

Thoracic Ultrasound Limitations in the Differential Diagnosis of Respiratory Failure Causes

To the Editor:

The article by Sekiguchi et al¹ in *CHEST* (October 2015) is particularly important because they concurrently “evaluated the diagnostic utility of combined cardiac and thoracic critical care ultrasonography” in acute hypoxic respiratory failure. This comprehensive approach is particularly valuable since, by others, lung ultrasound B-line (wrongly referred to as comet) assessment is considered unrealistically to be a very simple procedure, suitable as a stand-alone tool and not as a complementary tool of the other and more contributory clinical and ultrasound signs. Particularly relevant is, in our opinion and experience, that a very practical (and clinical) criterion is used for the assessment of pulmonary artifacts—the “B-line ratio” (proportion of chest zones with positive B-lines of all zones examined).¹ This approach should be strongly recommended against the approximate, if not erratic, count or width measurement of B-line artifacts, analyzed in several subsequently checked areas.²

We would respectfully ask if the authors considered, as we do, that these measures may have limited value if intraobserver and interobserver variability information is not provided,² particularly because the measures are taken off-line, with the possible bias related to the different operators’ recordings (interoperator variability of the actual examination and of the recording time-frame choice). It is particularly significant that in their study they confirm that the B-line criterion is predictive of miscellaneous cause vs cardiogenic pulmonary edema or ARDS. Also in this regard, we would respectfully remark that more B-lines are commonly visible, and reported, in other common conditions, such as pulmonary fibrosis and COPD.² It is reasonable to conclude, and we wish to respectfully ask the authors if this is also their thought, that these confounding factors and overlap of conditions, so often observed in intensive care, should be considered a major limitation in the practical use of this criterion in elective and emergency medicine. Actually, the measure of B-line artifacts in emergency is still warranted, and we wish to respectfully

ask the authors¹ if they think that in these conditions the possibility that the inaccuracy of ultrasonography as an imaging and diagnostic tool could increase further.³

Francesca M. Trovato, MD
Giuseppe Musumeci, PhD
Catania, Italy

AFFILIATIONS: From the Department of Clinical and Experimental Medicine (Dr Trovato), The University Hospital of Catania; the Accident and Emergency Department (Dr Trovato), Ospedale Civile, Ragusa, Italy; and the Department of Biomedical and Biotechnological Sciences (Dr Musumeci), Human Anatomy and Histology Section, School of Medicine, University of Catania.

CONFLICT OF INTEREST: None declared.

CORRESPONDENCE TO: Francesca M. Trovato, MD, Department of Clinical and Experimental Medicine, The University Hospital of Catania, via Santa Sofia, 79-95123 Catania, Italy; e-mail: trovatofrancesca@gmail.com

© 2015 AMERICAN COLLEGE OF CHEST PHYSICIANS. Reproduction of this article is prohibited without written permission from the American College of Chest Physicians. See online for more details.

DOI: 10.1378/chest.15-1879

References

1. Sekiguchi H, Schenck LA, Horie R, et al. Critical care ultrasonography differentiates ARDS, pulmonary edema, and other causes in the early course of acute hypoxemic respiratory failure. *Chest*. 2015;148(4):912-918.
2. Trovato GM, Sperandeo M. Sounds, ultrasounds, and artifacts: which clinical role for lung imaging? *Am J Respir Crit Care Med*. 2013;187(7):780-781.
3. Al Deeb M, Barbic S, Featherstone R, Dankoff J, Barbic D. Point-of-care ultrasonography for the diagnosis of acute cardiogenic pulmonary edema in patients presenting with acute dyspnea: a systematic review and meta-analysis. *Acad Emerg Med*. 2014;21(8):843-852.

Response

To the Editor:

We appreciate the insightful comments made by Drs Trovato and Musumeci about our article in *CHEST*.¹ In our study, each patient was examined once by a trained sonographer; therefore, no intraoperator or interoperator variability was measured on critical care ultrasonography image acquisition.¹ Stored cardiac and thoracic images were independently reviewed by two cardiologists and two radiologists, and thoracic images were reviewed by an intensivist. The weighted κ on agreement of the number of chest zones with positive B-lines per patient was 0.97 (95% CI, 0.96-0.99). Previously, studies

reported excellent intraoperator and interoperator agreement on both image acquisition and image interpretation of B-lines.²

It has been described that COPD or asthma manifests as a low number of total B-lines or few chest zones with positive B-lines.²⁻⁴ On the other hand, multiple B-lines or many chest zones with positive B-lines are often observed in interstitial syndrome (IS), such as pulmonary edema of various causes (cardiogenic or noncardiogenic), pneumonia, and diffuse parenchymal lung disease.⁵ Interestingly, the majority of studies that evaluated a role of positive B-lines for the diagnosis of cardiogenic pulmonary edema (CPE) did not enroll patients with exacerbation of diffuse parenchymal lung disease or ARDS.² Diagnostic accuracy of positive B-lines for CPE may still remain high in a population where the prevalence of ARDS or noncardiogenic IS is low. However, the assessment of B-lines alone for the diagnosis of CPE may have a limited value in the ICU not because of the accuracy of B-lines for detecting IS but because of a high prevalence of ARDS or noncardiogenic IS, as seen in our study.¹

It is important to clarify that in our study, patients with bilateral noncardiogenic IS were categorized into the ARDS group as were those with concurrent noncardiogenic IS with COPD exacerbation.¹ Patients with concurrent CPE and ARDS were categorized into the CPE group.¹ This diagnostic categorization was created with a goal to guide intensivists to recognize patients who either require aggressive diuretic therapy for CPE or more targeted therapy for ARDS or noncardiogenic IS, such as low tidal volume ventilation, corticosteroids, prone positioning, and paralytics. The same categorical approach may not be applicable in the care of patients with mild or chronic hypoxemia in the outpatient clinic or on the regular hospital ward where a specific

diagnostic etiology must be identified and treated accordingly.

Hiroshi Sekiguchi, MD
Ognjen Gajic, MD, FCCP
Rochester, MN

AFFILIATIONS: From the Division of Pulmonary and Critical Care Medicine, Mayo Clinic.

CONFLICT OF INTEREST: None declared.

FUNDING/SUPPORT: This work was supported by a Mayo Clinic Department of Medicine Write-up and Publish (WRAP) grant.

CORRESPONDENCE TO: Hiroshi Sekiguchi, MD, Division of Pulmonary and Critical Care Medicine, Mayo Clinic, 200 First St SW, Rochester, MN 55905; e-mail: sekiguchi.hiroshi@mayo.edu

© 2015 AMERICAN COLLEGE OF CHEST PHYSICIANS. Reproduction of this article is prohibited without written permission from the American College of Chest Physicians. See online for more details.

DOI: 10.1378/chest.15-2034

Acknowledgments

Role of sponsors: The sponsor had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; or preparation, review, or approval of the manuscript.

References

1. Sekiguchi H, Schenck LA, Horie R, et al. Critical care ultrasonography differentiates ARDS, pulmonary edema, and other causes in the early course of acute hypoxemic respiratory failure. *Chest*. 2015; 148(4):912-918.
2. Al Deeb M, Barbic S, Featherstone R, Dankoff J, Barbic D. Point-of-care ultrasonography for the diagnosis of acute cardiogenic pulmonary edema in patients presenting with acute dyspnea: a systematic review and meta-analysis. *Acad Emerg Med*. 2014;21(8):843-852.
3. Prosen G, Klemen P, Štrnad M, Grmec S. Combination of lung ultrasound (a comet-tail sign) and N-terminal pro-brain natriuretic peptide in differentiating acute heart failure from chronic obstructive pulmonary disease and asthma as cause of acute dyspnea in prehospital emergency setting. *Crit Care*. 2011;15(2):R114.
4. Lichtenstein D, Mezière G. A lung ultrasound sign allowing bedside distinction between pulmonary edema and COPD: the comet-tail artifact. *Intensive Care Med*. 1998;24(12):1331-1334.
5. Volpicelli G, Elbarbary M, Blaivas M, et al; International Liaison Committee on Lung Ultrasound (ILC-LUS) for International Consensus Conference on Lung Ultrasound (ICC-LUS). International evidence-based recommendations for point-of-care lung ultrasound. *Intensive Care Med*. 2012;38(4):577-591.