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A Surge of FoCUS on COVID-19 POCUS

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Dear Editor,

In their article, Anile et al.[1] provide a novel and creative framework for the use of ultrasound to evaluate critically ill COVID-19 patients. We agree that ultrasound offers key advantages over other imaging modalities during the current pandemic and may be the preferred method for the routine assessment of these patients[2]. New handheld ultrasound devices may be particularly useful for this proposed application, as they incorporate sophisticated imaging technology while offering portability, affordability, and ease of decontamination[3] to reduce the spread of infection. Some of the latest ultrasound devices offer additional features such as video tutorials and teleguidance, in which a remote expert can guide a novice user in performing an ultrasound exam or procedure[4]. With these advances, ultrasound is becoming increasingly accessible to healthcare providers across all specialties and training levels.

The authors highlight the versatility of ultrasound in evaluating not only the lungs (i.e. presence of B-lines and lung sliding) and heart (i.e. global size and function, pericardial effusion), but also to assess airway anatomy, endotracheal tube placement, end-organ perfusion, intravascular volume status, and peripheral vasculature for evidence of thrombosis. By considering the manifestations of COVID-19 on multiple organ systems, Anile et al.[1] offer a holistic approach to clinical management. We applaud the authors for highlighting several less conventional but very useful applications of critical care ultrasound, all of which can be performed by a single bedside provider, thus limiting infectious exposure to additional staff members. Their clever mnemonic, COVID, will also serve as a useful cognitive aid to the clinician performing these examinations.

In our intensive care units, bedside ultrasound has become a standard tool for assessing and optimizing the management of critically ill COVID-19 patients (Table 1). Markers of volume status evaluated by bedside ultrasound, such as IVC collapsibility, stroke volume variation, and evaluation of diastolic dysfunction, can help to avoid over diuresis and consequent renal injury in patients undergoing conservative fluid management. We employ ultrasound to monitor response to interventions, including the titration of PEEP or the administration of pulmonary vasodilators such as nitric oxide, which can have profound hemodynamic effects due to changes in RV afterload. For patients with refractory hypoxemia in whom ventilation management is challenging, our institution has a dedicated team that performs a trifecta of transthoracic echocardiography, esophageal balloon placement, and electrical impedance tomography to provide physiologic data that can be used to optimize ventilation settings[5,6]. We believe that the ability to monitor cardiac function and titrate ventilatory and hemodynamic parameters using bedside ultrasound may lead to improved outcomes.

We also use focused echocardiography to screen for myocardial injury such as from myocarditis, which may prompt administration of steroids, intracardiac shunting, stress cardiomyopathy, valvulopathies, and the need for mechanical circulatory support such as veno-arterial instead of veno-venous extracorporeal membrane oxygenation in severe illness. Diastolic dysfunction may contribute to failure to wean from mechanical ventilation and can be evaluated with ultrasound. All of these assessments can be performed rapidly at the bedside, including in the prone position, thus minimizing disruption and infectious exposures to additional staff members.

The use of ultrasound in airway management is becoming increasingly utilized amongst clinicians, particularly for confirmation of endotracheal tube placement and ventilation by lung sliding. Tracheal ultrasound can rapidly identify esophageal intubation prior to ventilation, thus providing the opportunity to avoid insufflation as required for confirmation by auscultation. We have also found ultrasound to be useful in assessing gastric volume to evaluate the risk of aspiration and the need for rapid sequence induction prior to endotracheal intubation.

In summary, we thank the authors for providing a valuable framework for the use of ultrasound during the current pandemic. These efforts will serve to improve the clinical care of COVID-19 patients worldwide.

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Potential indications for ultrasound evaluation in the management of critically ill patients with COVID-19 infection
Optimize fluid management (e.g. LVOT VTI variation, IVC collapsibility/distensibility index, evaluation of diastolic dysfunction)
Determine the presence of intracardiac shunting as a cause of hypoxemia and need for intervention (i.e. PFO closure device)
Guide PEEP optimization while monitoring RV function
Quantitative assessment of RV function to guide titration and weaning of pulmonary vasodilators, inotropic support, and mechanical circulatory support
Assess for the presence of pulmonary hypertension and response to interventions
Workup for pulmonary embolus and guide resource utilization (i.e. CT scan)
Determine the presence of other cardiac causes of hypoxemia (e.g. ruptured papillary muscle, post-myocardial infarction VSD)
Assess for left ventricular diastolic dysfunction as an etiology of difficulty weaning from mechanical ventilation
Guide the need for diuresis using diastology to assess left atrial pressures
Assist in determining the cause of undifferentiated shock
Assess for major valvular abnormalities in order to guide hemodynamic optimization and potential need for valve repair
Workup for consideration of mechanical circulatory support including the need for veno-arterial ECMO vs veno-venous ECMO, ventricular assist devices, and to exclude contraindications to mechanical circulatory support (i.e. severe aortic insufficiency in peripheral ECMO)

Table 1. Indications for ultrasound evaluation in the management of critically ill patients with COVID-19 infection

ARDS, acute respiratory distress syndrome; CT, computed tomography; ECMO, extracorporeal membrane oxygenation; IVC, inferior vena cava; LVOT VTI, left ventricular outflow tract velocity time integral; PEEP, positive end expiratory pressure; PFO, patent foramen ovale; RV, right ventricular; VSD, ventricular septal defect.