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Predictive validity of acromio-axillo-suprasternal notch index for assessing difficult laryngoscopic view

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Abstract
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. All patients were enrolled in the study after obtaining written consent. Study was conducted after obtaining permission from ethical committee of the hospital. It was a prospective, comparative, observational study. A sample size of 250 was calculated. Of the total 219 patients in EVL 20(9.1) were having AASI of >0.5 and 199(90.9) had AASI <0.5; Out of 31 patients in DVL 21(67.7) had AASI >0.5 and 10(32.3) had AASI<0.5. Pre-operative detection of difficult intubation in patients at risk forms the most important part of pre-anesthetic evaluation.

Keywords: Predictive validity, acromio-axillo-suprasternal notch index, difficult laryngoscopic view

Introduction
The incidence of tracheal intubation was reported to be in the range of 0.1-20.2%; this variation was due to the different patient populations and criteria used. 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. AASI, a relatively new test, based on surface land mark, has been suggested to reliably predict difficult visualization of larynx [1].

Mohammad R. *et al.* [2] conducted a study, comparing acromio-axillo-suprasternal notch index (A new test) with modified mallampati test in predicting difficult visualization of larynx. They carried out preoperative assessment of airway using modified mallampati test (MMP) and acromio-axillo-suprasternal notch index (AASI) in 603 patients undergoing elective surgeries under general anaesthesia. In total, 38 patients had a laryngoscopic view of Cormack-Lehane Grades III (30) and IV (8). The prevalence of difficult laryngoscopy was 6.3% [4.5-8.5%, 95% confidence interval (CI)]. Using discrimination analysis, AASI of 0.5 was defined as the best cutoff point for difficult intubation. The main finding of this study was the area under the receiver operative characteristic curve for AASI (AUC = 0.89; 95% CI, 0.83-0.97) was higher than that of MMP (AUC = 0.74; 95% CI, 0.62-0.86). An AASI of ≤ 0.49 was able to pick 78.9% of the patients with difficult visualization of larynx as against 52.4% for MMP. Among the patients who had easy visualization of larynx on direct laryngoscopy 89.4% as against 85.7% (MMP) were correctly predicted by AASI. AASI had higher predictive values and a lower false negative rate than MMP. Statistically significant differences were observed between sensitivity, positive predictive values, and accuracy of the two mentioned tests ($p< 0.05$), showing higher levels for AASI. Comparisons of specificity and negative predictive values between two tests did not show significant differences ($p> 0.05$). AASI, as a new diagnostic test, was shown to be a good predictor of Difficult Visualization of Larynx (DVL), with higher sensitivity, accuracy when compared with MMP. They concluded that further studies were needed to validate the findings of their study.

Safavi M, *et al.* [3] conducted a randomized, double-blind, comparative study, in which preoperative assessment of airway using EMT (Extended mallampati test), modified mallampati test (MMT), upper lip bite test (ULBT), and ratio of height (RHTDM) and thyromental test (TDM) was done in 476 adult patients who were candidates for elective surgery under general anesthesia requiring endotracheal intubation. Laryngoscopic view was graded based on Cormack and Lehane's classification by an experienced anaesthetist. They calculated sensitivity, specificity, and area under receiver-operating characteristic curve

(ROC) was significantly more for both ULBT (AUC = 0.820, P = 0.049) and RHTMD score (AUC = 0.845, P = 0.033) than the EMT (AUC = 0.703). However EMT fared better when compared with MMT (0.703 vs. 0.569, P = 0.046 respectively). There was no significant difference between the AUC of the ROC for the ULBT and the RHTMD score (P = 0.685). The optimal cut-off point for the RHTMD for predicting difficult laryngoscopy was 29.30 (sensitivity =75.6%, specificity =58.5%).They concluded that the EMT was better predictor of difficult laryngoscopy than MMT in general population. The RHTMD and ULBT were superior to the EMT in this regard. Combination of EMT with the other scores did not significantly increase accuracy in predicting difficult airway. They concluded that more studies with larger samples were required.

Arne *et al* [4] conducted, a prospective study to develop and validate a single clinical index for prediction of difficulty in tracheal intubation in 1200 patients undergoing ENT and general surgical procedures. They defined difficult intubation as intubation requiring an unusual technique. Clinical criteria were tested using univariate and multivariate analysis. Logistic regression was used to identify seven independent criteria to predict difficult tracheal intubation. Previous history of difficult intubation, pathologies associated with difficult intubation, clinical symptoms of pathological airway, inter-incisor gap and mandible luxation, thyromental distance, head and neck movement, and Mallampati modified test. Point values were assigned to each of these factors in proportion to regression coefficients representing the relative weight of each factor predicting difficult intubation, the sum comprised the score. The best predictive threshold was chosen using a receiver operating characteristic curve. Incidence of difficult intubation was 3.8%. They, then prospectively studied and validated the score in a population of 1090 ENT and general surgery patients. The sensitivity and specificity of the prediction in general surgery was 94% and 96%.The sensitivity and specificity of the predictions was 90% and 93% in non-cancer ENT surgery respectively. Meanwhile for ENT cancer surgery sensitivity and specificity was 92% and 66% respectively.

Methodology

A total of 250 adult patients, of either gender, with normal airway, aged 18-60 years, belonging to ASA class 1 and 2 who were candidates undergoing elective surgery under general anaesthesia requiring tracheal intubation were enrolled in this study at Medical College Hospital. All patients were enrolled in the study after obtaining written consent. Study was conducted after obtaining permission from ethical committee of the hospital. It was a prospective, comparative, observational study. A sample size of 250 was calculated.

Inclusion criteria

- Age 18 to 60 years.
- ASA class 1 and 2.

Exclusion criteria

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

Results

Table 1: Gender distribution in sample.

Sex	Frequency (n)	Percent (%)
Male	129	48.4%
Female	121	51.6%
Total	250	100%

We recruited 250 patients, of which 129 (48.4%) were male patients and 121(51.6%) were female patients

Table 2: Mean ± SD Weight, Height and BMI in sample

Anthropometry	Mean	SD
Weight in kg	74.3	11.45
Height in cms	158.6	5.5
BMI in kg/m^2	29.53	4.42

Anthropometric measurements (values expressed as Mean± SD) in our study showed, Weight of 74.3 ±11.45 kg, Height of 158.6 ±5.5 cms and Body mass index 29.53±4.42 kg/m^2 among the patients.

Table 3: Distribution of ASA grade in sample.

ASA Grading	Frequency (n)	Percent
I	92	36.8%
II	129	51.6%
III	29	11.6%
Total	250	100%

More than half the study population was of ASA grade 2.

Table 4: 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%

Distribution of patients based on Acromio-Axillo Suprasternal Notch Index (AASI) in sample, AASI of more than 0.5 were 16.4% (41) and AASI less than 0.5 were 83% (209).

Table 5: Comparison of AASI, EVL and DVL.

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%)

Of the total 219 patients in EVL 20(9.1) were having AASI of >0.5 and 199(90.9) had AASI <0.5; Out of 31 patients in DVL 21(67.7) had AASI >0.5 and 10(32.3) had AASI<0.5.Sensitivity, specificity, positive predictive value, negative predictive value, odd's ratio, positive likelihood ratio, negative likelihood ratio, chi-square test and p value for AASI are shown below.

χ^2= 68.038, df=1, p value =0.000, (Sig.) Sensitivity = 67.7%, Specificity=90.9%, Positive predictive value=51.2%, Negative predictive value=95.2%, Odd's ratio=20.9, Positive likelihood ratio=9.6, Negative likelihood ratio=0.

Discussion

Difficult intubation and inability to secure airway remains a significant source of morbidity and mortality in anesthetic practice [5, 6]. 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-anesthetic evaluation. At present there is no single reliable test to detect difficult airway [7, 8].

The existing literature suggests that incidence of difficult visualization of larynx can vary between 1.7-20.2% [9]. The incidence of difficult visualization of larynx in our study was 12.4% which concurs with Huh *et al* study [10], 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 [11, 12].

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* [13]. 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* [13], 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 [14].

Conclusion

Sensitivity and specificity of modified mallampati test in our study were slightly higher compared to values obtained by other studies.

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