

the carotids provides a window into the state of the arterial system. It is rare to have atherosclerosis limited just to the carotids. Cardiac murmurs, especially aortic stenosis, are easily detected by auscultating the heart. Preoperative auscultation of the lungs prevents one from wondering if that wheeze or rhonchi started intraoperatively. While the ultrasound appears to be more diagnostic of endobronchial intubation, it is premature to dismiss the use of the stethoscope.

Competing Interests

The author declares no competing interests.

Mitchell L. Jablons, M.D. Overlook Medical Center, Summit, New Jersey. jabl0431@gmail.com

Reference

1. Isono S, Sandberg WS, Jiang Y: Do you believe what you see or what you hear? Ultrasound *versus* stethoscope for perioperative clinicians. *ANESTHESIOLOGY* 2016; 124:989–91

(Accepted for publication August 17, 2016.)

In Reply:

We thank you for your interest in reading the article by Ramsingh *et al.*¹ and our accompanying editorial² and appreciate the concerns raised in the letters that auscultation may not have been optimally performed, that the cost of using ultrasound to differentiate tracheal *versus* bronchial intubation might not have been properly appreciated (Dr. Levy), or that the editorial dismisses the stethoscope as a useless thing of the past (Dr. Jablons).

In their article, Ramsingh *et al.*¹ stated: “Since auscultation for breath sounds is regarded as a basic skill, all attending anesthesiologists, with more than 4-yr posttraining, were allowed to perform the auscultation examination.” We assumed that auscultation would be optimally performed, but we also contacted Dr. Ramsingh and obtained more detailed information about their auscultation technique. Dr. Ramsingh responded: “Manual ventilation was initiated with target volumes of approximately 8 to 10 ml/kg ideal body weight, auscultation was performed bilaterally in each axilla at the mid-axillary line (approximately at the level of the fifth rib space).” This description of the auscultation technique represents a reasonable practice and may exceed the quality of true clinical practice. In this regard, we think that the comparison is reasonable: a new technique *versus* a routine clinical practice. In addition, there are several other studies demonstrating low sensitivity and specificity of auscultation for differentiating tracheal *versus* bronchial intubation, and the values Ramsingh *et al.*¹ reported in their study are comparable with those reported by other investigators.^{3–5} Nevertheless, we do agree with you that the sensitivity and/or specificity of auscultation might improve if it was executed in combination with other clinical assessments as you suggested. However, the sensitivity and specificity of

auscultation unlikely approach the sensitivity (93%) and specificity (96%) obtained with ultrasound alone.¹

Regarding the cost of using ultrasonography to assess the appropriate endotracheal tube cuff location, portable ultrasound devices are already widely available in the perioperative setting. For the purposes of financial analysis, it is reasonable to posit that new devices are not purchased specifically for only assessing the endotracheal tube cuff position, so the incremental cost of additional uses of existing equipment is the appropriate analysis. Because the probe is used for skin (not mucosa) contact only, the level of cleaning and sterilization requirement is much less rigid than that of cleaning and sterilization for a device such as a fiberoptic bronchoscope. We could not find any quote of the cost to wipe down the probe, screen, and keyboard of the ultrasound device with a sanitizing wipe. However, the cost estimate for one wipe and 3 to 5 min of a technician's time is surely minimal.

The key message of our editorial is to emphasize that unquestioning reliance on the auscultation technique is not supported by scientific observation and to point out the value of exploring better techniques for common tasks (such as the ultrasound technique for endotracheal tube positioning). Innovation should always remain in our interests as we strive to improve the safety and reliability of anesthesiology. We are not recommending abandoning the stethoscope and do agree with its usefulness for a variety of clinical situations when properly used (including proper cleaning between patients to avoid transmission of disease). However, we must appreciate the low sensitivity and specificity of auscultation, even in the hands of experienced clinicians. We agree that the well-trained clinician needs to use all of his or her senses, including common sense, to provide optimal care for their patients.

Competing Interests

The authors declare no competing interests.

Shiroh Isono, M.D., Ph.D., Warren S. Sandberg, M.D., Ph.D., Yandong Jiang, M.D., Ph.D. Graduate School of Medicine, Chiba University, Chiba, Japan (S.I.). isonos-chiba@umin.ac.jp

References

1. Ramsingh D, Frank E, Haughton R, Schilling J, Gimenez KM, Banh E, Rinehart J, Cannesson M: Auscultation *versus* point-of-care ultrasound to determine endotracheal *versus* bronchial intubation: A diagnostic accuracy study. *ANESTHESIOLOGY* 2016; 124:1012–20
2. Isono S, Sandberg WS, Jiang Y: Do you believe what you see or what you hear? Ultrasound *versus* stethoscope for perioperative clinicians. *ANESTHESIOLOGY* 2016; 124:989–91
3. Brunel W, Coleman DL, Schwartz DE, Peper E, Cohen NH: Assessment of routine chest roentgenograms and the physical examination to confirm endotracheal tube position. *Chest* 1989; 96:1043–5
4. Sitzwohl C, Langheinrich A, Schober A, Krafft P, Sessler DI, Herkner H, Gonano C, Weinstabl C, Kettner SC: Endobronchial

intubation detected by insertion depth of endotracheal tube, bilateral auscultation, or observation of chest movements: Randomised trial. *BMJ* 2010; 341:c5943

5. Vezzani A, Manca T, Brusasco C, Santori G, Valentino M, Nicolini F, Molardi A, Gherli T, Corradi F: Diagnostic value of chest ultrasound after cardiac surgery: A comparison with chest X-ray and auscultation. *J Cardiothorac Vasc Anesth* 2014; 28:1527–32

(Accepted for publication August 17, 2016.)

In Reply:

In 1834, the *Times Newspaper of London*¹ reported that the medical profession was unlikely ever to start using the stethoscope “because its beneficial application requires much time and gives a good bit of trouble.”^{2,3} In fact, Dr. Laënnec created the stethoscope by rolling up paper in the shape of a tube, secondary to his concern of placing his ear on a female patient’s chest (the common practice at the time). He reported to be “surprised” to discover an improvement in his diagnostic assessment.⁴ Today, we are at the same story with point-of-care ultrasound and the perioperative medical community.

We thank Drs. Priebe, Hester, El-Orbany, and colleagues for their insight on the topic of point-of-care airway ultrasound and their letters to the editor for the published manuscript entitled “Auscultation *versus* Point-of-Care Ultrasound to Determine Endotracheal *versus* Bronchial Intubation: A Diagnostic Accuracy Study”⁵ and its editorial by Isono *et al.*⁶ We have summarized the authors’ letters to several common themes, including (1) further discussion of the limitations of ultrasound, (2) inappropriate direct comparison between ultrasound and auscultation *only* for localization of the endotracheal tube (ETT), and (3) dismissal of the stethoscope as a diagnostic tool. We seek to address each of these concerns. Foremost, we would like to highlight that both auscultation and point-of-care ultrasound can coexist as important diagnostic tools. However, the concept of point-of-care ultrasound is very much in its infancy for the perioperative arena. We sought to demonstrate the utility of a *novel* technique of assessing the ETT location in hopes that further research in this area can develop a skillset that can serve as an *adjunct* to what is currently available to anesthesiologists.

(1) Regarding limitations of point-of-care ultrasound, as with any diagnostic test, ultrasound has its limitations. (i) There are several patient pathologies and surgical procedures that would prevent the ability to either perform the ultrasound exam or be unable to interpret the ultrasound images as described in this study. As suggested in the letters to the editor, examples include patients requiring rapid sequence intubation, cervical collar placement, patients with pleural disease, and procedures involving the area in which the Pulmonary tree and Lung expansion Ultrasound Study (PLUS) exam would be performed. Despite these limitations, there is a much larger body of perioperative patients that can have the exam performed, and we advocate that these limitations should not result in our specialty dismissing the evaluation of further utility of perioperative point-of-care ultrasound. (ii) It

is true that ultrasound is more costly and less available than the stethoscope. However, ultrasound, in particular point-of-care ultrasound, is a rapidly advancing area in medicine, with decreasing cost. Importantly, the PLUS exam was designed to utilize an ultrasound machine that is most readily available in the perioperative setting (portable/laptop system with a linear probe) for central vascular access and regional anesthesia. Since the use of ultrasound for central vascular access has been suggested to be a standard of care,^{7,8} the cost cannot be directly compared between auscultation and any isolated point-of-care ultrasound modality (same machine can have many utilities). Rather, one could suggest that by incorporating new ultrasound modalities into perioperative care, one can justify the current cost of ultrasound equipment. (iii) Performance of the PLUS exam was under 4 min. While this is longer than one would prefer for detection of tracheal *versus* esophageal intubation, Ramsingh *et al.*⁵ designed this study to evaluate the ETT location within the airway (tracheal *vs.* bronchial). For this question, the time of 4 min may be similar to the time it would require to obtain other evaluation techniques such as a portable chest x-ray or a fiberoptic evaluation.

(2) Ramsingh *et al.*⁵ directly compared auscultation to ultrasound *in isolation* to determine the diagnostic accuracy of endotracheal *versus* bronchial intubation between these diagnostics tools. The specific auscultation examination that was performed was as follows: manual ventilation was initiated with target volumes of approximately 8 to 10 ml/kg ideal body weight. This was determined by gross estimation by deformation of the standard 3-l manual ventilation bag (visual estimation of 20 to 30% deformation). The auscultation exam was performed as follows: the diaphragm of the stethoscope was placed bilaterally in the axilla at the mid-axillary line (approximately at the level of the fifth rib space). All auscultators were faculty with at least 4-yr posttraining experience.

The authors chose to directly compare auscultation to ultrasound, in isolation, to allow for a direct accuracy comparison between the diagnostic tools. It was the authors’ hope that the results of the study would indicate the high degree of accuracy with ultrasound and support further research on this topic. Since the other routine monitors used for the assessment of ETT location (pulse oximetry, inspiratory pressures, and capnography) are not impacted by ultrasound (just as with auscultation), we did not compare ultrasound to the combined information of all the standard monitors for the study. To restate, this study was simply a diagnostic comparison study between two assessment tools (auscultation *vs.* ultrasound). Finally, it is important to state that it was beyond the scope of the study to evaluate the clinical impact of incorporating this examination, and this warrants further research.

Related to this is the use of ETT insertion depth to avoid endobronchial intubation. In the letters to the editor, a referenced study by Sitzwohl *et al.*⁹ demonstrated the ETT insertion depth to be superior to chest auscultation and palpation to determine endobronchial intubation. While we do not disagree that ETT insertion depth is an important