https://doi.org/10.37939/jrmc.v27i3.2269

Diagnostic Accuracy Of Acromioaxillosuprasternal Notch Index For Prediction Of Difficult Airway Taking Cormack And Lehane Grading System As Gold Standard

Muhammad Mohsin Sajjad[1], Amina Tariq[2], Muhammad Shabbir[3], Sidra Yousaf[4]

Abstract

Background: Difficult airway is a well-known entity and a long list of predicting scores is present, yet a high degree of diagnostic accuracy still needs to be improved. Acromioaxillosuprasternal notch index (AASI) has shown some excellent results in recent times.
Objective: Its objective is to determine the diagnostic accuracy of the acromioaxillosuprasternal notch index for predicting difficult airways and to take the Cormack and Lehane grading system as the gold standard.
Methodology: In this study, adults of both genders aged 20 to 70 years undergoing any surgery under general anaesthesia having ASA class I to IV were included. AASI score of equal or less than 0.49 was taken as a difficult airway while on Cormack and Lehane grade; it was labelled as yes where grade III or IV was seen.
Results: The total number of cases was 350 cases, out of which 218 (62.29%) were males, and 132 (37.71%) were females. The mean age was 40.20±12.86 years, and the mean BMI was 24.71±3.13 (table 17). There were 294 (84%) cases in ASA Class I and II and 56 (14%) in Class III and IV. Difficult intubation on AASI was seen in 54 (15.43%) and 57 (16.29%) cases on Cormack and Lehane grading. The diagnostic accuracy of AASI for prediction of difficult intubating a difficult was 96.29% with a sensitivity of 90.74%, specificity of 97.30%, PPV of 85.96%, NPV of 98.29% with p= 0.001. This difference was also statistically significant with all the confounding variables like age, gender, ASA class, and BMI.
Conclusion: The acromioaxillosuprasternal notch index is a significant predictor for tubing a difficult airway and taking Cormack and Lehane's grading as the gold standard. This difference is considerably better regarding age, gender, BMI, and ASA class.
Keywords: AASI, Cormack and Lehane, difficult airway intubation.

[1] Assistant Consultant, Shifa International Hospital, Islamabad; [2] Assistant Professor, Gajju Khan Medical College, Swabi; [3] Assistant Professor of Medicine, Shaqra College of Medicine, Shaqra University Saudi Arabia.
Correspondence: Dr. Muhammad Mohsin Sajjad, Assistant Consultant, Shifa International Hospital, Islamabad. **Email:** drmohsin345@gmail.com
Cite this Article: Sajjad, M. M., Tariq, A., Shabbir, M., & Yousaf, S. (2023). Diagnostic Accuracy Of Acromioaxillosuprasternal Notch Index For Prediction Of Difficult Airway Taking Cormack And Lehane Grading System As Gold Standard. *Journal of Rawalpindi Medical College*, *27*(3). https://doi.org/10.37939/jrmc.v27i3.2269.
Received March 31, 2023; accepted July 13, 2023; published online September 26, 2023

1. Introduction

Airway assessment plays a vital role in preoperative evaluation as it identifies potential problems. Difficulty in ventilation and maintenance of oxygenation during general anaesthesia are the sole indicators that may help in formulating an appropriate airway plan. Drawing out an appropriate plan with the help of preoperative assessment is the first step for the management of an unanticipated difficult airway.

An airway assessment test requires it to be simple yet cost-effective. Only those screening tests should be utilized for airway assessment that holds a high sensitivity, specificity, and positive predictive value. There is dramatic variation in the diagnostic accuracy of various screening tests which can be summarized as differences in definition and incidences of difficult intubation in different studies, contrasting patient characteristics, inadequate statistical power, and distinct test thresholds. The general population has a low prevalence of difficult airways; this makes the positive predictive value consistently low. There is no accurate screening test that may predict a failed intubation in the general population. It is, therefore, impertinent that every anaesthetist should be well-equipped and skilled to manage such cases. (1)
The acromioaxillosuprasternal notch index (AASI) is a new index measured by a line (A) connecting the upper surface of the acromion process with the axillary upper margin. Line (B) extends from the middle of the suprasternal notch horizontally, transecting line (A). A part of line (A), which lies above the intersection is a line (C). Line C is divided by line A to obtain AASI The formula for calculating AASI can be summarized as AASI = C/A as shown in Figure 1.

Very little data is available regarding the utility of AASI for predicting difficult airways, but it has shown good sensitivity and specificity.

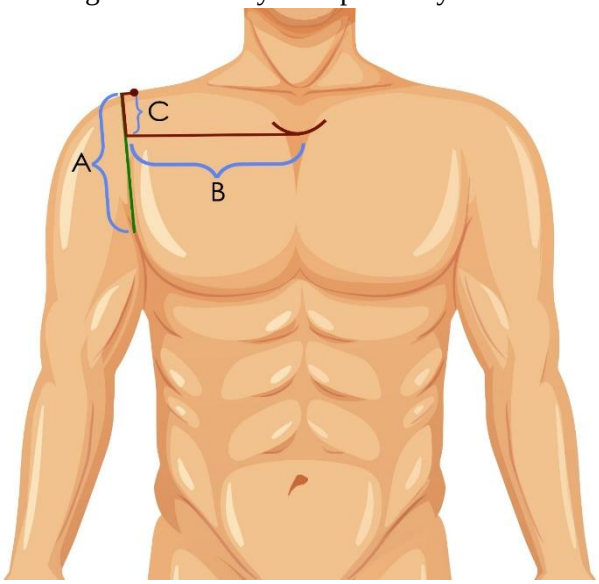


Figure-1 Acromioaxillosuprasternal notch index; AASI

It is well-studied about individuals with a deep neck in the chest, are associated with difficult visualization of the larynx (DVL). One study conducted on 440 non-obstetric adult patients concluded that AASI is a reliable and useful bedside predictor for difficult visualization of the larynx (DVL){2}. This takes into consideration an anatomical landmark test that can easily be done at the bedside. The main focus of this study is to evaluate the diagnostic accuracy of the acromioaxillosuprasternal notch index (AASI). It is a new index which can be measured by landmarks on the surface anatomy of the chest. It is compared with the Cormack and Lehane grading system for the assessment of difficult laryngoscopy views in patients for general anaesthesia.

2. Materials & Methods

After taking approval from the ethical review committee of the hospital and informed consent from the enlisted patients, 350 patients aged between 20 to 70 years with ASA status I-IV planned for elective surgery requiring endotracheal intubation were included in this cross-sectional validation study from May 13, 2022, to November 13, 2022.
The exclusion criteria were; cancer of the head and neck region, prior history of radiation to the head and neck region, any anatomical abnormality affecting the opening of the mouth and BMI > 35 kg/m^2. After consent, these patients were assessed for acromioaxillosuprasternal notch index (AASI) and Cormack and Lehane grading system and difficult intubation was labelled as per the operational definition. All the results were collected and recorded on the same proforma.
AASI was calculated using a ruler or measuring tape. The patient was asked to lie supine on a flat surface with upper arms on the side. The following measurements were recorded: 1) line (A) from the upper border of the acromion process to the upper margin of the axilla. 2) Line (B) from the suprasternal notch to line (A). 3) The portion of line A lying above the intersection was a line (C). 4) AASI was obtained by dividing line C by line A with the help of the following formula, i.e. AASI = C/A.
All patients undergoing general anaesthesia were predicated with intravenous midazolam (0.3 to 0.5 mg/kg). The anesthesiologist commenced the intravenous anaesthetic induction with propofol (5mg/kg) and muscle relaxant atracurium (0.5mg/kg). Lungs were ventilated with 100% oxygen for three minutes, and the consultant anesthesiologist performed the laryngoscopy with the head of the patient in sniffing position with Macintosh blade # 3, blinded to the measurements of AASI and Cormack and Lehane grading system was assessed. The following grades of laryngoscopy view were utilized for assessment; grade I shows fully exposed glottis, grade II shows partly exposed glottis, grade III shows only epiglottis and grade IV shows no epiglottis. The easy laryngoscopy grades were I and II and III and IV were denoted as the grades for difficult visualization of the larynx.
If there was a failure to intubate in the first attempt, a re-attempt with modification of head position and Macintosh blade # 4 was made. The data was analyzed by SPSS version 23. Quantitative variables i.e., BMI and age were assessed by standard deviation. Frequency and percentages were calculated for categorical data like sex, ASA class and outcome i.e. difficult intubation as yes or no for acromioaxillosuprasternal notch index and Cormack and Lehane grading system. A 2×2 table was formed for the detection of sensitivity, specificity, PPV, NPV and diagnostic accuracy. The stratification of age, sex, BMI and ASA status controlled the effect modifiers. Post-stratification Chi-square test was applied to calculate the p-value. The p-value ≤0.05 was taken as significant and post-stratification diagnostic accuracy was also calculated.

3. Results

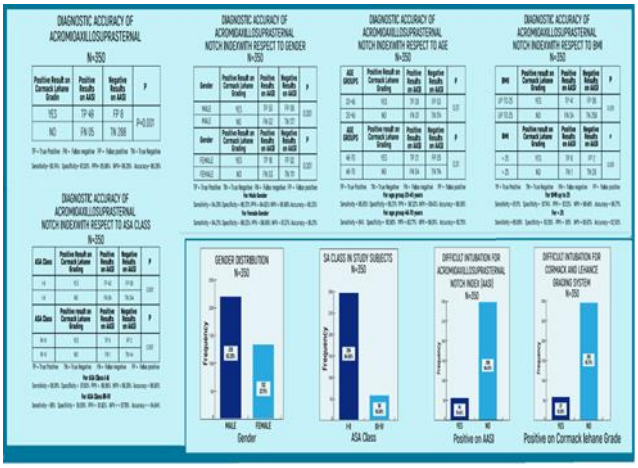
This study comprised of 350 subjects, 218 (62.29%) were males and 132 (37.71%) were females. The mean age was 40.20±12.86 years and the mean BMI was 24.71±3.13, all mentioned in Table 01 respectively. There were 294 (84%) cases in ASA Class I and II and 56 (14%) in Class III and IV as in Figure 2. AASI ≤ 0.49 was taken as the best cutoff point for all difficult intubation. Difficult intubation on AASI was seen in 54 (15.43%) and 57 (16.29%) cases on Cormack and Lehane grading system.

The diagnostic accuracy of AASI for prediction of difficult intubation was 96.29% with a sensitivity of 90.74%, specificity of 97.30%, PPV of 85.96%, NPV of 98.29% with p= 0.001 as shown in the table. This difference was also statistically significant with all the confounding variables like age, gender, ASA class and BMI as shown in the tables mentioned below.

Table-1 Patients Characteristics

	All (350)
Gender Male Female	 218(62.29%) 132(37.71%)
Age	40.20 ± 12.86
BMI	24.71 ± 3.13

Table-2



5. Discussion

All surgical procedures requiring general anaesthesia usually have to be intubated with an endotracheal tube by an anesthesiologist for the maintenance of a patent airway. Difficult and failed intubation is always a concern and an unanticipated difficult airway is still considered a grave cause of morbidity and mortality during induction of anaesthesia.[3]

The incidence ranges between 0.1-20% for difficult laryngoscopy view or difficult tracheal intubation. This wide range can be attributed to a variable patient population and criteria used. Various investigators have used several simple bedside tests based on anatomical landmarks to predict difficult intubation in preoperative evaluation. These tests include the modified Mallampati test (MMP), inter-incisor distance, sternomental distance, thyromental distance (TMD), hyomental distance ratio, and upper lip bite test, each with a different degree of success.[4,5]

A short neck and a prominent mandible are the two most important risk factors for difficult visualization of the larynx (DVL). The acromioaxillosuprasternal notch index (AASI) is a new tool used for the prediction of DVL. This index is based on the anatomical landmarks of the chest where the portion of the arm–chest junction lies above the level of the suprasternal notch.[6,7]

In this study, the diagnostic accuracy of AASI for prediction of difficult intubation was 96.29% with sensitivity of 90.74%, specificity of 97.30%, PPV of 85.96%, NPV of 98.29% with p= 0.001 taking Cormack and Lehane grading system as the gold standard. This difference was also statistically significant with all the confounding variables like age, gender, ASA class and BMI. The findings obtained from this study can be compared with the previous ones done in the same context.

Kamranmanesh MR et al. compared this AASI to MMP classification, and it showed the prediction of difficult intubation to be 15.25%, which was very close to the findings of the present study, with a prevalence of 15.43%. They had a sensitivity of 78.90% and a specificity of 89.40% of AASI.[8] These results were

also supported by a slightly lower sensitivity and specificity by the study by Shiga et al.

The other studies also used a similar protocol for index cut-off values. The study by Kamranmanesha MR et al. also used the statistical cutoff point of 0.49 cm for AASI; which was rounded off to 0.5. A value less than 0.5 were set as a criterion for EVL and that higher than 0.5 was set for DVL.{8}

In a study by Safavi M et al., they compared various grading scores to predict difficult intubation. AASI had the highest sensitivity and specificity. Not only this, it also showed a positive likelihood ratio and positive and negative predictive values along with other tests. Furthermore, AASI is independent of patient position and it reflects the intra-thoracic indexes. The AASI holds an advantage over the use of easily available inexpensive equipment for this measurement. The limitation of their study was that their results did not apply to all populations, such as morbidly obese infants, and obstetric populations.{8}

Different studies have shown various risk factors affect the difficulty of intubation. This variability in incidence is due to multiple factors which are modified by airway management protocols with anthropomorphic features among diverse populations. It is also affected by the varying degree of muscle relaxation during intubation, appropriate head position, grades of laryngoscopy view, use of cricoid pressure for better visualization, and type or size of laryngoscope blade used. {9,10}

In the present study, the AASI was significantly better in predicting difficult airways. These results illustrate alignment with the studies that were performed on obstetric patients for an association of patient weight with difficult laryngoscopy views. {11,12}

However, Brodsky et al. study showed contrasting results regarding BMI and obesity not associated with difficult laryngoscopy. {13}In a large cohort study, Lundstrom et al. indicated the association of BMI with difficult intubation and was statistically significant. However, the predictive value was weak for BMI so it might be more appropriate than weight. {14}

AASI has a high specificity, positive predictive value, and negative predictive value in predicting difficult laryngoscopy, making it a potentially useful tool for clinical decision-making. {15}

There were a few limitations of the study as it did not compare with the other commonly used scores and grading systems to see better results. Moreover, it took a lot of work to measure in a few cases due to different angles for pre-assessment. There were many strengthening points as well as this study described a very high yield of diagnostic accuracy and introduced a relatively newer test. However, more research is needed to confirm the diagnostic accuracy of AASI for predicting difficult airways using the Cormack and Lehane grading system as the gold standard.

5. Conclusion

In conclusion, the acromioaxillosuprasternal notch index (AASI) shows promising results as a predictor of difficult airway. Acromioaxillosuprasternal notch index is a significantly good predictor for predicting difficult intubation taking Cormack and Lehane grading system as the gold standard and this difference is significantly better in terms of age, gender, BMI and ASA class as well.

CONFLICTS OF INTEREST- None

Financial support: None to report.
Potential competing interests: None to report
Contributions:
M.M.S - Conception of study
M.M.S - Experimentation/Study Conduction
A.T - Analysis/Interpretation/Discussion
A.T - Manuscript Writing
M.S - Critical Review
S.Y - Facilitation and Material analysis

References

[1] Cobley M, Vaughan RS. Recognition and management of difficult airway problems. Br J Anaesth. 1992 Jan;68(1):90-7. doi: 10.1093/bja/68.1.90. PMID: 1739575.
[2] Rajkhowa T, Saikia P, Das D. An observational prospective study of the performance of acromioaxillosuprasternal notch index in predicting difficult visualisation of the larynx. Indian Journal of Anaesthesia. 2018 Dec;62(12):945.
[3] Arné J, Descoins P, Fusciardi J, Ingrand P, Ferrier B, Boudigues D, Ariès J. Preoperative assessment for difficult intubation in general and ENT surgery: predictive value of a clinical multivariate risk index. Br J Anaesth. 1998 Feb;80(2):140-6. doi: 10.1093/bja/80.2.140. PMID: 9602574.

[4] Khan ZH, Eskandari S, Yekaninejad MS. A comparison of the Mallampati test in supine and upright positions with and without phonation in predicting difficult laryngoscopy and intubation: A prospective study. J Anaesthesiol Clin Pharmacol. 2015 Apr-Jun;31(2):207-11. doi 10.4103/0970-9185.155150. PMID: 25948902; PMCID: PMC4411835.

[5] Roth D, Pace NL, Lee A, Hovhannisyan K, Warenits AM, Arrich J, Herkner H. Airway physical examination tests for detection of difficult airway management in apparently normal adult patients. Cochrane Database Syst Rev. 2018 May 15;5(5): CD008874. doi 10.1002/14651858.CD008874.pub2. PMID: 29761867; PMCID: PMC6404686.

[6] Kheterpal S, Han R, Tremper KK, Shanks A, Tait AR, O'Reilly M, Ludwig TA. Incidence and predictors of difficult and impossible mask ventilation. Anesthesiology. 2006 Nov;105(5):885-91. doi: 10.1097/00000542-200611000-00007. PMID: 17065880.

[7] Law JA, Broemling N, Cooper RM, Drolet P, Duggan LV, Griesdale DE, Hung OR, Jones PM, Kovacs G, Massey S, Morris IR, Mullen T, Murphy MF, Preston R, Naik VN, Scott J, Stacey S, Turkstra TP, Wong DT; Canadian Airway Focus Group. The difficult airway with recommendations for management--part 2--the anticipated difficult airway. Can J Anaesth. 2013 Nov;60(11):1119-38. doi: 10.1007/s12630-013-0020-x. Epub 2013 Oct 17. PMID: 24132408; PMCID: PMC3825645.

[8] Kamranmanesh MR, Jafari AR, Gharaei B, Aghamohammadi H, Poor Zamany N K M, Kashi AH. Comparison of acromioaxillosuprasternal notch index (a new test) with modified Mallampati test in predicting difficult visualization of larynx. Acta Anaesthesiol Taiwan. 2013 Dec;51(4):141-4. doi: 10.1016/j.aat.2013.12.001. Epub 2014 Jan 21. PMID: 24529668.

[9] Lee HC, Yun MJ, Hwang JW, Na HS, Kim DH, Park JY. Higher operating tables provide better laryngeal views for tracheal intubation. Br J Anaesth. 2014 Apr;112(4):749-55. doi: 10.1093/bja/aet428. Epub 2013 Dec 18. PMID: 24355831.

[10] J. D. Walker, Posture used by anaesthetists during laryngoscopy†, BJA: British Journal of Anaesthesia, Volume 89, Issue 5, November 2002, Pages 772–774,

[11] Goodman SN, Berlin JA. The use of predicted confidence intervals when planning experiments and the misuse of power when interpreting results. Ann Intern Med. 1994 Aug 1;121(3):200-6. doi: 10.7326/0003-4819-121-3-199408010-00008. Erratum in: Ann Intern Med 1995 Mar 15;122(6):478. PMID: 8017747.

[12] Mehta T, Jayaprakash J, Shah V. Diagnostic value of different screening tests in isolation or combination for predicting difficult intubation: A prospective study. Indian J Anaesth. 2014 Nov-Dec;58(6):754-7. doi: 10.4103/0019-5049.147176. PMID: 25624545; PMCID: PMC4296366.

[13] Brodsky JB, Lemmens HJ, Brock-Utne JG, Vierra M, Saidman LJ. Morbid obesity and tracheal intubation. Anesth Analg. 2002 Mar;94(3):732-6; table of contents. doi: 10.1097/00000539-200203000-00047. PMID: 11867407.

[14] Lundstrøm LH, Møller AM, Rosenstock C, Astrup G, Wetterslev J. High body mass index is a weak predictor for difficult and failed tracheal intubation: a cohort study of 91,332 consecutive patients scheduled for direct laryngoscopy registered in the Danish Anesthesia Database. Anesthesiology. 2009 Feb;110(2):266-74. doi: 10.1097/ALN.0b013e318194cac8. PMID: 19194154.

[15] Safavi SM, Honarmand A, Sheikhani G. Comparing “acromio-axillo-suprasternal notch index (AASI)” as a new screening test for predicting difficult laryngoscopy with four commonly used tests. Journal of Isfahan Medical School. 2016 Apr 20;34(375):245-50.