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EVALUATING THE RELATIONSHIP BETWEEN PREOPERATIVE ULTRASONOGRAPHIC AIRWAY ASSESMENT AND CORMACK-LEHANE GRADING IN DIRECT LARYNGOSCOPIC VIEW FOR PREDICTING DIFFICULT AIRWAY IN ADULT PATIENTS

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ABSTRACT

Background: Difficult tracheal intubation is associated with serious morbidity and mortality and cannot be always predicted based on Preoperative airway assessment using conventional clinicalpredictors. Ultrasonographic airway assessment could be useful adjunct, so the present study was conducted to find the correlation between Preoperative ultrasonographic airway assessment using a parameter - Measuring the distance from skin to epiglottis for prediction of difficult direct laryngoscopy and the Cormack-Lehane grade at laryngoscopic view in adult patients. **Methodology:** The study was Prospective Randomized Comparative study. A predesigned proforma was be used, rating scales were be used. During preanesthestic evaluation of the patients, demographic variables were collected from each patient and clinical screening tests to predict a difficult airway were performed in the form of Mallam patti grading, Thyromental distance & ultrasonographic measured distance from skin to epiglottis (DSE). Statistical analysis and interpretations were performed using PASW (Predictive Analysis Software 26). **Results:** There were 66 patients. Association of the demographic variables (age, sex, height, weight and BMI) were assessed using student t-test for age, height, weight and BMI while fisher's exact test was used for sex. There was no statistical association between these demographic variables and intubation status. The association between Cormack Lehane grading & Mallampati grading was significant. The association between DSEM (thyrohyoid membrane) & Cormack Lehane Grading were significant. ($P< 0.05$). ROC curve was 0.842 with Sensitivity - 81.8% & Specificity – 30.6%. **Conclusion:** In our study, skin-to-epiglottis distance (DSEM) measured at the thyrohyoid membrane level emerged as a strong predictor of difficult airway.

Key words: Airway management, intubation, laryngoscopy, ultrasonography.

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INTRODUCTION

Airway management is a major concern for the anaesthesiologists. "Difficult tracheal intubation that can cause intubation delay or failure, significantly increases the morbidity and mortality of general anesthesia". Patients undergoing general anesthesia have reported a wide range of incidences of difficult laryngoscopy and intubation, ranging from 1% to 15% in different circumstances.

According to reports, the prevalence of difficult laryngoscopy ranges from "1.5% to 20%" worldwide. A common procedure for maintaining the airway during general anesthesia is endotracheal intubation. Even highly skilled anesthesiologists may have difficulties during an unexpectedly difficult intubation, which may result in a failed intubation and raise morbidity and death. The appropriate management of challenging airway disorders is aided by routine preoperative airway examination. "Clinical screening tests used routinely in airway assessment lack adequate sensitivity and specificity for detecting difficult laryngoscopy". "Cormack-Lehane (CL) grading view, obtained during direct laryngoscopy, is an invasive procedure and cannot be used for routine preoperative airway assessment". Using ultrasound to check the airway before to surgery is a non-invasive diagnostic technique that can be used to measure features that could indicate a problematic airway.

"Cormack and Lehane grading are a gold standard to predict difficult laryngoscopy and tracheal intubation". But this is done after induction and muscle relaxation, not good to predict difficult laryngoscopy before induction. Anticipating difficult airway in the preoperative period and preparedness to manage it is an important task of anesthetist.

One of these parameters which recently had good predictive results was the ultrasonic measured distance from skin to epiglottis at level of thyrohyoid membrane but with marked variation of its value.

The purpose of this study is to evaluate the variability and accuracy of ultrasonography in assessing the airway.

AIM AND OBJECTIVES

AIM

To study "the correlation between ultrasonographic airway assessment of distance from skin to epiglottis & Cormack-Lehane grading at laryngoscopic view for prediction of difficult laryngoscopy in adult patients".

OBJECTIVES

1. To measure the distance from skin to epiglottis using ultrasound for prediction of difficult laryngoscopy.
2. To study the correlation between ultrasonographic airway assessment & Cormack-Lehane grading in direct laryngoscopic view.
3. To evaluate difficult airway using ultrasound guided measurement of distance from skin to epiglottis in adult patients.

METHODOLOGY

After obtaining Institutional Ethical Committee approval, study was conducted in Government Medical College Hospital, Cuuddalore in the Department of Anesthesiology.

Once written informed consent has been obtained, the test group was be enrolled in the research. "Pre-anesthetic evaluation of the patients involved gathering demographic information from each individual and performing clinical screening tests (Mallampati score,

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thyromental distance, and ultrasonographic determined distance from skin to epiglottis) to anticipate a difficult airway (DSE)".

US-DSE was measured with a linear probe of a Sonosite ultrasound machine with a frequency of 10–13 mhz in transverse plane and varying degrees of cephalad/caudal angulation when patients were in a supine position with neutral head and neck and no pillows at the thyrohyoid membrane level (midway between the hyoid bone & thyroid cartilage). At the level of the thyrohyoid membrane, the epiglottis was shown to have a linear hypoechoic structure. Its hyperechoic pre-epiglottic area defines its posterior boundary. The measurement of the distance in centimetres was made from the skin's surface to the thyrohyoid membrane's middle axis, which is the highest point of the epiglottis.

Based on clinical and sonographic data, the patients were categorized as easy or difficult candidates for laryngoscopy after undergoing preoperative evaluation. Our own pilot study served as the basis for selecting the criteria for the sonographic parameters.

The patient was moved to the operating room the following morning, and baseline monitors for the ECG, noninvasive blood pressure, and pulse oximeter were connected and recorded. Midazolam 1 mg and fentanyl 2 µg/kg were given intravenously (IV) following a 3-minute preoxygenation with FiO2 1. Propofol injections at a dose of 2 mg/kg were used to induce anesthesia. Vecuronium 0.1 mg/kg IV injection for muscular relaxation, an anesthesiologist performed a direct laryngoscopy using a suitably sized curved Macintosh blade, noting the Cormack-Lehane (CL) laryngoscopic grade. The sonographic airway examination and preoperative clinical evaluation did not involve the intubating anesthesiologist.

Cormack Lehane early laryngoscopy was assigned to grades I and II, and difficult laryngoscopy to grades III and IV. After receiving an endotracheal tube of the proper size, the patients were intubated and permitted to undergo surgery. The patient was extubated and the neuromuscular block was reversed at the conclusion of the procedure. Confidentiality will be maintained.

OBSERVATION AND RESULTS

This research was carried out at the Cuddalore Government medical College.

Following the acquisition of well-informed permission, the study was started on 66 samples,in that 60 samples met the inclusion/exclusion criteria.

The following observation are

TABLE 1: SUMMARY OF PATIENT DEMOGRAPHIC & ANTHROPOMETRIC VARIABLE (N=40)

Variables	Mean ± Standard Deviation	Range
AGE (YEARS)	42.75±10.77	19-60
HEIGHT(CM)	158.33±5.89	148-171
WEIGHT (KG)	58.67±7.79	41-75
BMI(KG/M2)	23.25±1.90	18.72-26.47

TABLE 2: ASSOCIATION OF DEMOGRAPHIC VARIABLES WITH DIFFICULT INTUBATION

Variables	INTUBATION		P VALUE
	EASY (n=45)	DIFFICULT(n=15)	
AGE (YEARS)	**43.13**±10.18	**44.07**±14.88	0.358

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HEIGHT(CM)		158.78±6.215	157.00±4.76	0.164
WEIGHT (KG)		58.80±7.98	58.27±7.45	0.295
BMI(KG/M2)		23.14±1.88	23.58±71.97	0.441
GENDER	MALE	18(69.2%)	8(30.8%)	0.386
	FEMALE	27(79.4%)	7(20.6%)	

Association of the demographic variables (age, sex, height, weight and BMI) were assessed using student t-test for age, height, weight and BMI while fisher's exact test is used for sex. There is "no statistical association between these demographic variables and intubation status". Among study participants, the majority (66.7%) were in grade 1 ASA followed by 33.3% in grade II respectively.

TABLE 3: DISTRIBUTION OF STUDY SUBJECTS BASED ON MALLAMPATTI GRADING

Mallampatti grade	Frequency	Percent
I	45	75.0
II	10	16.7
III	5	8.3
IV	0	0.0
Total	60	100.0

Among study participants, the majority were in grade 1 (75%) grading distribution, followed by 16.7% in grade II, 8.3% in grade III respectively.

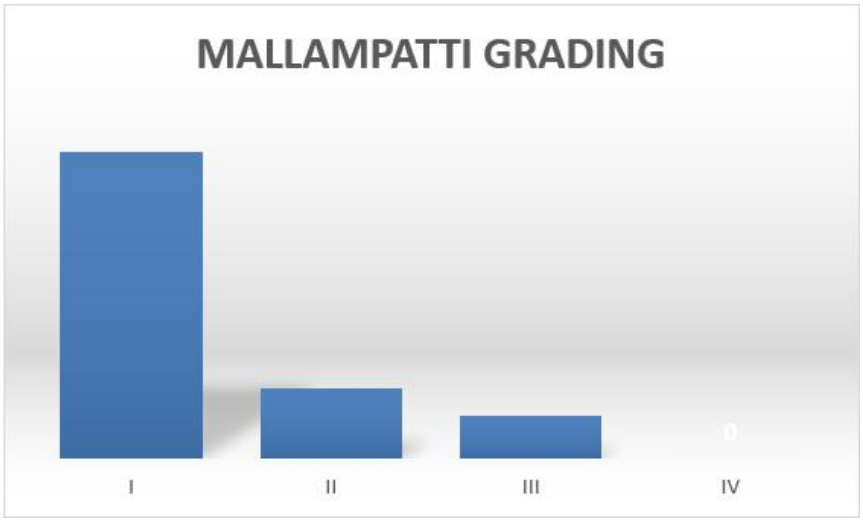

FIGURE 1: DISTRIBUTION OF STUDY SUBJECTS BASED ON MALLAMPATTI GRADING

TABLE 4: DISTRIBUTION OF STUDY SUBJECTS BASED ON CORMACK LEHANE CLASSIFICATION

Cormack-Lehane grading	Frequency	Percent
I	36	60.0
IIA	7	11.7
IIB	8	13.3

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III	9	15.0
IV	0	0.0
Total	60	100.0

Among study subjects, 60% were in grade 1 Cormack Lehane grade, followed by 15% in grade III, 13.3% in grade II B, 11.7% in grade II A respectively.

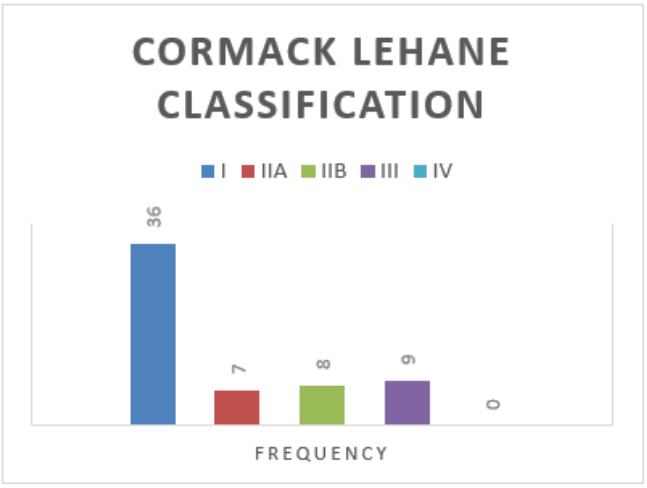

FIGURE 2: DISTRIBUTION OF STUDY SUBJECTS BASED ON CORMACK LEHANE CLASSIFICATION

TABLE 5: ASSOCIATION BETWEEN CORMACK LAHANE & DSEM (DISTANCE BETWEEN SKIN & EPIGLOTTIS) GRADING

CORMACK LAHANE	DISTANCE BETWEEN SKIN & EPIGLOTTIS (cm)						Total
	1.30-1.50	1.51-1.70	1.71-1.90	1.91-2.10	2.11-2.30	>2.31	
I	15(41.7%)	13(36.1%)	7(19.4%)	1(2.8%)	0(0.0%)	0(0.0%)	36(100%)
IIA	0(0.0%)	0(0.0%)	1(14.3%)	4(57.1%)	0(0.0%)	2(28.6%)	7(100%)
IIB	1(12.5%)	0(0.0%)	1(12.5%)	2(25.0%)	2(25.0%)	2(25.0%)	8(100%)
III	2(22.2%)	0(0.0%)	2(22.2%)	2(22.2%)	3(33.3%)	0(0.0%)	9(100%)
Total	18(30.0%)	13(21.7%)	11(18.3%)	9(15.0%)	5(8.3%)	4(6.7%)	60(100%)

PEARSON CHI SQUARE-51.49; DF-6 P VALUE-0.001 (SIGNIFICANCE)
Among study subjects, DSEM (distance between skin & epiglottis) ranges from 1.30-1.50 with Cormack Lehane grading is majority observed in grade I (41.7%) followed by III (22.2%), II B (12.5%). The range of 1.51-1.70 with Cormack Lehane grading is the majority observed in grade I (36.1%) & range of 1.71-1.90 the majority were seen in grade III, I (19.4%), II A (14.3%) II B (12.5%). The range of 1.91- 2.10 with Cormack Lehane grading is the majority observed in grade II A (57.1%), II B (25%), III (22%), I (2.8). The range of 2.11- 2.30 with Cormack Lehane grading is majority observed in grade III (33.3%), II B (25%). The range of >2.31 with Cormack Lehane grading is majority observed in II A (28.6%) followed by II B (25%) respectively. “The association between DSEM (distance between skin & epiglottis) & Cormack Lehane Grading were significant (P< 0.05)”.

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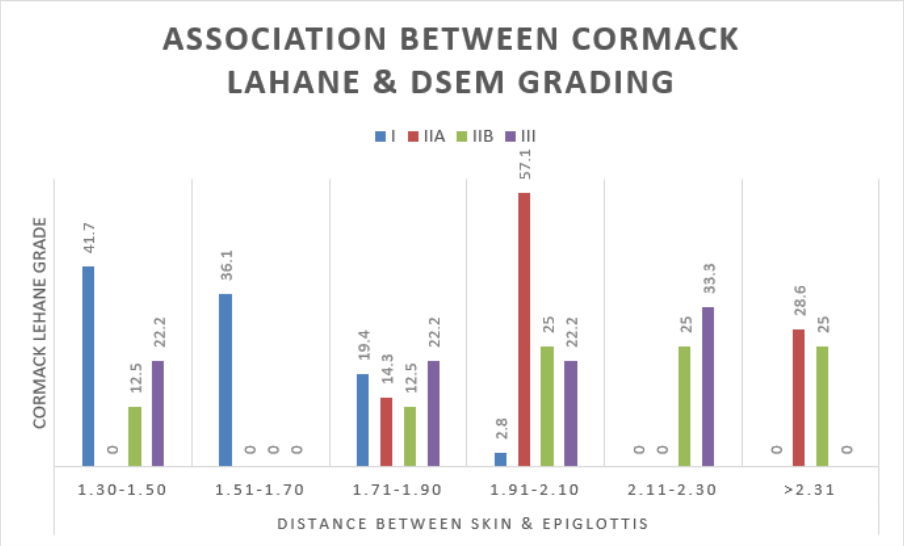

FIGURE 3: ASSOCIATION BETWEEN CORMACK LAHANE & DSEM (DISTANCE BETWEEEN SKIN & EPIGLOTTIS) GRADING

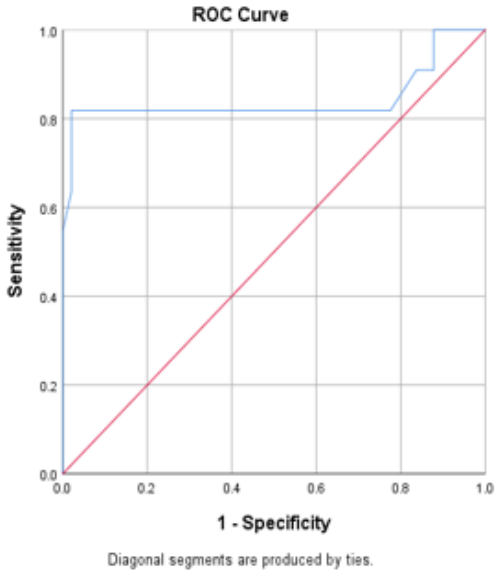

FIGURE 4: ROC Curve Analysis to obtain sensitivity and specificity of ultrasound parameter

When the ultrasound parameter was analyzed for their efficacy in diagnosis of DSEM the area under the ROC curve was 0.842. Sensitivity - 81.8% & Specificity – 30.6%

TABLE 6: Area Under the Curve

Test Result Variable(s): DSEM				
Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.842	.098	.000	.650	1.000

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The test result variable(s): DSEM has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.
a. Under the nonparametric assumption
b. Null hypothesis: true area = 0.5

DISCUSSION

The current study shows the Correlation between preoperative ultrasonographic airway assessment with Cormack-Lehane grading in direct laryngoscopic view for predicting difficult airway in adult patients at Government Cuddalore Medical College and Hospital.

In the present study 66 patients were analysed. Among them 60 patients only met the inclusion and exclusion criteria. Association of the demographic variables (age, sex, height, weight and BMI) are assessed using student t-test for age, height, weight and BMI while fisher's exact test is used for sex. There is no statistical association between these demographic variables and intubation status.

The MPG Grade-wise distribution of patients shows that 75% of patients are of MPG Grade I followed by MPG II i.e.,16.7% and 8.3% patient having MPG III.

Among study subjects, 60% were in grade 1 Cormack Lehane grade, followed by 15% in grade III, 13.3% in grade II B, 11.7% in grade II A respectively.

In the present study, when the ultrasound parameter was analyzed for their efficacy in diagnosis of DSEM the area under the ROC curve was 0.842. Sensitivity is 81.8% & Specificity is 30.6%. the cut off value is 1.87.

Among study subjects, DSEM (Distance from skin to epiglottis midway) ranges from 1.30-1.50 with Cormack Lehane grading is majority observed in grade I (41.7%) followed by III (22.2%), II B (12.5%). The range of 1.51-1.70 with Cormack Lehane grading is the majority observed in grade I (36.1%) & range of 1.71-1.90 the majority were seen in grade III, I (19.4%), II A (14.3%) II B (12.5%). The range of 1.91- 2.10 with Cormack Lehane grading is the majority observed in grade II A (57.1%), II B (25%), III (22%), I (2.8). The range of 2.11- 2.30 with Cormack Lehane grading is majority observed in grade III (33.3%), II B (25%). The range of >2.31 with Cormack Lehane grading is majority observed in II A (28.6%) followed by II B (25%) respectively. The association between DSEM (thyrohyoid membrane) & Cormack Lehane Grading were significant. ($P< 0.05$)

Pinto's study was conducted on Portuguese population and included 74 adult patients with 17 difficult laryngoscopies. Pinto *et al.* concluded that US-DSE of 2.75 cm could be used as a cutoff point for difficult laryngoscopy with sensitivity of 64.7% and specificity of 77.1%.

In 2020, Martínez-Garcia's study included 16 difficult laryngoscopy (32%) of 50 Spanish patients. They established that DSE $\geq$ 3 cm, could predict a with sensitivity of 56.3% and specificity of 88.2%. On the other hand, more confliction was noted in Parameswari's results which were inconsistent with the results of all authors especially with Mirunalini & Nazir as their studies were in India, also. Parameswari's study was conducted on Indian 130 patients with 12 difficult laryngoscopy patients. The study showed that patients with skin to epiglottis distance 18 mm were predicted to be easy with sensitivity of 75% and specificity of 63.6%.

CONLCUSION

Ultrasound is a viable tool for pre-operative airway assessment and allows for the measurement of various sonographic parameters. In our study, skin-to-epiglottis distance (DSEM) measured at the thyrohyoid membrane level emerged as a strong predictor of difficult airway.

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