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Dr. Shabbir Ali Jafarali Mulla
Resident, Department of Anaesthesia, Dr. B. R. Ambedkar Medical College, Bengaluru, Karnataka, India

Dr. Salim Iqbal
Professor, Department of Anaesthesia, Dr. B. R. Ambedkar Medical College, Bengaluru, Karnataka, India

Corresponding Author:
Dr. Salim Iqbal
Professor, Department of Anaesthesia, Dr. B. R. Ambedkar Medical College, Bengaluru, Karnataka, India

Comparision of acromio-axillo-suprasternal notch index with modified mallampati test and thyromental distance in predicting difficult visualisation of larynx- a prospective, comparative, observational study

Dr. Shabbir Ali Jafarali Mulla and Dr. Salim Iqbal

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Abstract
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.
Methodology: A total of 250 adult patients 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.
Results: Out of 250 patients, 31 patients had DVL in which 21(67.7%) had AASI of >0.5 and 10(32.3%) had AASI of <0.5. 219 patients had EVL of which 20 patients had AASI of >0.5% and 199 patients had AASI of <0.5%. There was significant difference in sensitivity between MMP & TMD and TMD & AASI ($p<$ 0.05). There was no significant difference between the specificity, positive predictive value & negative predictive value of MMP and TMD (p>0.05) and TMD and AASI.
Conclusion: There was no significant difference between the sensitivity, specificity, positive predictive value & negative predictive value of MMP and AASI.

Keywords: AASI: acromio-axillo-suprasternal notch index, cl: Cormack-Lehane, ems: extended mallampati score

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 populations and criteria used [2].
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 [3, 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 [5, 6]. 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 [7, 8].
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.

Methodology

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.

Preoperative

Preoperative airway assessment was carried out with AASI, TMD and MMP. The new AASI score will be calculated based on the following measurements:

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).
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).

A represents the vertical distance between the superior aspect of the acromion process and superior border of axillary area, B the perpendicular line from suprasternal notch to line A and C the part of line A that lies above the cross-section between line A and B.AASI is defined as C divided by A. (AASI=C/A). AASI (acromio-axillo-suprasternal notch index). AASI of more than 0.5 was defined as EVL and less than o.5 was defined as DVL.

Intraoperative management

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).

If the first intubation attempt failed and difficulty was encountered then intubation will be attempted with Macintosh blade No. 4, coupled with adjustment of external laryngeal pressure and head position. All preoperative assessments including MMP, TMD and AASI were performed by an attending anesthesiologist.

Results

Table 1: Distribution of various age groups in sample.

Age in years	Frequency	Percent
Less than 20 years	2	0.8
21-30 years	71	28.4
3-40 years	44	17.6
41-50 years	52	20.8
51-60 years	65	26.0
More than 60 years	16	6.4
Total	250	100

Table 2: Composition of various grades of Modified Mallampati Test

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

Grade 1 constituted 35.6% (89), Grade 2-50.4% (126), Grade 3-13.6% (34) and Grade 4 constituted 0.4% (1).

MMP 1 &2 were considered to predict EVL and MMP 3& 4 to predict DVL and hence were grouped together for the purpose of analysis and comparison.

Table 3: Interpretation of MMP 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)

Distribution of patients based on thyromental distance in study sample; less than 6 cms was observed in 10.4% patients (26) and more than 6 cms was observed in 89.6% patients (224).

Table 4: Distribution of patients thyromental distance in sample.

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

Patients among EVL group 202(92.2) were MMP 1 & 2, and 17(7.8) patients were MMP 3 & 4; Of the 31 patients among DVL group 13(41.9) were MMP 1&2, and 18(58.1) patients were MMP3 & 4. Other statistical parameters like sensitivity, specificity, positive predictive value, negative predictive value, odd's ratio, positive likelihood ratio, negative likelihood ratio, chi-square value and p value for MMP are shown below.

Table 5: 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, 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.

Distribution of patients based on TMD among EVL and DVL groups. Of the total 219 patients in EVL group 14(6.4) patients had TMD of<6cm and 205(93.6) patients had>6cm; Among DVL 12(38.7) patients had TMD<6 cm and 19 (61.3) patients had TMD>6cm and Statistical parameters like sensitivity, specificity, positive predictive value, negative predictive value, odd's ratio, positive likelihood ratio, negative likelihood ratio, chi-square test and p value for TMD are shown below.

Table 6: 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 = 0.001 (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

Distribution of EVL, DVL and Cormack-Lehane (C-L) grading. (Table-14) We observed that 31 patients had DVL and 219 patients had EVL. Incidence of DVL being 12.4%.

Table 7: Comparison of EVL, DVL and C-L grading.

Interpretation	C-L grading	
	I & II [n (%)]	III & IV [n (%)]
DVL	0	31 (100)
EVL	219 (100)	0
Total	219 (100)	31 (100)

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.

Discussion

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 [8, 9]. 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* [10]. 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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