

Utility of ultrasonography in preanaesthetic airway assessment

A.Vishnuvardhan Reddy¹, Karthik Satya^{2*}, Rajendra Prasad², Syed Ali Aasim³

¹Assistant Professor, Department of Anesthesiology, Chalmeda Anandrao Institute of Medical Sciences, Bommakal Village, Karimnagar District, Telangana, India

²Post Graduate, Department of Anesthesiology, Chalmeda Anandrao Institute of Medical Sciences, Bommakal Village, Karimnagar District, Telangana, India

³Professor & HOD, Department of Anesthesiology, Chalmeda Anandrao Institute of Medical Sciences, Bommakal Village, Karimnagar District, Telangana, India

ABSTRACT

Background: Better airway management during induction of anaesthesia can be predicted by systems like Cormack-Lehane (CL) grade. **Aims and Objectives:** To evaluate the utility of ultrasonography in preanaesthetic airway assessment. **Materials and Methods:** Ultrasound measurements of the anterior neck soft tissue thickness at the level of the hyoid (ANS-Hyoid), anterior neck soft tissue thickness at the level of the vocal cords (ANS-VC) and ratio of the depth of the pre-epiglottic space (Pre-E) to the distance from the epiglottis to the mid-point of the distance between the vocal cords (E-VC) were obtained in 80 patients. CL grade was noted during intubation. **Results:** Chi-square test was used to find if there was any statistical difference in the measurements of patients with different CL grades. Difficult intubation was seen in 14%. An ANS-VC >0.23 cm had a sensitivity of 85.7% in predicting a CL Grade of 3 or 4, which was higher than that of MP class, TMD and SMD. **Conclusion:** Ultrasound is a useful tool in airway assessment

Keywords: Airway, Cormack-Lehane grade, direct laryngoscopy, ultrasonography

Introduction

Anaesthesiologists perform preoperative assessment of patient's airway in order to carry out intubation, which is one of the main challenges in the field of anaesthesiology. Proper airway management is vital for mortality and morbidity of patients. Various clinical criteria are used to evaluate patient's airway prior to induction of anesthesia like Mallampati classification, Wilson scoring system, Samssoon and Young scoring system using anatomical structures like thyromental distance, mouth-opening size, neck extension, jaw protrusion and the upper-lip bite test. But of all these methods, Cormack-Lehane classification has been shown to be more reliable one [1].

The basis for the use of ultrasonography (USG) for assessing tissues in close vicinity to the larynx is by observing through direct laryngoscopy.

It involves using the laryngoscope blade into the mouth and displacing the tongue, epiglottis and hyoid bone into the subglottal space. Authors hypothesised that increase in anterior neck soft tissue thickness may impair the forward mobility of the pharyngeal structures [2,3] and that an increase in the pre-epiglottic space or a decrease in the distance from the epiglottis to the vocal cords could be associated with increasingly difficult laryngoscopy and intubation [4]. Very few studies are conducted to compare the ultrasound (US) parameters to the Cormack-Lehane (CL) grade and physical parameters. Hence, we carried out our study to determine the utility of the US measurement of three parameters in the evaluation of the airway: anterior neck soft tissue thickness at the level of the hyoid (ANS-Hyoid), anterior neck soft tissue thickness at the level of the vocal cords (ANS-VC) and ratio of the depth of the PES (Pre-E) to the distance from the

*Correspondence

Dr. Karthik Satya

Post Graduate, Department of Anesthesiology, Chalmeda Anandrao Institute Of Medical Sciences, Bommakal Village, Karimnagar District, Telangana State, India

epiglottis to the mid-point of the distance between the vocal cords (E-VC). We used three physical parameters: Mallampati (MP) class, thyromental distance (TMD) and sternomental distance (SMD)[5-8].

Materials and Methods

After obtaining Institutional ethical committee approval, 80 patients undergoing elective surgery under general anaesthesia with endotracheal intubation were included in our study. Ours is a prospective, observational study conducted in the neuroanaesthesia department of a tertiary care centre. We studied 80 patients undergoing general endotracheal anaesthesia. Mallampati (MP) class, thyromental distance (TMD) and sternomental distance (SMD) were noted. Ultrasound measurements of the anterior neck soft tissue thickness at the level of the hyoid (ANS-Hyoid), anterior neck soft tissue thickness at the level of the vocal cords (ANS-VC) and ratio of the depth of the pre-epiglottic space (Pre-E) to the distance from the epiglottis to the mid-point of the distance between the vocal cords (E-VC) were obtained. CL grade was noted during intubation.

Inclusion criteria

1. Patients above the age of 18 years
2. Patients without any known airway pathology

Exclusion Criteria

1. Patients requiring rapid sequence intubation,
2. Patients with cervical spine pathology,

3. Patients scheduled for fiberoptic tracheal intubation,
4. Uncooperative patients and
5. Pregnant patients

US measurements were obtained using a SonoSite® MicroMaxx® ultrasound system (SonoSite INC, Bothell, WA, USA) with HFL38/13-6 MHz transducer. All the patients were induced and intubated by a senior anaesthesiologist with more than 10 years of experience. Direct laryngoscopy was done with a Macintosh blade (size 3 blade in female patients and medium sized male patients or size 4 blade in well built male patients) and the CL grade was noted. Intubation was classified as easy (CL Grade 1 and 2) or difficult (CL Grade 3 and 4).

The MS Excel® and SPSS® 10.5 (SPSS Inc., Chicago, IL, USA) software packages were used for data entry and analysis. The results were averaged (mean \pm standard deviation [SD]) for each parameter for continuous data. The Chi-square test was used to determine whether there was a statistical difference between the patients with easy and difficult intubations.

Results

It was found that 41% of the patients had CL Grade 1, 51% had CL Grade 2 and 8 % had CL Grade 3. There were no patients with CL Grade 4. Tables 1 show the distribution of the CL grade in comparison with the US parameters, MP class, TMD and SMD.

Table 1: Comparison of ultrasound parameters with Cormack–Lehane (CL) grade

Parameter	CL grade	N	MEAN
ANS-HYOID	1	29	0.32
	2	35	0.34
	3	6	0.38
ANS-VC	1	29	0.22
	2	35	0.24
	3	6	0.33
Pre-E	1	29	0.88
	2	35	1.02
	3	6	1.06
E-VC	1	29	0.82
	2	35	0.87
	3	6	0.78
Pre- E/E- VC	1	29	1.22
	2	35	1.25
	3	6	1.38

Discussion

It has become mandatory for anaesthesiologists to keep ultrasound as a part of their armamentarium both in operation theatre and critical care areas. US may be used for prediction of paediatric ETT size, prediction of double lumen tube size, confirmation of correct placement of ETT, diagnosis of upper airway pathology, guidance of percutaneous tracheostomy and cricothyroidotomy for performing nerve blocks. It has also been used to assess the size of the tongue, floor of the mouth musculature, Pre-E, E-VC and anterior neck soft tissue thickness[9-12]. In our study, we found that ANS-VC measurement is a potential tool in airway assessment and a thickness of more than 0.23 cm correlated with the prediction of difficult intubation. Our findings are in accordance with Ezri et al who found that the patients in whom laryngoscopy was difficult had more pre-tracheal soft tissue (mean [SD] 28 [2.7] mm vs. 17.5 [1.8] mm; $P < 0.001$) and greater neck circumference (50 [3.8] vs. 43.5 [2.2] cm; $P < 0.001$)[13-15]. We could not prove that ANS-Hyoid to be a significant predictor of difficult intubation. However Adhikari et al found conflicting findings. This might be due to the differences in the study populations involved [2]. We found that MP and SMD as good predictors of difficult intubation, but not TMD. Amongst all the parameters assessed, the ANS-VC had the highest sensitivity in predicting difficult intubation, which was higher than that of the MP class, TMD and SMD. US measurement of the ANS-Hyoid was not a useful indicator of difficult intubation in our study group. The ratio Pre-E/E-VC was useful in predicting a difficult intubation. We recommend such studies on a larger sample size and with more parameters.

Conclusion

US measurement of the ANS-VC is a potential predictor of difficult intubation, whereas ANS-Hyoid is not a useful indicator in predicting difficult intubation. The ratio Pre-E/E-VC has a low to moderate predictive value.

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