

Jan 28, 2023  
Dr. Jerzy Tadeusz Chudek,  
Editor in Chief  
*World Journal of Clinical Cases*

Dear Professor Chudek:

We wish to resubmit an article for publication in the *World Journal of Clinical Cases* titled "Airway ultrasound for patients anticipated to have a difficult airway: perspective for personalized medicine (ID 82299)".

Thank you for giving us the opportunity to resubmit the paper. We have responded to the reviewers' comments in a point-by-point fashion. Thank you for your consideration. We look forward to hearing from you.

Sincerely,

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Reviewer #1:

**Scientific Quality:** Grade C (Good)

**Language Quality:** Grade B (Minor language polishing)

**Conclusion:** Minor revision

**Specific Comments to Authors:**

1. Abstract From the mode of writing the review abstract, the abstract needs to be more general and global, especially the description of the cricothyroid membrane identification by airway ultrasound. It is to be hoped that the abstract will be further improved to comply with this requirement.

Thank you very much for the suggestion. We have tried to make it more generalized and also added the following sentence to the revised manuscript:

*The goal of this review is to present practical applications of airway ultrasound for patients predicted to have a difficult airway and who undergo cricothyroidotomy.*

2. The authors conclude that there are two main types of methods for predicting difficult airways. The first type is the skin-to-airway distance. The second type of method is the hyomental distance ratio, which corresponds to different types of difficult airways according to their anatomical significance.

1) I would like to see a more detailed description of "skin to epiglottis distance as a predictor of difficult intubation" by the authors. In P8, the authors mention that skin-to- epiglottis distance is also a predictor of difficult mask ventilation, and I would like the authors to provide a more detailed description and more literature support.

Thank you very much for the suggestion. We have added the following sentences to the revised manuscript to give a more detailed description with further literature

support as you suggested.

*Skin to epiglottis distance is a highly evaluated index with excellent sensitivity and specificity for predicting the difficult airway<sup>[22]</sup>. Skin to epiglottis distance is anatomically considered to reflect the distance from the skin to the airway<sup>[22]</sup>. A longer distance is associated with increasing difficulty when performing direct laryngoscopy<sup>[22]</sup>. Anatomical reasons are explained by the three column model of the upper airway described by Greenland et al<sup>[23]</sup>. Briefly, the increase in skin to epiglottis distance makes the orientation of the tracheal axis (secondary curve of the three column model) to be downward. The skin to epiglottis distance may be an indicator of the difficulty for both mask ventilation and direct laryngoscopy.*

**22 Falcetta S, Cavallo S, Gabbanelli V, Pelaia P, Sorbello M, Zdravkovic I, Donati A.** *Evaluation of two neck ultrasound measurements as predictors of difficult direct laryngoscopy: A prospective observational study. Eur J Anaesthesiol. 2018;35:605-612. [PMID: 29889671, DOI: 10.1097/EJA.0000000000000832]*

**23 Greenland KB.** *Airway assessment based on a three column model of direct laryngoscopy. Anaesth Intensive Care. 2010;38:14-9. [PMID: 20191771, DOI: 10.1177/0310057X1003800104]*

2) The distance from skin to hyoid bone and skin to the anterior commissure of vocal cords, the anterior cervical soft tissue thickness at the level of the thyrohyoid membrane. The above indicators have clinical significance in previous studies, and I would like the authors to add these indicators, such as the advantages and disadvantages in clinical application.

Thank you for your opinion. These indicators have been shown to have sensitivity

and specificity, but there are no studies yet on advantage or disadvantage in clinical application. We added some comments about these indicators, and a new reference.

*The measurement of anterior neck thickness may make sense based on the anterior obstacles of the oral airway space theory<sup>[14]</sup>. These measurement points are the distance from the skin to the hyoid bone, the distance from the skin to the anterior commissure, and the thickness of the anterior neck soft tissues at the level of the hyoid bone. The authors speculate that anterior cervical thickness would be associated with obesity, which is clearly a predictor of an airway difficulty. In this paper, three predictors were chosen based on anatomical considerations. However, there is still the potential for more accurate prediction by combining anterior neck thickness with other independent predictors.*

**23 Greenland KB.** Airway assessment based on a three column model of direct laryngoscopy. *Anaesth Intensive Care*. 2010;**38**:14-9. [PMID: 20191771, DOI: 10.1177/0310057X1003800104]

3. In Table 1, the authors give the cut-off values of ultrasound indicators for predicting difficult airways, which should be cited from the following studies, with a citation mark.

1) Falcetta S, Cavallo S, Gabbanelli V, Pelaia P, Sorbello M, Zdravkovic I, Donati A. Evaluation of two neck ultrasound measurements as predictors of difficult direct laryngoscopy: A prospective observational study. *Eur J Anaesthesiol*. 2018 Aug;**35**(8):605-612. doi: 10.1097/EJA.0000000000000832. PMID: 29889671.

2) Rana S, Verma V, Bhandari S, Sharma S, Koundal V, Chaudhary SK. Point-of-care ultrasound in the airway assessment: A correlation of ultrasonography-guided parameters to the Cormack-Lehane Classification. *Saudi J Anaesth*. 2018 Apr-Jun;**12**(2):292-296. doi: 10.4103/sja.SJA\_540\_17. PMID: 29628843; PMCID:

PMC5875221.

3) Xu L, Dai S, Sun L, Shen J, Lv C, Chen X. Evaluation of 2 ultrasonic indicators as predictors of difficult laryngoscopy in pregnant women: A prospective, double blinded study. *Medicine (Baltimore)*. 2020 Jan;99(3):e18305. doi: 10.1097/MD.00000000000018305. PMID: 32011432; PMCID: PMC7220303. 4. I would like the authors to explain why these cutoffs are presented in Table 1. Is it because these cutoff values have better sensitivity and specificity compared to other studies?

We have added these papers to the references.

5. In P8 “The distance from the skin to the epiglottis is a predictor of difficulty for direct laryngoscopy and mask ventilation. The hyomental distance ratio is a predictor of difficult direct laryngoscopy, and tongue base thickness is a predictor of difficult mask ventilation.” This is an attractive description, and I hope the author will discuss it in detail and provide supporting literature.

To date, the effectiveness of many predictors has been evaluated. However, it is up to the anesthesiologist to decide how to secure the airway in clinical practice. We have proposed an anatomically-based categories of predictors, which is mask ventilation difficulty and direct laryngoscopy difficulty. This perspective article is the meaning of the title of this paper “perspective for personalized medicine”. Since we have already presented literature supporting this reasoning, we have not added further references.

6. In this manuscript, the authors summarize a number of single ultrasound parameters used to predict the difficult airways and hope that the authors can complement the research content on multi-parameter combinations of ultrasound parameters used to predict the difficult airways.

Multi-parameter combinations have the potential to increase the predictive accuracy of airway securement. However, the author's argument in this paper is the opposite, arguing that dividing airway difficulties into mask ventilation difficulties and intubation difficulties, may lead to an improved strategy for securing the airway.

7. In P12 "Kristensen et al. recommend that the technique used for identification of the cricothyroid membrane should be chosen by the patient" This statement may be confusing to the reader. I want the authors to determine "by the patient" or "by the doctor"

It would literally be, "by the patient".

8. In P14 "In many cases, overlap of different degrees of difficult tracheal intubation and difficult mask ventilation are present." What this describes is clinically significant because it is a huge problem. In the following paragraph, the author quotes "The American Society of Anesthesiologists' Task Force on Management of the Difficult Airway" to describe how to deal with such difficulties. It is to be hoped that the author will be able to give a more detailed account of the solution of this difficult problem.

We have included an outline in the manuscript. We expect that all can follow that outline for their strategies. However, the question is not only the effectiveness of the means to implement the outline, but also to what extent the predictions are correct. Even if the predictions are infinitely correct, if there is no backup plan B, it will not be truly safe.

The authors apologize sincerely for failure to reply to the comment from the reviewer. However, the clinical practice of airway ultrasound has just begun, and

the authors hope that future studies will develop more specific strategies and tools.

9. Endotracheal intubation in a child or newborn infant may also present a difficult airway for the physician because the determination of the correct diameter of the endotracheal tube (ETT) is difficult, in cases of tracheal stenosis or for a double-lumen tube (DLT), especially in small patients, it is useful to precisely know the diameter of the subglottic upper airway. It is to be hoped that the authors will be able to add to this.

*The following text and references have been added to respond to this important point.*

#### *Can airway ultrasound be used to predict tracheal tube size?*

*Tracheal intubation in a pediatric patient may also present difficulty securing the airway for the physician because determination of the optimal diameter of the tracheal tube is difficult. In pediatric patients, the cross-sectional shape of the trachea is circular at the cricothyroid level and oval at the subglottic level<sup>[58]</sup>. The narrowest part of the trachea is the transverse diameter at the subglottic level<sup>[58]</sup>. Using airway ultrasound, the subglottic diameter can be directly measured<sup>[59]</sup>. A recent meta-analysis showed that airway ultrasound can accurately predict tracheal tube size estimates, unlike the usual age or height-based formulas used in pediatric patients<sup>[60]</sup>. The minimal transverse diameter of the cricoid cartilage level was reported to be important to select the tracheal size for ventilation setting<sup>[61]</sup>. The ultrasound measurement points for determining tube size vary slightly among investigators, which include the narrowest part of the subglottic airway, the middle or most caudal part of the cricoid cartilage, and so on<sup>[62]</sup>. Although the usefulness of ultrasound in selecting tube size in pediatric tracheal intubation is unquestioned, further research is needed to standardize this approach.*

- 58 **Mizuguchi S**, Motomura Y, Maki J, Baba R, Ichimiya Y, Tokuda K, Kaku N, Takada H, Maehara Y, Ohga S. Tracheal Size and Morphology on the Reconstructed CT Imaging. *Pediatr Crit Care Med* 2019;**20**:e366-e371 [PMID: 31162371 DOI: 10.1097/PCC.0000000000001996]
- 59 **Bharathi BM**, Somayaji S, Tulasi T, Sheriff NK, Bagliker JS. Prediction of Endotracheal Tube Size in Pediatric Population Using Ultrasonographic Subglottic Diameter and Age-Related Formulas: A Comparative Study. *Anesth Essays Res* 2022;**16**:1-6 [PMID: 36249135 DOI: 10.4103/aer.aer\_11\_22]
- 60 **Gupta B**, Ahluwalia P. Prediction of endotracheal tube size in the pediatric age group by ultrasound: A systematic review and meta-analysis. *J Anaesthesiol Clin Pharmacol* 2022;**38**:371-383 [PMID: 36505227 DOI:10.4103/joacp.JOACP\_650\_20]
- 61 **Schramm C**, Eisleben LS, Kessler J, Jensen K, Plaschke K. Role of ultrasound measuring position and ventilation pressure in determining correct tube size in children. *Paediatr Anaesth* 2017;**27**:1241-1246 [PMID: 29063711 DOI: 10.1111/pan.13267]
- 62 **Park S**, Shin SW, Kim HJ, Byeon GJ, Yoon JU, Kim EJ, Kim HY. Choice of the correct size of endotracheal tube in pediatric patients. *Anesth Pain Med (Seoul)* 2022;**17**:352-360 [PMID: 36317427 DOI: 10.17085/apm.22215]

10. As a novel prediction method for difficult airways, ultrasound outperforms traditional prediction methods in terms of sensitivity and specificity, such as such as the thickness of the anterior cervical soft tissues, Hyomental distance ratio. However, it is still believed that airway ultrasound is still inadequate in predicting difficult airways and is affected by several factors. Examples include the training of ultrasound examiners, the patient's position, as far as the timing of the evaluation (whether the patient is awake or under anesthesia, etc.), we hope that the authors



can make more additions here.

We added the following text and references to the revised manuscript.

### ***Limitations of airway ultrasound***

*POCUS is influenced by factors such as skill of the operator and the measurement environment. Therefore, airway ultrasonography is also influenced by several factors. To overcome this weak point of airway ultrasound, development and standardization of an educational program is needed<sup>[63]</sup>. Bowness et al. showed that the location of the cricothyroid membrane identified by a skilled operator did not change when returned to the extended neck position after moving the neck transiently for tracheal intubation<sup>[64]</sup>. The study showed that airway ultrasound may provide reproducible and reliable results with sufficient operator proficiency. In the future, as education becomes standardized and acquisition of appropriate airway ultrasound skills becomes more widespread, airway ultrasound will be the best means of assessing the ever-changing airways of patients.*

**63** Li L, Yong RJ, Kaye AD, Urman RD. Perioperative Point of Care Ultrasound (POCUS) for Anesthesiologists: an Overview. *Curr Pain Headache Rep* 2020;**24**:20 [PMID: 32200432 DOI: 10.1007/s11916-020-0847-0]

**64** Bowness J, Teoh WH, Kristensen MS, Dalton A, Saint-Grant AL, Taylor A, Crawley S, Chisholm F, Varsou O, McGuire B. A marking of the cricothyroid membrane with extended neck returns to correct position after neck manipulation and repositioning. *Acta Anaesthesiol Scand* 2020;**64**:1422-1425 [PMID: 32698252 DOI: 10.1111/aas.13680]

Reviewer #2:

**Scientific Quality:** Grade B (Very good)

**Language Quality:** Grade B (Minor language polishing)

**Conclusion:** Accept (General priority)

**Specific Comments to Authors:** Well written article

Thank you very much.

Reviewer #3:

**Scientific Quality:** Grade C (Good)

**Language Quality:** Grade A (Priority publishing)

**Conclusion:** Accept (General priority)

**Specific Comments to Authors:** Congratulations to the authors for their successful reviews.

Thank you very much.