Insufficient Proof of Concept for Using Ultrasound to Guide Fluid Resuscitation

To the Editor:

The well-designed article by Volpicelli et al.1 sets out to “assess whether B-lines, and eventually a combination with left ventricular ejection fraction (LVEF) assessment, are useful to differentiate low/high pulmonary artery occlusion pressure and extravascular lung water (EVLW) in critically ill patients.” This study strives to propose a novel monitoring approach but, in our opinion, requires some clarification of the methods and interpretation of the data. Accordingly, we would respectfully ask a few simple queries to the authors.

First, we wonder whether the novel terminology proposed, that is, “A” and “B” patterns defined, respectively, as the “absence of multiple B-lines with regular sliding” and “multiple B-lines, that is, at least three B-lines in a single longitudinal scan, on at least two areas per side” the latter apparently representing “a sign of diffuse interstitial syndrome” may cause confusion with the existing definition and ultrasound detection of A-line and B-line artifacts because A-lines and B-lines may coexist.

Moreover, we wonder whether the study design is reproducible elsewhere, considering that neither interobserver nor intraobserver variability of measures is reported. Because the authors correctly acknowledge that “the number of cases enrolled remained below than was expected and is too small to allow definitive conclusions,”1 we would respectfully ask whether the reported results, that is, 3 of 18 false positives for the A pattern and 4 of 14 false positives (29.6%) for the B pattern for EVLW 10 ml/kg or less, as shown in the second graph of the article,1 and 60% of false negatives for the A pattern and 14.3% for the B pattern for pulmonary artery occlusion pressure of 18 mmHg or less, are robust enough to prompt their conclusion “in the first approach to critically ill patients, the concept of using ultrasound to guide fluid resuscitation to avoid deleterious effects on the lung function is confirmed” because even “combination of cardiac evaluation for the LVEF with lung examination did not improve the accuracy of lung ultrasound standing alone in predicting the level of invasive EVLW.” In other words, we would like to know whether the authors advocate the use of this approach only to guide initial therapy, before definitive monitoring in place, or as it appears from their statements, also thereafter since, based on the current evidence, we would caution against both.

We also respectfully ask whether the authors are recommending this approach as a means of overcoming the current “imprecise monitoring, which may easily lead to iatrogenic catastrophic consequences, such as pulmonary edema due to overhydration, impairment of pulmonary blood gas exchange, or others.” If so, do they consider their reference cardiological assessment, “Impaired function was diagnosed after the eyeballing visual estimation of reduced function corresponding to an LVEF less than 55%, without further distinction between poor and moderate reduction,”1 suitable for the workup of their “study population, which included a wide range of conditions, from the septic to heart failure patients, from acute respiratory stress disorder to posttransplant patients?” In other words, whether the 55% cutoff for LVEF, assessed “by subcostal view …. by visual estimation of gross wall contraction…. visually considered normal or impaired”1 was actually used as evidence of heart failure in a widely diverse population of critically ill patients, and whether they consider it adequate for heart failure management guidance in intensive care patients?

We hope that the authors will clarify the above, as this challenging article is likely to be quoted as a reference and used as a basis for future research.

Competing Interests

The authors declare no competing interests.

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Reference


(Accepted for publication February 16, 2015.)

Lack of Evidence for the Use of Ultrasound B-line Artifacts to Guide Fluid Resuscitation

To the Editor:

Volpicelli et al.1 recently published an article advocating the usefulness of B-line counts to differentiate and predict pulmonary congestion and hemodynamic congestion in intensive care patients. May I kindly ask the authors1 whether there is any evidence that, as the authors write, “the gross evaluation of left ventricular ejection fraction coupled with B-lines assessment is an easy-to-learn technique?” Experience dictates that this would not, in fact, be the case, as B-lines are poorly reproducible measures with different levels of reliability in different hands, in different clinical subsets,
and with different equipment. The authors state that echocardiographic “advanced skill is more expensive in terms of cost and time,” but this is true of any medical expertise, and the cost/benefit ratio of B-line assessment needs to be carefully weighed. Can we really recommend B-line assessment and gross echocardiographic evaluation of ejection fraction (defined abnormal <55%) as a stand-by-alone method of “addressing fluid resuscitation to avoid deleterious effects on the lung function?”

The very wide clinical spectrum observed in this study, including cases of septic shock, liver transplant, cardiogenic pulmonary edema, respiratory failure from chronic pulmonary disease, pneumonia, cardiogenic shock or cardiac arrest, hemorrhagic shock from aortic rupture, respiratory failure (other), severe trauma, acute pancreatitis, and cerebral hemorrhage, may be perceived as a limitation in terms of interpreting the information provided by the results. Although it is true that we are still lacking any quick and easy definitive or established monitoring methods to guide fluid resuscitation, the results of this study cannot be reliably extrapolated to a wide variety of causes of respiratory and circulatory impairment, especially considering the limitations detailed above. Until these shortcomings are overcome, we therefore strongly advise adhering to tried and tested means, no matter how difficult they are to implement.

Competing Interests

The author declares no competing interests.

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( Accepted for publication February 16, 2015 )

Inappropriate Use of B-lines for Fluid Assessment and Management in Intensive Care Patients

To the Editor:
The article by Volpicelli et al.1 aimed to assess the possible role of B-lines by lung ultrasound (LUS) alone or in combination with left ventricular ejection fraction (LVEF) in predicting high or low levels of pulmonary artery occlusion pressure (PAOP) and extravascular lung water (EVLW). The multicenter study comprises the evaluation of critically ill patients from different clinical settings and conditions predisposing to hemodynamic instability. Notwithstanding these valuable aspects, the study in our view did not add any useful information on the role of LUS in the clinical management of these patients. Data indeed appear to fail in demonstrating any usefulness of A- and B-patterns alone in detecting high PAOP, as sensitivity and specificity of these methods achieve considerable values only when LVEF, a widely recognized and used index of cardiac performance, is added to the model. As per authors’ conclusions, “only the combination of the A-pattern at LUS and the normal LVEF estimated by focused cardiac ultrasound reliably indicates low PAOP,” meaning that this point represents the most important finding of the study. In this context, it is our opinion that many issues need to be addressed. The authors did not clearly state why LVEF was used, namely the rationale of combining LUS findings with a measure of systolic function. Considering the variety of clinical conditions reported, LVEF cannot indeed be supposed to be affected in any case and is therefore neither a valuable nor a sensitive predictor of hemodynamic instability in any given patient. This consideration also leads us to underline the need of including LVEF data in the article, as well as of detailing the conditions of patients whose evaluation of LVEF and LUS pattern was associated with high predictive values for PAOP assessment. The absence of any improvement of accuracy in predicting EVLW by combining LVEF and A-pattern further supports the hypothesis that LVEF cannot be chosen as a target tool to assess hemodynamic state in the particular population studied.

As far as LUS findings, the article did not accurately describe how patients were studied (supine or seated position), the clinical setting (dyspneic patients?), potentially increasing the detection of LUS artifacts,2 as well as the possible underlying mechanisms. Indeed, the authors did not provide any explanations on possible related mechanisms associated with the high prevalence of A-pattern and high PAOP in chronic heart disease patients, whereas B-pattern was mostly found in combination with high PAOP in patients with normal cardiac function (mostly sepsis and pulmonary failure).1 Is the study showing that lung fluid is increased in the setting of sepsis and acute pulmonary failure regardless of the underlying disease? If this is the case, which are the EVLW values in this group of patients? Also, which kind of interstitial syndrome, whose detection through B-lines is advocated throughout the article, are the authors referring to in the study, and particularly in this patient group?2

With no answers to these questions, we wonder how the conclusion of using LUS in the first approach of patients requiring fluid resuscitation could be driven by the present data.

We therefore claim the need for emphasizing the useful but limited power of LUS in the evaluation of critically ill patients,2 having no study been performed to actually validate the aforementioned ultrasound signs as pathophysiologically associated with any of the disease causing hemodynamic instability.