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TO MEASURE THE CORRELATION BETWEEN ULTRASONOGRAPHY MEASURED HYOMENTAL DISTANCE RATIO AND EASE OF LARYNGOSCOPY.

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Abstract

Background: Difficult and failed tracheal intubation after direct laryngoscopy is a dreaded complication of general anesthesia as it is associated with serious morbidity and mortality.

Methods: Prospective Observational conducted at Department of Anesthesiology, Dr. RPGMC Kangra at Tanda, Himachal Pradesh.

Results: In the present study, the mean hyomental distance ratio was (mean±SD:1.1.±.127 and 1.04±.018) in predicting CL grade 3 and 4 respectively (P=0.010) and 1.12±.033, 1.11±.035 in grade 1 and 2 respectively.

Conclusion: Ultrasound is better and fast in confirming endotracheal intubation.

Keywords: Ultrasound, endotracheal intubation, direct laryngoscopy.

Introduction

Difficult and failed tracheal intubation after direct laryngoscopy is a dreaded complication of general anesthesia as it is associated with serious morbidity and mortality.[1] There are several conventional clinical airway assessment parameters such as the modified Mallampati classification, hyomental and thyromental distance, neck movements, interincisor distance, and neck circumference, which are usually used to predict a difficult airway and are components of multivariate risk indices. Despite the use of these parameters, the diagnostic accuracy of a preanesthetic airway assessment in predicting difficult intubation is very low.[4] Ultrasound has been evolving as a useful device for airway assessment, and sublingual ultrasound has been used for this purpose.[5] The ability to visualize the hyoid through sublingual ultrasound has been recently shown to be an objective modality for predicting difficult laryngoscopic view.

Material and Methods

Type of Study- Prospective Observational

Place of Study–Department of Anesthesiology, Dr. RPGMC Kangra at Tanda, Himachal Pradesh

Study Population– After approval by institutional ethics committee and obtaining informed consent, prospective and observational study was carried out over the period of one year.

Inclusion criteria

1. Males and females between the age group 18-60 years.
2. ASA physical class I-II.
3. BMI 18.5-29.9.

Exclusion criteria

1. Patient's refusal to participate in the study
2. Rapid-sequence induction of anesthesia
3. Inability to open the mouth due to existing trauma or medical condition, preexisting neck or facial disease-causing distortion of the airway, edentulous, and/or a history of difficult intubation
4. Altered level of consciousness, confusion, or inability to follow commands
5. Preexisting limitation or pain with cervical spine movement. Patients requiring rapid-sequence induction are already at high risk for aspiration; the airway should be rapidly secured with an endotracheal tube and not subjected to repeated or delayed assessment as might occur in the study.

Blinding

The interpreter reliability was double-blinded, that is, the anesthesiologist assessing glottic exposure and the investigator recording the observations were blinded to the preoperative sonographic airway assessment results.

Methodology

The enrolled patients underwent sonographic assessment of airway by the anesthesiologist in the pre-operative holding area. The ultrasound view of the airway of all study patients was assessed with a high-frequency linear probe or low frequency curved probe (SonoSite® MicroMaxx® ultrasound system (SonoSite INC, Bothell, WA). The following measurements were obtained with the patient in supine position and head and neck in a neutral position:

A curved low-frequency (5-MHz) transducer was used to visualize the tongue and shadows of the hyoid bone and mandible. The mentum and hyoid bone appear in midsagittal scans as hyperechoic structures with hypoechoic shadowing. The hyomental distances in the neutral and head-extended positions were measured from the upper border of the hyoid bone to the lower border of the mentum in the neutral and extended head positions.

The thicknesses of anterior neck soft tissue at the hyoid bone and the thyrohyoid membrane were obtained transversely across the anterior surface of the neck with a 13–6 MHz linear array ultrasound probe attached to a SonoSite S-nerve machine (SonoSite Inc., Bothell, WA, USA). At hyoid bone level, the minimal distance from the hyoid bone to the skin surface (DSHB) was measured and at thyrohyoid membrane level, the distance from skin to epiglottis midway (DSEM) between the hyoid bone and thyroid cartilage was measured.

The following measurements were obtained with the oblique-transverse ultrasound view of the airway: (a) the distance from the epiglottis to the midpoint of the distance between the vocal folds, (b) the depth of the pre-epiglottic space

After intravenous induction with midazolam 0.04 mg/kg, propofol 2–2.5 mg/kg, fentanyl 2μg/kg, and atracurium besylate 0.5 mg/kg, endotracheal intubation was carried out by anesthesia providers with a minimum of 2 years experience in endotracheal intubation with the patient in a neutral position without neck overextension or over-bending. The Macintosh blades were used to expose the target larynx, and no external laryngeal pressure was used to facilitate this process. Classification of laryngoscopic views was based on the method described by Cormack and Lehane.[2] Grade I is full view of the glottis. Grade II is a partial view of the glottis or arytenoids. Grade III is the only epiglottis seen. Grade IV is neither glottis nor epiglottis visible. Grade I and II are categorized as easy laryngoscopy. Grade III or IV are categorized as difficult laryngoscopy.

Real-time tracheal ultrasonography was performed during the intubation with the transducer placed transversely just above the suprasternal notch, to assess for endotracheal tube positioning and exclude esophageal intubation. The position of trachea was identified by a hyperechoic air-mucosa (A-M) interface with posterior reverberation artifact (comet-tail artifact). The endotracheal tube position was considered as endotracheal if single A-M interface with comet-tail artifact was observed. Endotracheal tube position was defined as intra-esophageal if a second AM interface appeared, suggesting a false second airway (double tract sign).

A standard protocol was followed for auscultation with the investigator first auscultating over the epigastrium, then in the right and left lung in that order. Unchanged ETCO2 levels and capnography after six ventilations were regarded as final proof of endotracheal intubation. Time measurement was started when the laryngoscope blade was introduced into the mouth to confirmation of the tube placement by sonographically, auscultation and capnography.

Statistical analysis

Data were presented as frequency, percentages or mean±SD, wherever applicable. Categorical variables between the groups were compared using Chi-square test. Quantitative variables between the groups were compared using student t-test. A P values less than 0.05 considered significant. Statistical analyses were performed using SPSS trial version 21.

Results

The present study was aimed to preoperative assess airway by the point of care USG in patients undergoing surgery under general anesthesia. The prospective observational study was conducted for a period of one year in Department of Anesthesiology, Dr. RPGMC, Kangra at Tanda, Himachal Pradesh. A total of 200 patients were included in the study after they fulfilled inclusion criteria

Age

The patients' age ranged from 18 to 60 years with a mean age of 41.68 years. Majority of the patients (28%) were in 31-40 year age-group followed by 51-60 years (27%), 21-30 years (22.5%), and 41-50 years (21%)

Table 1: Age-based distribution of the patients

		Number of patients (n=200)
Age (years)		41.68
Age-group (Years)	<21	3 (1.5%)
	21-30	45 (22.5%)
	31-40	56 (28%)
	41-50	42 (21%)
	51-60	54 (27%)

The patients were classified according to Cormack Lehane grading system. It was observed that 44% patients (n=88) were in grade 2 followed by 27 % (n=54) in grade 1, grade 3 was observed in 24.5% patients (n=49) whereas Cormack Lehane grade 4 was seen in 4.5% patients (n=9) (fig 2).

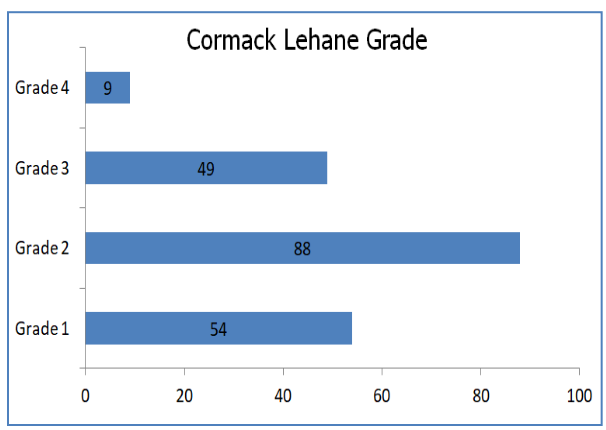

Fig. 1: Distribution of patients on the basis of Cormack Lehane Grading

Table 2: Comparison of Different variables in different grades

	Cormack Lehane Grading (n=200)				P Value
	Easy (n=142)		Difficult (n=58)		
	Grade 1 (n=54)	Grade 2 (n=88)	Grade 3 (n=49)	Grade 4 (n=9)	
HMDN (cm)	5.52±.366	5.48±.349	5.64±.431	5.41±.421	p^{1234}=0.072
HMDE (cm)	6.19±.395	6.12±.379	6.14±.475	5.71±.438	p^{1234}=0.014 p^{14}= 0.007 p^{24}=0.023 p^{34}=0.023
HMDR (cm)	1.12±.033	1.11±.035	1.10±.127	1.04±.018	p^{1234}=0.010 p^{14}= 0.007 p^{24}=0.010

The present study found that there was a significant difference (P=0.072) in HMDN of the patients in grade 1 (5.52±.366), grade 2 (5.48±.349), grade 3 (5.64±.431), and grade 4 (5.41±.421)

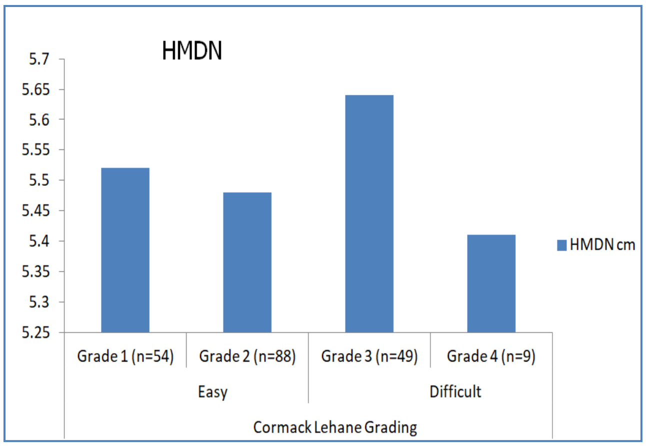

Fig. 2: HMDN

HMDE

HMDE was significantly different (P=0.014) in grade 1 (6.19±.395), grade 2 (6.12±.379), grade 3 (6.14±.475), and grade 4 (5.71±.438). We also found a significant difference in HMDE between grade 1 and 4 (P=0.007), grade 2 and 4 (P=0.023), and grade 3 and 4 (P=0.023).

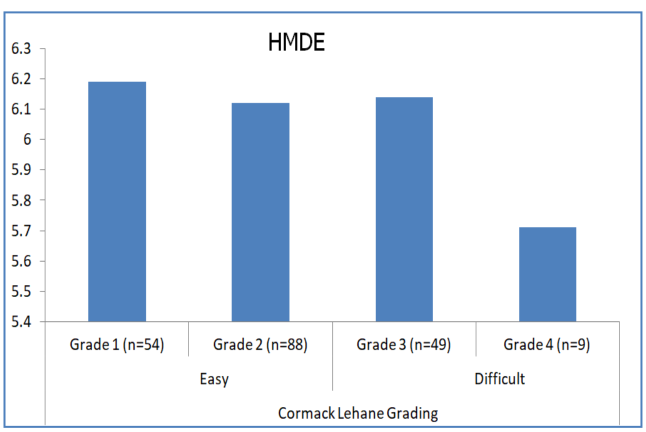

Fig.3s: HMDE

HMDR was significantly different (P=0.010) in grade 1 (1.12±.033), grade 2 (1.11±.035), grade 3 (1.10±.127), and grade 4 (1.04±.018). We also found a significant difference in HMDR between grade 1 and 4 (P=0.007) and grade 2 and 4 (P=0.010).

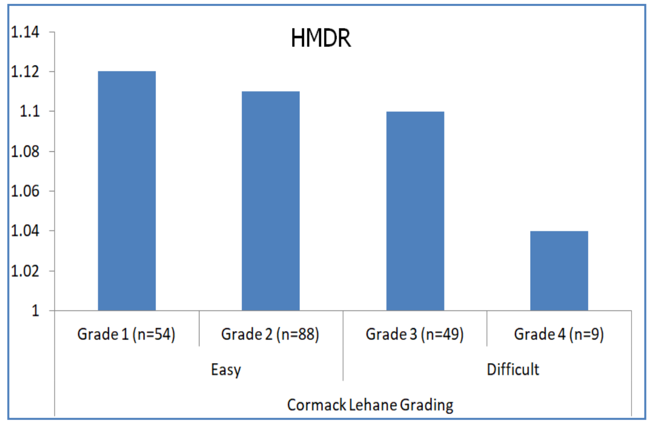

Fig. 4: HMDR

Table 3: Diagnostic Values of Hyomental distance-related parameters

	HMDN	HMDE	HMDR
Sensitivity	56.90%	31.03%	65.52%
Specificity	66.20%	88.03%	77.46%
Positive Predictive Value	40.74%	51.43%	54.29%
Negative Predictive Value	78.90%	75.76%	84.62%
P Value	0.044	0.405	0.000

Discussion

Maintaining a patent airway is a prime responsibility of an anesthesiologist. Interruption of gas exchange, even for few minutes can lead to catastrophic events like brain damage or can lead to death. Theoretically, accurate preoperative airway evaluation can reduce or avoid unanticipated difficult intubation. However, the difficult laryngoscopy and tracheal intubation rate still remain at 1.5–13% due to poor reliability of traditional protocols, algorithms, and combinations of screening tools in identifying a potentially difficult airway.

Many screening tests have been designed for airway assessment during pre-anesthetic checkup. These include mouth opening, Modified Mallampati classification, thyromental distance assessment, and atlanto-occipital extension, jaw protrusion, and the upper lip bite test. Even when these tests are used alone or combination, they do not predict accurately the CL grading during direct laryngoscopy. These non-invasive tests have lower predictive value.

Therefore there is a need for new non-invasive methods like USG which can predict CL grading preoperatively with a higher predictive value. The ultrasonography has brought a paradigm shift in the practice of airway management. With increasing awareness, portability, accessibility and further sophistication in technology, it is likely to find a place in routine airway management.

In the present study, the mean hyomental distance ratio was (mean±SD:1.1.±.127 and 1.04±.018) in predicting CL grade 3 and 4 respectively (P=0.010) and 1.12±.033, 1.11±.035 in grade 1 and 2 respectively (P=.007)

In a similar study by Wojtczak JA,[6] five obese and 7 morbidly obese adult patients with a history of either difficult or easy intubation had a submandibular sonographic examination performed in the supine position. The mean hyomental distance ratio in 6 patients who presented with a history of difficult intubation was 1.02 ± 0.01, and the ratio in 6 patients whose airway was easy to intubate was 1.14 ± 0.02 (P< .002). The authors observed that the sonographic hyomental distance ratios in the difficult intubation group were in the 1 to 1.05 range and those in the easy intubation group were in the 1.12 to 1.16 range.

The difference in the range could be because, in the study by Wojtczak JA[6], only 12 obese patients were recruited, in comparison to the present study having 200 patients with basal metabolic index less than 29.9 kg/m^2.

In the present study, the specificity and negative predictive value of HMDR in predicting easy intubation is 77.46% and 84.62% respectively. The sensitivity and positive predictive value of HMDR in predicting difficult intubation was 65.52% and 54.29% respectively. In our study, the cutoff value of HMDR in predicting easy and difficult intubation is 1.09500.

In a similar study by Huh et al[7] evaluated the predictive value of surface hyomental distance ratio measurements in 203 consecutive nonobese adult patients undergoing elective surgery and anesthesia with tracheal intubation. There were 28 out of 203 patients categorized as difficult laryngoscopy. The hyomental distance ratio alone had the highest predictive validity for difficult laryngoscopy with an optimal cut off point of 1.2. At this cutoff point, the hyomental distance ratio had a sensitivity of 88% and specificity of 60% for predicting difficult laryngoscopy.

The difference could be because of the lesser number of patients in the difficult laryngoscopy group.

Conclusion

Hyomental distance ratio is a good predictor for predicting difficult intubation. The low sensitivity of the hyomental distance ratio and the hyomental distance in extension shows that the airway assessment must not rely on these predictors only.

Bibliography

1. Peterson GN, Domino KB, Caplan RA, Posner KL, Lee LA, Cheney FW, et al. Management of the difficult airway: A closed claims analysis. Anesthesiology 2005;103:33-9.
2. Mallampati SR. Clinical sign to predict difficult tracheal intubation (hypothesis). Can Anaesth Soc J 1983;30:316-7.
3. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, et al. A clinical sign to predict difficult tracheal intubation: A prospective study. Can Anaesth Soc J 1985;32:429-34.
4. Karkouti K, Rose DK, Wigglesworth D, Cohen MM. Predicting difficult intubation: A multivariable analysis. Can J Anaesth 2000;47:730-9.
5. El-Ganzouri AR, McCarthy RJ, Tuman KJ, Tanck EN, Ivankovich AD. Preoperative airway assessment: Predictive value of a multivariate risk index. Anesth Analg 1996;82:1197-204
6. Wojtczak JA. Submandibular sonography: assessment of hyomental distances and ratio, tongue size, and floor of the mouth musculature using portable sonography. *J Ultrasound Med*. 2012;31(4):523-528.
7. Huh J, Shin H-Y, Kim S-H, Yoon T-K, Kim D-K. Diagnostic Predictor of Difficult Laryngoscopy: The Hyomental Distance Ratio. *Anesth Analg*. 2009;108(2):544-548.