

PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (<http://bmjopen.bmj.com/site/about/resources/checklist.pdf>) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Determining correct tracheal tube insertion depth by measuring Distance Between Endotracheal Tube Cuff and Vocal Cords by Ultrasound in Chinese Adults: A prospective case control study
AUTHORS	Chen, Xuanling; Zhai, Wenwen; Yu, Zhuoying; Geng, Jiao; Li, Min

VERSION 1 – REVIEW

REVIEWER	William P. McKay University of Saskatchewan, Canada
REVIEW RETURNED	11-May-2018

GENERAL COMMENTS	<p>I thank you for the privilege of reviewing your interesting paper. General comments: Congratulations on a well designed and conducted experiment with potential clinical application.</p> <p>Specifics: -page 4 line 50: "cuff free zone above the cords". Since we are interested in the cuff-free zone BELOW the cords, is there a clearer way to express this? (The phrase appears later in the paper a s well.) -page 5 line 55" "The results will not be disseminated to study participants." This is an unusual statement in my experience. Our ethics board likes us, on the consent form, to tell the participants how to view the results, usually de-identified and usually on our departmental website. -page 7, line 48 - 53: Is it necessary or useful to replace the saline with air? Previous studies suggest not (~70 references going back to the 1980s, coinciding with airway laser surgery problems). -page 10 Table 3. The tables uses the terms "correct" and "incorrect"; the table descriptive legend uses "proper" and "improper". Change to be consistent. -page 14, line 48: Have you tried a water-filled pad? -page 15, line 11. Please comment on clinical logistics and feasibility of the technique. How long will it take? Must the patient be awake and cooperative to ultrasound the cords?</p>
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REVIEWER	Sussan Soltani Mohammadi, M.D. Department of Anesthesiology Tehran University of Medical Sciences, IRAN
REVIEW RETURNED	12-May-2018

GENERAL COMMENTS	Dear Sir The study is well designed and useful in clinical practice. there are some question and suggestions that should be answered before final decision:
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	<p>1-the title is better to be changed as "Determining correct tracheal tube insertion depth by measuring Distance Between Endotracheal Tube Cuff and Vocal Cords by Ultrasound in Chinese Adults: A prospective case control study" to make it more understandable.</p> <p>2-Key words are better to be written in alphabetic sequences.</p> <p>3-methods:It was better to calculate the time needed for performing ultrasonography and FOB and possible SPO2 changes.</p> <p>4-Results and discussion are well written.</p> <p>Regard</p>
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REVIEWER	Kiyoshi Moriyama Department of anesthesiology, Kyorin university, Tokyo, Japan
REVIEW RETURNED	17-May-2018

GENERAL COMMENTS	<p>In this manuscript, the authors hypothesized that ultrasound can be used to estimate the distance between the upper edge of the ETT cuff and the vocal cords in adults so that the depth of the ETT can be adjusted accordingly. They showed that Among the 105 cases using the 23/21 rule, two cuffs were too close to the vocal cords and one too far away from the vocal cords. The diagnoses of too deep intubation and too shallow intubation made by ultrasound were in agreement with video-assisted laryngoscopy. The distances measured by ultrasound had high accuracy, sensitivity, specificity, PPV, and NPV for identifying the position of ETT at the level of the glottis, when video-assisted laryngoscopy was used as the standard criterion. It is a well-written manuscript, and the experiment was performed in a scientific manner. However, this reviewer has several concerns.</p> <p>Major comment In this study, the authors used video-assisted laryngoscopy as the standard criterion. In addition, the authors state that this technique was used to avoid too shallow intubation, rather than to avoid too deep intubation. Then, this reviewer conclude that ETT placement using video-assisted laryngoscopy is the standard technique to avoid too shallow endotracheal intubation. Because ultrasound technique takes time, this reviewer did not understand the usefulness of ultrasound, when video-assisted laryngoscopy became popular.</p> <p>Minor comment In page 9 line 55, the authors stated that the distances from the ETT tip to the carina measured by FOB was less than 2 cm for 1 male and 8 female patients. These results mean the ETTs were too deep in 9 patients. The authors need to mention haw they corrected the ETT in these 9 patients.</p>
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VERSION 1 – AUTHOR RESPONSE

ASSESSORS' COMMENTS:

Reviewer: 1

Reviewer Name: William P. McKay

Institution and Country: University of Saskatchewan,
Canada

Please state any competing interests: None declared

Please leave your comments for the authors below

I thank you for the privilege of reviewing your interesting paper.

General comments:

Congratulations on a well designed and conducted experiment with potential clinical application.

Specifics:

-page 4 line 50: "cuff free zone above the cords". Since we are interested in the cuff-free zone BELOW the cords, is there a clearer way to express this? (The phrase appears later in the paper a s well.)

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Thank you for pointing out our error. We are very sorry for our incorrect writing. It should be written as "cuff free zone below the cords". This mistake has been corrected (page 4 line 18, and page 11 line 26).

page 5 line 55" "The results will not be disseminated to study participants." This is an unusual statement in my experience. Our ethics board likes us, on the consent form, to tell the participants how to view the results, usually de-identified and usually on our departmental website.

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Thanks for your comment. We have mistaken the writing format of Patient and public involvement section. This paragraph has been rewritten (page 7, line 19-24).

page 7, line 48 - 53: Is it necessary or useful to replace the saline with air? Previous studies suggest not (~70 references going back to the 1980s, coinciding with airway laser surgery problems).

-Thanks for your question. We agree with you that it may not be necessary to replace the saline with air. We did so just for the convenience of other colleagues who did not participate our study but took care of the patients during anesthesia maintenance and emergence period. We are not sure whether we should correct the manuscript as you suggested, or leave there just as what we did. Please give us another advice.

page 10 Table 3. The tables uses the terms "correct" and "incorrect"; the table descriptive legend uses "proper" and "improper". Change to be consistent.

Thanks for your comment. The table legend has been revised (page 11, line 1-2).

-page 14, line 48: Have you tried a water-filled pad?

-Actually not. We tried water-filled plastic bags, but the different bags available in the OR were all too bulky. A specially designed water-filled pad or gel-like pad which fits the surface of the probe should be required. The manuscript has been revised accordingly (page 13, line 21-22).

page 15, line 11. Please comment on clinical logistics and feasibility of the technique. How long will it take? Must the patient be awake and cooperative to ultrasound the cords?

Thank you for your questions. It is technically feasible with the method we described. We hope to find a way to avoid cuff impingement when the depth markers of ET cannot be observed, especially for the patients with neck extension during surgery. It took about 30 sec to 1 min to find the vocal cords and mark on the skin, and it took another 3 to 5 min to finish the rest of the procedure, from filling the cuff with saline to finishing measurement with FOB. This statement as been added to the section of result (page 9, line 7-9) and limitation (page 13, line 29). It is possible to identify the vocal cords when the patient is asleep. In the present study, we hoped the measurement to be precise, so we asked the patient to take deep breath or say "Ah", causing the vocal cords to vibrate.

Reviewer: 2

Reviewer Name: Sussan Soltani Mohammadi, M.D.
Institution and Country: Department of Anesthesiology

Tehran University of Medical Sciences

IRAN

Please state any competing interests: None declared

Please leave your comments for the authors below

Dear Sir

The study is well designed and useful in clinical practice. There are some questions and suggestions that should be answered before final decision:

1-The title is better to be changed as "Determining correct tracheal tube insertion depth by measuring Distance Between Endotracheal Tube Cuff and Vocal Cords by Ultrasound in Chinese Adults: A prospective case control study" to make it more understandable. Thank you for your excellent suggestion. We have changed the title as you suggested.

2-Key words are better to be written in alphabetic sequences.

Thanks. The sequences of the key words have been adjusted (page 1, line 14-15).

3-Methods: It was better to calculate the time needed for performing ultrasonography and FOB and possible SpO₂ changes.

Thank you for your great suggestion. When designing the present study, we learned from previous relevant studies 1-4 (listed at the end of the reply) in which multiple steps were taken. None of them calculated the procedure time, so we did not arrange another investigator to record the time either. It's a pity that we can only provide a vague number. As the reply to the first reviewer, the explanation has been added to the result and limitation section (page 9, line 7-9; page 13, line 29). The ventilator was stopped for no more than 20 seconds during FOB examination. No change of SpO₂ was found. This statement has been added to the manuscript (page 9, line 9-10).

4-Results and discussion are well written.

Regards

Thank you for your encouragement.

Reviewer: 3

Reviewer Name: Kiyoshi Moriyama

Institution and Country: Department of anesthesiology, Kyorin university, Tokyo, Japan

Please state any competing interests: None declared

Please leave your comments for the authors below

In this manuscript, the authors hypothesized that ultrasound can be used to estimate the distance between the upper edge of the ETT cuff and the vocal cords in adults so that the depth of the ETT can be adjusted accordingly. They showed that among the 105 cases using the 23/21 rule, two cuffs were too close to the vocal cords and one too far away from the vocal cords. The diagnoses of too deep intubation and too shallow intubation made by ultrasound were in agreement with video-assisted laryngoscopy. The distances measured by ultrasound had high accuracy, sensitivity, specificity, PPV, and NPV for identifying the position of ETT at the level of the glottis, when video-assisted laryngoscopy was used as the standard criterion. It is a well-written manuscript, and the experiment was performed in a scientific manner. However, this reviewer has several concerns.

Major comment

In this study, the authors used video-assisted laryngoscopy as the standard criterion. In addition, the authors state that this technique was used to avoid too shallow intubation, rather than to avoid too deep intubation. Then, this reviewer conclude that ETT placement using video-assisted laryngoscopy is the standard technique to avoid too shallow endotracheal intubation. Because ultrasound technique takes time, this reviewer did not understand the usefulness of ultrasound, when video-assisted laryngoscopy became popular.

Thank you for your comment. In the discussion section, we wrote that "In the present study, although patients with Mallampati classification 3 and 4 and mouth opening less than 3 fingers were excluded, vocal cords could not be completely exposed using video-assisted laryngoscope in 11 out of 120 patients. Measuring the VCD as shown in the present study may serve as an alternative under such circumstances." We think this technique is still useful in some special cases.

Minor comment

In page 9 line 55, the authors stated that the distances from the ETT tip to the carina measured by FOB was less than 2 cm for 1 male and 8 female patients. These results mean the ETTs were too deep in 9 patients. The authors need to mention how they corrected the ETT in these 9 patients. Thank you for your comment. In previous studies, although the ETT was confirmed as too deep by FOB2 , 5, the tube position was not corrected as long as no endobronchial intubation occurred. In the present study, only the ETT position of NO.3 patient in Table 3 was corrected. For the other 8 patients, fiberoptic bronchoscopy was performed during surgery to ensure no endobronchial intubation occurred. This statement has been added to the manuscript (page 9, line 19 - page 10, line 2).

1. Ramsingh D FE, Haughton R, et al. Auscultation versus point-of-care ultrasound to determine endotracheal versus bronchial intubation: A diagnostic accuracy study. *Anesthesiology* 2016;124(5):1012-20. doi: 10.1097/ALN.0000000000001073
2. Li Y, Xie Y, Hu B, et al. Sensitivity and specificity of a novel approach to confirm the depth of the endotracheal tube. *Medicine* □ 2015;94(34):e1460. doi: 10.1097/MD.0000000000001460
3. Tessaro MO SE, Arroyo AC, et al. . Tracheal rapid ultrasound saline test (T.R.U.S.T.) for confirming correct endotracheal tube depth in children. *Resuscitation* 2015;89(10):8-12. doi: 10.1016/j.resuscitation.2014.08.033
4. Alonso Quintela P OEI, Mora Matilla M, et al. Usefulness of bedside ultrasound compared to capnography and X-ray for tracheal intubation. *An Pediatr* 2014;81(5):283-88. doi: 10.1016/j.anpede.2014.01.002
5. Chong DY GK, Tan ST, et al. The clinical implication of the vocal cords-carina distance in anaesthetized Chinese adults during orotracheal intubation. *British journal of anaesthesia* 2006;97(4):489-95. doi: 10.1093/bja/ael186

VERSION 2 – REVIEW

REVIEWER	William P. McKay University of Saskatchewan, Canada
REVIEW RETURNED	22-Jul-2018
GENERAL COMMENTS	Clarified. Thank you. Line 14 typo ultrasound proBe
REVIEWER	Kiyoshi Moriyama

	Department of anesthesiology, Faculty of medicine, Kyorin university, Tokyo, Japan
REVIEW RETURNED	07-Jul-2018

GENERAL COMMENTS	The authors responded well to my questions.
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