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Acromio Axillo Suprasternal Notch Index a New Method of Predicting Difficult Intubation: Prospective Observational Study

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Abstract

Background: The fundamental responsibility of anesthetist is to maintain the airway and provide adequate oxygenation. Failure to do this will lead to hazardous complication. So identification of difficult airway is important during pre operative evaluation. Difficult intubation can be predicted by modified mallampati test (MMP), inter-incisor distance, thyro-mental distance (TMD), sterno-mental distance, upper lip bite test and hyo-mental distance ratio, but no single factor reliably predicts difficult intubation. AASI, a relatively new test, based on surface land mark, has been suggested to reliably predict difficult visualization of larynx. *Methods:* A total of 250 adult patients, of either sex, aged 18- 65 years, belonging to ASA class 1, 2 and 3 who were candidates undergoing elective surgery under general anaesthesia requiring tracheal intubation participated in a prospective, comparative, observational study. Preoperative airway assessment was carried out with AASI, TMD and MMP. Sensitivity, specificity, positive predictive value, negative predictive value, odd's ratio, positive likelihood ratio, negative likelihood ratio were calculated for MMP, TMD and AASI. Chi-square test was used to analyze data. P value of less than 0.05 was considered statistically significant. *Results:* The demographic data was normally distributed in terms of age, height, weight, bmi, and gender distribution. The sensitivity between MMP and TMD was statistically significant. There was no significant difference between the Specificity, positive predictive value & negative predictive value of MMP and TMD ($p>0.05$). There was no significant difference between the Sensitivity, Specificity, positive predictive value & negative predictive value of MMP and AASI. ($p>0.05$) There was significant difference in Sensitivity of TMD & AASI. But, there was no significant difference between the Specificity, Positive predictive value & Negative predictive value between TMD and AASI. *Conclusion:* Upon comparing AASI, MMP and TMD, AASI was found to be better only with regards to sensitivity no difference in any of the measured parameters in comparison to modified mallampati test. To conclude we would recommend further studies with larger sample size before validating or refuting the ASSI.

Keywords: Acromio-Axillo-Suprasternal Notch Index; Thyromental Distance; Modified Mallampati Test.

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Introduction

The fundamental responsibility of an anesthesiologist is to maintain adequate gas exchange in the patient after induction of general anaesthesia. For this to be done, the patient's airway must be managed so that it is almost continuously patent. Failure to maintain a patent airway for more than a few minutes results in brain damage or death [1]. So identification of difficult airway is very important aspect of pre operative evaluation.

The incidence of difficult laryngoscopy or tracheal intubation was reported to be in the range of 0.1–20.2%; this variation was due to the different patient

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populations and criteria used [2,3]. Prediction of difficult intubation in preoperative evaluation has been attempted by many investigators using simple bedside physical examinations based on anatomical landmarks such as modified mallampati test (MMP), inter-incisor distance, thyro-mental distance (TMD), sterno-mental distance, upper lip bite test and hyo-mental distance ratio [4], all of which have shown different sensitivities and specificities.

At present, no single factor reliably predicts difficult intubation. Consequently, prediction of difficult intubation relies on various tests and their combinations. Yet, these tests either individually or in combination failed to predict difficult visualization of larynx reliably. So the quest for a new test continues. A new test should be simple, painless, requiring no special equipment for screening of difficult airway. The test should be objective, with little inter-examiner variation and with high sensitivity and positive predictive value.

AASI, a relatively new test, based on surface land mark, has been suggested to reliably predict difficult visualization of larynx. It has been observed that DVL was observed in individuals with neck situated deep in chest. So, portion of arm chest junction above the level of suprasternal notch could be used as an indicator to estimate DVL. Hence this study was designed to evaluate the ability of this new test to predict DVL and compare it with TMD and MMP.

Aims

To evaluate the predictive validity of a new index called acromio-axillo-suprasternal notch index and compare it with a previously established test (MMP) and TMD for assessing difficult laryngoscopic view in conformation with Cormack- Lehane grading in patients who were candidates for general anaesthesia.

Objectives

To compare acromio-axillo-suprasternal notch index with modified mallampati test and thyromental distance in terms of sensitivity, specificity, negative predictive value, positive predictive value, odd's ratio, positive likelihood ratio and negative likelihood ratio in predicting difficult visualization of larynx.

Methodology

Source of Data

After institutional medical ethics committee approval written informed consent was obtained from all patient. A total of 250 adult patients, of either gender, aged 18- 65 years, belonging to ASA class 1,2 and 3 who were candidates undergoing elective surgery under general anaesthesia requiring tracheal intubation.

Study Design

Prospective, randamised, comparative, observational study.

Sampling Technique

A sample size of 250 was calculated with the help of statistician using the URL www.statstodo.com Where: Probability of type I error (α) =0.05, Power (1-β): 0.8, Expected sensitivity of group I: 0.789, Expected sensitivity of group II: 0.524. The sample size required for unpaired comparison per group was 46 patients. This was the minimum sample required for each test. So we decided to select a sample size of 250 patients for our study.

Inclusion Criteria

1. Age 18 to 65 years.
2. ASA class 1, 2 and 3.

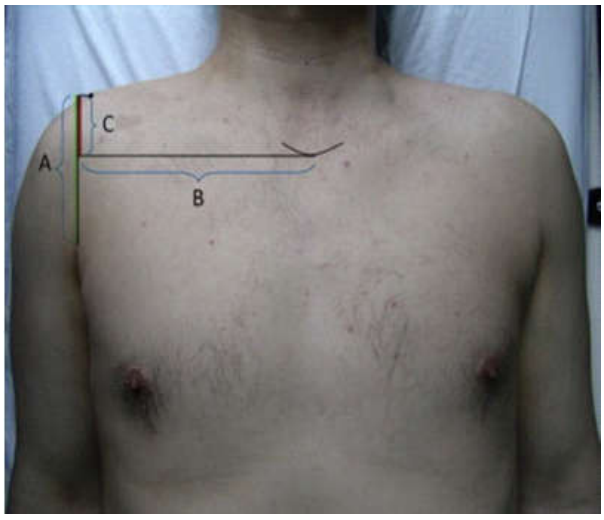
Exclusion Criteria

1. ASA class other than 4, 5 and 6.
2. Regional Anatomical abnormality.
3. Tongue tumor, maxillo facial tumor, fracture.
4. Recent head and neck surgery.
5. Restricted mouth opening.

Preoperative airway assessment was carried out with AASI, TMD and MMP. The new AASI score will be calculated based on the following measurements: (Figure 1) (1) using a ruler, a vertical line was drawn from the top of the acromion process to the superior border of the axilla at the pectoralis major muscle (line A); (2) a second line was drawn perpendicular to line A from the suprasternal notch (line B); and (3) the portion of line A that lies above the point where line B intersects it will be line C. AASI was calculated by dividing the length of line C by that of line A (AASI = C/A).

MMP (Modified mallampati) classification will be graded as follows:

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.

Class IV= soft palate was not visible.

TMD was graded with neck in full extension as follows:

More than (>) 6 cms -easy intubation

Less than (<) 6 cms- intubation may be impossible.

After induction of anesthesia, the laryngeal view was recorded according to the Cormack-Lehane grading system. All patients were pre-medicated with midazolam (0.03mg/kg) and fentanyl (2mcg/kg).All patients were induced with propofol (2mg/kg) and atracurium (0.6 mg/kg). With the head in the sniffing position, laryngoscopy was attempted by an attending anesthesiologist blinded to the measurements following ventilation of the lungs with 100% oxygen. Laryngoscopy was performed after the loss of the fourth twitch in the train of four, with a Mackintosh blade (No. 3) and Cormack–Lehane grading was assessed. The laryngeal view was graded according to the Cormack and Lehane grading system:

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.

Grades I and II was considered as easy visualization of larynx (EVL) and Grades III and IV as difficult visualization of larynx (DVL). All preoperative assessments including MMP, TMD and AASI were performed by an attending anesthesiologist. Sensitivity, specificity, positive predictive value, negative predictive value, odd's ratio, positive likelihood ratio, negative likelihood ratio were calculated for MMP, TMD and AASI were calculated. Chi-square test was used to analyze data of MMP, TMD and AASI. P value of less than 0.05 was considered statistically significant.

Results

(Tables 1-7).

Table 1: Shows distribution according to modified mallamapati test

MMP	Frequency (n)	Percent
1	89	35.6%
2	126	50.4%
3	34	13.6%
4	1	0.4%
Total	250	100%

Table 2: Shows interpretation in terms of EVL and DVL

MMP	C – L grading	
	I & II(EVL) n (%)	III & IV(DVL) n (%)
1 & 2	202 (92.2)	13 (41.9)
3 & 4	17 (7.8)	18 (58.1)
Total	219 (100)	31 (100)

Table 3: Shows thyromental distance in sample

TMD	Frequency(n)	Percent
< 6 cms	26	10.4%
> 6 cms	224	89.6%
Total	250	100%

Table 4: Shows Distribution of Acromio-Axillo Suprasternal Notch Index (AASI) in sample

AASI	Frequency(n)	Percent
> 0.5	41	16.4%
< 0.5	209	83.6%
Total	250	100%

Table 5: Shows Comparison of MMP, EVL and DVL

MMP	C – L grading	
	I & II(EVL) N (%)	III & IV(DVL) N (%)
1 & 2	202 (92.2)	13 (41.9)
3 & 4	17 (7.8)	18 (58.1)
Total	219 (100)	31 (100)

χ^2= 57.07,
Degree of freedom DF=1,
p value =0.000, (Significant)
Sensitivity = 58.1%
Specificity=92.2%
Positive predictive value=51.4%
Negative predictive value=94.0%
Odd's ratio=16.5
Positive likelihood ratio=7.4
Negative likelihood ratio=0.5

Table 6: Shows Distribution of patients based on TMD among EVL and DVL

TMD	C – L grading	
	I & II(EVL) N (%)	III & IV(DVL) N (%)
< 6 Cms	14 (6.4)	12 (38.7)
> 6 Cms	205 (93.6)	19 (61.3)
Total	219 (100)	31 (100)

χ^2= 30.436,
Degree of freedom (DF) =1,
p value =0.000, (Sig.)
Sensitivity = 38.7%
Specificity=93.6%
Positive predictive value=46.2%
Negative predictive value=91.5%
Odd's ratio=9.2
Positive likelihood ratio=9.6
Negative likelihood ratio=0.4

Table 7: Shows distribution of patients based on AASI

AASI	C – L grading	
	I & II(EVL) N (%)	III & IV(DVL) N (%)
> 0.5	20 (9.1%)	21(67.7%)
< 0.5	199 (90.9%)	10(32.3%)
Total	219 (100%)	31 (100%)

χ^2= 68.038,
Degree of freedom (df)=1,
p value =0.000,(Sig.)
Sensitivity = 67.7%
Specificity=90.
Positive predictive value=51.2%
Negative predictive value=95.2%
Odd's ratio=20.9
Positive likelihood ratio=9.6
Negative likelihood ratio=0.4

Discussion

The demographic data was normally distributed in terms of age, height, weight, bmi, and gender distribution. The sensitivity between MMP and TMD was statistically significant. There was no significant difference between the Specificity, positive predictive value & negative predictive value of MMP and TMD (p>0.05). There was no significant difference between the Sensitivity, Specificity, positive predictive value & negative predictive value of MMP and AASI. (p>0.05) There was significant difference in Sensitivity of TMD & AASI. But, there was no significant difference between the Specificity, Positive predictive value & Negative predictive value between TMD and AASI. Difficult intubation and inability to secure airway remains a significant source of morbidity and mortality in anaesthetic practice. The most common cause of difficult intubation has been attributed to difficult visualization of larynx. Pre-operative detection of difficult intubation in patients at risk forms the most important part of pre-anaesthetic evaluation. At present there is no single reliable test to detect difficult airway. The existing literature suggests that incidence of difficult visualization of larynx can vary between 1.7-20.2%[11]. The incidence of difficult visualization of larynx in our study was 12.4 % which concurs with Huh et al study[12], but it is almost twice of what was observed in Mohammed et al (6.3%). This variability in incidence of difficult visualization of larynx has been attributed to age, gender, obesity, degree of relaxation, previous history of difficult intubation and oropharyngeal view.[4]

We observed difficult visualization of larynx had a male preponderance, 20 patients accounting for 64.5% of cases. Similar finding was observed by Rose et al. [4]. This can possibly be explained by increased muscle mass around neck in men as compared to women. We also observed increased incidence of difficult visualization of larynx in the age group of 51-60 years accounting for 26% of all cases. Rose et al. [5], in their study to identify risk factors for difficult intubation also found an increased incidence of difficult visualization of larynx in the age group 40-59 years. They attributed this to patient illness, reasons for operation or dental pattern.

Mohamed et al. [2], in their study to evaluate acromio-axillo-suprasternal notch index, found that AASI was better than modified mallampati test in predicting difficult visualization of larynx with regard to sensitivity, specificity, positive predictive value and accuracy.

We observed that there was no significant difference between modified mallampati test and acromio-axillo-suprasternal notch index with regard to sensitivity, specificity, positive predictive value & negative predictive value with regards to predicting difficult visualization of larynx (p>0.05). Mohammed et al noted that sensitivity of acromio-axillo-suprasternal notch index 78.9% as against 67.7% in our study. However, specificity was similar in both of our studies (90.9% and 89.4% respectively). However, sensitivity and specificity of modified mallampati test in our study were slightly higher compared to values obtained by Mohamed et al. [2] (58.1% & 92.2 % as against 52.4% & 85.7%) The values we obtained were similar to

the observations made by Shiga et al. in their meta analysis [11].

Upon comparing AASI and TMD, AASI was found to be better only with regards to sensitivity (67.7% and 38.7%, $p<0.05$). Specificity, positive predictive value, negative predictive value, odds ratio, positive and negative likelihood ratio were found to be similar ($p>0.05$).

MMT was found to be better than TMD only with regards to sensitivity (58.1% and 38.7%, $p<0.05$). No significant difference was observed between the specificity, positive predictive value & negative predictive values of MMT and TMD ($p>0.05$). In contrast Ferk [9] had obtained higher sensitivities for MMT and TMD (81.2% and 90.9% respectively), but specificities observed were slightly lesser compared to our study (81.5% and 81.5%respectively).

Even though AASI has been advocated as having low inter-observer variability, we observed that for correct interpretation of AASI, positioning of patient, lying flat with hand by side is of utmost importance. Slight variation in position can introduce error in interpretation of AASI. This might explain the difference in observations between our study and the study conducted by Mohamed et al. As a result of which we might not have been able to validate the findings of their study. A smaller sample size (250 as against 603) and different sample population might also have contributed to this.

In our study, we compared a novel test, acromio-axillo-suprasternal notch index for detection of difficult visualization of larynx with commonly used tests, like modified mallampati test and thyromental distance. However we failed to validate the findings of study by Mohamed et al. Diagnostic test should be associated with low false negative rate and high sensitivity. No single test can reliably detect difficult visualization of larynx, so various tests; individually or in combination have to be used to predict difficult visualization of larynx. So the need for development of new tests or their combinations in predicting difficult visualization of larynx continues.

Conclusion

Though acromio-axillo-suprasternal notch index, a novel test was better than thyromental distance in terms of sensitivity, it did not fare better in terms of other parameters like specificity, positive predictive value, negative predictive value, odds ratio, positive and negative likelihood ratios. We could not demonstrate difference in any of the measured parameters in comparison to modified mallampati test. To conclude we would recommend further studies with larger sample size before validating or refuting the ASSI.

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