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RESEARCH ARTICLE
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DIAGNOSTIC ACCURACY OF HYOMENTAL DISTANCE RATIO FOR PREDICTION OF DIFFICULT VISUALIZATION OF LARYNX

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ABSTRACT

Background: For general Anesthesia most of the time we use ETT and some time it is very difficult to pass ETT and some time it is even impossible to pass ETT which can lead to morbidity and mortality. There are different clinical methods to assess such a difficult intubation before induction of anesthesia like Mallampati classification, upper lip bite test, Lemon score, thyromental distance and hyomental distance ratio.

Objectives: To find the diagnostic accuracy of the hyomental distance ratio for the prediction of difficult visualization of larynx.

Material & Methods: This cross-sectional study was done at Mayo Hospital Lahore. Total 250 patients undergoing elective surgeries with general anesthesia were included. After approval from ethical committee inform consents and their basic demographic detail were taken. All anesthetics procedures and assessments were done by single consultants. Position of patient was supine with firmed head with the table. All Patients were advised to look straight by keeping head in neutral position with mouth close and no swallowing at the time of assessment.

Results: Mean age of patients were 39.12±38.50 years. There were 109(43.6%) Male & 141(56.4%) female cases. 45(18%) cases were assessed as difficult visualization on Cormack Lehane and 50(20%) cases were having difficult visualization on hyomental distance ratio. The sensitivity, specificity, positive predictive value, negative predictive value and overall diagnostic accuracy of hyomental distance ratio was 89.89%, 95.12%, 80%, 97.50% & 94% taking Cormack Lehane as gold standard and P-value was < 0.05.

Conclusion: The diagnostic accuracy of the hyomental distance Ratio was found high for prediction of difficult visualization of larynx by taking Cormack Lehane as gold standard.

Keywords: General Anesthesia, Hyomental Distance Ratio, Cormack Lehane Classification.

INRODUCTION

General anesthesia is a medically induced state during which patient is completely unconscious and unresponsive to painful stimuli during all invasive procedure. Endotracheal intubation is a very important part of general anesthesia.[12] During endotracheal intubation cardiovascular effects are very common in patients[3]. Marked hypertensin or hypotension can cause adverse outcome of patient[45.] To reduce this stress response during induction of general anesthesia different gadgets are also used instead of endotracheal tube like supra glottic devises and intubating laryngeal mask airways (ILMA)[6]. During anticipated or un anticipated difficult intubation the laryngoscopy time increases which causes very sever pressor response but during anticipated difficult intubation most of the time prophylactic measures are taken which are very helpful to prevent such surge of increase in pressures. Different clinical methods are used to find difficult intubation like upper lip bite test (ULBT), Mallampati classification, Sternomental distance (SMD), Horizontal length of mandible (HLM), Inter- incisor gap(IIG), Thyromental distance (TMD), Neck circumference and hyomental distance ratio[7]. In this study we will analyze the hyomental distance ration and it is defind as "The ration of hyomental distance in neutral position and at head extension"[8]. The ultrasound (POCUS) is a reliable air way assessment tool both in adults and children[9 10 11]. The measurement taken with ultrasound are comparable with the measurements taken with other methods and are reliable [12]. Similarly ultrasound measurement of hyomental distance ration in morbid obese patients is also very reliable due to difficulties in palpating anatomical structure of air way [13]. Similarly measurement of hyomental distance with ultrasound is also very reliable in newborns for forecasting difficult laryngoscopy [14]. Measurement of hyomental angel and distance is also very important factor for assessment of air way [15]. The rationale of this study is that we want a reliable and accurate method for prediction of difficult visualization of larynx by taking Cormack Lehane as gold standard. To prevent a patient from any kind of complication of laryngoscopy and endotracheal intubation.

METERIAL &METHODS

After approval by research and ethics committee of Mayo Hospital LHR, this cross sectional study was done by anesthesia department by total 250 patients undergoing elective surgery with general anesthesia were included. Informed consent and basics demographic details were taken. All anesthetic procedure and assessment were done by single consultant. Position of all patients during assessment was supine with firmed head with the table. All patient were advised to look straight by keeping head in neural position with mouth close and swallowing at the time of assessment. The sampling the technique was non-probability consecutive sampling. We used 95% confidence interval and 12%margen of error for both sensitivity and specificity and the prevalence of DVL (Difficulty in visualization of larynx) as 12.2% using sensitivity 88% and specificity 60% [16].

The ruler was pressed on the skin surface above the hyoid bone, and the distance from the tip to the anterior-most part of the mentum and hyoid bone was measured and said as the Hyomental distance (HMD) in the neutral position. The patients were then said to to extend the head maximally, take consideration that shoulders would not be lifted while extending the head. The HMD was measured again in this position, and this variable was defined as the HMD at the extreme of head extension. The Hyomental distance ratio (HMDR) was calculated as the ratio of HMD at the extreme of head extension to that in the neutral position. After pre-oxygenation all patients was induced with propofol and paralyzed with muscle relaxant according to body weight to facilitate good orotracheal intubating condition. Laryngoscopy was performed after full relaxation. The head was placed in sniffing position and an appropriate Macintosh blade was used. Glottic visualization was assessed by using modified Cormach and Lehane classification without external laryngeal manipulation. External laryngeal pressure was permitted after evaluation for insertion of endotracheal tube.

SPSS version 22 was used for data analysis mean ± S.D was used for quantitative data like age and frequency (%) was use for qualitative variables gender. Sensitivity, specificity and diagnostic accuracy was calculated after making 2 X 2 table. Data was stratified for age, gender and BMI to

address the affect modifiers. Post stratified sensitivity, specificity and overall diagnostic accuracy was also calculated.

RESULTS

Table -1: Descriptive statistics of age (years)

Mean	39.12
Std. Deviation	12.04
Range	42.00
Minimum	18.00
Maximum	60.00

Table-2: Comparison of hyomental distance ratio taking Cormack Lehane as gold standard

Difficult visualization on		**Cormack Lehane**		**Total**
		Positive	**Negative**	
Hyomental distance ratio	**Positive**	40	10	50
	Negative	5	195	200
Total		45	205	250

Sensitivity	89.89%
Specificity	95.12%
Positive Predictive Value	80%
Negative Predictive Value	97.5%
Diagnostic Accuracy	94%

Table-3: Comparison of hyomental distance ratio taking Cormack Lehane as gold standard with respect to age groups (years)

Age groups	**Difficult visualization on**		**Cormack Lehane**		**Total**	**p-value**
			Positive	**Negative**		
18-39	**Hyomental distance ratio**	**Positive**	17	7	24	<0.001
		Negative	3	102	105	
40-60	**Hyomental distance ratio**	**Positive**	23	3	26	<0.001
		Negative	2	93	95	

	Age groups	
	18-39	40-60
Sensitivity	85%	92%
Specificity	93.58%	96.88%
Positive Predictive Value	70.83	88.46%
Negative Predictive Value	97.14%	97.89%
Diagnostic Accuracy	92.25%	95.87%

Table-4: Comparison of hyomental distance ratio taking Cormack Lehane as gold standard with respect to gender

Gender	**Difficult visualization on**		**Cormack Lehane**		**Total**	**p-value**
			Positive	**Negative**		
Male	**Hyomental distance ratio**	**Positive**	22	2	24	<0.001
		Negative	4	81	85	

Female	**Hyomental distance ratio**	**Positive**	18	8	26	<0.001
		Negative	1	114	115	

	Gender	
	Male	**Female**
Sensitivity	84.62%	97.74%
Specificity	97.59%	93.44%
Positive Predictive Value	91.67%	69.23%
Negative Predictive Value	95.29%	99.13%
Diagnostic Accuracy	94.5%	93.62%

Table-5: Comparison of hyomental distance ratio taking Cormack Lehane as gold standard with respect to ASA

ASA	**Difficult visualization on**		**Cormack Lehane**		**Total**	**p-value**
			Positive	**Negative**		
I	**Hyomental distance ratio**	**Positive**	29	2	31	<0.001
		Negative	3	62	65	
II	**Hyomental distance ratio**	**Positive**	11	8	19	<0.001
		Negative	2	133	135	

	ASA	
	I	**II**
Sensitivity	90.63%	84.62%
Specificity	96.88%	94.33%
Positive Predictive Value	93.55%	57.89%
Negative Predictive Value	95.38%	98.52%
Diagnostic Accuracy	94.79%	93.51%

Table-6: Comparison of hyomental distance ratio taking Cormack Lehane as gold standard with respect to BMI

BMI	**Difficult visualization on**		**Cormack Lehane**		**Total**	**p-value**
			Positive	**Negative**		
Non-obese	**Hyomental distance ratio**	**Positive**	18	6	24	<0.001
		Negative	3	175	178	
Obese	**Hyomental distance ratio**	**Positive**	22	4	26	<0.001
		Negative	2	20	22	

	ASA	
	I	**II**
Sensitivity	85.71%	91.67%
Specificity	96.69%	83.33%
Positive Predictive Value	75%	84.62%
Negative Predictive Value	98.31%	90.91%
Diagnostic Accuracy	95.54%	87.5%

DISCUSSION

The main factor involved in difficult intubation is difficulty in visualizing the larynx with laryngoscope. To solve this problem different techniques are used. In our study we used the hyomental distance ratio for prediction of difficult visualization of larynx and found it sensitive in 89.89%, specificity in 95.12%, positive predicative value was 80%, negative predicative value was 97.5% and overall diagnostic accuracy was 94%.

Huh et al conducted a study in Korea where they reported that HMDR was a good predictor for difficulty in visualizing the larynx with a sensitivity of 88% and specificity of 66%[16].In the study of Rao et al they evaluate the usefulness of hyomental distance ratio for accurately predicting difficult visualization of the larynx and found the sensitivity 27.78%, specificity 98.89%, positive predictive value 71.43% and negative predictive value 93.19% [17]. These finding are some how favor the result of current study. In the study of Bin Wang et al the compared the thyromental distance with hyomental distance ratio by using ultrasound and found that HMDR was more sensitive in predicting difficult intubation [18]. In the study of Simin Abraham et al they found that by using ultrasound hyomental distance is a more valid criterion in predicting difficult intubation[19].

CONCLUSION

In current study the diagnostic accuracy of the hyomental distance ratio is found high for prediction of difficult visualization of larynx taking Cormack Lehane as gold standard. So, in future, it can be used as it is a clinically reliable predictor of DVL to certain extent because of its high sensitivity and specificity.

REFERENCE

1. Nazeer T, Tahir A, Khan MBA, Din ST, Shoaib M, Asif M. Comparison of propofol and Etomidate in hemodynamic changes at the time of induction of general anesthesia. Pak J Med Health Sci Apr, 2021; 15(4): 685-687.
2. Dar SR, Hussain R, Nazeer T, Tahir A. Comparison of outcome of laryngeal mask airway (LMA Classic) & I-gel devices in patient undergoing general anesthesia in elective surgeries. Pak J Med Health Sci July, 2015; 9(3):1036-1038.
3. Nazeer T, Hussain R, Chaudry T, Ali M, Mehmood T, Younis M, Dar T, Tahir A.Hemodynamic Changes during induction ; comparison of propofol with mixture propofol & ketamine. Pak J Med Health Sci Oct, 2012; 6(4): 1006-1009.
4. Asghar HF, Aziz NK, Tariq N, Ali M, Tahir A, Hussain R, Javaid A, Nazeer T. Comparison of the frequency of hypotension with propofol & mixture of propofol – ephedrine during induction of general anesthesia.Pak J Med Health Sci July, 2019; 13(3):798-799.
5. Hussain U, Tahir A, Javaid Y, Nazeer T, Hussain R. Patient's Preference Regarding General or Regional Anesthesia for Elective Cesarean Section.Pak J Med Health Sci Jan, 2017; 11(1):409-410.
6. Asim MA, Hussain R, Nazeer T, Ali M. Blind Endotracheal intubation through intubating laryngeal mask airway: Is chandymanuever beneficial?Pak J Med Health Sci Apr, 2013;7(2):496-499.
7. Dar S, Khan MS, Iqbal F, Nazeer T, Hussain R. Comparison of upper lip bite test (ULBT) with mallampati classification, regarding assessment of difficult intubation. Pak J Med Health Sci Apr, 2017;11(2)767-769.
8. Hrithma DR, Rooparani K, Mahadevaiah DR T, Wikas KN. A cross – sectional study on hyomental distance ratio as a new predictor of difficult laryngoscopy in ICU patients. Cureus 2022 May 28; 14(05):e25435.doi:10.7759/cureus.25435.ecollection 2022may.
9. Koundal V, Rana S, Thakur R, Chauhan V, Ekke S, Kumar M. The usefulness of point of care ultrasound (POCUS) in preanesthetic airway assessment. Indian J anaesth 2019 Dec;63(12):1022-1028.doi:10.4103/ija.IJA_492_19.epub2019Dec11.
10. Zheng Z, Wang X, Du R, Wu Q, Chen L, Ma W. Effectiveness of ultrasonic measurement for the hyomental distance and distance from skin to epiglottis in predicting difficult laryngoscopy

in children. EurRadiol. 2023Nov;33(11):7849-7856DOI: 10.1007/s00330-023-09757-z.Epub2023May31.
11. Gottlieb M, O'Brien J R, Ferrigno N, Sundaram T. Point-of-care ultrasound for airway management in the emergency and critical care setting. Clin Exp Emerg Med. 2024 Mar;11(1):22-32. doi: 10.15441/ceem.23.094. Epub 2023 Nov 25.
12. Sotoodehnia M, Abbasi N, Bahri R A, Abdollahi A, Baratloo A. Accuracy of airway ultrasound parameters to predict difficult airway using the LEMON criteria as a reference: A cross-sectional diagnostic accuracy study. Turk J Emerg Med. 2023 Jan 2;23(1):38-43. doi: 10.4103/2452-2473.366484. eCollection 2023 Jan-Mar.
13. Petrișor C, Trancă S, Szabo R, Simon R, Prie A, Bodolea C. Clinical versus Ultrasound Measurements of Hyomental Distance Ratio for the Prediction of Difficult Airway in Patients with and without Morbid Obesity. Diagnostics (Basel). 2020 Mar 3;10(3):140. doi: 10.3390/diagnostics10030140.
14. Liu X, Han F, Zhang L, Xia Y, Sun Y Value of the Hyomental Distance Measured With Ultrasound in Forecasting Difficult Laryngoscopy in Newborns.J PerianesthNurs2023 Dec;38(6):860-864. doi: 10.1016/j.jopan.2023.02.004. Epub 2023 Jun 30.
15. Gadepalli C, Stepien KM, Tol G Hyo-Mental Angle and Distance: An Important Adjunct in Airway Assessment of Adult Mucopolysaccharidosis. J Clin Med 2021 Oct 25;10(21):4924. doi: 10.3390/jcm10214924.
16. Huh J, Shin HY, Kim SH, Yoon TK, Kim TK Diagnostic predictor of difficult laryngoscopy: the hyomental distance ratio.AnesthAnalg 2009 Feb;108(2):544-8. doi: 10.1213/ane.0b013e31818fc347.
17. Rao ST, Gowda V, Reddy RV. Hyomental distance ratio as a diagnostic predictor of difficult laryngoscopy. Ind J Applied Res. 2013;3(8):511-3.
18. Wang B, Wang M, Yang F, Zheng C, Yu Y, Xu J, Chen Y, Yao W. Predicting difficult intubation: the hyomental distance ultrasound evaluation is superior to the thyromental distance.Anaesth Crit Care Pain Med 2022 Dec;41(6):101144. doi: 10.1016/j.accpm.2022.101144. Epub 2022 Aug 18.
19. Abraham S, Himarani J, Nancy SM, Shanmugasundaram S, Raja VBK Ultrasound as an Assessment Method in Predicting Difficult Intubation: A Prospective Clinical Study.
J Maxillofacial Oral Surg 2018 Dec;17(4):563-569. doi: 10.1007/s12663-018-1088-1. Epub 2018 Mar 8.