

## Lung Ultrasound in the Emergency Setting

### Accuracy Cannot Exclude Expertise

#### To the Editor:

The article in *CHEST* (July 2015) by Pivetta et al<sup>1</sup> reported data on the role of lung ultrasonography (LUS) in the clinical assessment of acute decompensated heart failure (ADHF), raising several concerns regarding study design and clinical implications of the results. The main conclusion from this report is that chest radiograph showed moderate accuracy in the identification of ADHF. We believe that this point needs to be clarified, and roles of different diagnostic modalities should be better defined. LUS and chest radiography can help define factors associated with dyspnea, mainly of pulmonary origin, while ECG and echocardiography are widely used to identify subclinical heart disease.

Patient's clinical assessment, past medical history, physical examination, ECG, and blood gas analysis were performed in the study as the standard workup and followed by LUS. Those standardized methods have been defined as "heavily undermined by several factors, such as the poor sensitivity of the physical examination, ECG inaccuracy, and unreliability of chest radiography (CXR) findings."<sup>1</sup> This statement has to be defined in the clinical context: We believe that such a low value of the standard workup could, in selected cases, possibly be related to poor professional accuracy of the operator in charge of performing the workup, interpreting results, or both. In this scenario, chest radiography, as well as any diagnostic workup (including ultrasound, an operator-dependent procedure, by definition) could conceivably be useless for exploring the cause of dyspnea.

Additionally, Pivetta et al<sup>1</sup> did not provide comprehensive details on LUS images a posteriori revision. Were image frames or videos evaluated? B-line artifacts are not real images and are not easily quantifiable.<sup>2-5</sup> Are the three B lines used for identifying interstitial syndrome referring to the numbers in an image frame or during a video evaluation? If the latter, what was the duration of those videos? This is a methodologic drawback that alone could influence validity and interpretation of results, particularly considering that, "The accuracy of LUS alone was determined by reanalyzing, a posteriori, the

sonographic images; the presence of diffuse IS [interstitial syndrome] was considered diagnostic for ADHF."<sup>1</sup>

With these concerns in mind, we believe that the "pragmatic real world" should focus on the actual role of LUS as a complementary but not superior imaging technology in the emergency setting. Attempts at encouraging inexperienced medical doctors to use LUS artifacts in the definition of the differential diagnosis of acute heart disease should definitely be avoided.

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### References

1. Pivetta E, Goffi A, Lupia E, et al; for the SIMEU Group for Lung Ultrasound in the Emergency Department in Piedmont. Lung ultrasound-implemented diagnosis of acute decompensated heart failure in the ED: a SIMEU multicenter study. *Chest*. 2015;148(1):202-210.
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. Trovato GM, Sperandeo M, Catalano D. Ultrasound diagnosis of acute pulmonary edema: the oblivion of a great future behind us. *Acad Emerg Med*. 2015;22(2):244-245.
4. Trovato GM, Sperandeo M. The resistible rise of B-line lung ultrasound artefacts. *Respiration*. 2015;89(2):175-176.
5. Catalano D, Trovato GM, Sperandeo M. Acute heart failure diagnosis by ultrasound: new achievements and persisting limitations. *Am J Emerg Med*. 2014;32(4):384-385.

### Response

#### To the Editor:

We appreciate the comments of Drs Cipriani and Ghittoni, which give us the opportunity to further clarify the

message of our study.<sup>1</sup> We believe our study demonstrates that an integrated approach combining lung ultrasonography (LUS) and the standard clinical assessment significantly improves the accuracy of the diagnostic process for acute decompensated heart failure (ADHF). We do not believe that the study outcome can be summarized as “chest radiography (CXR) showed moderate accuracy in the identification of ADHF.” The poor diagnostic performance of CXR for identifying ADHF is not a new finding.<sup>2,3</sup> Although very specific, detection of pulmonary venous congestion, interstitial edema, or alveolar edema on CXR has unacceptably low sensitivity.<sup>3</sup> Current guidelines, indeed, caution physicians from using CXR in the diagnosis of ADHF, instead highlighting the value of CXR in the identification of alternative pulmonary causes of a given patient’s dyspnea.<sup>4</sup>

In their letter, Drs Cipriani and Ghittoni suggest that the “low value of the standard workup could, in selected cases, possibly be related to poor professional accuracy of operator in charge of performing the workup, interpreting the results, or both.” This statement is unsubstantiated. In our study, the sensitivity and specificity of the standard evaluation were as high as 85.3% and 90%, and LUS implementation was able to further increase them to 97% and 97.4%.<sup>1</sup> Although our study included ED physicians with varying levels of expertise, we believe this is part of real-world practice and should have equally affected both clinical and LUS-implemented approaches. In addition, LUS is highly reproducible and easy to learn as compared with CXR interpretation, even when performed by physicians with minimal training.<sup>1,5</sup> Finally, we remind Drs Cipriani and Ghittoni that our study was conducted in seven EDs from academic, university-affiliated, and community<sup>1</sup> hospitals, providing a level of external validity not previously available in similar studies.

Drs Cipriani and Ghittoni also question the methodology used to compare the performance of CXR and LUS. In our study, the CXR reports completed by staff radiologists were compared with the original LUS findings obtained by ED physicians. No new a posteriori revision of LUS loops was performed; we simply categorized the presence of diffuse interstitial syndrome as ADHF on the basis of case report forms completed at the time of the examination.

In conclusion, we believe that our study, rather than encouraging indiscriminate LUS use, suggests a sound and prudent use of LUS integrated in the diagnostic evaluation of patients presenting to the ED with acute dyspnea. LUS implementation should not raise unjustified

alarms but rather be evaluated, as with all novel medical technologies, using a scientific and unbiased approach.

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## References

1. Pivetta E, Goffi A, Lupia E, et al; for the SIMEU Group for Lung Ultrasound in the Emergency Department in Piedmont. Lung ultrasound-implemented diagnosis of acute decompensated heart failure in ED: a SIMEU multicenter study. *Chest*. 2015;148(1):202-210.
2. Collins SP, Lindsell CJ, Storrow AB, Abraham WT; ADHERE Scientific Advisory Committee, Investigators and Study Group. Prevalence of negative chest radiography results in the emergency department patient with decompensated heart failure. *Ann Emerg Med*. 2006;47(1):13-18.
3. Wang CS, FitzGerald JM, Schulzer M, Mak E, Ayas NT. Does this dyspneic patient in the emergency department have congestive heart failure? *JAMA*. 2005;294(15):1944-1956.
4. McMurray JJ, Adamopoulos S, Anker SD, et al; ESC Committee for Practice Guidelines. ESC guidelines for the diagnosis and treatment of acute and chronic heart failure 2012: the Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2012 of the European Society of Cardiology. Developed in collaboration with the Heart Failure Association (HFA) of the ESC. *Eur Heart J*. 2012;33(14):1787-1847.
5. Martindale JL, Noble VE, Liteplo A. Diagnosing pulmonary edema: lung ultrasound versus chest radiography. *Eur J Emerg Med*. 2013;20(5):356-360.