used so far have, on their own, proved sufficiently accurate and reliable in identifying and predicting difficult airway.Thus anaesthesiologists usually relay on combination of multiple tests.
These routine examination requires patient to remove his/her mask before opening the mouth. This process will undoubtedly increase the risk of nosocomial infectionto the examiner in the current pandemic situation. Therefore, it is necessary to find new methods for protecting anesthesiologist from direct exposure of the upper respiratory tract without compromising accuracy and simplicity during preoperative airway evaluation.

Condyle-tragus maximal distance (C-TMD) can be used for preoperative airway assessment. This method reflects the degree of TMJ mobility directly[3]. But compared with other indicators, such as Mallampati classification, IID, and ULBT, the predictive value of the C-TMD remains unknown.
The purpose of this study was to observe the correlation between C-TMD and other predictive indicators of difficult laryngoscopy in classifying laryngoscopy and predicting difficult laryngoscopy, and to calculate the predictive value of CTMD.

Objectives of the study

- COMPARISON OF DIFFERENT TESTS TO PREDICT DIFFICULT LARYNGOSCOPY
- CALCULATING PREDICTIVE VALUE FOR C- TMD

Subjects and Methods:

Source of data: Patients undergoing elective surgery with endotracheal intubation under general anaesthesia in hospitals attached to Bangalore medical college and research institute

Methods Of Collection Of Data:

Study design: Prospective randomized control study

Study period: 1.5 years (Nov 2019- Aug 2021)

Place of study: Patients undergoing elective surgeries with endotracheal intubation under general anaesthesia in hospitals attached to Bangalore medical college and research institute.

Inclusion Criteria:

Patients who are willing to give informed written consent
Patients aged between 18 - 60 years
Patients scheduled for elective surgery with endotracheal intubation under general anaesthesia
Patients who belong to ASA I and ASA II

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 08, 2023

Exclusion Criteria:

Patients who are not willing to give consent
Patients belonging to ASA III and ASA IV
Patients who are edentulous or with facio maxillary injuries
Patients not belonging to inclusion criteria

After informed written consent , we enrolled patients who underwent elective surgeries with endotracheal intubation under general anesthesia and fullfiling inclusion criteria

For all the patients enrolled in this study, during the preoperative examination, a skilled anesthesiologist examined whether the C-TMD could accommodate one finger width. The specific measurement procedure was as follows:

The patient sat upright, and the examiner used the index fingers of both hands to locate the mandibular condyle of the mandible, instructed the patient to open mouth as wide as possible, and felt that the condyle moved with the mouth opening movement, the examiner then evaluated whether the distance between the condyle and the tragus could accommodate the width of one finger.

Later, another anesthesiologist, who was not aware of the evaluation results of C-TMD, measured other relevant indicators for airway evaluation.

Mallampati classification: The patient sat upright, opened the mouth wide, and extended the tongue to the maximum. The patient was then scored according to the pharyngeal structure that could be observed. Mallampati class > 2 was considered to be a predictive risk factor for difficult airways

Interincisor distance (IID): The patient sat and openedmouth as wide as possible, and then the examiner estimated IID with fingers. IID less than the width of three fingers was a predictive risk factor for difficult airways.

Upper lip bite test (ULBT) classification: The patient sat with the chin extending forward. The patient was asked to try his/her best to bite the upper lip with the lower incisors. According to the ability of the lower incisors to bite the upper lip, the test result was divided into three classes:

- Class 1: The lower incisors completely bit the upper lip above the vermilion border and completely covered the upper lip membrane
- Class 2: The lower incisors only bit half of the upper lip membrane and failed to reach the vermilion border
- Class 3: The lower incisor could not bite the upper lip.

Classes 2 and 3 were the predictive risk factors for difficult airways

In the operating room, intravenous cannula is secured and ringer lactate infusion started. Standard monitors were attached.

- Premedication was given with injection midazolam 0.05 mg/kg, glycopyrrolate 0.004mg/kg and fentanyl 2mcg/kg
- Preoxygenation done for 3 minutes with 100% oxygen at 8l/min
- Patient induced with propofol 2mg/kg
- In sniffing position laryngoscopy was done after 3 minutes of injection vecuronium 0.01mg/kg using no. 3/4 blade.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 08, 2023

The Cormack-Lehane classification was used to grade laryngoscopic exposure, and observations of the structure ofthe larynx and the glottis

Class 1: The glottis structure was fully exposed, and the front and back joint structure could be seen

Class 2: The glottis was partially revealed, and the rear glottal joint structure could be seen

Class 3: Only the epiglottis was seen

Class 4: Neither the glottis nor epiglottis was visible

Classes > 2 were defined as difficult laryngoscopy

Time of intubation and number of attempts for intubation are noted.

An intubation attempt was defined as attempt of laryngoscopy. First-pass success was defined as successful intubation during the first attempt. The time of intubation defined when the laryngoscope blade tip passed the incisors until confirmation of the first wave of carbon dioxide of the capnometer.

Assessment tools:

- Ease of intubation
- Number of attempts

Outcome measures:

1. Intubation time
2. Number of attempts
3. Hemodynamic changes

Statistical analysis

Data wasanalyzed by descriptive statistics such as mean, median, standard deviation, inter quartile range, percentage, tables and graphs wherever necessary.

Suitable parametric and non parametric tests were used to determine significant difference between parameters.

P value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Results: Eighty patients who underwent elective surgeries under general anaesthesia with endotracheal intubation were included 2 patients were excluded. Out of 78 patients, 25 were identified as difficult laryngoscopy by CL grading. All the patients were successfully intubated within 4 attempts.

Descriptive data of the patients included in this study were statistically not significant

Out of 78 patients ease of intubation in all predictors were noted and difficult laryngoscopy was predicted in 13 patients by CTMD, 11 by Mallampati grading, 25 by CL grading and 9 by IID and the remaining patients had easy laryngoscopy(Table 1)

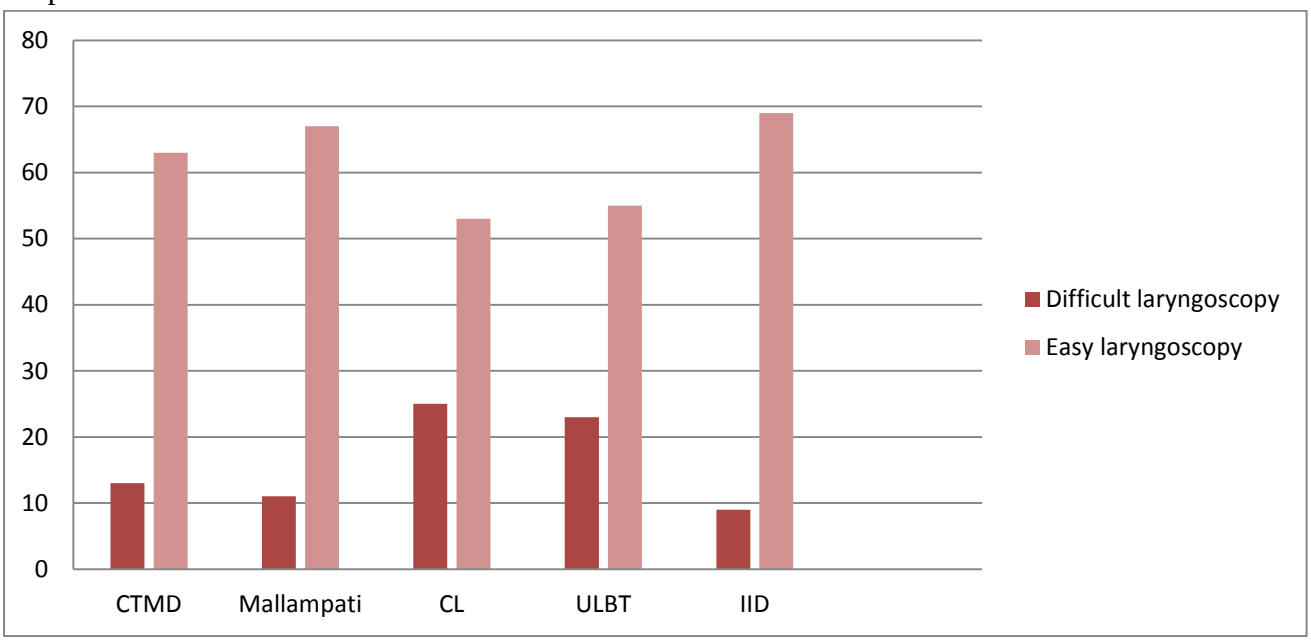
Table 1

	Difficult Laryngoscopy	Easy Laryngoscopy
CTMD	13	63

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 08, 2023

Mallampati	11	67
CL grading	25	53
ULBT	23	55
IID	9	69

Graph 1

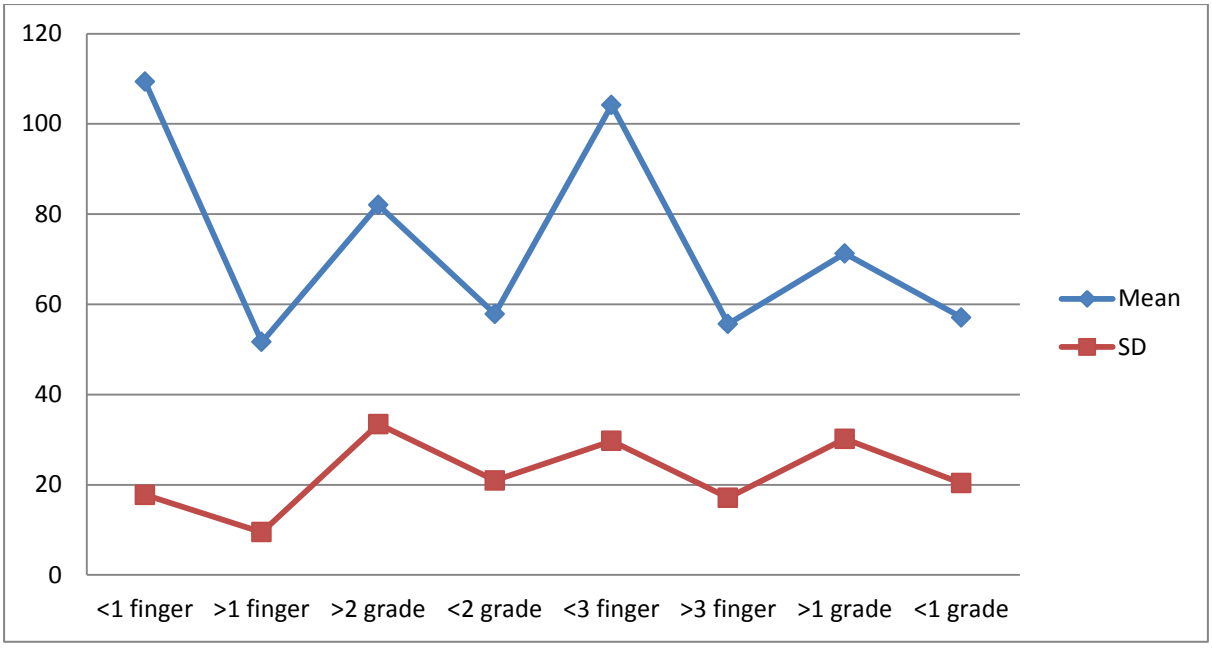


The time of intubation was comparatively shorter in CTMD > 1 finger and IID > 3finger with a mean time of 51.63 seconds and 55.65 seconds respectively and standard deviation of 9.47 and 17.1 respectively which statistically significant. (Table 2)

Table 2

		Mean	Standard deviation	P value
CTMD	<1 finger >1 finger	109.38 51.63	17.75 9.47	<0.001
Mallampati	>grade 2 <grade 2	82 57.85	33.45 20.94	0.002
IID	<3 finger >3 finger	104.2 55.65	29.71 17.1	<0.001
ULBT	>1 grade <1 grade	71.26 57.07	30.17 20.35	0.018

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 08, 2023



Graph 2

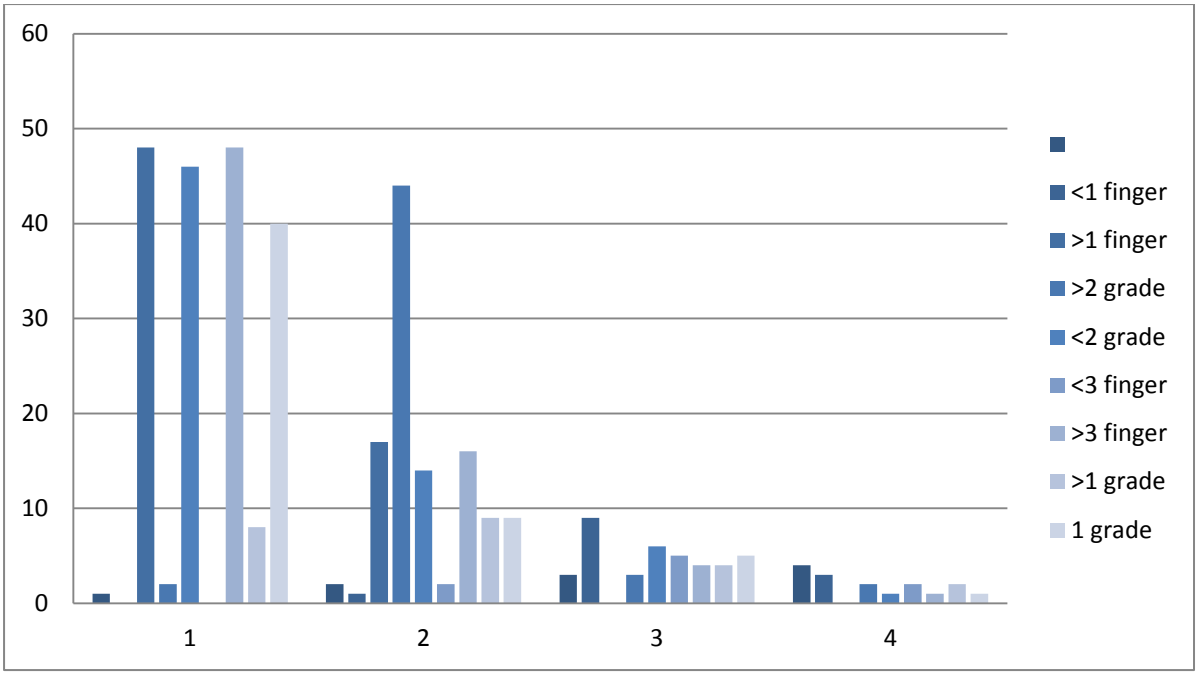
Number of attempts to intubate was statistically significant in CTMD and IID group with p value < 0.05(Table 3)

Table 3

		1	2	3	4	
CTMD	<1 finger >1 finger	0(0) 48(100)	1(5.6) 17(94.4)	9(100) 0(0)	3(100) 0(0)	<0.001
Mallampati	>grade 2 <grade 2	2(4.2) 46(95.8)	44(77.8) 14(22.2)	3(33.3) 6(66.7)	2(66.7) 1(33.3)	0.002
IID	<3 finger >3 finger	0(0) 48(100)	2(11.1) 16(88.9)	5(55.6) 4(44.1)	2(66.7) 1(33.3)	<0.001
ULBT	>1 grade <1 grade	8(16.7) 40(83.3)	9(50) 9(50)	4(44.1) 5(55.6)	2(66.7) 1(33.3)	0.015

Graph 3

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 08, 2023



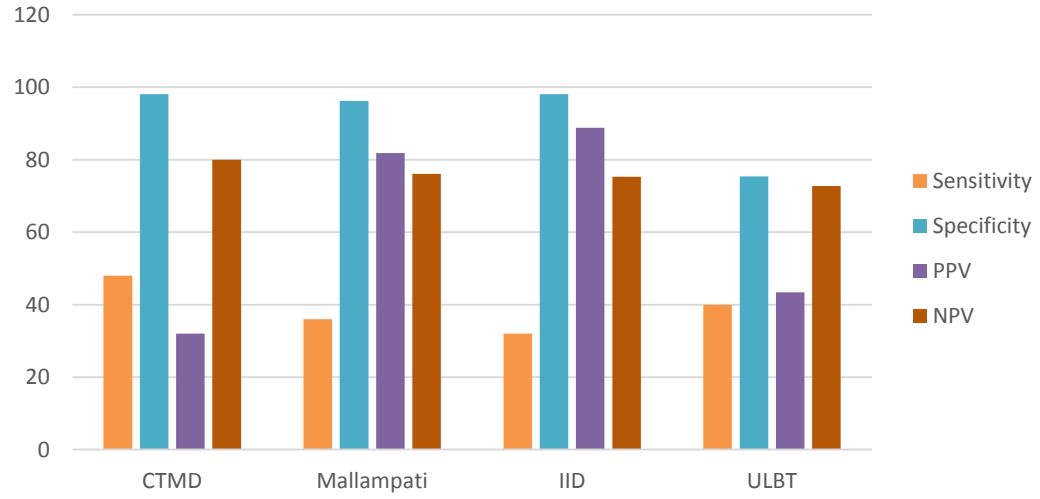
Sensitivity , specificity, positive predictive value(PPV) and negative predictive value(NPV) of CTMD is 48.0(27.8-68.6), 98.1(89.9-99.9), 32.0(21.9-43.5) and 80.0(73.2-85.3) respectively(Table 4)

Table 4

	Sensitivity	Specificity	PPV	NPV	Kappa
CTMD	48(27.8-68.6)	98.1(89.9-99.9)	32(21.9-43.5)	80.0(73.2-85.3)	0.52
Mallampati	36(17.9-57.4)	96.2(87-99.5)	81.8(51.1-95)	76.1(70.2-81.1)	0.37
IID	32(14.9-53.5)	98.1(89.9-99.9)	88.8(51.3-98.3)	75.3(69.6-80)	0.36
ULBT	40.0(21.1-61.3)	75.4(61.7-86.2)	43.4(28.1-60.1)	72.7(65-79.1)	0.15

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 08, 2023

Graph 4



When compared to Mallampati grading CTMD has more specificity and NPV. Specificity is same as that of IID and NPV is more in CTMD compared to IID. Sensitivity, specificity and NPV is more in CTMD when compared to ULBT.
Kappa value is in moderate agreement with CTMD test

Discussion:

Thedemographic variables were comparable between patients of difficult and easy laryngoscopy .

It is very crucial for anesthesiologist to predict difficult airway to prevent mortality and morbidity[5], and it is important to pre evaluate the patients using simple techniques which are accurate in identifying difficult airway.

A test should have high sensitivity and high positive predictive value , so that the intubation is truly difficult in those patients. It should also have high negative predictive value to predict ease of intubation[6]

Many meta analysis and studies have been conducted to compare the accuracy and predictive values of different tests with variable results. Recent data show modified Mallampati score is a poor predictor of difficult intubation[7-10]

From the above results we can conclude that by evaluating C-TMD we can predict difficult airway. If CTMD can accommodate one finger then laryngoscopy is comparatively easy and number of attempts to intubate and time for intubation is less.

Kappa value is 0.52 which implies moderate agreement with CTMD test.

Wu H et al[3] conducted a comparative studyon difficult airway predictors, the study findings co relates with our study findings i.e Compared to IID, Mallampati grading and ULBT, CTMD has higher value in predicting difficult laryngoscopy whereas in our study CTMD has more specificity and Negative predictive value than other predictive tests.

In a study conducted by Shah PJ[4] et al, predictive value of ULBT and ratio of height to thyromental distance compared to other multivariate airway predictors and concluded that ULBT is the best predictor for difficult laryngoscopy whereas in our study Sensitivity, specificity and Negative predictive value is more in CTMD when compared to ULBT.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 08, 2023

Similar results were obtained in study conducted by Khan Z H et al[6] ,Salimi A et al[11] and Dawood A S et al[12], concluding ULBT as best predictor for difficult laryngoscopy contrary to our result showing CTMD and IID the better predictors compared to ULBT.

CTMD reflects the degree of TMJ mobility directly and the degree of mobility directly co relates with the laryngoscopic exposure. The wider the movement greater is the laryngoscopic exposure.

If CTMD cannot accommodate 1 finger, the possibility of difficult is more with more number of attempts to intubate and increased time for intubation which has more specificity of 98.1% when compared to other predictive tests and negative predictive value of 80%.

Measuring CTMD is a simple technique, not requiring instruments, easy to perform, non invasive and does not require exposure of airway to environment during examination. Better than other predictors during pandemic or when patient has air borne respiratory diseases.

No single predictive tests are absolute indicator for difficult airway[13]

Limitation of our study is that not many studies have not been conducted for the predictive value of CTMD and hence more studies to be conducted in future

Other limitation is no single predictive test can be as effective as multivariate approach in predicting difficult airway.

Conclusion: CTMD evaluation can be used as an alternative to other tests for predicting difficult airway without exposing upper respiratory tract to the environment and the assessor, which is safe considering the present pandemic situation

References

1. Narkhede HH, Patel RD, Narkhede HR. A prospective observational study of predictors of difficult intubation in Indian patients. J Anaesthesiol Clin Pharmacol2019;35:119-23.

2. Tamire T, Demelash H, Admasu W. Predictive Values of Preoperative Tests for Difficult Laryngoscopy and Intubation in Adult Patients at TikurAnbessa Specialized Hospital. Anesthesiology Research and Practice. 2019;2019:1-13.

3. Wu H, Hu D, Chen X, Zhang X, Xia M, Chai X et al. The evaluation of maximum condyle-tragus distance can predict difficult airway management without exposing upper respiratory tract; a prospective observational study. BMC Anesthesiology. 2021;21(1).

4. Shah P, Dubey K, Yadav J. Predictive value of upper lip bite test and ratio of height to thyromental distance compared to other multivariate airway assessment tests for difficult laryngoscopy in apparently normal patients. Journal of Anaesthesiology Clinical Pharmacology. 2013;29(2):191

5. Badheka JP, Doshi PM, Vyas AM, Kacha NJ, Parmar VS. Comparison of upper lip bite test and ratio of height to thyromental distance with other airway assessment tests for predicting difficult endotracheal intubation. Indian J Crit Care Med. 2016

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 08, 2023

Jan;20(1):3-8. doi: 10.4103/0972-5229.173678. PMID: 26955210; PMCID: PMC4759991.

6. Khan, Zahid Hussain MD; Mohammadi, Mostafa MD; Rasouli, Mohammad R. MD; Farrokhnia, Fahimeh MD; Khan, Razmeh Hussain. 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. Anesthesia & Analgesia 109(3):p 822-824, September 2009. | DOI: 10.1213/ane.0b013e3181af7f0d

7. Rao KVN, Dhatchinamoorthi D, Nandhakumar A, Selvarajan N, Akula HR, Thiruvenkatarajan V. Validity of thyromental height test as a predictor of difficult laryngoscopy: A prospective evaluation comparing modified Mallampati score, interincisor gap, thyromental distance, neck circumference, and neck extension. Indian J Anaesth. 2018 Aug;62(8):603-608. doi: 10.4103/ija.IJA_162_18. PMID: 30166655; PMCID: PMC6100275.

8. Lee A, Fan LT, Gin T, Karmakar MK, Ngan Kee WD. A systematic review (meta-analysis) of the accuracy of the Mallampati tests to predict the difficult airway. AnesthAnalg2006;102:1867-78.

9. Krobbuaban B, Diregpoke S, Kumkeaw S, Tanomsat M. The predictive value of the height ratio and thyromental distance: Four predictive tests for difficult laryngoscopy. AnesthAnalg2005;101:1542-5.

10. Cattano D, Panicucci E, Paolicchi A, Forfori F, Giunta F, Hagberg C. Risk factors assessment of the difficult airway: An Italian survey of 1956 patients. AnesthAnalg2004;99:1774-9.

11. 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 Jun;46(2):61-5. doi: 10.1016/S1875-4597(08)60027-2. PMID: 18593650.

12. Dawood AS, Talib BZ, Sabri IS. Prediction of difficult intubation by using upper lip bite, thyromental distance and mallampati score in comparison to cormack and lehane classification system. Wiad lek. 2021;74(9 pt 2):2305-2314. Pmid: 34824177.

13. Liaskou C, Vouzounerakis E, Trikoupi A, Staikou C. Avaliação de testes à beiraleito e proposta de modelo para preverlaringoscopiadifícil: estudoprospectivoobservacional [Evaluation of bedside tests and proposal of a model for predicting difficult laryngoscopy: an observational prospective study]. Braz J Anesthesiol. 2020 Mar-Apr;70(2):125-133. doi: 10.1016/j.bjan.2020.02.007. Epub 2020 May 13. PMID: 32482358; PMCID: PMC9678250.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 08, 2023

Acknowledgement: Corresponding author heartfully thanked to co authors, parents , tearchers, patients who are participated in study with profer consent.
No conflict of interest
Ethical clearance obtained