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COMPARISON OF ACROMIOAXILLOSUPRASTERNAL NOTCH INDEX WITH ULTRASOUND PARAMETERS AND CORMACK LEHANE GRADING FOR PREDICTING DIFFICULT INTUBATION

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Abstract

Background: Acromioaxillosuprasternal notch index (AASNI) and ultrasound ratio of pre epiglottic space and distance between epiglottis to midpoint of vocal cord (Pre-E/E-VC) are relatively new indicators for difficult laryngoscopy and intubation. Our aim was to compare AASNI with ultrasound ratio (Pre-E/E-VC) preoperatively for assessing difficult intubation.

Methods: This analytical cross-sectional study was done with 100 patients undergoing elective surgery requiring general anesthesia with endotracheal intubation. Sample size calculated based on Yamane equation was 100. Amongst these 99 patients met the inclusion criteria. Preoperatively Acromioaxillosuprasternal notch index and ratio of pre epiglottic space and distance between epiglottis to midpoint of vocal cord (Pre-E/E-VC) (ultrasound ratio) were determined. Cormack lehane grading was done with laryngoscopy once general anesthesia was established.

Results: Difficult laryngoscopy (Cormack lehane grade III &IV) was found in 26 patients. AASNI had better sensitivity (92.31%) compared to ultrasound ratio (Pre-E/ E-VC) (84.62%). But in terms of specificity both had little difference (AASNI – 97.26% & USG ratio (Pre-E/ E-VC) – 95.89%). AASNI was more accurate when compared to ultrasound ratio (Pre-E/ E-VC) (95.96% v/s 92.93%).

Conclusion: AASNI proved to be a better predictor of difficult intubation when compared to ultrasound ratio.

Keywords: AASNI, ultrasound ratio, Cormack lehane grading, difficult laryngoscopy, Pre-E/E-VC

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1. INTRODUCTION

Airway management is prime responsibility of all anesthesiologists. Despite the advent of newer airway equipments, endotracheal intubation by direct laryngoscopy remains the gold standard in maintaining definitive airway. Although Cormack lehane grading is accepted as gold standard to define difficult laryngoscopy, it can be assessed only during laryngoscopy[1]. Hence, establishment of multiple criteria to predict difficult intubation before laryngoscopy is imminent. Ultrasound of the upper airway has proven to be a better predictor compared to conventional clinical assessment to assess difficult laryngoscopy[2]. This research is performed to evaluate Acromioaxillosuprasternal notch index (AASNI), which indicates the depth of the neck in relation to the chest (sloping clavicle), to assess difficult visualization of the larynx (DVL) in comparison with ultrasound and Cormack lehane grading.[3]
Our objective is to compare Acromio axillo suprasternal notch index with ultrasound parameter i.e., ratio of pre epiglottic space and distance between epiglottis to midpoint ofvocal cord (Pre-E/E-VC) preoperatively for assessing difficult intubation.

2. MATERIALS AND METHODS

This analytical cross-sectional study was done after obtaining institutional ethical committee clearance (RRMCH-IEC /69/2019-20) for 3 months with 100 patients undergoing elective surgery (including all specialties) requiring general anesthesia with endotracheal intubation in Department of Anesthesiology, Rajarajeswari medical college, Bangalore.
The CRTI registration number for this study was CTRI/2020/11/028853.
As there were no similar studies available and our study was cross sectional study, the patients getting admitted for elective surgeries in Rajarajeswari Medical College requiring general anesthesia and intubation were taken as target population.
Sample size was calculated based on Yamane equation. $n = N / K + Ne^2$
n = sample size
N= target population size (136)
K = constant (1)
e = margin of error for confidence interval of 95% (0.05)
Based on this equation, sample size considered here was 100.
Patients between the age group 17 - 80 years of either sex, belonging to ASA physical status I – III and patients undergoing elective surgeries undergeneral anesthesia requiring endotracheal intubation were included. Patients requiring rapid sequence intubation, with cervical spine pathology, scheduled for fiber optic tracheal intubation and uncooperative patients were excluded from the study. Informed and written consent was taken and preanesthetic evaluation of the patient was done before the surgery. Airway assessment was done by the principal and co-investigators.
Following details of the patient were recorded in the Preanesthetic evaluation.

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1. Acromio axillo suprasternal notch index

Line A - From the top of the acromion process, a vertical line is drawn to the superior border

of the axilla in relation to pectoralis major muscle.

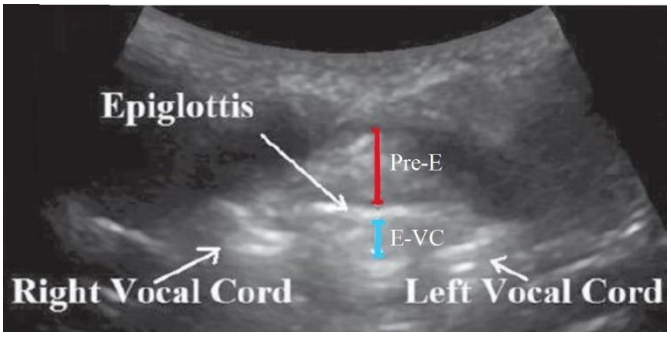
Line B – a perpendicular line is stretched from suprasternal notch to the line ALine C – part of line A that is above the point where line B intersects it

AASNI = C/A, i.e., length of Line C/ length of Line A.

The measurements were taken in supine with neck in neutral position with help of 2 scales and the obtained measurements were recorded by the co-investigator.

The cutoff point for difficult visualization of larynx was defined as AASNI > 0.49 based on the study done by Kamranmanesh et al. [4]

2. Ultrasound parameters (Pre-E/E-VC)- depth of the pre-epiglottic space (Pre-E) distance from the epiglottis to the midpoint of the vocal folds (E-VC)



All the ultrasound studies of the airway were conducted by principal investigator after getting trained by a radiologist and attending airway ultrasound workshop using high frequency linear ultrasound probe (HFL38/13-6 MHz transducer). The study subjects were placed in supine position with maximum head tilt and the probe was placed in midline in the submandibular space. Initially the probe was placed in transverse plane where the epiglottis was visualized and later the probe was angled from caudal to cephalad, in the same position to an oblique transverse plane to visualize both epiglottis and the vocal cords. The study measurements were acquired in the above-mentioned view i.e., pre-epiglottic space depth and distance from the epiglottis to the midpoint of the vocal cords. The ratio of these 2 parameters (Pre-E/E-VC) were further assessed. The Pre-E/E-VC <2 was considered easy laryngoscopy and ≥2 was taken as difficult laryngoscopy based on the study done by Gupta et al[8]. All the measurements were entered in Microsoft Excel sheet.

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Once the patient was shifted to operation theatre, patient was connected with pulse oximetry, NIBP and ECG and baseline pulse rate, blood pressure, respiratory rate were recorded. Difficult airway cart was kept ready for difficult airway situations.
Patient was preoxygenated with 100% Oxygen for 3 minutes and premedicated with injection midazolam 1mg and injection glycopyrrolate 0.2mg intravenously. Patient was induced with injection propofol 2mg/kg and injection succinylcholine 1.5mg/kg intravenously. Laryngoscopy was done by the staff in the operating room and Cormack lehane grading was noted.

3. Cormack lehane grading

Cormack lehane I and II was considered as easy intubation and III and IV was considered as difficult intubation. In case of Cormack lehane III /IV, AIDAA (All India difficult airway association) guidelines were followed for difficult airway.
Following this, the patient was intubated with the appropriate size endotracheal tube andfixed at appropriate length after confirming the tube placement with 5point auscultation andEtCO2.

Statistical Analysis

Data was entered in MS-Excel and analyzed in SPSS V25. Descriptive statistics were represented with percentages mean with SD. Shapiro wilk test was applied to find normality. Chi-square test and Kappa statistics were applied. ROC curve was drawn. Area under the curve was calculated. Sensitivity and specificity were calculated. $P<0.05$ was considered as statistically significant.

4. RESULTS

In our study, AASNI and Pre-E/E-VC ratio were taken for 99 patients who met the inclusion criteria. Demographic parameters with mean values and standard deviation are presented in the table 1.

Variable	E/D Intubation	Minimum	Maximum	Mean	SD
Age	Difficult	25.00	68.00	48.40	12.51
	Easy	18.00	75.00	36.62	14.99
BMI	Difficult	23.14	37.40	30.74	3.33
	Easy	19.00	29.35	22.67	2.44

Table I - Demographic parameters of patients

In our study, out of 99 patients, 73 had easy intubation and 26 had difficult intubation based on Cormack Lehane grading.
The age of the patients ranged from 18 to 75years. The mean age was 48.40 and 36,62 in difficult and easy intubation respectively. Majority of the patients (29.29%) belong to the age group 18 – 27 years.
The mean BMI was higher among difficult intubation group (30.74) compared to easy intubation group (22.67).

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Variable	Category	E/D Intubation	
		Difficult	Easy
		Count	Count
Sex	Male	13	31
	Female	13	42

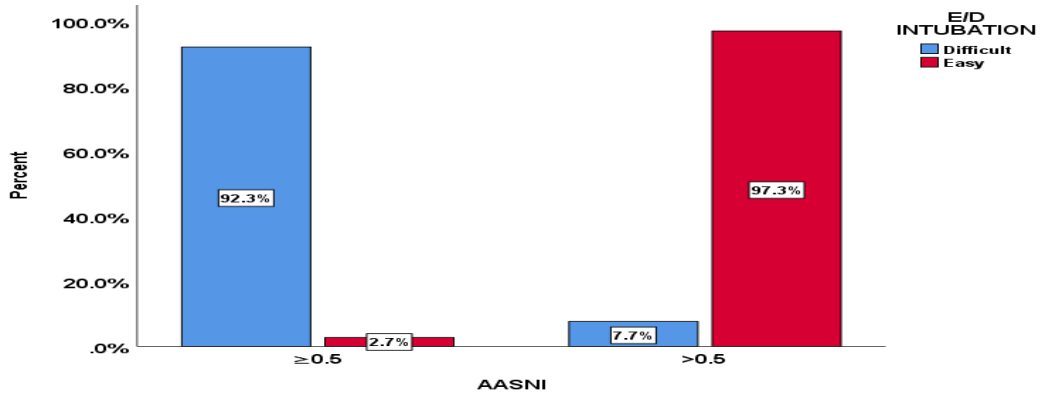
Table 2 – sex distribution

There were 44 males and 55 females out of which 13 in each group had difficult intubation. Comorbidity profile within the study group was as follows; 12 patients had hypertension, 7 had diabetes mellites, 10 had both hypertension and diabetes; and 2 had bronchial asthma.
The study participants underwent the following surgeries; 47 general surgery procedures, 25 head and neck surgeries, 14 orthopedic surgeries, 5 urology procedures and 8 neurosurgical procedures.

Out of 99 patients, 73 had AASNI < 0.5 out of which 71 had easy and 2 had difficult intubation. 26 patients had AASNI ≥0.5 out of which 2 had easy and 24 had difficult intubation. Chi square value for this contingency table was 79.42 and kappa value was 0.896 with P value <0.001.(table 3). Graph 1 shows easy and difficult intubations according to AASNI.

AASNI	E/D Intubation		Total
	Difficult	Easy	
≥0.5	24	2	26
	92.3%	2.7%	26.3%
<0.5	2	71	73
	7.7%	97.3%	73.7%
Total	26	73	99
	100.0%	100.0%	100.0%
Chi-square value = 79.42 (**P<0.001**); Kappa value = 0.896 (**P<0.001)**			

Table 3 – table demonstrating number of patients with AASNI values in patients with easy and difficult intubation



Graph 1 – graph demonstrating percentage of patients with AASNI values in patients with easy and difficult intubation

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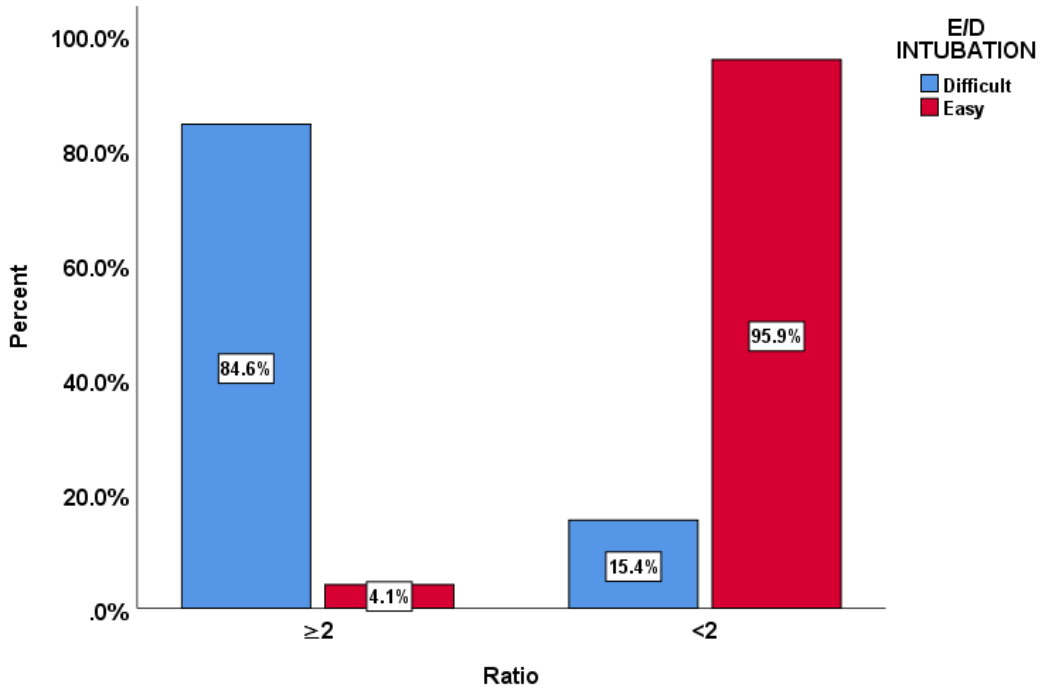
Out of 99 patients, 74 had Pre-E/E-VC <2 out of which 70 had easy and 4 had difficult intubation. 25 patients had Pre-E/E-VC ≥2 out of which 3 had easy and 22 had difficult intubation. Chi square value for this contingency table was 65.83 and kappa value was 0.815 with P value <0.001.(table 4). Graph 2 shows easy and difficult intubations according to ultrasound ratio (Pre-E/E-VC).

(Pre-E/E-VC)	E/D Intubation		Total
	Difficult	Easy	
≥2	22	3	25
	84.6%	4.1%	25.3%
<2	4	70	74
	15.4%	95.9%	74.7%
Total	26	73	99
	100.0%	100.0%	100.0%
Chi-square value = 65.83 (**P<0.001**); Kappa value = 0.815 (**P<0.001)**			

Table 4 – table demonstrating number of patients with ultrasound ratio values in patients with easy and difficult intubation



Graph 2 – Graph demonstrating percentage of patients with ultrasound ratio values in patients with easy and difficult intubation

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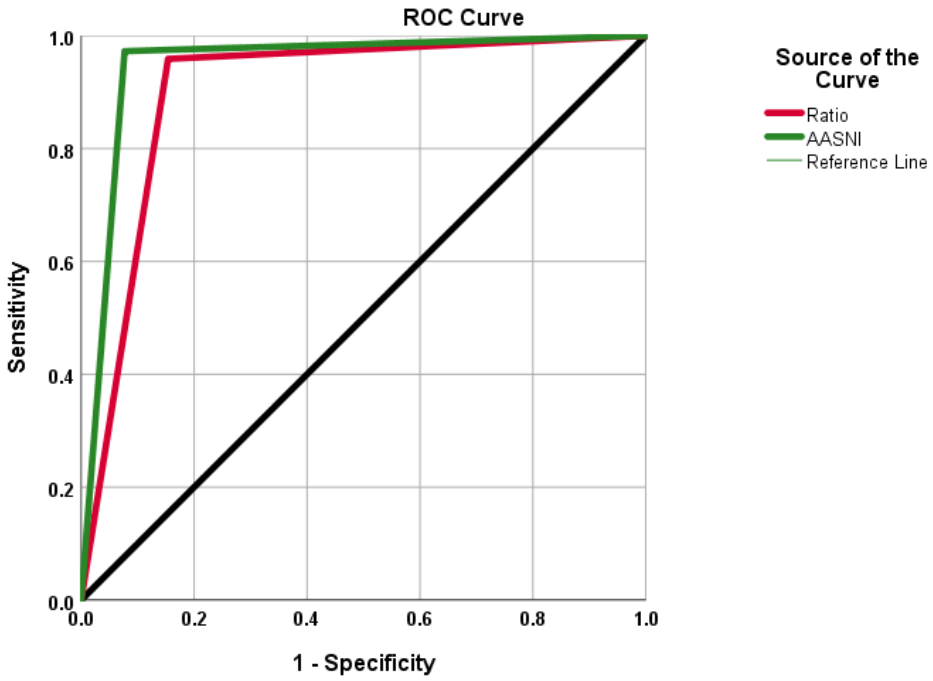
	Ultrasound ratio (Pre-E/E-VC)		AASNI	
Statistic	**Value**	**95% CI**	**Value**	**95% CI**
Sensitivity	84.62%	65.13% to 95.64%	92.31%	74.87% to 99.05%
Specificity	95.89%	88.46% to 99.14%	97.26%	90.45% to 99.67%
Positive Predictive Value (*)	88.00%	70.52% to 95.74%	92.31%	75.28% to 97.93%
Negative Predictive Value (*)	94.59%	87.65% to 97.74%	97.26%	90.36% to 99.26%
Accuracy (*)	92.93%	85.97% to 97.11%	95.96%	89.98% to 98.89%

Table 5 – predictive values of AASNI and ultrasound parameters

According to table 5, AASNI had sensitivity and specificity of 92.31%and 97.26% respectively. In comparison Pre-E/E-VC had sensitivity and specificity of 84.62% and 95.89% respectively. The positive predictive value for AASNI and Pre-E/E-VC were 92.31% and 88% respectively. AASNI had accuracy of 95.96% and Pre-E/E-VC had 92.93%.



Graph 3 – ROC curve

In ROC analysis, Area under the curve for estimating easy and difficult intubation by ultrasound ratio (Pre-E/E-VC) was 0.903 with 95% CI 0.817-0.988 whereas by AASNI, it was

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0.948 with 95% CI 0.884 – 1. So Predictive accuracy for easy and difficult intubation was more with AASNI than the ultrasound ratio (Pre-E/E-VC).

5. DISCUSSION

AASNI has emerged as a parameter to predict difficult intubation in the recent times. Also, increased usage of ultrasonography lately has led to many ultrasound-based parameters to identify difficult intubation. As both the parameters are relatively new, this study was conducted to determine the better parameter to predict difficult intubation amongst the two. In our study, we have estimated the sensitivity, specificity, positive & negative predictive value and accuracy of AASNI comparing with ultrasound ratio (Pre-E/E-VC) taking Cormack Lehane grading as a standard for easy and difficult intubation.

Kamranmanesh et al[4], in 2013 compared modified mallampati with AASNI and derived the cut off >0.49 for determining difficult visualization of larynx. He also concluded that AASNIhas lower false negative rate, higher positive predictive values, increased sensitivity and accuracy. In our study we have taken AASNI ≥0.5 as difficult intubation for the sake of simplification during measurement.

Similarly, Safavi et al[5], Mansouritehrani et al[6], Rajkhowa et al[3] and Sunkam et al compared AASNI with the older, regularly used anatomical head and neck criteria.

Safavi et al[5] found that sensitivity of AASNI was 66.67% and upper lip bite test had sensitivity of 52.38% and both were good predictors for difficult airway. In comparison to modified mallampati, ratio of neck circumference to thyromental distance and ratio of height to thyromental distance were not good predictors.

Sunkam et al[6] compared AASNI with conventional predictors like upper lip bite test and modified mallampati and found that AASNI had higher specificity and positive predictive value. Mansouritehrani et al[7] concluded that in pediatric cases AASNI and neck circumference have higher sensitivity than ratio of height to thyromental distance.

Similarly, Rajkhowa et al[3] concluded in his study that AASNI ≥0.5 is a good predictor of difficult visualization of larynx.

Gupta et al[8] published that prediction of Cormack lehane grading can be made by ratio of pre epiglottic space and distance from epiglottis to vocal cord with sensitivity of 68% distances (Pre- E/E-VC) {0<[Pre-E/E-VC] <1 ≈ CL grade 1; 1< [Pre- E/E-VC] <2 ≈ CL grade 2; and 2<[Pre-E/E-VC] <3 ≈ CL grade 3}. Hence, we considered ratio ≥2 as difficult intubation.

Falceta et al[9] concluded that pre-epiglottic space thickness at the level of thyrohyoid membrane and the pre-epiglottic area were the best predictors of a Cormack-Lehane grade 2bat direct laryngoscopy and of difficult intubation.

Chan et al[2], studied ultrasound ratio of pre epiglottic space and distance from epiglottis to anterior vocal fold, mallampati, thyromental distance and ratio of neck circumference to thyromental distance. They concluded that the ultrasound ratio >1 was potentially difficult airway, with sensitivity and specificity of 79.5% and 39.2% compared to traditional clinical tests. Also, ultrasound ratio had lowest negative likelihood ratio.

In our study, among the patients who had AASNI ≥ 0.5, 92.3% had difficult intubation whereas in patients who had Pre-E/E-VC ≥2, 84.6% had difficult intubation. The chi square and kappa values for both the contingency table were significant with p value <0.001 indicating both Pre-E/E-VC and AASNI to be good predictors of difficult intubation.

AASNI was more sensitive (92.31%) than Pre-E/E-VC (84.62%). Similarly, specificity of AASNI was 97.26% and of Pre-E/E-VC was 95.89% indicating that AASNI has better ability to predict difficult intubation. Even positive predictive value for AASNI was more than

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ultrasound ratio (Pre-E/E-VC). Hence AASNI was found to be more accurate (95.96%) than ultrasound ratio (Pre-E/E-VC) (92.93%).

6. CONCLUSION

To conclude, AASNI proved to be a better predictor of difficult intubation when compared to ultrasound ratio (Pre-E/E-VC).

LIMITATIONS

1. This study was done with a small sample size.
2. No emergency cases were included

7. REFERENCES

1. Krage R, van Rijn C, van Groeningen D, Loer SA, Schwarte LA, Schober P. Cormack-Lehane classification revisited. Br J Anaesth. 2010 Aug;105(2):220–7.
2. Chan SMM, Wong WY, Lam SKT, Wong OF, Law WSS, Shiu WYY, et al. Use of ultrasound to predict difficult intubation in Chinese population by assessing the ratio of the pre-epiglottis space distance and the distance between epiglottis and vocal folds. Hong Kong Journal of Emergency Medicine. 2018 May;25(3):152–9.
3. Rajkhowa T, Saikia P, Das D. An observational prospective study of performance of acromioaxillosuprasternal notch index in predicting difficult visualization of the larynx. Indian J Anaesth. 2018 Dec;62(12):945–50.
4. Kamranmanesh MR, Jafari AR, Gharaei B, Aghamohammadi H, Poor Zamany NKM, Kashi AH.Comparison of acromioaxillosuprasternal notch index (a new test) with modified Mallampati test inpredicting difficult visualization of larynx. Acta Anaesthesiol Taiwan. 2013;51:141–4. [PubMed:24529668]
5. Department of Anesthesiology and Critical Care Research Center, Isfahan University of Medical Sciences, Isfahan, Iran, Safavi M. Acromio-Axillo-Suprasternal Notch Index: A New Screening Test to Predict Difficult Laryngoscopy in General Population. JAS. 2016;3(4):1–6.
6. Sunkam R, Pujari V, Shenoy B, Bevinaguddaiah Y, Parate L. A comparative study of acromio-axillo-suprasternal notch index with upper lip bite test and modified Mallampati score to predict difficult laryngoscopy. Indian Anaesth Forum. 2020;21(1):33.
7. Mansouritehrani N. Acromioaxillosuprasternal Notch Index and Old Head and Anatomic Neck Criteria in Predicting Difficult Laryngoscopy in Tracheal Intubation in Children under General Anesthesia. IMMINV [Internet]. 2019 Mar 3 [cited 2021 Feb 17];4(2). Available from: http://imminv.com/index.php/imminv/article/view/207
8. Gupta D, Srirajakalidindi A, Ittiara B, Apple L, Toshniwal G, Haber H. Ultrasonographic modification of Cormack Lehane classification for pre-anesthetic airway assessment. Middle East J Anaesthesiol. 2012 Oct;21(6):835–42.
9. Falcetta S, Cavallo S, Gabbanelli V, Pelaia P, Sorbello M, Zdravkovic I, et al. Evaluation of two neck ultrasound measurements as predictors of difficult direct laryngoscopy: A prospective observational study. Eur J Anaesthesiol 2018;35:605-12.