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A COMPARISON OF ACROMIO-AXILLO-SUPRASTERNAL NOTCH INDEX (A NEW TEST) WITH MODIFIED MALLAMPATI CLASSIFICATION FOR PREDICTION OF DIFFICULT AIRWAY IN THE INDIAN POPULATION: A PROSPECTIVE OBSERVATIONAL STUDY.

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ABSTRACT **Background:** Unanticipated difficult intubation or failed intubation during surgery under general anaesthesia may result in cardiac arrest or brain death. We designed a double-blind prospective study to evaluate and compare the efficacy of Acromio - Axillo -Suprasternal notch index (AASI) with most commonly used modified Mallampati test (MMT) as a predictor of difficult intubation.

Methods: 407 adult patients in American society anaesthesiologist physical status (ASA) I and II, requiring tracheal intubation undergoing elective surgery were enrolled in this single blinded study. Preoperative airway assessment was carried out with AASI and MMT. Following general anaesthesia, direct visualization of the larynx was graded on Cormack-Lekane classification (C-L) by an experienced anaesthesiologist.. C-L grade III and IV were considered as difficult visualization of larynx (DVL). Patient data and airway predictors were compared by Chi-square/Fishers exact test. and for quantitative variable statistical significance was determined by T-test/ Mann Whitney Test .The primary objective was to evaluate AASI as a predictor of DVL and the secondary objective was to compare AASI and MMT for DVL.

Results: Difficult visualization of the larynx (DVL, Cormack - Lehane III & IV) was observed in 28 (6.8%) of patients. AASI with higher predictive values and low false values in comparison to MMT at cut off point ≥ 0.5 cms can detect DVL better .

Conclusion: AASI (≥ 0.5 cms) can be a useful and reliable predictor of DVL in routine anaesthesia practice.

KEYWORDS : Airway assessment , Intubation, Endotracheal , modified Mallampati test

INTRODUCTION:

Prediction of difficult tracheal intubation is the main concern for the anesthesiologists to take precautions to decrease the happening of critical event like hypoxemia, brain death and cardiac arrest [1]. The reported incidence of difficult laryngoscopy synonym with tracheal intubation is in 1.5%–13% of patients [2].

Preoperative assessment of airway is thus essential to reduce the risk associated with a difficult airway. Many single risk factor or multifactorial index have been mentioned by various investigators but which anatomical landmarks and clinical factors are the best predictors of difficult airway is a matter of controversy [3,4]. The most commonly performed bedside test worldwide is Modified Mallampati Classification by the opening of the mouth revised by Samsoon and Young, is neither sensitive nor specific enough to be a single predictor [5]

Acromio-axillo-supersternal notch index, based on the surface anatomy of the chest is a new test described for the prediction of difficult intubation with higher predictive value in comparison to Modified Mallampatti test [6].

We therefore, designed this prospective study to evaluate the validity of acromio-axillo-suprasternal notch index (AASI) as primary aim and compared it with most established and frequently practiced test i.e, Modified Mallampati test (MMT) as secondary aim for assessing the difficult laryngoscopic view in Indian patients requiring endotracheal intubation for general anaesthesia preoperatively .

Method

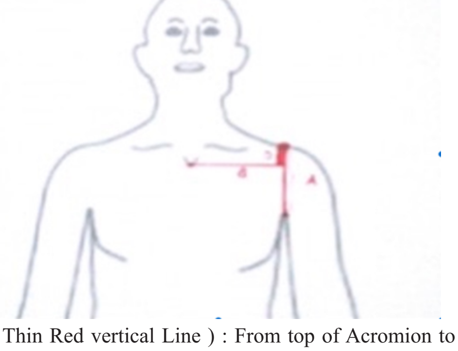
After approval from our local Ethics Committee and written consent from 407 adult patients aged between 20 to 65 years of both the gender with ASA class I &II, scheduled for elective surgery requiring endotracheal intubation were enrolled in this prospective observational study during the period June 2014 to May 2015. Patients with an obvious anatomical abnormality, upper airway abnormality (e.g.oral tumor, maxillofacial tumor, or fracture), recent head and neck surgery, ASA class III &IV, and inability to open the mouth were excluded. Each patient underwent a general physical examination prior to surgery and AASI and MMT were also assessed.

CALCULATION OF AASI [7]: With the patients lying in a supine position and arms resting by the sides of the body, AASI was calculated based on the following measurements (Figure1):

(1) The first vertical line was drawn from the top of the acromion process to the superior border of the axilla was marked as Line A
(2) a second line was drawn perpendicular to line A from the suprasternal notch marked as line B; and
(3) The third line marked as Line C was the portion of line A that lies above the point at which line B intersected line A.

AASI was calculated by dividing the length of line C by that of line A i.e, C/A.

Figure 1. Showing measurement of AASI



Line A (Thin Red vertical Line) : From top of Acromion to upper border of axilla.
Line B (Thin Red horizontal Line) : Perpendicular line on Line A from suprasternal notch
Line C (Thick red Line) : portion of Line above point on line A where line B intersect on Line A

MMT as described by Samsoon and Young was classified with patient in sitting position, mouth open and tongue fully protruded without phonation as class I = soft palate, fauces, uvula, and pillars were visible; class II = soft palate, fauces, and uvula were visible; class III = soft palate and base of uvula were visible; and class IV = soft palate was not visible.[7]

All the patients were pre-medicated with Tab Alprazolam 0.25mgs at night before surgery and on the morning of surgery.

In the operation theatre, heart rate, systemic blood pressure, SpO2 was noted. Intravenous access was secured with 18 G IV cannula in the non-dominant hand and intravenous Inj. Ringer lactate was started.

After pre-oxygenation, general anaesthesia was induced using a standard technique. After 3 minutes of intermittent positive pressure ventilation (IPPV) with head in sniffing position, direct laryngoscopy was done by size#3 / # 4 Macintosh blade by anaesthesiologists with minimum of three years of experience and was unaware of preoperative assessment. The best possible laryngoscopic view was noted on Cormack Lehane (CL) grade as Grade I = full view of the glottis; Grade II = glottis partly exposed, anterior commissure not seen, Grade III = only epiglottis seen; Grade IV = epiglottis not seen [8]. Grades I and II were considered as easy visualization of the larynx (EVL) and Grades III and IV as difficult visualization of the larynx (DVL). Successful intubation was confirmed by auscultation and capnography. The number of attempts to intubation, any ancillary method used to improve to the laryngeal view like use of external laryngeal pressure or use of bougie or use of Proseal laryngeal mask airway (PLMA) or Fastrack was also recorded.

On the basis of the original study [6], area under the receiver operative characteristic curve for AASI (AUC = 0.89) was higher than that of MMT (AUC = 0.74). With $\alpha = 0.05$ and Power equal to 80 %. Sample size for 2 ROCs (using sample size calculation formula for comparison of two ROCs) with probability of Type 1 error (α) = 0.05andPower ($1 - \beta$) = 0.80 The two anticipated ROC values are = 0.89 and 0.74 calculated sample size per group was 37. To lower the margin of error, number of subject was 200 in each group. So sample size taken was 400.

Patient data were presented as mean ± SD. Patient data and airway predictors were compared by Chi-square/Fishers exact test. For quantitative variables statistical significance were determined by T-test/ Mann Whitney Test. Correlation between the parameters were determined by Pearson correlation coefficient. Sensitivity, Specificity, Positive predictive value (PPV), Negative predictive value (NPV) ,likelihood ratio and diagnostic accuracy were compared using Macnamer Test (paired proportions). Area under ROC (Receiver Operating Characteristics) curve of two methods for validity of test were compared using Delong ER methodology. $P \leq 0.05$ will be taken as a level of statistical significance. The data was analyzed by SPSS Statistical software version 17.0RESULTS

A total of 407 patients requiring endotracheal intubation were analyzed. The demographic characteristics based on Cormack-Lehane's view on direct laryngoscopy of patients are shown in the Table 1. There was a significant difference in age, height, weight between EVL and DVL.

The prevalence of difficult laryngoscopy (DVL) was 6.8% (28 patients) in our study. In our study all the predictive values of AASI were superior. The diagnostic accuracy of AASI (64%) was higher than MMT suggesting AASI carried lower false positive and negative values in predicting difficult laryngoscopic view. (Table:2)

Table 2: Predictive values of the AASI and MMP scores to predict the occurrence of difficult laryngoscopy (Cormack Lehane Grade III& IV).

	MMP	AASI
Sensitivity	57.1%	85.7%
	95% CI [37.18 – 75.54]	95%CI [67.33-95.97]
Specificity	78.9%	95.78%
	95%CI [74.43 – 82.89%]	95%CI [93.23 – 97.57]
PLR	2.71	20.3
	95%CI [1.86 -3.94)	95%CI [12.28 -33.57]
NLR	0.54	0.15
	95% CI [0.35 – 0.84]	95% CI [0.06 -0.37]
PPV	16.7%	60%
	95% CI [9.84 – 25.64]	95% CI [43.33 – 75.13]
NPV	96.14%	98.91%
	95%CI [93.36 – 97.99]	95% CI [97.23 – 99.7]
Diagnostic Accurancy	52-5%	64.5%
FP	80	12
FN	12	4
TP	16	24
TN	299	363
Prevalence of DVL	6.88% 95% CI [4.62-9.79]	6.88% 95% [4.62-9.79]

PLR: Positive likelihood ratio; NLR: Negative likelihood ratio; PPV: Positive predictive value

NPV: Negative predictive value; FP : False positive ; FN : False negative; TP : True positive;

TN: True Negative.

The main observation of this study was that the area under receiver operative cure (ROC) for AASI was higher 0.958(95% CI= 0.93-0.95 ; p< .0001) than MMT 0.648(95% CI= .59 - .69; p=.0185). Table 3, Figure 1&2. The best cut off value of 0.5 cms for AASI as a predictor of difficult intubation was noted in our study.

TABLE 3: Comparison of Area under curve for AASI and MMP in prediction of difficult laryngoscopy

	AUC	Standard Error	95% CI	P value	Cut-off	Sensitivity	Specificity
MMP And CLG	0.648228	0.0629	0.599660 to 0.694623	0.0185	>2	57.14	78.89
AASI And CLG	0.957972	0.0185	0.933652 to 0.975283	<0.0001	>0.5	85.71	95.78

Figure1. Receiver Operating curve for MMP in prediction of difficult laryngoscopy

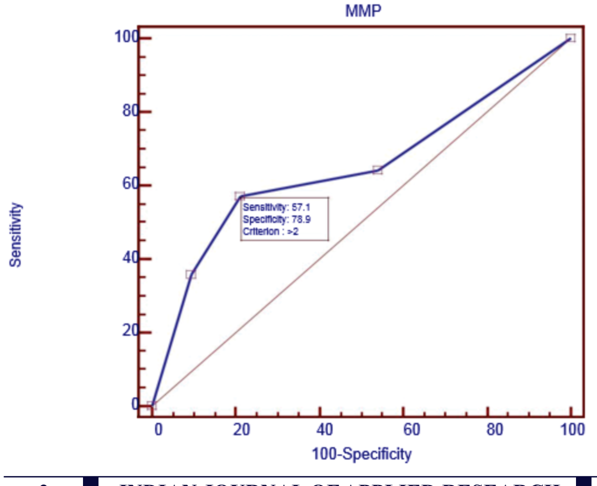
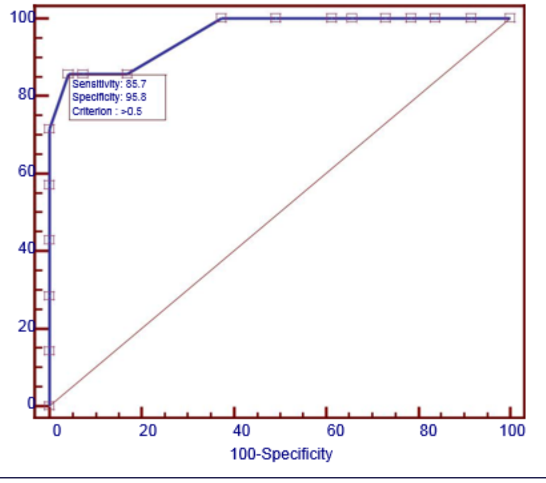


Figure 2: Receiver Operating curve for AASI in prediction of difficult laryngoscopy



DISCUSSION:

The safe outcome of anaesthesia continues to be an important goal for every anaesthesiologist. The best test must be easy to perform and should have high sensitivity, specificity, with high positive predictive value and a low false positive and negative rate to predict difficult intubation. Unfortunately, there is still no test or group of tests that can predict 100% of difficult intubation.

The incidence of DVL was 6.8% in our study which is comparable to various similar studies [9,10, 11,12,]

Our study revealed higher predictive values of of AASI as compared to that of MMT (Table 2) this is similar to other studies. (6,13,14) Sensitivity and specificity of MMT were comparable as in other study (6,13,14). Though the modified Mallampati test is the most commonly used bedside test for airway assessment, studies showed that Mallampati classification was insufficient in predicting difficult intubation because of low predictive values (13,14)The low predictive value of MMT could be due to involuntary phonation during the test, which probably alters the Mallampati classification and the inter-observariabiltity [14].

The likelihood ratio (LR1) measures the number of times more likely that a patient with a positive test result will present with difficult laryngoscopy. The high LR1 (20.3) for the AASI in comparison to the modified Mallampati test in our study suggests an AASI to be a useful predictive tool in daily practice. [13]

Higher diagnostic accuracy of AASI (64%) than MMT suggests AASI carried lower false positive and negative values in predicting difficult laryngoscopic view(Table 2) these results were in concurrence to various studies (6,13,14).

The consequence of the false negative results may be deleterious and even life-threatening. A lower false negative prediction rate is more important than falsely predicting difficult laryngoscopy in normal patients. In our study, a lower false negative value (FP =4) in ASSI as compared MMT was in concurrence with other study.

The validity of ASSI and MMT as a tool in the prediction of difficult intubation was also analyzed on ROC. The wider AUC of ROC curve for AASI in comparison to MMT for prove the validity of the test in predicting difficult intubations.

In our study, the cut off point of AASI as predictor of a difficult intubation was noted as 0.5cm . AASI value of less than 0.5 can be taken as EVL and value more than 0.5cm is taken as criteria for DVL.This was in concurrence with the finding of original study with the best cut off point 0.49cms .(rounded off to 0.5cms)

The limitation with our study was that it included only elective surgical patients, emergency patients, obstetrics and morbidly obese patients were not included.

CONCLUSION

Airway evaluation with AASI was simple to perform as a bedside test, and had high sensitivity, specificity and predictive value, with low false negativity to identify difficult airways, especially when the cut off value >0.5.

Thus AASI can be good inferential test to assess the difficult intubation in the adult population for surgery under anaesthesia.

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