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Airway Ultrasound Versus Mallampati Score as a Predictor of Difficult Direct Laryngoscopy in Obese Patients an Observational Study

Sherif Hany Adly Loka [1,*], Mohamed Ismail Abd El Fattah El Seidy [1], Ahmed Elsayed Elshafeey [1], Mohamed Abd Alsalam Algendy [1]

[1] Department of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain-Shams University, Cairo, Egypt

[*] ***Corresponding Author:*** Department of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain-Shams University, Cairo, Egypt. Email: sh_1507@hotmail.com

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Abstract

Background: The accuracy of tests has been documented and demonstrated in daily practice; however, a few patients classified as having an easy airway may still present with unexpectedly difficult intubation.

Objectives: This study aims to compare the Mallampati score with various airway ultrasound measurements and assess the sensitivity and specificity of different airway ultrasound measurements. The primary outcome is to identify a rapid, non-invasive, and user-friendly tool for predicting difficult laryngoscopy using a readily available device in operating rooms (ultrasound).

Methods: This study was an observational, single-blinded, prospective study involving 63 patients. The enrolled participants, aged 18 to 60 years of both sexes, had an American Society of Anesthesiologists (ASA) score of I to III. They were scheduled for an elective surgical procedure that necessitated the insertion of an endotracheal tube, with a Body Mass Index (BMI) higher than 30 kg/m^2.

Results: The analysis revealed that the distance from the skin to the trachea at the level of the suprasternal notch demonstrated the highest area under the curve (AUC). This was followed by the distance from the skin to the hyoid bone, then the Mallampati test. The least predictive was the distance from the skin to the thyroid cartilage. The Mallampati score had a sensitivity of 41.2% and a specificity of 73.9%. The distance from the skin to the hyoid bone had a sensitivity of 58.8% and a specificity of 80.4%. The distance from the skin to the thyroid cartilage had a sensitivity of 82.4% and a specificity of 37%. Lastly, the distance from the skin to the trachea at the level of the suprasternal notch had a sensitivity of 64.7% and a specificity of 87%.

Conclusions: The combination of BMI and Mallampati score with the distance from the skin to the trachea and the distance from the skin to the hyoid bone is thought to show a higher predictive value than the combination with other predictors. However, further investigations need to be conducted with a larger sample size.

Keywords: Thyroid Cartilage, Trachea, Laryngoscopy

1. Background

Airway assessment is a critical component for anesthesiologists. The clinical practice of anesthesiology commonly encounters adverse respiratory outcomes through inappropriate ventilation, esophageal intubation, or challenging tracheal intubation. Given these concerns, there is a need to identify a highly accurate tool to assess the airway as an adjunct to routine clinical approaches (1). Assessing the thickness of soft tissue in the anterior part of the neck before surgery, along with the usual screening tests and evaluation of risk factors for difficult laryngoscopy, might surpass the capability to predict the chances of difficult laryngoscopy (2). The inadequate effectiveness of traditional screening methods in detecting a potentially problematic airway has led to difficult rates of laryngoscopy and tracheal intubation ranging from 1.5% to 13%. It is hypothesized that the existence of fat pads has a negative impact on

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visualization during direct laryngoscopy (3). In recent years, the use of ultrasound in the operating room has significantly expanded, particularly for guiding procedures such as nerve blocks and central venous catheter placement. It offers clinicians a fast, user-friendly, and reliable means of obtaining information that holds both diagnostic and therapeutic value. Despite its proven utility in various clinical applications, ultrasound has long been underutilized in the assessment of the airway and in predicting the likelihood of difficult laryngoscopy (2). Commonly used assessment tools — such as the thyromental distance (TMD), Mallampati classification, and Wilson score — have been shown in prior studies to have notably high false-positive rates, which limits their reliability and reduces their clinical utility in accurately identifying difficult airway cases (4).

2. Objectives

This study aims to compare the Mallampati score with various airway ultrasound measurements and assess the sensitivity and specificity of different airway ultrasound measurements in predicting difficult intubation, to develop a new, more accurate, and simple tool to anticipate difficult intubation.

3. Methods

The present study was conducted at Ain Shams University Hospitals, Faculty of Medicine, Ain Shams University. Scientific and ethical approval was obtained from the Faculty of Medicine, Ain Shams University Research Ethics Committee (FMASUREC) on April 9, 2023, with the approval number MD99/2023.

Sample size: Using the PASS 15 program for sample size calculation, with power set at 80% and α-error at 0.05, and according to "Abdelhady et al, 2020", the expected area under the curve (AUC) for ultrasound prediction of difficult intubation is 0.76. It is estimated that a sample size of 60 patients will be needed to predict an expected 20% rate of difficult intubation. The airway ultrasound was performed before anesthesia induction for all 63 patients participating in the study after they provided written and informed consent.

In the pre-anesthetic evaluation, demographic information was gathered from all patients, and clinical screening examinations to predict difficult intubation were conducted using the Mallampati test while the patient was in a seated, neutral position. The pre-anesthesia care unit admitted the patient, and an experienced anesthesiologist skilled in ultrasound attended to them. The ultrasound was performed while the patients were seated, with their heads in a neutral position, using the linear probe 13 - 6i of the SonoSite model M-Turbo c with a 13 - 6 MHz frequency. All patients in the study underwent preoperative airway evaluation using ultrasonography. The ultrasound operator, with over two years of experience post-qualification, conducted the assessment. The procedure was explained to the patients before the study began. The operator positioned himself to the patient's right side. Positioning the ultrasound transducer with the right hand, the transducer was held horizontally just above the suprasternal notch to observe the tracheal cartilage, a horseshoe-shaped hypo-echoic structure. The transducer was then moved upwards to examine the rest of the structures. The transducer was positioned along the transverse axis to measure ultrasound distances. The measured distances included the distance from the hyoid bone to the surface of the skin, the distance from the skin to the thyroid cartilage, and the distance from the skin to the trachea at the point of the suprasternal notch. All assessments were performed utilizing ultrasound measurements, with adjustments made to the gain and depth in millimeters to achieve the optimal viewpoint.

The tray and equipment for managing difficult intubation were prepared and accessible before induction. Patients were transferred to the operating room and monitored by American Society of Anesthesiologists (ASA) standard monitors. An anesthesiologist with over two years of experience post-qualification attempted direct laryngoscopy with a properly sized curved Macintosh blade, and the modified Cormack-Lehane laryngoscopic grade was assessed and recorded. Confirmation of the proper placement of the endotracheal tube was achieved using capnography and by auscultating both lungs on each side (3). Assessing the glottis aperture involved using the modified Cormack-Lehane scale. A rating of 2b, 3, or 4 was regarded as a difficult endotracheal intubation view for the patient. The anesthesiologist responsible for intubation did not participate in the pre-operative clinical or sonographic airway assessment. Consequently, the preoperative airway evaluation findings were not known to him, resulting in his being blinded to the findings.

Assessment of patients included evaluating the Mallampati score, measuring the distance from the skin to the thyroid cartilage, determining the distance from the skin to the anterior aspect of the trachea at the level of the suprasternal notch, and measuring the distance from the skin to the hyoid bone.

Inclusion criteria: Eligible participants were both male and female adults between 18 and 60 years old, with an ASA classification score ranging from I to III, scheduled for a non-emergency surgical procedure that necessitated the insertion of an endotracheal tube, and with a Body Mass Index (BMI) greater than 30 kg/m^2.

Exclusion criteria: Excluded were patients who declined to participate, those with a history of airway or neck surgery, abnormalities in neck mobility, syndromes that could potentially affect the airway, facial or cervical vertebrae fractures, maxillofacial abnormalities, cervical masses or thyroid goiter, a history of difficult intubation, patients who have already undergone tracheostomy, and pregnant individuals.

4. Results

The patients were categorized into two groups regarding intubation difficulty: The D group (difficult intubation) and the E group (easy intubation). Seventeen patients were considered to have difficult intubation, and 46 patients were considered to have easy intubation.

Demographics (Table 1): Demographic data for the groups were compared, specifically in terms of age, sex, and BMI (mean ± SD). This table shows an insignificant effect of age and BMI in the prediction of difficult intubation, with P-values of 0.077 and 0.262, respectively, versus a significant effect of sex in anticipation, with a P-value < 0.001.

Intubation predictors (Table 2): Groups were compared regarding intubation predictors' data (in terms of skin-to-hyoid length, skin-to-thyroid cartilage length, skin-to-tracheal length at the level of the suprasternal notch, and Mallampati score). No meaningful differences between the groups were found, except in the length of the trachea, with a P-value of 0.005, while the p-value was 0.091 for the distance from skin to hyoid bone and 0.985 for the distance from skin to thyroid cartilage.

ROC analysis (Table 3): ROC analysis was conducted for predictors to predict difficult intubation. Tracheal length showed the best AUC, followed by hyoid length, then Mallampati score, thyroid cartilage length, and least was BMI. This indicates that the best predictor for difficult intubation was the distance from the skin to the trachea, while the least predictive was BMI. This table shows the cutoff values after which the probability of difficult intubation increases and their sensitivity and specificity of different parameters. The Mallampati test cutoff value was > 2, with a sensitivity of 41.2% and specificity of 73.9%. The distance from skin to the hyoid bone cutoff value was > 1.18 cm, with a sensitivity of 58.8% and specificity of 80.4%. The distance from skin to thyroid cartilage cutoff value was > 0.59 cm, with a sensitivity of 82.4% and specificity of 37%. The distance from skin to trachea at the level of the suprasternal notch cutoff value was > 1.41 cm, with a sensitivity of 64.7% and specificity of 87%. The BMI cutoff value was ≥ 31.38 kg/m^2, with a sensitivity of 82.4% and specificity of 34.8%.

Logistic regression analysis (Table 4): The logistic regression analysis shows that the risk factors associated with difficult intubation are the BMI of the patient and the distance from the skin to the trachea at the level of the suprasternal notch.

5. Discussion

The objective of this study was to predict difficult direct laryngoscopy before endotracheal intubation using airway ultrasound versus the Mallampati score for obese patients undergoing general anesthesia, using the modified Cormack-Lehane classification as a reference. The current research investigates the effectiveness of using ultrasound to assess the neck, which only takes a few minutes, to determine the state of the patient's airway and predict difficult intubation before administering anesthesia. The skin-to-thyroid cartilage distance and BMI demonstrated greater sensitivity but lower specificity compared to the other predictive measures. In contrast, both the skin-to-trachea distance at the suprasternal notch and the skin-to-hyoid bone distance exhibited high specificity but low sensitivity. Combining BMI and Mallampati score with skin-to-trachea and skin-to-hyoid bone distances is believed to offer superior predictive accuracy compared to combinations involving other parameters.

Assessing the airway rapidly and efficiently can be a useful additional resource for anesthesiologists with busy schedules in their daily work. It allows the anesthesia care teams to obtain insightful, non-invasive visuals of the patient's airways without causing significant delays in their routine patient care procedures. This can provide anesthesiologists with valuable information about the patient's airway before transferring them to the operating room, thereby enhancing the overall quality and safety of anesthetic management.

A total of 63 patients participated in this study as part of a single group. During this time, demographic information was gathered from each patient during the pre-anesthetic assessment, and the Mallampati score was used as the screening test to anticipate a difficult

Table 1. Demographic Data [a]

Demographic Data	Group E (n = 46)	Group D (n = 17)	P-Value
Age (y)	43.76 ± 9.5	48.65 ± 9.6	0.077 [b]
BMI	37.51 ± 8.6	35.03 ± 4.6	0.262
Gender			< 0.001 [c]
Male	11 (23.9)	12 (70.6)	
Female	35 (76.1)	5 (29.4)	

[a] Values are expressed as mean ± SD or No. (%).
[b] *t*-test.
[c] Chi-square.

Table 2. Intubation Predictors [a]

Skin To	Group E (n = 46)	Group D (n = 17)	P-Value
Hyoid (cm)	0.94 ± 0.3	1.09 ± 0.3	0.091 [b]
Thyroid (cm)	0.726 ± 0.3	0.724 ± 0.2	0.985 [b]
Trachea (cm)	1.14 ± 0.3	1.42 ± 0.4	0.005 [b]
Mallampati			0.209 [c]
1	9 (19.6)	1 (5.9)	
2	25 (54.3)	9 (52.9)	
3	12 (26.1)	6 (33.3)	
4	0 (0)	1 (5.9)	

[a] Values are expressed as mean ± SD or No. (%).
[b] *t*-test.
[c] Chi-square.

Table 3. Roc Analysis

Variables	AUC	Cut-off	Sensitivity (%)	Specificity (%)
Mallampati	0.619	> 2	41.2	73.9
Hyoid (cm)	0.671	>1.18	58.8	80.4
Thyroid (cm)	0.542	> 0.59	82.4	37
Trachea (cm)	0.723	> 1.41	64.7	87
BMI	0.480	≥ 31.38	82.4	34.8

Abbreviations: AUC, area under the curve; BMI, Body Mass Index.

airway while the patients were sitting in a neutral position. Following this, the patients were transferred to the pre-anesthesia care unit and were attended to by an experienced anesthesiologist who performed ultrasound examinations with the patients seated and their heads in a neutral position.

Results of this present study revealed that the ultrasonographic distance from the skin to the hyoid bone was 1.09 ± 0.3 cm in group D compared to 0.94 ± 0.3 cm in group E, indicating that this distance increases in obese patients with a difficult airway. Although the result did not reach statistical significance, the observed effect may still be clinically meaningful, particularly in a larger sample size. Results of this present study are in agreement with a pilot study conducted (5), which assessed the use of ultrasound to evaluate difficult laryngoscopy by measuring the distance from the skin to the hyoid bone. The results were 1.69 ± 0.47 cm in the difficult group and 1.37 ± 0.31 cm in the easy group, respectively. Most of the significant difference may be

Table 4. Logistic Regression Analysis of Predictors for Difficult Intubation

Variables	Coefficient	Standard Error	Wald	P-Value	Odds Ratio	95% CI
BMI (kg/m ^{2})	-0.18795	0.079831	5.5432	0.0186	0.8287	0.7086 to 0.9690
Malembati	1.06825	0.55667	3.6825	0.0550	2.9103	0.9774 to 8.6652
Hyoid (cm)	0.95162	1.15130	0.6832	0.4085	2.5899	0.2712 to 24.7335
Thyroid (cm)	-1.38893	1.86892	0.5523	0.4574	0.2493	0.0064 to 9.7197
Trachea (cm)	3.76229	1.28255	8.6051	0.0034	43.0470	3.4851 to 531.7059
Constant	-1.44747	2.37794	0.3705	0.5427	-	-

Abbreviation: BMI, Body Mass Index.

attributed to the difference in the ultrasound technique or ethnicity of the candidates.

The results were clinically consistent with those of another study (6), which found that the distance in the difficult group was 1.51 ± 0.27 cm compared to 0.98 ± 0.26 cm for the easy group, with a P-value < 0.0001. This may be attributed to a larger sample size of 203 participants. Other studies found that at the level of the hyoid bone, patients with difficult laryngoscopy had a remarkably longer length from the skin to the hyoid bone of 1.08 ± 0.41 cm. However, unlike Reddy et al., whose results were not proven to be an effective method for predicting difficult intubation with a P-value of 0.857, this was statistically consistent with the present study (7, 8).

The results of this present study revealed that the ultrasonographic distance from the skin to the thyroid cartilage was 0.724 ± 0.2 cm in group D compared to 0.726 ± 0.3 cm in group E, indicating a statistically non-significant result with a P-value of 0.985. Adhikari et al. found no notable variance in the thickness of the frontal neck soft tissue at the level of the thyroid cartilage between the easy and difficult intubation groups, which was consistent with the present study (5).Similarly, Abraham et al.'s study had the same results as this study, finding that the skin pad thickness over the thyroid cartilage in the easy group was 1.08 ± 0.48 cm versus 1.29 ± 0.47 cm in the difficult group, with a non-significant P-value of 0.191 (1).

Reddy P et al.'s study found that the measurement of the distance from the skin to the thyroid cartilage is a considerable method in airway evaluation, and a measurement of more than 0.23 cm in thickness was associated with the forecast of challenging intubation. Using a ROC curve, he found that the distance from the skin to the thyroid cartilage of > 0.23 cm was associated with a difficult airway, which disagrees with this present study's outcomes. This discrepancy could be attributed to the larger sample size of Reddy's study and his technique, as he took his measurements while the patients were in a sniffing position in a supine position with active maximum head extension (8).

On the other hand, the present study showed a significant value in the prediction of difficult intubation with the measurement of skin-to-trachea thickness at the level of the suprasternal notch. The D group showed a distance of 1.42 ± 0.4 cm, and the E group showed 1.14 ± 0.3 cm, with a P-value of 0.005. This was consistent with Ioan Marchis et al. in their review titled "Trends in Preoperative Airway Assessment" (9).

Unlike Adhikari et al., whose study showed that none of the ultrasound measurements of the frontal neck soft tissue demonstrated any statistically significant differences at the level of the suprasternal notch, this may be due to a smaller sample size, ultrasound technique, and ethnicity, as his study candidates were Whites and African Americans. In contrast, the present study was conducted on Middle Eastern Egyptian patients. It has been previously noted in past studies that there are variations in the distribution of neck fat tissue among various ethnic groups. Additionally, his candidates' mean BMI was lower by 10-20 kg/m² than the patient populations in the present study, which started from 30 kg/m², yet he did not mention any measurements in his study for comparison (5).

In the current study, we compared the ultrasonographic findings and the Mallampati score significance in detecting difficult intubation. The Mallampati score results were insignificant, with a P-value of 0.209, a sensitivity of 41.2%, and a specificity of 73.9%. Kuppuswamy and Srinivasan's study on the Mallampati score showed a sensitivity of 70.5%, a specificity of 54.7%, and a significant P-value of 0.001. These results are quite opposite to the current findings but may be attributed to different factors, such as the large sample size they used in their study, which included 354 patients (10).

Detsky et al.'s analysis of 47 studies about the Mallampati test found that the prediction of difficult intubation had moderate accuracy when the

Mallampati score was 3 or 4. Nonetheless, a Mallampati score of 1 or 2 did not necessarily indicate easy intubation. For a score of ≥ 3, the sensitivity is 0.55 and specificity is 0.87, which is almost consistent with the present study (11).

Generally, the variability in sensitivity and specificity reported for the Mallampati test in different studies may be attributed to various factors. The primary ones include discrepancies between observers, as there is no distinct boundary between class 2 and class 3, and between class 3 and class 4. The Mallampati test has certain restrictions, such as its failure to evaluate neck mobility, which is a significant factor in anticipating difficult intubation. Furthermore, studies have demonstrated that a low Mallampati score prediction is associated with the occurrence of involuntary phonation during the examination, which can affect the score. Numerous research studies have shown that the key element in obtaining a dependable Mallampati test result is maximizing tongue protrusion and opening the mouth. If these actions are not performed, the test results will be negatively impacted.

5.1. Conclusions

The individual tests for predicting challenging intubation have only mild to moderate ability to distinguish when used independently. The combination of tests provides additional diagnostic value compared to each test if used alone. In the current study, the distance from the skin to the thyroid cartilage and BMI had higher sensitivity and lower specificity than the other predictors. In contrast, the distance from the skin to the trachea at the suprasternal notch and the distance from the skin to the hyoid bone both had high specificity and low sensitivity. The combination of BMI and Mallampati score with the distance from the skin to the trachea and the distance from the skin to the hyoid bone is thought to show a higher predictive value than combinations with other predictors. However, further investigations need to be conducted with a larger sample size to precisely determine the sensitivity and specificity of this combination and strengthen the results, as no test has 100% sensitivity. Unavoidable difficult tracheal intubations and difficult laryngoscopies may be missed, and some false positives may occur, but they should be less frequent. The results of commonly utilized airway assessment tests can vary, but it is important for every anesthesiologist to be knowledgeable about the difficult airway algorithm.

5.2. Limitations

This study has several limitations. First, it was conducted at a single center with the same population (Egyptians), which may limit the generalizability of the results. Second, the use of ultrasound is operator-dependent and may be subject to interobserver variability. A larger sample size may yield better results. Lastly, some of the clinical assessment tools used, such as the Mallampati score, are inherently subjective.

Footnotes

Authors' Contribution: Study concept and design: M. E.; Acquisition of data: S. L; Analysis and interpretation of data: A. E.; Drafting of the manuscript: M. A.; Critical revision of the manuscript for important intellectual content: S. L.

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References

1. Abraham S, Himarani J, Mary Nancy S, Shanmugasundaram S, Krishnakumar Raja VB. Ultrasound as an Assessment Method in Predicting Difficult Intubation: A Prospective Clinical Study. *J Maxillofac Oral Surg*. 2018;**17**(4):563-9. [PubMed ID: 30344401]. [PubMed Central ID: PMC6181859]. https://doi.org/10.1007/s12663-018-1088-1.
2. Alessandri F, Antenucci G, Piervincenzi E, Buonopane C, Bellucci R, Andreoli C, et al. Ultrasound as a new tool in the assessment of airway difficulties: An observational study. *Eur J Anaesthesiol*. 2019;**36**(7):509-15. [PubMed ID: 31742568]. https://doi.org/10.1097/EJA.0000000000000989.
3. Abdelhady BS, Elrabiey MA, Abd Elrahman AH, Mohamed EE. Ultrasonography versus conventional methods (Mallampati score and thyromental distance) for prediction of difficult airway in adult patients. *Egypt J Anaesth*. 2020;**36**(1):83-9. https://doi.org/10.1080/11101849.2020.1768631.

4. Amruthraju CM, Rao SS, Rooparani K, Vinay R, Vikas KN, Deepak TS, et al. The ratio of height to thyromental distance (RHTMD) and height to sternomental distance (RHSMD) as the predictive tests for difficult tracheal intubation. *Cureus*. 2022;**14**(9).
5. Adhikari S, Zeger W, Schmier C, Crum T, Craven A, Frrokaj I, et al. Pilot study to determine the utility of point-of-care ultrasound in the assessment of difficult laryngoscopy. *Acad Emerg Med*. 2011;**18**(7):754-8. [PubMed ID: 21707828]. https://doi.org/10.1111/j.1553-2712.2011.01099.x.
6. Wu J, Dong J, Ding Y, Zheng J. Role of anterior neck soft tissue quantifications by ultrasound in predicting difficult laryngoscopy. *Med Sci Monit*. 2014;**20**:2343-50. [PubMed ID: 25403231]. [PubMed Central ID: PMC4247231]. https://doi.org/10.12659/MSM.891037.
7. Gomes SH, Simoes AM, Nunes AM, Pereira MV, Teoh WH, Costa PS, et al. Useful Ultrasonographic Parameters to Predict Difficult Laryngoscopy and Difficult Tracheal Intubation-A Systematic Review and Meta-Analysis. *Front Med (Lausanne)*. 2021;**8**:671658. [PubMed ID: 34124099]. [PubMed Central ID: PMC8193063]. https://doi.org/10.3389/fmed.2021.671658.
8. Reddy PB, Punetha P, Chalam KS. Ultrasonography - A viable tool for airway assessment. *Indian J Anaesth*. 2016;**60**(11):807-13. [PubMed ID: 27942053]. [PubMed Central ID: PMC5125183]. https://doi.org/10.4103/0019-5049.193660.
9. Marchis IF, Negrut MF, Blebea CM, Crihan M, Alexa AL, Breazu CM. Trends in Preoperative Airway Assessment. *Diagnostics (Basel)*. 2024;**14**(6). [PubMed ID: 38535030]. [PubMed Central ID: PMC10968937]. https://doi.org/10.3390/diagnostics14060610.
10. Kuppuswamy B, Srinivasan C. Comparison of validity of airway assessment tests for predicting difficult intubation. *Indian Anaesth Forum*. 2017;**18**(2). https://doi.org/10.4103/TheIAForum.TheIAForum_31_17.
11. Detsky ME, Jivraj N, Adhikari NK, Friedrich JO, Pinto R, Simel DL, et al. Will This Patient Be Difficult to Intubate?: The Rational Clinical Examination Systematic Review. *JAMA*. 2019;**321**(5):493-503. [PubMed ID: 30721300]. https://doi.org/10.1001/jama.2018.21413.