

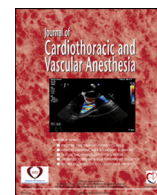


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## Editorial

## Point-of-Care Ultrasound in Critically Ill Patients— Assessing Value in an Ever-Changing Environment

Point-of-care ultrasound (POCUS) has gained remarkable popularity in recent years for assessment of cardiovascular function, volume status, lung pathology, and intra-abdominal pathology, to name a few indications. This modality has become an extension of the physical examination for operators well-versed in ultrasonography and has gained even more traction during the current novel coronavirus pandemic. Use of POCUS decreases the need for multiple healthcare workers to be involved in image acquisition, therefore preventing exposure and need for personal protective equipment.

In a retrospective, observational, single-center report published in this issue of the *Journal of Cardiothoracic and Vascular Anesthesia*, Lu et al. studied a cohort of critically ill patients in an effort to identify the indications for rescue POCUS (r-POCUS) and to analyze its utility in making time-sensitive diagnoses and clinical decisions.<sup>1</sup> The authors evaluated 189 r-POCUS examinations in 141 patients and generated several interesting findings. The most important result from this study was the analysis of indications for which POCUS can be useful. The authors noted that the most common indication for r-POCUS was hypotension (~50% of examinations). Other common indications were extracorporeal membrane oxygenation/ventricular assist device evaluation and arrhythmias. Assessment of the etiology of hypotension, especially as it relates to volume assessment, is of utmost importance in the intensive care unit setting. A combination of clinical examination and data from invasive monitoring (such as pulmonary artery catheters) are used routinely to guide decision-making. Echocardiography can add to the intensivist's tool kit's assessment of volume status by assessment of inferior vena cava size and collapsibility for fluid responsiveness. Although some suggest that in mechanically ventilated patients, a respiratory variation of >15% (distensibility) is suggestive of fluid responsiveness, the American Society of Echocardiography recognizes that the inferior vena cava may not provide an accurate measurement of central

venous pressure in these patients.<sup>2-4</sup> Additionally, the location of measurement, plane of imaging, and use of M-mode versus 2-dimensional imaging can all affect the quality of measurements. In the current study, the authors used visual estimation of left ventricular end-diastolic volume for assessment of volume. The accuracy of this method is uncertain and, therefore, it is essential to recognize that ultrasonography cannot replace the physical examination and clinical assessment, but may form an adjunctive tool for assessment of volume status in critically ill patients.

About one-third of the examinations conducted in this study were normal and yet 21% of these normal examinations were associated with interventions. The authors described a case of atrial fibrillation without intracardiac thrombus, requiring subsequent cardioversion as one example of how a normal examination could lead to an intervention. However, one has to recognize that if the patient is truly hemodynamically unstable, then imaging (whether point-of-care or not) may not be truly necessary prior to intervention such as cardioversion and, similarly, if the intervention is not emergent, such patients may benefit from a thorough complete imaging examination. Findings, such as extracorporeal membrane oxygenation/ventricular assist device cannula malposition or cardiac tamponade, also were reported frequently in 5% and 11% of examinations, respectively. These findings require immediate intervention, which can be lifesaving. Rescue POCUS, by its design, is expeditious, allows quick recognition of critical pathology, and may guide the intervention (such as cannula repositioning or pericardiocentesis) required to correct the pathology. Most of the interventions in this report occurred within 30 minutes of the imaging, validating the role of this modality as a time-saving measure.

The authors noted that only 8% of their r-POCUS examinations led to further imaging. The authors also noted that 72% of the ultrasound examinations were performed during off-hours. This is an important finding from this study and highlights the usefulness of this modality during times when resources may be limited. Point-of-care ultrasound also may provide physicians working in resource-limited healthcare

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settings a new tool to aid diagnosis and guide treatment. These hospitals often do not have access to 24/7 transthoracic echocardiography. The current study was performed in a quaternary academic hospital, with a 24/7 multidisciplinary physician-intensivist team consisting of anesthesiologist-intensivists, cardiologist-intensivists, emergency medicine-intensivists, and a cardiac surgeon-intensivist. It would have been valuable to study the differential use of r-POCUS among these subspecialties and the individual utility of r-POCUS in each specialty. In general, the quality and resultant interpretation of ultrasonography are operator-dependent, and it is possible that a cardiologist-intensivist may be more likely to use echocardiography as a POCUS modality, whereas a pulmonary medicine-intensivist may be more adept at lung and body ultrasonography. A systematic review of these issues will help identify gaps in POCUS learning and help create programs for credentialing and training of physicians in these methods. The authors did note that the operators performing these exams had extensive experience in these examinations. An additional issue to consider is billing and documentation of r-POCUS. In general, these examinations should always be documented with the patient identifiers so that they can be reviewed, if needed, at a later time. However, often, in an emergency setting, the examinations are conducted without appropriate recording of the ultrasound data. Lastly, these examinations should always be conducted with full knowledge of their limitations and any pathology detected on r-POCUS should be assessed in the clinical context with a low threshold to mobilize resources for further imaging if indicated. In an effort toward standardization, the National Board of Echocardiography has developed a formal Critical Care Echocardiography certification process requiring attestation of 150 scans to be performed and interpreted.<sup>5</sup> Further standardization of methods, credentialing, and interpretation of these studies, as well as

the recognition of limitations of this modality, will advance the field significantly.

### Conflict of Interest

The authors have no conflict of interest or financial involvement with this manuscript

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