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Original Research Article

Comparison of upper airway ultrasound parameters with Wilson's score for prediction of difficult airway in adult patients: A prospective observational study

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Abstract

Background: Pre-operative airway assessment is an essential component of General Anaesthesia. Adequate airway assessment helps better prepare with airway gadgets during intubation and prevents complications associated with laryngoscopy and intubation attempts. Conventional airway assessment tools used clinical parameters like Wilson's score. We aimed to compare this with the ultrasound airway parameters in predicting difficult airways.

Materials and Methods: The study included 130 patients scheduled for general anaesthesia with endotracheal intubation. A clinical airway assessment was done and Wilson`s score was noted. Ultrasound airway assessment was done and parameters like distance from Skin to the epiglottis, geniohyoid muscle thickness, skin to the hyoid bone, and skin to the vocal cord were noted. Laryngoscopy was performed by independent anesthesiologists who were blinded to the parameters, and the Cormack-Lehane grading was recorded.

Results: The distances from the skin to the epiglottis at the thyrohyoid membrane and from the skin to the vocal cords have demonstrated high sensitivity in predicting a difficult airway, with values of 89.74% and 92.31%, respectively. The cutoff values for these measurements are 1.81 cm and 0.78 cm, with corresponding AUROC values of 0.83 and 0.80, indicating strong predictive accuracy. In contrast, Wilson's score showed a much lower sensitivity of only 20.5% with an AUROC value of 0.764.

Conclusion: Compared to Wilson's score, ultrasound airway assessment is more accurate in predicting difficult airways. Ultrasound can be an easy, rapid, non-invasive bedside screening tool for evaluating the airway. The Distance of skin to vocal cords (DSVC) and skin to epiglottis (DSE) were more sensitive in predicting difficult airways.

Keywords: Airway ultrasound, Wilson's score, Distance of skin to epiglottis (DSE), Distance of skin to vocal cords (DSVC), Distance of skin to hyoid bone (DSH), Geniohyoid muscle thickness (TGM).

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1. Introduction

Pre-operative assessment of the airway is a vital step in administering general anaesthesia. Delay in securing the airway on the table can lead to complications like hypoxia, desaturation, bradycardia and cardiac arrest. Adequate airway assessment helps in better preparedness prepare with airway gadgets during intubation and prevents complications associated with laryngoscopy and intubation attempts.

Several individual airway assessment tests are used for predicting difficult airway, like the Mallampati score, neck movements, mouth opening etc. In addition to individual indices, several scoring systems are used to predict difficult airways, such as Wilson's score, Rocke's risk probability, Arne's simplified score model, Benumof's 11-parameter analysis, and the LEMON score.[1] Most clinical predictors have low sensitivity and moderate specificity, resulting in an incidence of difficult laryngoscopy and tracheal intubation ranging from 1.5% to 13%.[2]

Wilson's score is one of the group indices in enhancing the sensitivity of predicting difficult airways. It analyses 5 parameters simultaneously – weight, head and neck movement, jaw movement, receding mandible and buck teeth. Among all the group indices, Wilson's score stands out

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as a simple, quick, and effective bedside tool for airway assessment.[3] Wilson's score was found to be the most reliable predictor of difficult laryngoscopy when compared to the Modified Mallampati Classification, Hyomental Distance Ratio, and the ratios of height to sterno-mental and thyromental distances, either individually or in combination.[4] However, unanticipated difficult airway though rare, can occur following the routine induction of general anaesthesia.

Although Wilson's score is a well-established group index for difficult airways it relies on subjective assessments of factors such as neck movement, jaw movement, and the patient's build as it considers external physical features, which may not fully capture internal anatomical variations critical to airway management. While it may identify some at-risk patients, Wilson's score can generate false positives, overestimating the likelihood of a difficult airway in certain individuals. Wilson's score does not account for situations where difficult airways arise due to pathological or situational factors, such as tumours or trauma which may not align with the criteria assessed by the score. These limitations suggest that while Wilson's score can be a helpful tool, it is less reliable as a standalone predictor and may benefit from combining more objective measurements or other predictive methods.[5]

Existing resources like portable ultrasound is an emerging tool for quick airway assessment and prediction of difficult airways. Ultrasound (US) has recently become a valuable, portable, non-invasive, and safe tool for quick airway assessment and management in settings such as the operating room, intensive care unit and emergency department. There are several ultrasound-guided airway assessment parameters like Distance from skin to epiglottis (DSE), Thickness of geniohyoid muscle (TGM), Distance from skin to hyoid (DSH), and Distance of skin to vocal cords (DSVC). The thickness of pre-tracheal soft tissue predicts the laryngoscopic view, increased thickness leads to reduced mobility of pharyngeal structures affecting the laryngoscopic view.[6] Few studies have shown that measurements of airway assessment done on ultrasound are better than clinical tests like modified Mallampati for discrimination between easy and difficult laryngoscopy.

Several studies have compared Wilson's score with traditional airway assessment methods, concluding that Wilson's score is a more accurate predictor of a difficult airway.[4] There are also few studies evaluating ultrasound parameters in comparison to traditional airway assessment methods. However, no studies have compared Wilson's score with ultrasound parameters. Hence, we decided to conduct this study to compare the ultrasonographic airway assessment with Wilson's score to predict a difficult airway.

This study aimed to evaluate the ultrasound parameters DSE, TGM, DSH, and DSVC against Wilson's score for predicting difficult airways. The secondary goal was to identify the optimal cut-off values for these ultrasound parameters to accurately classify laryngoscopy as easy or difficult based on Cormack Lehane (CL) grading.

2. Materials and Methods

This prospective observational study was conducted at a 1200-bed tertiary hospital between December 2021 and December 2023, following approval from the institutional ethical committee (RRMCH-IEC/43/2021). The study was registered with the Central Trial Registry of India under CTRI no. CTRI/2021/07/034820.

The study included 130 patients, aged 18 to 70 years, with ASA Grade I-III, scheduled for elective surgery under general anaesthesia with endotracheal intubation. The sample size was estimated by using the sensitivity of US-DSE in the diagnosis of the difficult airway concerning gold standard CL grading from the study by B. S. Abdelhady et al. using the formula.[6]

$$n = [Z\alpha^2 \text{ x Sn x } (100 - \text{Sn})] / (d^2 \text{ x p})$$

where,

Z = Standard normal value at 95% Confidence level
Sn = Sensitivity = 80%
d = desired absolute precision = 5%
p = prevalence = 2%

Using these values, the required sample size was calculated to be 123 subjects. To account for potential non-responses, an additional 10% was added, resulting in a total of 135 subjects needed for the study.

Patients with pre-existing airway abnormalities or conditions such as facial or cervical fractures, pregnant women, those requiring rapid sequence induction, patients needing awake fiberoptic intubation, and individuals who declined participation were excluded. Informed written consent was obtained from all participants.

The study was carried out in two phases: the first involved a clinical airway evaluation the day before surgery during the pre-anesthesia check-up, and the second phase consisted of an ultrasound assessment conducted in the preoperative room on the day of surgery. During the pre-anaesthesia visit, clinical airway parameters were assessed per the protocol, including Wilson's score, which involves five parameters scored from 0 to 2. Based on the sum of the scores, the difficulty of laryngoscopy and intubation was predicted.[3]

Patients scoring ≤2 have easy laryngoscopy, a score of 3-7 is considered a difficult airway moderate laryngoscopy, and those scoring 8-10 have severe difficulty during conventional laryngoscopy. For our study, we considered a score ≤2 as easy laryngoscopy and more than 2 as difficult laryngoscopy.[3]

Wilson scoring system:

S. No.	Parameter	0	1	2
1	Weight (kg)	< 90	90-110	>110
2	Head and Neck movement	>900	= 900	<900
3	Jaw movement (Inter-incisor gap)	>5cm	= 5 cm	< 5 cm
	(Sliding mandibular beyond maxillary incisors)	>0	= 0	< 0
4	Receding Mandible	None	Moderate	Severe
5	Buck teeth	None	Moderate	Severe

The principal investigator conducted the ultrasonographic airway assessment using a portable SonoSite® M-Turbo ultrasound system equipped with an HFL 38x/13-6 MHz transducer to ensure consistency and avoid inter-observer variability. The assessment was performed with the patient lying supine, head in a neutral position without pillow support, and eyes directed straight ahead. The patient's mouth was closed, and the tongue remained still on the floor of the mouth, as illustrated in **Figure 1**.

Figure 1: The patient is positioned supine with the head in a neutral position to measure the ultrasound parameters of airway

Using a linear high-frequency transducer positioned on the patient's neck in a transverse plane (short axis) with an imaging depth of 3.3 cm, the investigator took measurements at various levels. The precise positioning and technique allowed for accurate and reproducible measurements of different airway structures.

The Skin-to-Epiglottis Distance (DSE) was measured at the thyrohyoid membrane level, located midway between the hyoid bone and thyroid cartilage. The epiglottis appeared as a hypoechoic structure, with its anterior border defined by the hyperechoic pre-epiglottic space and its posterior boundary marked by a bright air-mucosa interface (**Figure 2**).[7]

The Geniohyoid Muscle Thickness (TGM) was assessed by placing the probe transversely beneath the chin, at the midsection of the tongue. The measurement was taken between the outermost points of the geniohyoid muscle, which appeared hyperechoic dorsally (**Figure 2**).[7]

For the Skin-to-Hyoid Bone Distance (DSH), the probe was positioned at the hyoid bone level, and the distance from the skin to the anterior surface of the hyoid bone was recorded. The hyoid bone was visualized as a hyperechoic line with a posterior acoustic shadow (**Figure 2**).[7]

Lastly, the Skin-to-Vocal Cords Distance (DSVC) was measured. The true vocal cords appeared as a triangular hypoechoic structure with hyperechoic vocal ligaments. The measurement was taken from the skin surface to the anterior commissure of the true vocal cords (**Figure 2**).[7]

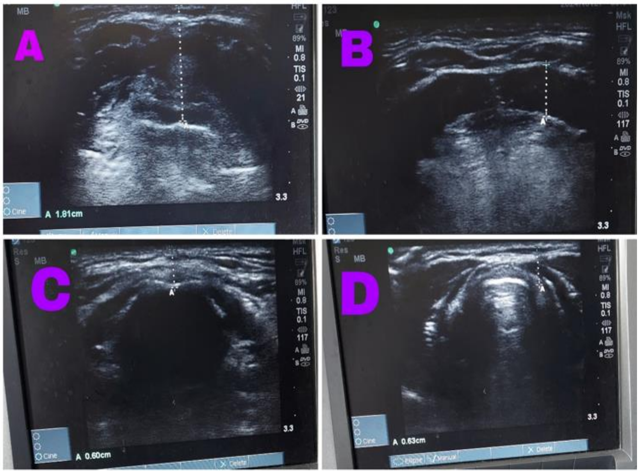

Figure 2: **A**: **Distance from skin to epiglottis**: The ultrasound image shows a hyperechoic line representing the skin surface, followed by several hypoechoic layers corresponding to subcutaneous tissues. The epiglottis appears as a curved, slightly hyperechoic structure deeper in the image. The dotted line represents the vertical distance from the skin surface to the anterior surface of the epiglottis. **B**: **Geniohyoid muscle thickness**: The geniohyoid muscle is visible as a hypoechoic band sandwiched between two hyperechoic lines representing fascial layers. The thickness is measured perpendicular to the muscle fibers using a dotted line. **C: Skin to hyoid bone**: The image shows the skin surface as a hyperechoic line at the top. Deeper, the hyoid bone appears as a strong, hyperechoic arc with posterior shadowing due to its dense bony structure. The dotted line indicates the distance between the skin and the hyoid bone. **D**: **Skin to vocal cords:** This image shows the skin surface as the hyperechoic top layer, with multiple hypoechoic layers representing subcutaneous tissue and muscles. The vocal cords are identified as a hyperechoic vertical line deeper in the field. The dotted line measures the distance from the skin to the vocal cords.

Patients were connected to standard ASA monitors upon entering the operation theatre. A 20 G IV cannula was used to start Ringer lactate infusion. Pre-medication consisted of intravenous administration of 1 mg Midazolam and 0.2 mg Glycopyrrolate. All patients underwent anesthesia induction following a standardized protocol. Laryngoscopy was performed after achieving full muscle relaxation with a non-depolarizing muscle relaxant. A trained anaesthesiologist with 3 years of experience, blinded to Wilson's score and ultrasound parameters, conducted the laryngoscopy. The Cormack-Lehane (CL) grading system was employed due to its widespread use, clinical familiarity, and extensive citation in guidelines and research.

The Modified Cormack-Lehane classification used in this study included five grades: Grade 1 with full view of the glottis, Grade 2a showing partial view of glottis, Grade 2b where only the posterior extremity of the glottis or arytenoids cartilage was visible, Grade 3 with only epiglottis visible and no glottic structures seen, and Grade 4 where neither glottis nor epiglottis were visible.

The backwards, upward, and rightward pressure (BURP) manoeuvre was applied when requested, and any changes in CL grade noted. Patients were intubated using appropriately sized endotracheal tubes after CL grading. Grades 1 and 2 (with or without BURP) were categorized as easy laryngoscopies, while grades 3 and 4 were considered difficult. Initial intubation attempts were made without airway adjuncts. If unsuccessful, a second attempt using a stylet or bougie was performed. Subsequent attempts, if necessary, were conducted by a senior anaesthesiologist with at least 5 years of experience. Intubation was classified as difficult if more than two attempts were required. Post-intubation, patients were managed according to standard anaesthesia practices by the attending anaesthesiologist.

2.1. Statistical analysis

The data were analysed using descriptive and inferential statistics. Continuous variables such as age, weight, height, and ultrasound parameters were expressed as mean ± standard deviation (SD). Categorical variables like gender distribution, laryngoscopy grades, and alternative intubation techniques were expressed as proportions or percentages. The chi-square test was used for comparison of categorical variables, while independent sample t-tests were used to compare mean values between the easy and difficult laryngoscopy groups. Statistical significance was set at p <0.05.

Receiver operating characteristic (ROC) curve analysis was performed for Wilson's score and ultrasound parameters, including skin-to-epiglottis distance (DSE), geniohyoid muscle thickness, skin-to-hyoid bone distance (DSH), and skin-to-vocal cords distance (DSVC), to assess their diagnostic accuracy in predicting difficult laryngoscopy. The Area Under the ROC Curve (AUC) was calculated to measure the overall performance of each parameter, with values interpreted on a scale from excellent (0.9-1.0) to not reliable (0.5-0.6).[8] Youden's Index was applied to determine optimal cut-off values for ultrasound parameters, maximizing the balance between sensitivity and specificity.[8] For each parameter, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated to provide a comprehensive assessment of their predictive capabilities.

3. Results

A total of 130 patients scheduled for elective surgeries under general anesthesia with endotracheal intubation were included. The average age was 42±12 years, with 67 females (51.5%) and 63 males (48.5%). The mean weight and height were 70.29±14.43 and 166±10cm, respectively (**Table 1**).

Based on the Cormack-Lehane (CL) grading, patients were categorized into easy (n=91, 70%) and difficult (n=39, 30%) laryngoscopy groups (**Table 2**). The difficult laryngoscopy group exhibited significantly higher weight and BMI values compared to the easy group. Among 119 patients with a BMI < 30 kg/m², 90 (75.6%) had easy laryngoscopy, while 29 (24.4%) had difficult laryngoscopy (p<0.000). In contrast, 10 out of 11 patients with BMI > 30 kg/m² experienced difficult laryngoscopy, with only one patient categorized as having easy laryngoscopy (p<0.0001).

External laryngeal pressure altered the CL grading in 52 patients. Alternative intubation techniques, such as changes in the blade, use of a stylet, or bougie, were required in 35 patients. Three patients needed three intubation attempts. No cases of failed intubation were reported in this study.

Table 1: Patient demographics

	N	Minimum	Maximum	Mean	Std. Deviation
Age (yrs)	130	19	70	42.29	12.81
Height (metres)	130	1.43	1.88	1.66	.10
Weight (kgs)	130	40	112	70.29	14.43
BMI (kg/m2)	130	16.90	42.06	25.55	4.37

Table 2: Comparison between difficult airway based on CL grading and Wilson score difficult airway

Difficult Airway	Yes	39	30.0%
	No	91	70.0%
	Total	130	100.0%
Wilson's score	0	86	66.2%
	1	22	16.9%
	2	14	10.8%
	3	4	3.1%
	4	4	3.1%
	Total	130	100.0%
Wilson's score difficult airway yes/no	Yes	8	6.2%
	No	122	93.8%
	Total	130	100.0%

Wilson's score predicted difficult laryngoscopy in 8 patients. The area under the ROC Curve (AUROC) for Wilson's score was 0.765, indicating fair diagnostic accuracy. It exhibited a sensitivity of 20.5%, specificity of 100%, PPV of 100%, and NPV of 74 (**Table 4** and **Figure 3**).

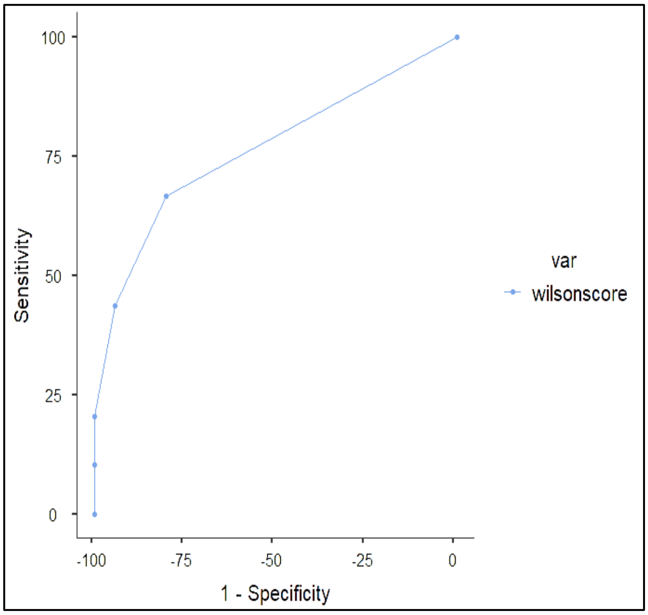

Figure 3: ROC for Wilson's score

Ultrasound parameters significantly differed between the easy and difficult laryngoscopy groups.

1. Skin-to-epiglottis distance (DSE): Mean values were 1.78 ± 0.24 cm for easy and 2.13 ± 0.28 cm for difficult laryngoscopy ($p < 0.0001$). ROC analysis showed an AUC of 0.83, with a cut-off of > 1.81 cm indicating difficult intubation (**Table 3** and **Table 4**).
2. Geniohyoid muscle thickness: Mean values were 0.71 ± 0.12 cm for easy and 0.86 ± 0.13 cm for difficult laryngoscopy ($p < 0.0001$). AUC was 0.80, with a cut-off of > 0.86 cm (**Table 3** and **Table 4**).
3. Skin-to-hyoid bone distance (DSH): Mean values were 0.76 ± 0.17 cm for easy and 0.92 ± 0.18 cm for difficult laryngoscopy ($p < 0.0001$). AUC was 0.76, with a cut-off of > 0.78 cm (**Table 3** and **Table 4**).
4. Skin-to-vocal cords distance (DSVC): Mean values were 0.75 ± 0.14 cm for easy and 0.97 ± 0.18 cm for difficult laryngoscopy ($p < 0.0001$). AUC was 0.83, with a cut-off of > 0.78 cm (**Table 3** and **Table 4**).

DSE and DSVC demonstrated the highest sensitivity (89.74% and 92.31% respectively) and negative predictive values (93.55% and 95.31% respectively) among all ultrasound parameters. Geniohyoid muscle thickness and DSH showed moderate sensitivity (71.79% each) with good and negative predictive values (86.59% and 86.08%, respectively) (**Table 4**). Both had an AUC of 0.83, indicating their reliability as predictors of difficult airways. The ROC analysis for all parameters is depicted in **Figure 4**.

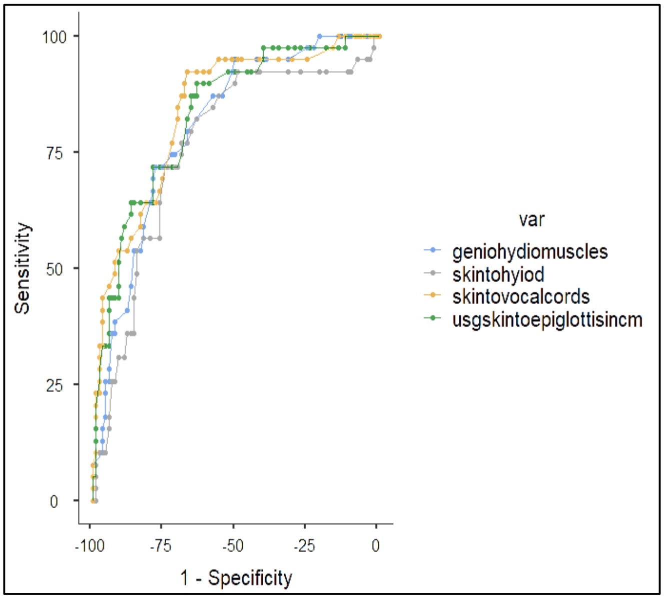

Figure 4: ROC for distance from skin to epiglottis, skin to hyoid, skin to vocal cords and geniohyoid muscle thickness

Table 3: Statistical analysis of ultrasound parameters based on actual difficult airway based on CL grading

Ultrasound parameter	Difficult airway	N	Mean	Std. Deviation	95% Confidence Interval for Mean		t test p-value	
					Lower Bound	Upper Bound		
Skin to epiglottis thickness (DSE)	Yes	39	2.13	0.28	2.04	2.22	<0.0001*	**HS**
	No	91	1.78	0.24	1.73	1.83		
	Total	130	1.88	0.30	1.83	1.94		
Geniohyoid muscle thickness (TGM)	Yes	39	0.86	0.13	0.81	0.90	<0.0001*	**HS**
	No	91	0.71	0.12	0.69	0.74		
	Total	130	0.76	0.14	0.73	0.78		
Skin to hyoid (DSH)	Yes	39	0.92	0.18	0.86	0.97	<0.0001*	**HS**
	No	91	0.76	0.17	0.73	0.80		
	Total	130	0.81	0.18	0.78	0.84		
Skin to vocal cords (DSVC)	Yes	39	0.97	0.18	0.91	1.03	<0.0001*	**HS**
	No	91	0.75	0.14	0.72	0.78		
	Total	130	0.82	0.18	0.78	0.85		

Table 4: Cut-off, sensitivity, specificity, PPV, NPV and P-value for each parameter

Parameters	Cut-off point (cm)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	AUC	p-value
Skin to epiglottis at the level of thyrohyoid membrane (DSE)	1.81	89.74	63.74	51.47	93.55	0.83	<0.0001*
Geniohyoid muscle thickness (TGM)	0.78	71.79	78.02	58.33	86.59	0.76	<0.0001
Skin to hyoid (DSH)	0.86	71.79	74.73	54.90	86.08	0.80	<0.0001
Skin to vocal cords (DSVC)	0.79	92.31	67.03	54.55	95.31	0.83	<0.0001
Wilson score	2	20.5	100	100	74.6	0.764	<0.0001

p-value: 0.05 is statically significant

4. Discussion

Various conventional methods are used for the prediction of difficult airways, but none of the tests are 100% sensitive or specific. Wilson's score is one of the simplest and most frequently used group indices where 5 different parameters are used to predict difficult airways. These group indices are better as compared to independent tests. Airway ultrasound has gained popularity in recent times for airway assessment. It is a non-invasive diagnostic tool for measuring different airway dimensions which helps in predicting difficult airway.

In our study, demography profiles of patients like Age, Height, Weight, and gender were comparable in easy and difficult intubation groups. (**Table 1**) Obesity with a BMI of more than 30 kg/m2 is associated with a difficult airway. As increased soft tissue in the neck influences the visualization of vocal cords so, we may have encountered a difficult airway in patients with higher BMI.

In our study, we compared Wilson's score with different ultrasound parameters to predict a difficult airway. Wilson's score predicted difficult airway in 8 patients out of 130 patients with sensitivity, specificity and accuracy of 20%, 100% and 76% respectively. Contradictory to our study Aasif Hamid et al in their study compared Wilson's score with Mallampati's grading and found that Wilson's score is a better predictor of difficult intubation than Mallampati's score with sensitivity, specificity and accuracy of 84.44%, 90% and 85% respectively.[9] This difference may be because they considered intubation difficulty score to define easy and difficult intubation whereas in our study we have used Cormack- Lehane grading.

Siddiqui et al did a study combining the Mallampati and Wilson score to predict difficult airways in obese patients and found sensitivity, specificity and accuracy of 75%, 98.8% and 94.6% by correlating with Cormack-Lehane grading as the gold standard. The higher sensitivity in their study may be because of the study population chosen, which included only obese patients.[10] Sri Vidhya et al compared the Wilson score and intubation prediction score for the prediction of difficult airway in the eastern Indian population and found sensitivity and accuracy of Wilson score 38.9% and 78.33% respectively which is similar to our study results.[5]

Ultrasound airway assessment offers objective, real-time visualization of structures like the tongue, epiglottis, and cricothyroid membrane, providing precise measurements (e.g., airway diameter, soft tissue thickness) and superior predictive accuracy for difficult intubation. In contrast, Wilson's score relies on subjective, static assessments prone to inter-observer variability and fails to provide direct anatomical insights, making it less reliable in predicting difficult airways, especially in complex cases like obesity or trauma and restricted neck mobility.

Among all the ultrasound parameters, we found that US-DSE had a higher AUROC of 0.83. In our study, the cut-off values of DSE > 1.81 cm with a sensitivity of 89.74% for predicting a difficult airway. Our study was comparable to Abdelhady et al., which found that the DSE cut-off value was 1.85 cm with a sensitivity of 80%.[6] Shetty et al had a negative predictive value of 98.80% for DSE which was similar to our study with an NPV value of 93.55%.[7] Rana et al in their study had a cut-off value of 1.8 cm which is comparable with our study.[11] Similar to our study, Adhikari et al in their study had a cut-off value of 1.9 cm for DSE.[12] Bhagavan et al found a DSE cut-off of 2.03cm.[13]

In our study we found the DSVC had a sensitivity of 92.31% with an AUROC curve of 0.839 which was similar to a study done by Urvashi et al, which showed a sensitivity of 87.5% with an AUROC value of 0.887.[14] Shetty et al found the cut-off value of DSVC of 0.6 ±0.3 cm with NPV of 98.6% which was similar to our study results which had a cut-off value of 0.78 cm with NPV of 95.31%.[7] Alessandri et al found a cut-off of 0.75cm from the skin to vocal cords distance which is similar to our study.[15]

DSVC directly measures the depth of the vocal cords, which is critical for predicting the ease or difficulty of their visualisation during laryngoscopy. Unlike parameters such as the distance to the hyoid bone or epiglottis, DSVC corresponds to the endpoint of intubation. While parameters like skin-to-epiglottis distance (DSE) assess earlier steps of laryngoscopy, DSVC encompasses the entire visual pathway to the vocal cords, providing a more comprehensive assessment of airway difficulty.[13] DSVC is particularly useful in obese or morbidly obese patients, where increased soft tissue thickness can obscure visualisation. It quantifies this challenge more effectively than other parameters like geniohyoid thickness or skin-to-hyoid distance.

In our study, we found that geniohyoid muscle thickness had a cut-off of 0.78 cm for predicting difficult airways with a sensitivity of 71.79% and specificity of 78.02% with AUROC 0.76. Similar to our study, Yao et al had a sensitivity of 75% and specificity of 72%.[16] The NPV of our study was 86.59% which was similar to Anushaprakash et al who found the NPV of tongue thickness of 90.8%.[17] Yadav et al also found geniohyoid muscle thickness is a good predictor for difficult airway with specificity and sensitivity of 72% and 71% respectively, with AUROC of 0.72 which is similar to our study.[18]

The hyoid bone, as the sole bony component of the larynx, is identified on ultrasound as a clear hyperechoic structure. According to findings by C. M. Hui et al., the hyoid bone becomes less likely to align with the ultrasound probe when it is positioned more caudally. They concluded that the inability to see the hyoid bone on sub-lingual ultrasound is associated with difficult laryngoscopic views.[19] The cut-off value of Skin to hyoid bone distance (DSH) in our study was 0.86 cm. Anushaprakash et al measured the ultrasound airway parameters and found that the skin to the hyoid bone had a cut-off value of 0.92 cm. which was comparable with our study.[17] Mehran et al, in their study, found a cut-off of 1.03 cm with a sensitivity of 57% and specificity of 84%. The higher cut-off value in Mehran et al may be due to the change in ethnicity of the study population.[20] Kanoujiya et al had a cut-off value of 0.81 cm which correlates with our study.[21] Alessandri et al had a cut-off value of 0.88cm in predicting difficult airway which is similar to our study results.

The study has certain limitations. Firstly, the use of ultrasound for airway assessment may introduce inter-observer variability in measurements, as it depends on the skill and experience of the anaesthesiologist performing the assessment. Additionally, the exclusion of pregnant patients limits the applicability of the results to this specific population. The study also focused on a specific age range (18-70 years), indicating a need for further research to validate findings in younger individuals and those over 70. Moreover, the requirement for specialized training and equipment may hinder the widespread implementation of ultrasound in clinical practice, particularly in resource-constrained settings. Future research should aim to validate the utility of airway ultrasound across diverse populations and clinical environments, standardize its application, and explore its potential for broader clinical use. Large-scale, multicentre studies and advancements in technology will be essential to establish airway ultrasound as a universally reliable tool in airway management.

5. Conclusion

Ultrasound airway assessment proves to be a superior predictor of difficult airways compared to Wilson's score. While Wilson's score, a combination of clinical parameters, was previously considered a reliable predictor in the pre-ultrasound era, the advent of ultrasonography has enabled more precise airway assessment than clinical predictors alone. Among the airway ultrasound parameters evaluated, the Distance of skin to vocal cords (DSVC) and skin to epiglottis (DSE) demonstrated higher accuracy in predicting difficult airways. Ultrasound can be utilized as a simple, quick, and non-invasive bedside screening tool for airway assessment. With appropriate training, investment, and protocol adjustments, ultrasound has the potential to become a valuable and indispensable tool in modern healthcare for airway management.

6. Source of Funding

None.

7. Conflict of Interest

None.

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