Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 32s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Acromioaxillosuprasternal notch index(AASI)Versus Traditional Airway Parameters In Predicting Difficult Visualisation Of Larynx - An Observational Study

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Cite this paper as: Dr. Thatha Lakshmi Bharathi, Dr. Harish babu ravulapalli, Dr. Vijaya rekha.S, Dr. Kakani Vishnu vandana, Yekollu Hari krishna, (2025) Acromioaxillosuprasternal notch index(AASI)Versus Traditional Airway Parameters In Predicting Difficult Visualisation Of Larynx - An Observational Study. *Journal of Neonatal Surgery*, 14 (32s), 4362-4368.

ABSTRACT

Background: Predicting difficult laryngoscopy remains a challenge in anesthesia. The acromio axillo suprasternal notch index (AASI) is a novel, objective test designed for this purpose.

AIM: To assess the diagnostic accuracy of AASI in predicting difficult laryngoscopy and compare its performance with other conventional airway predictors: Modified Mallampati Grading (MPG), Sternomental Distance (SMD), and Thyromental Distance (TMD).

Methods: This prospective, observational, double-blinded study included 150 patients undergoing elective surgeries under general anesthesia. Preoperative airway assessment included AASI, MPG, TMD, and SMD. The Cormack-Lehane (CL) grading was assessed during direct laryngoscopy. Statistical analysis was performed using ROC curves, sensitivity, specificity, PPV, and NPV calculations.

Results: The incidence of difficult visualization of larynx (CL grade 3 & 4) was 33.3%. AASI showed the highest sensitivity (93.3%) and specificity (91.2%) at a cutoff value of >0.49. AUC for AASI was 0.933, outperforming MPG (AUC = 0.765), TMD (AUC = 0.702), and SMD (AUC = 0.728).

Conclusion: AASI is a superior predictor for difficult laryngoscopy compared to MPG, TMD, and SMD, offering a simple, reliable, and objective tool, especially useful in supine or uncooperative patients.

Keywords: *Difficult laryngoscopy, Acromio Axillo Suprasternal notch index (AASI), Airway assessment, Cormack-Lehane grading.*

1. INTRODUCTION

The American Society of Anesthesiologists (ASA) defines a difficult airway as "a clinical situation in which a conventionally trained anesthesiologist experiences difficulty with facemask ventilation of the upper airway, difficulty with tracheal intubation, or both."[1] Such situations can result in serious complications—including hypoxia, increased risk of aspiration, vocal cord injury or displacement, hoarseness, stridor, challenging extubation—which may lead to hypoxic brain injury, cardiac arrest, and even death.[1]

It is challenging to accurately predict which cases will present added difficulties: nearly 90% of difficult airways are not anticipated.[2,3] Direct laryngoscopy itself may cause trauma and further complicate airway management, and no single predictive assessment demonstrates reliable sensitivity and specificity.[2,4]

Consequently, research continues to seek the most accurate predictor of difficult tracheal intubation. Despite using numerous individual predictors—such as Mallampati classification, thyromental and sternomental distances, and inter-incisor gap—none meet the diagnostic performance standards required in clinical settings.[5] As such, thorough preoperative airway

evaluation remains essential in anesthesia practice. Therefore, prior anesthesia, assessing the patient's airway is crucial. So, we hypothesised that AASI alone and in combination with other parameters such as MPG,SMD,TMD would make it easy to predict difficult airway.

2. MATERIALS AND METHODS

The study was conducted in the Department of Anesthesiology, Narayana medical college and hospital, Nellore, Andhra Pradesh after getting approval from institutional ethics committee with a sample size of 150 patients between August 2023 to January 2025. Patients aged between 18 – 60 years belonging to ASA physical status I, II undergoing elective surgeries under general anesthesia requiring endotracheal intubation were included in this study and those with anatomical deformity of head, neck, and thorax, use of cervical collar or having cervical spine abnormality, previous history of head and neck surgery,any previous history difficult airway,obese patients (BMI >30 kg/m2), obstetric patients and Patients with inadequate mouth opening, patients failed to give consent were excluded from this study. All the patients were subjected to pre anesthetic evaluation on the day before surgery A detailed medical history was taken, Basic laboratory investigations were carried out in all patients. General examination, physical examination, systemic examination was carried out.

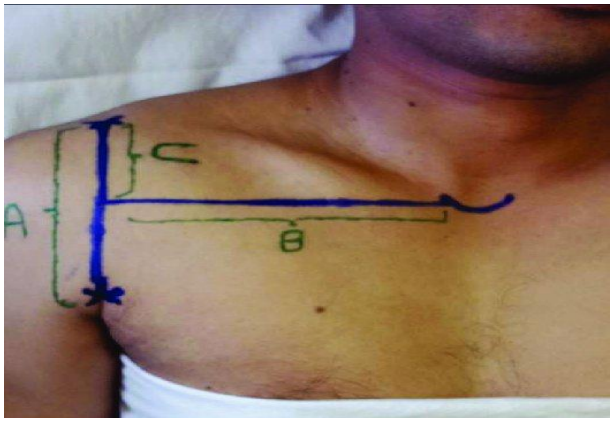
As per the departmental protocol the patients posted for elective surgery were investigated. All patients underwent airway examination prior to surgery during which Acromio axillo suprasternal notch index (AASI) and Modified Mallampati test (MMP), Thyromental distance and sternomental distance were assessed and recorded in the proforma.

Acromio Axillo Suprasternal Notch Index (AASI):

Acromio Axillio Suprasternal notch index (AASI) is a new index used in airway assessment, for difficult visualization of larynx It was measured by patients lying in supine position.

A vertical line is drawn from the top of the acromion process to the superior border of the axillary line A. Then a second line is drawn perpendicular to line A from the suprasternal notch. The portion of line A that lie above the point at which line B intersected line A was termed as line C. AASI was calculated by dividing the length of line C by that of line A (AASI = C/A).

Figure 1 Acromio Axillo Suprasternal Notch Index (AASI)



After airway assessment patients shifted into operating room and all ASA standard monitors such as pulse oximetry (SpO2), non invasive blood pressure (NIBP), and electrocardiogram (ECG) were attached. Baseline pulse rate, blood pressure and oxygen saturation were recorded. An intravenous (IV) line was secured and Ringer lactate started before the procedure. Standard preparations and precautions were taken for general anesthesia with endotracheal tube intubation and controlled mechanical ventilation for all the patients.

The airway cart was kept ready which consists of manual resuscitator bag, anatomical masks of all sizes, oropharyngeal and nasopharyngeal tubes of all sizes, suction cannula of all sizes, laryngoscope handle with blades of all sizes, McCoy blade, endotracheal tubes(ETT) of all sizes, Laryngeal mask airways(LMA) of all sizes, intubating laryngeal mask airway(ILMA), stylet, ventilating bougie, emergency cricothyrotomy set, and emergency tracheostomy set. The availability of fiberoptic bronchoscope was ensured whenever we encountered a suspected case of difficult airway.

Preoxygenation was done with 100% oxygen for 3 min, Induction done with inj. fentanyl 2 mcg/kg and Inj. propofol 2 mg/kg, Inj. succinylcholine 2 mg/kg given after ability to ventilate the patients was confirmed. Laryngoscopy was done with No.

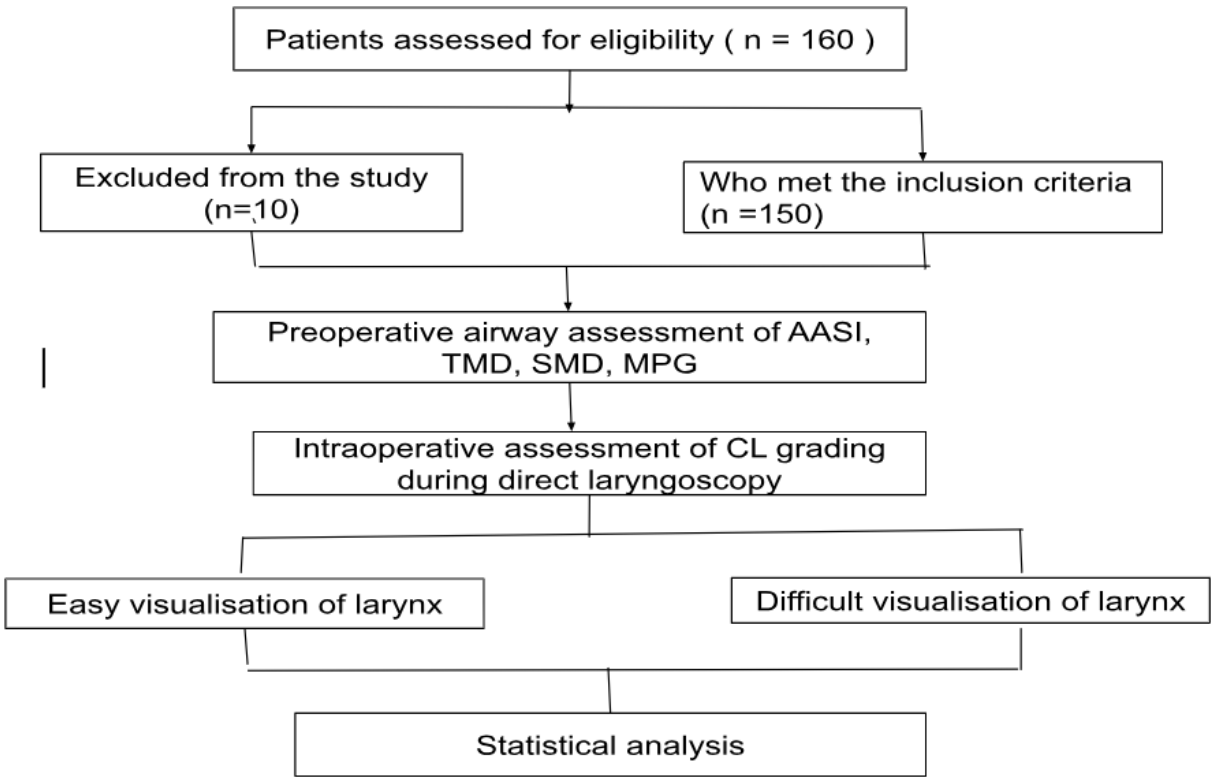
3(or No.4 MAC blades only if required) after disappearance of fasciculations or within 1 min of injection of succinylcholine.

After assessment of the glottic view and grading it as per the Cormack and Lehane grading system the endotracheal tube of appropriate size was passed into the trachea under direct vision. It was followed by confirmation of correct placement of the tube by checking of bilateral air entry and appearance of the first square wave of capnography. Once equal air entry was established the tube was fixed. Inj cisatracurium 0.2mg/kg IV was given. Patient was put on a mechanical ventilator and all ventilator parameters was adjusted according to the patient's requirements.

Table - 1: Cormack lehane grading.

Cormack-Lehane Grade	Laryngoscopic View
Grade I	**Visualization of entire vocal cords**
Grade II	**Visualization of posterior part of laryngeal aperture**
Grade III	**Visualization of epiglottis**
Grade IV	**No glottic structures seen**

CONSORT DIAGRAM:



3. STATISTICAL ANALYSIS

Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Science Inc., Chicago, IL). All the collected data was entered in MS excel sheet

- Data were presented as mean, standard deviation, frequency and percentage.
- Cut off value was calculated using ROC and cross tabs were created to find the sensitivity and specificity.
- Significance was defined by P values less than 0.05 using a two-tailed test.

4. RESULTS

This current study didn't show any statistical difference in terms of age, BMI, gender distribution and ASA status of patients.

Table - 2 Modified Mallampati Grading (MPG) Distribution

MPG	Count	Column N %
1 & 2	88	58.7%
3 & 4	62	41.3%

In this study, MPG Grades 1 & 2 were observed in 58.7% of patients, while Grades 3 & 4 were seen in 41.3%.

Table - 3 Descriptive Statistics of Airway Assessment Parameters

Parameters	Mean	± SD
TMD (cm)	7.70	2.08
SMD (cm)	12.81	3.56
C (cm)	4.59	1.47
A (cm)	9.91	1.77
AASI	0.46	0.13

Table - 4 Cormack lehane grading distribution

Cormack lehane grading	count	column N %
1&2	**100**	**66.7%**
3&4	**90**	**33.3%**

Table - 5 Association Between AASI and CL Grading

AASI	CL Grading	
	Difficult	Easy
> 0.50	45	16
< 0.49	5	84

In this study, difficult laryngoscopy was observed in 73.8% of patients with AASI > 0.50, compared to only 5.6% in those with AASI < 0.49, indicating a strong association between higher AASI and difficult visualization.

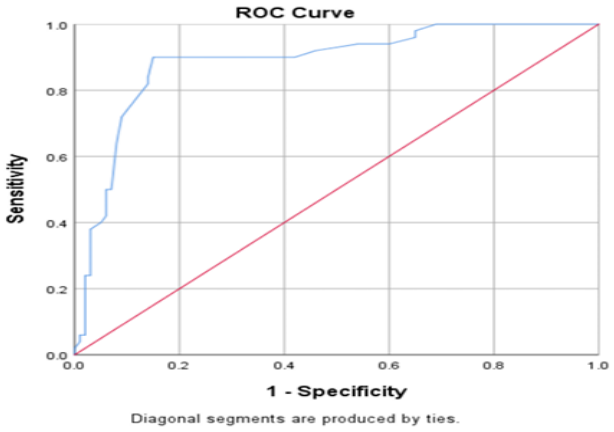


Figure - 2 ROC CURVE OF AASI

Table - 6 Diagnostic Performance of AASI, TMD , SMD ; MPG for Predicting Difficult

	AASI	TMD	SMD	MPG	MPG + TMD+ SMD	MPG +SMD +TMD+ AASI
Sensitivity	**90.00%**	**56.00%**	**62.00%**	**44.00%**	**94.00%**	**100.00%**
specificity	**84.00%**	**55.00%**	**48.00%**	**60.00%**	**16.00%**	**13.00%**
PPV	**73.77%**	**38.36%**	**37.35%**	**35.48%**	**35.88%**	**36.50%**
NPV	**94.38%**	**71.43%**	**71.64%**	**68.18%**	**84.21%**	**100.00%**
accuracy	**86.00%**	**55.33%**	**52.67%**	**54.67%**	**42.00%**	**42.00%**

Table - 7 Association between Sternomental distance (SMD), thyromental distance (TMD), Mallampati grade (MPG) and CL grading

		CL Grading	
		Difficult	Easy
SMD , TMD, MPG	Difficult	47	84
	Easy	3	16

Figure 3 Association between Sternomental distance (SMD), thyromental distance (TMD), Mallampati grade (MPG) and CL grading

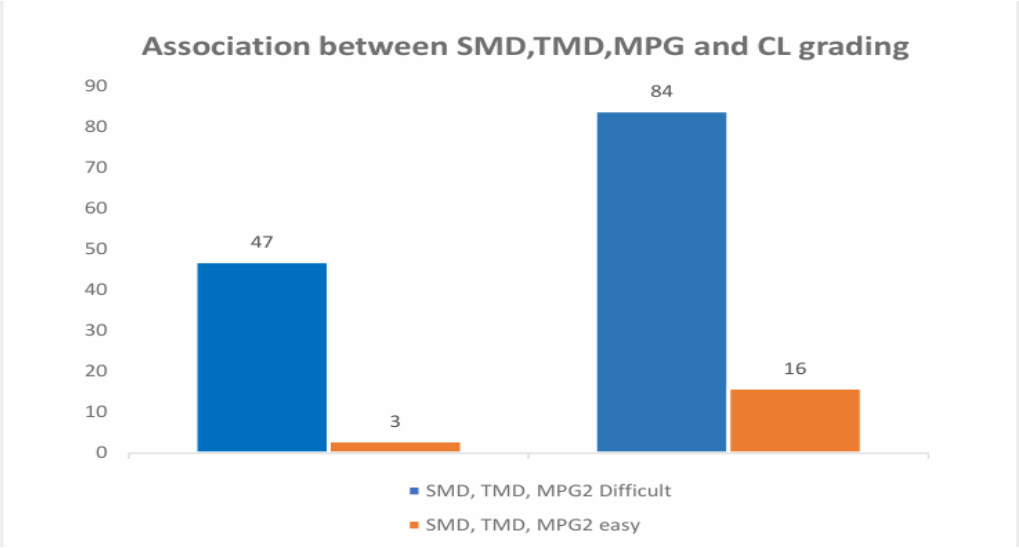


Table - 8 Sensitivity, Specificity, PPV, NPV, for combined Sternomental distance (SMD), thyromental distance (TMD), Mallampati grade (MPG)

Sensitivity	**94.00%**
Specificity	**16.00%**
PPV	**35.88%**
NPV	**84.21%**
Accuracy	**42.00%**

In this study, combined clinical predictors (SMD, TMD, and MPG—any one being difficult) predicted difficult laryngoscopy with a sensitivity of 94.0%, specificity of 16.0%, positive predictive value (PPV) of 35.88%, negative predictive value (NPV) of 84.21%, and overall accuracy of 42.0%, indicating high sensitivity but limited predictive reliability due to poor specificity.

Table - 9 Association between SMD, TMD, MPG, AASI and CL grading

		CL Grading	
		Difficult	Easy
SMD , TMD, MPG and AASI	Difficult	50	87
	Easy	0	13

Figure 4 : Association between SMD, TMD, MPG, AASI and CL grading

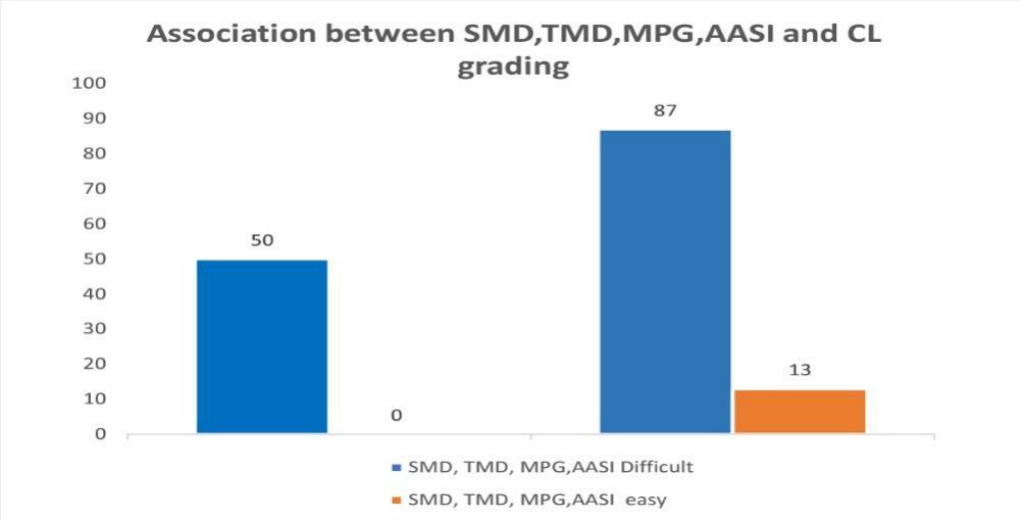


Table -10 Sensitivity, Specificity, PPV, NPV, for combined Sternomental distance (SMD), thyromental distance (TMD), Mallampati grade (MPG) and AASI.

Sensitivity	100.00%
Specificity	13.00%
PPV	36.50%
NPV	100.00%
Accuracy	42.00%

In this study, combined clinical predictors including AASI (SMD, TMD, MPG, and AASI—any one being difficult) predicted difficult laryngoscopy with a sensitivity of 100.0%, specificity of 13.0%, positive predictive value (PPV) of 36.50%, negative predictive value (NPV) of 100.0%, and overall accuracy of 42.0%, indicating excellent sensitivity but limited predictive reliability due to poor specificity.

5. DISCUSSION

Airway Management is the most important aspect of general anaesthesia which involves intubating the patient with the aid of a laryngoscope. Since long, identification of a difficult airway preoperatively has posed a diagnostic challenge to the anaesthetic community. No single diagnostic test has received an approval by consensus[6].

In our study we observed no statistically significant association in patients having easy laryngoscopy compared with patients having difficult laryngoscopy with respect to their age, gender, ASA grades.The overall mean age of study population was 40.83 years. In our study the sensitivity, specificity and negative predictive value of acromio axillo suprasternal notch index were found to be 90%, 84%, 73.77% and 94.38% respectively with Accuracy of 86%. The area under the curve was 0.887. A statistical significance (P <0.05) was evident for the diagnostic accuracy of acromion-axillo suprasternal notch index.

Kamranmanesh MR et al[7] conducted a study on comparison of acromioaxillosuprasternal notch index (a new test) with modified Mallampati test in predicting difficult visualization of larynx. Difficult visualization of larynx (DVL, Cormack-Lehane III and IV) was observed in 38 (6.3%) patients. The best cutoff point for DVL was defined at AASI > 0.49. AASI had a lower false negative rate and higher predictive values (sensitivity, positive predictive value, and accuracy) in comparison with MMP.

Rajkhowa et al[8] conducted an observational prospective study of performance of acromioaxillosuprasternal notch index in predicting difcult visualisation of the larynx. DVL was observed in 3.6% patients. AUC of AASI was found to be better than MMT, SMD, TMD and IID. This study concluded that AASI (≥0.5) is a good predictor of difficult visualisation of the larynx at direct laryngoscopy. Our investigation revealed that the sensitivity and negative predictive values of the Acromio-Axillo-Suprasternal Notch Index (AASI) were comparable to those of the Modified Mallampati Test (MMT), Sternomental Distance (SMD), Thyromental Distance (TMD), as detailed in the referenced study.

Shilpa acharya et al[9] conducted a study on acromio-axillo-suprasternal notch index [aasi] : a screening method to predict difficult laryngoscopy in patient undergoing general anaesthesia and requiring endotracheal intubation found that AASI more than or equal to 0.5 is a good predictor of difficult visualisation of larynx (DVL) at direct laryngoscopy. This current study also showed similar results in terms of prediction difficulty visualisation of larynx.

6. CONCLUSION

This study concludes that AASI can be used routinely as a predictive tool for 'Difficult visualization of larynx' (DVL). Compared with Mallampati grade, sternomental distance and thyromental distance, AASI showed higher sensitivity as a predictor of DVL. Combined parameters of SMD, TMD, MPG together showed sensitivity of 94% as a predictor of DVL.

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