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Ultrasound Versus Conventional Methods (Mallampati Score and Thyromental Distance) for Prediction of Difficult Airway in Adult Patient without Anticipated Difficult Airway

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ABSTRACT

Background: Unpredictable difficult intubation continues to be a primary reason for morbidity and mortality, and it is regarded as the greatest obstacle to standard care. Therefore, any tool can enhance airway assessment should be considered complementary to the conventional clinical assessment.

Aim of the study: Was to determine if the distance from the skin to the epiglottis, estimated by Ultrasound (US), is useful for predicting laryngoscopy difficulty.

Patients and Methods: This was a prospective, randomized, single-blind clinical study involving sixty patients undergoing elective surgery while under general anesthesia. Three parameters were utilized to assess the airway prior to the operation: the thyrohyoid membrane-level ultrasound-measured distance from skin to epiglottis (DSE), the thyromental distance, and the Mallampati score. The Cormack-Lehane grading system was also used.

Results: Of the 60 included patients, 13 were considered to have difficult laryngoscopy because they showed an increased thickness in the US-measured distance from the skin to the epiglottis. We established that skin to epiglottis distance ≤ 2.15±0.489 cm could predict a difficult laryngoscopy with sensitivity of 80.85%, specificity of 69.23% and area under the receiver operating characteristic curve was 0.764. Slight correlation was found between difficult laryngoscopy and Mallampati score and among thyromental distance and easy laryngoscopy. Mallampati score and thyromental distance had poor area under the curve = (0.728 and 0.530 respectively).

Conclusion: Our research found a strong link among the skin-to-epiglottis distance and the Cormack-Lehane grade in the Egyptian population, suggesting that airway US might be utilized to predict laryngoscopy difficulties.

Keywords: Difficult intubation, Mallampati score, Thyromental distance.

INTRODUCTION

Unpredictable and difficult intubation is a key component to mortality and morbidity, and airway control is a primary concern for anesthesiologists [(1)]. When administering anesthesia in a clinical setting, it is essential to secure the airway. Complications throughout difficult intubation (DI) might vary from mild airway edema to potentially fatal occurrences [(2)]. The American Society of Anesthesiologists (ASA) guidelines describe a difficult airway as a clinical condition when an anesthesiologist with traditional training has trouble with either endotracheal intubation or face mask ventilation of the upper airway [(3)].

The structures of the neck and the airway may be easily seen and assessed with the utilization of US, a non-invasive and fast bedside technology. A number of US-related measures can be utilized in predicting airway difficulty, including tongue thickness, mandible condylar mobility, the thickness of the soft tissues in the anterior neck from the skin to the thyrohyoid membrane and the thickness of the hyoid bone, which is undetectable [(4)].

A straightforward scoring system, the modified Mallampati classification estimates the available space for oral intubation by direct laryngoscopy by correlating the proportion of tongue size to oral aperture [(5)].

If all four parts of the Mallampati scale—the soft palate, the uvula and the pillars—are visible, then the patient is in class I. If only the soft palate and the uvula are visible, then the patient is in class III. If only the soft palate and the base of the uvula are visible, then the patient is in class IV [(6)].

New research has demonstrated an association among difficult laryngoscopy and several US characteristics, and it additionally utilized the thickness of the anterior soft neck tissue to forecast intubation difficulties [(7)].

The persistent misunderstanding of TMD has added to the current state of bewilderment and aggravation around the prediction and comprehension of challenging intubations. Take **El-Ganzouri *et al.***'s [(8)] multivariate risk index research as an example, it didn't include TMD by name, but its data revealed that TMD accurately predicted 7% of difficult intubation cases (93% inaccurate). There was no distinction in TMD among simple and difficult (problematic) intubations in an investigation on morbid obesity and tracheal intubation [(9)].

AIM OF THE WORK

Primary outcome: Find out how well US-DSE can predict which adult cases will have a difficult laryngoscopy. Secondary outcomes: Find out how well US-DSE predicts difficult laryngoscopy contrasted with clinical airway screening tests like the Mallmpati score and thyromental distance.

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PATIENTS AND METHODS

Type and design of study:

Study population: The research was conducted at Al Azhar University Hospitals (Assiut) on 60 adult patients (age: 20-60 years old) whose elective surgeries included tracheal intubation and general anesthesia from June 2021 to October 2022.

Type of Study: Prospective, single blind randomized clinical research.

Sample size calculation: The size of the sample was determined with the help of the G Power program version 3.1.9.2. This depended on prior research done by **Pinto *et al.*** [(1)]. For the challenging group, a minimum of 13 cases was necessary, whereas for the easy group, a minimum of 47 cases was needed. Power and alpha were modified to be 95 percent and 5 percent respectively. The cases were separated into two groups at the conclusion of the research project: Group A and Group B. This categorization depended on the Cormack-Lehane classification of laryngoscopic vision. group A is the group that has an easy laryngoscopy, and B is the group that has a difficult laryngoscopy.

Inclusion criteria: ASA I-III adult patient (age :20 -60 years old). Elective surgical scheduled technique necessitating endotracheal intubation. BMI less than 40 kg/m_2.

Exclusion criteria: Patient decline. Consentless lack of ability: recent operation. Pathology or preexisting airway malformations, such as goiter, maxillofacial abnormalities, facial or cervical fractures, or cervical tumors. A history of laryngoscopy or intubation complications. Individuals who have tracheostomy devices. Pregnant individuals. BMI exceeding 40 kg/m^2.

Methods of blindness: The intubating anesthesiologist did not participate in the clinical and sonographic evaluation of the airway prior to the operation. His awareness of the results of the preoperative airway evaluation was obscured.

Preoperative:

Patients' demographic information was gathered throughout pre-anesthesia assessments, and clinical screening tests were administered to recognize cases at risk for a difficult airway utilizing the Mallampati score, thyromental distance and ultrasonographically determined DSE.

Sitting with their heads kept in a neutral position, cases were asked to keep their mouths open as wide as possible with their tongues sticking out as far as possible during the Mallampati score evaluation. They were also directed not to talk. The patient's neck was completely stretched with their mouth closed in order to determine the thyromental distance, which is expressed in cm. The mentum's tip was determined as the distance from the thyroid notch.

US-measured distance from skin to epiglottis (DSE):

Materials required: General Electric; GE, "LOGIQ e" US machine with the following controls setting: Transducer - Linear high frequency probe. Axis/Plane - Short axis/Transverse plane. Frequency - 10- 13MHz. Depth – 3.0 cm - 4.0 cm. Gain - 20 - 30. US Gel.

Technique:

The US-DSE was performed at the thyrohyoid membrane level, which is halfway among the hyoid bone and thyroid cartilage. The participant was asked to lie down with their head and neck neutral and without a pillow. The transverse plane US was done utilizing a linear probe from General Electric's "LOGIQ e" machine (General Electric Healthcare Systems, Waukesha, WI, USA). The frequency range was 10-13MHz, and there were different degrees of cephalad/caudal angulation. To avoid respiratory mistakes, participants were told to maintain their mouths closed and breathe slowly while they were measured. As a linear hypoechoic structure, the epiglottis was seen at the level of the thyrohyoid membrane. Its front boundary was defined by the hyperechoic pre-epiglottic area and its posterior boundary by a brighter linear air-mucosa contact. From the surface of the skin to the middle axis of the greatest section of the epiglottis, as seen through the thyrohyoid membrane, the distance in cm was determined.

Anesthesia:

Following the participants were admitted to the operating room and monitored utilizing ASA standard equipment (ECG, NIAB, pulse oximetry, capnography), they were preoxygenated with 100% FiO_2 for 3 minutes. Then, they were given intravenous (IV) midazolam 1 mg (Amoun Egypt) and fentanyl 1 ug/kg (Hameln pharma Gmbn-Germany). To induce anesthesia, an injection of propofol 1% (2 mg/kg) was administered by Fresenius Kabi Deutschland Gmbh. Anesthesiologists utilized a curved Macintosh blade of the appropriate size to perform direct laryngoscopy following relaxing the muscles with atracurium 0.5 mg/kgIV (Hameln pharma Gmbn, Germany) and breathing in a mixture of oxygen and isoflurane 1.5% (Sunny Pharmaceutical, Badr City, Egypt) for 3 minutes. The laryngoscopic grade, or Cormack-Lehane (CL), was recorded throughout the procedure. Capnography and bilateral auscultatory of the lungs verified the proper placement of the endotracheal tube. Clinical and sonographic airway evaluations done prior to surgery did not involve the intubating anesthesiologist. As a result, he did not know the results of the preoperative airway assessment. Isoflurane, booster doses of atracurium and fentanyl were utilized to maintain anesthesia as necessary. With a train-of-four ratio of 0.9 or above, the patient was extubated at the conclusion of the operation.

Outcome was evaluated by: Correlation between different methods of prediction of difficult airway in our study with Cormack and Lehane grading.

Ethical Considerations

The study was approved by the Institutional Ethical committee of Al Azhar University Hospitals, Assiut and the patients were given all the information they needed about the trial. An informed written consent was taken from each participant before enrolment in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis

The statistical analysis was done utilizing SPSS version 27 (IBM©, Armonk, NY, USA). For the purpose of determining whether or not the data were distributed normally, the Shapiro-Wilk test was utilized. Following the presentation of quantitative parametric data in the form of mean and standard deviation (SD), the data were analyzed utilizing the analysis of variance (ANOVA) test with the post hoc test (Tukey). For the purpose of contrasting the two groups, the Student T test was utilized. The Chi-square test or Fisher exact test was utilized to do the analysis of the qualitative variables, which were reported in the form of frequency and percentage (%). The statistical significance of a two-tailed P value less than 0.05 was regarded to be acceptable. A Kappa coefficient developed by Cohen was utilized for agreement. The estimation of the association among a dependent variable and one or more independent variables was done using logistic regression statistical technique.

RESULTS

Age and BMI were significantly greater in difficult group contrasted with easy group. Regarding gender and ASA, there was an insignificant difference among both groups [Table 1].

Table (1): Demographic data of the studied groups

Total (n=60)			**Easy group (n=47)**	**Difficult group(n=13)**	**P value**
Age (years)	**Mean ±SD**	41.02±13.68	37.40±2.57	54.08± 8.81	**<0.001***
BMI (kg/m^2)	Mean ±SD	28.75±5.9	27.80± 6.088	32.154±3.625	**0.017***
Gender	**Male**	34 (56.67%)	25(53.2%)	9(69.2%)	0.358
	Female	26 (43.33%)	22 (46.8%)	4(30.8%)	
ASA	**I**	35(58.33%)	25 (53.2%)	10 (76.9%)	0.365
	II	22 (36.67%)	19 (40.42%)	3 (23.1%)	
	III	3 (5%)	3(6.83%)	0	

SD: Standard deviation, data are represented as mean (SD)or frequency (%), *: Statistically significant

Mallampati (score) was significantly different between both groups. Thyromental distance was insignificantly variant among both groups. DSE was significantly greater in difficult group contrasted with easy group [Table 2].

Table (2): Preoperative variables of the studied groups

Total (n=60)			Easy (n=47)	Difficult(n=13)	P value
Mallampati (score)	**I**	21(35.0%)	18 (38.8%)	3 (23.1%)	**0.002***
	II	22(36.7%)	21(44.7%)	1 (7.7%)	
	III	10 (16.7%)	5 (10.6%)	5 (38.5%)	
	IV	7 (11.7%)	3 (6.4%)	4 (30.8%)	
Thyromental Distance **(cm)**	**<6**	52(86.66%)	40(85.1%)	12(92.3%)	0.499
	>6	8(13.33%)	7 (14.9%)	1 (7.7%)	
	Mean ±SD	4.06 ±1.32	4.08 ±1.38	3.84± 1.143	0.568
DSE	**Mean ±SD**	1.85±0.35	1.79±0.293	2.15±0.489	**0.0014***

SD: Standard deviation. DSE: Distance from skin to epiglottis estimated by US, *: Statistically significant

Table 3 shows a slight agreement between Cormack–Lehane (CL) grade and Mallampati (MP) score (K=0.152).

Table (3): Agreement between Cormack–Lehane (CL) grade and Mallampati (MP) score.

MP class	**CL grade, No. of patients (%)**				**Total**	**P**	K
	1	**2**	**3**	**4**			
I	10(47.6%)	8 (30.8%)	1 (14.3%)	2 (33.3%)	21(33.3%)	0.064	0.152
II	8(38.1%)	13 (50.0%)	0 (0.0%)	1 (16.7%)	22 (36.7%)		
III	1 (4.8%)	4 (15.4%)	2 (28.6%)	3 (50.0%)	10 (16.7%)		
IV	2 (9.5%)	1 (3.8%)	4 (57.1%)	0 (0.0%)	7 (11.7%)		
Total	21	26	7	6	60 (100%)		

Table 4 shows a poor agreement between Cormack–Lehane (CL) grade and thyromental distance (K=-0.29).

Table (4): Agreement between Cormack–Lehane (CL) grade and thyromental distance (TMD).

Thyromental Distance **(cm)**	**CL grade, No. of patients (%)**				**Total**	**P**	K
	1	**2**	**3**	**4**			
<6	17 (81.0%)	23 (88.5%)	7 (100.0%)	5 (83.3%)	52(86.7%0	0.339	-0.29
>6	4 (19.0%)	3 (11.5%)	0 (0.0%)	1(16.7%)	8 (13.3%)		
Total	21	26	7	6	60		

Table 5 shows significant difference between distribution of US-based measurements DES according to Cormack–Lehane (CL) grade. There was significant difference between grade 1 and 3 and between grade 2 and 3 according to distribution of US-based measurements DES.

Table (5): Distribution of US-based measurement (DES) according to Cormack–Lehane (CL) grade

CL grade	**No.**	**DSE (cm)**		P	P_1	P_2	P_3
		Mean	**±SD**				
1	21	1.79	±0.25	0.013*	0.0318	0.2374	0.0317
2	26	1.80	±0.32				
3	7	2.21	±0.19				
4	6	2.09	±0.7				
Total	60	1.87	0.371				

*: Statistically significant p_1: p value between grade 1 and grade 3 p_2: p value between grade 1 and grade 4 p_3: p value between grade 2 and grade 3

Mallampati score was a significant forecaster for difficult laryngoscopy with cutoff point >2. Thyromental distance was an insignificant predictor for difficult laryngoscopy with cutoff point >3. DSE was significant predictor for difficult laryngoscopy with cutoff point ≤1.92 [Table 6].

Table (6): Comparative analysis of the performance attributes of clinical airway evaluation and US airway assessment in distinguishing among cases of easy and difficult laryngoscopy.

	Mallampati score	**Thyromental Distance**	**DSE**
AUC	0.728	0.530	0.764
Cutoff value	>2	>3	≤1.92
Sensitivity (%)	82.98	57.54	80.85
Specificity (%)	69.23	84.62	69.23
PPV (%)	90.7	79.4	90.5
NPV (%)	52.9	22.4	50.0
P value	0.014*	0.7178	0.0154*

AUC: Area under receiver operating characteristic (ROC) curve, CI: Confidence interval, PPV: Positive predictive value, NPV: Negative predictive value

Mallampati score was a significant predictor for difficult laryngoscopy with cutoff point >2, AUC=0.628, 82.98% sensitivity, 69.23% Specificity, 90.7% PPV and 52.9% NPV. Thyromental Distance was an insignificant predictor for difficult laryngoscopy with cutoff point >3, AUC=0.530, 57.54% sensitivity, 84.62% Specificity, 79.4% PPV and 22.4%NPV.

DSE was significant predictor for difficult laryngoscopy with cutoff point ≤1.92, AUC=0.764, 80.85% sensitivity, 69.23% Specificity, 90.5% PPV and 50.0%NPV**.**

Table (7): Comparative analysis of the performance attributes of clinical airway evaluation and US airway assessment in distinguishing between easy difficult laryngoscopy.

	Univariable			**Multivariable**		
	P	**OR**	**95% CI**	**P**	**OR**	**95% CI**
Age	**0.001***	0.870	0.800 to 0.947	**0.014***	**0.8795**	0.7937 to 0.9745
Gender	0.306	1.98	0.5344 to 7.3366	0.217	**4.1236**	0.4348 to 39.1075
BMI	**0.028***	0.8893	0.8005 to 0.9879	0.410	**0.9355**	0.7983 to 1.0963
ASA	0.0981	2.8571	0.8236 to 9.9107	0.067	**6.3799**	0.8763 to 46.4475
Mallampati score	**0.0062***	0.3921	0.2005 to 0.7668	0.097	**0.3790**	0.1201 to 1.1957
Thyromental Distance	0.507	0.476	0.0532 to 4.2650	0.738	**0.2658**	0.0001 to 639.1262
DSE	0.0064*	0.0683	0.0099 to 0.4709	0.024*	0.3190	0.0193 to 0.9748

*: Statistically significant

DISCUSSION

US has emerged as a crucial instrument in critical care and operating rooms since a decade ago, serving a variety of diagnostic and therapeutic functions. US has been utilized for airway management only recently. Several traditional techniques exist to predict problematic laryngoscopy; however, none of them achieve 100 percent sensitivity and specificity and there are no established standard parameters for such prediction [(10)]. Numerous authors have utilized US to predict problematic laryngoscopy; however, consensus regarding the most accurate US parameters for this purpose is limited and there is little evidence to support such claims. Several studies have demonstrated the utility of US-DSE in forecasting problematic laryngoscopy with significant results; nevertheless, the findings appear contradictory, and surprisingly, some of those researches were done in the same country. We discovered a strong relationship among the US-DSE and Cormack–Lehane score on the ROC curves during direct laryngoscopy in this research; the association may be beneficial for predicting a difficult laryngoscopy. The US-DSE cutoff point for challenging laryngoscopy was determined to be ≤ 1.92, with a sensitivity of 80.85% and a specificity of 69.23%, according to our findings. Our results align with the conclusions drawn by **Wu *et al.*** [(11)] and **Nazir and Mehta** [(12)] regarding an almost identical threshold.

The research done by **Nazir and Mehta** involved 90 Indian patients who had undergone 19 difficult laryngoscopies. The results indicated that the US-DSE, with a specificity of 76.3% and a sensitivity of 78.9%, could predict difficult laryngoscopy with a cutoff point of 1.77cm [(12)].

Wu *et al.* [(11)] did their research on a cohort of 203 Chinese Han cases who had undergone 28 difficult laryngoscopies. For difficult laryngoscopy, the investigation revealed that US-DSE had a cut-off point of 1.78 cm, a specificity of 66.3% and a sensitivity of 100%. These findings, nevertheless, are considerably inferior to those of the other authors. 150 Indian cases who underwent 11 problematic laryngoscopies were involved in **Mirunalini's** [(13)] research. He illustrated that the US-DSE has a specificity of 99.3% and a termination point of 2.33 cm for difficult laryngoscopy. **Nazir and Mehta's** [(12)] termination point, on the other hand, was 1.77 centimeters.

US-DSE had a threshold point of 2.36 cm, specificity of 96.43%, and sensitivity of 60%, in accordance with an investigation by **Shi *et al.*** [(14)] involving 71 Chinese subjects. African Americans comprised 51 subjects in the research by **Adhikari *et al.*** [(15)]. Difficult laryngoscopy was declared for six subjects. For difficult laryngoscopy, the US-DSE cutoff point was 2.8 cm. Twenty-eight problematic laryngoscopy patients were among the 301 adult Italians involved in the research by **Falcetta *et al*.** With a sensitivity of 82 percent and specificity of 91 percent, the US-DSE had a cut-off value of 2.54 cm [(10)].

The investigation by **Pinto *et al.*** considered 74 adult patients who had undergone 17 difficult laryngiscopies and was conducted on the Portuguese population. With a sensitivity of 64.7 percent and specificity of 77.1 percent, they concluded that a US-DSE of 2.75cm could serve as a threshold for difficult laryngoscopy [(1)].

16 difficult laryngoscopies (32 percent) of 50 Spanish patients were included in the 2020 study by **Martínez-García *et al.*** With a sensitivity of 56.3 percent and a specificity of 88.2 percent they determined that DSE ≥ 3 cm could predict DL [(16)].

Findings of **Parameswari *et al.*** [(17)], on the other hand, were more contradictory with those of all other authors, particularly **Mirunalini** [(13)] **and Nazir** [(12)], whose research was also done in India. Thirty Indian patients, 12 of whom required difficult laryngoscopy, participated in the research by **Parameswari *et al.*** [(17)] With a sensitivity of 75 percent and a specificity of 63.6 percent, the research assessed the difficulty of prognosis for cases whose skin-to-epiglottis distance was less than 1.8 cm, while those whose distance was greater than 1.8 cm were deemed simple [(15)]. As a result of the aforementioned factors, involving the lack of standardized US scanning protocols and the dispersion of investigators' US expertise, study outcomes vary considerably and significantly. Furthermore, **Martínez-García *et al.*** [(16)] proposed that the CL could be impacted by the laryngoscopist's level of expertise and the absence of external laryngeal pressure application.

Furthermore, it is possible that this phenomenon is associated with variations in population size and racial composition [(18)]. It was hypothesized that the variation in fat distribution among ethnic groups accounts for the discrepancy between records. Prior research employing magnetic resonance imaging [(19)] provided support for this hypothesis. Additionally, **Komatsu's** study, which included obese African American and Caucasian patients, took into account this hypothesis. There was no statistically significant distinction detected in the pretracheal tissue thickness recorded by US among subjects experiencing simple and difficult laryngoscopy, as measured by the distance between the skin's surface and the airway's frontal surface, at the level of the vocal cords, before the thyroid cartilage[(20)]. Nevertheless, in the context of obese subjects from the Middle East and Israel, **Ezri *et al.*** identified a substantial and noteworthy distinction in the aforementioned parameter among the two laryngoscopy groups [(21)]. The variation in fat distribution among ethnic groups, as revealed by **Komatsu *et al.*** [(20)], accounted for the disparity among the two investigations. Undoubtedly, the present challenge in formulating recommendations stems from the lack of methodological homogeneity and the scarcity of published works.

The Mallampati score and thyromental distance have been regarded by some as reliable predictors of clinical airway screening, while others have deemed

their utility to be limited. Demographic and anthropometric distinctions among various populations and ethnicities, in addition to variations in DSE, may account for this significant variation [22].

Our analysis revealed a statistically significant correlation among the Mallampati score and difficult intubation, as well as among thyromental distance and simple intubation. The Mallampati score exhibited an AUC of 0.728, which was comparable to the findings reported in **Nazir and Mehta's**[12] study (AUC=0.637). Further, its AUC value of 0.645 was comparable to that of the research by **Andruszkiewicz *et al.*** [23]. Similar to the findings reported by **Pinto *et al.*** [1] (AUC=0.662), thyromental distance exhibited an AUC of 0.530. The most commonly administered tests, for example the Mallampati Score and thyromental distance measurement, have inconsistent ability to differentiate among cases with difficult and simple airways, in accordance with **Abdelhady *et al*,** [22] Consequently, their accuracy is only moderate to limited.

Vannucci and Cavallone [24] and **Roth *et al.*** [25], reported in their systematic review that the ability of commonly administered assessments, such as the Mallampati score and thyromental distance assessment, to differentiate among individuals with difficult and simple airways is restricted and inconsistent. Mallampati score was evaluated in 16 studies and 9884 patients were included. Only 5 studies of them were conducted in "special populations" such as patients with thyroid pathology, pregnant females, cases with obstructive sleep apnea, morbidly obese and maxillofacial surgery cases. These 5 studies had risk of bias and can affect the results. The estimated summary of sensitivity and specificity were 55% and 82 % respectively. Thyromental distance was evaluated in 12 studies and 6667 patients were included. Only 2 studies of them had risk of bias as they were conducted in "special populations" such as patients with thyroid pathology and maxillofacial surgery patients. The estimated summary sensitivity and specificity were 35% and 87% respectively [24]. Although this systematic review has small number of studies and has risk of bias, the results were in agreement with those of another systematic review conducted by **Roth *et al.***, which has larger number of studies and more patients were included in addition to low bias risk. It was determined that the Mallampati test, which was assessed in 80 researches including 232,939 individuals, was associated with 10,545 difficult laryngoscopy cases. From 0.00 to 1.00, both sensitivity and specificity varied. Summary specificity has been calculated at 0.80 (95% CI 0.74 to 0.85), and sensitivity was calculated at 0.53 (95% CI 0.47 to 0.59). With a total of 2364 difficult laryngoscopy cases, 42 studies involving 33,189 participants examined thyromental distance. The specificity ranged from 0.08 to 0.99, while the sensitivity ranged from 0.03 to 1.00. Summary specificity was determined at 0.89 (95% CI 0.84 to 0.93) and sensitivity was calculated at 0.37 (95%CI 0.28 to 0.47). Furthermore, they decided that frequently utilized airway examination measures had limited to moderate accuracy and that they do not appear to be effective screening tools for difficult airways in cases with no evident airway abnormalities. Conversely, the majority of the tests exhibited a low degree of variability and a great degree of specificity [25].

Predicting airway difficulties accurately continues to be a challenging task, as evidenced by the fact that up to 93% of difficult intubations occur unexpectedly, and situations in which a difficult intubation is anticipated, it rarely develops [26].

Our research is subject to various limitations. Owing to the small sample size and the existence of only one race. Furthermore, US assessment of a singular parameter is a straightforward process to acquire. Additionally, US measures were acquired by a single investigator, potentially introducing a degree of bias. Factors beyond our control involved the number of intubation attempts, the apparatus utilized for laryngoscopy, and the experience of the anesthesia physicians. In addition, external laryngeal manipulation and optimal sniffing position, which were not accounted for in our investigation protocol, may have an impact on glottis exposure and CL. These factors are considered essential for optimal laryngoscopy efficiency, which include external laryngeal manipulation, when necessary, a skilled laryngoscopist, and complete muscle relaxation.

CONCLUSION

Sonographic DSE measurement was superior to clinical airway tests (Thyromental distance and Mallmpati score) in differentiating among simple and difficult laryngoscopies, and demonstrated a strong relationship with difficult laryngoscopy. As such, it could potentially serve as a prognostic indicator for difficult laryngoscopy.

Declarations:
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