

Ultrasound: The New Frontier in Critical Care and Beyond

(Editorial for: Position Statement on the Use of Ultrasound in the Intensive Care Unit by Muralidhar K, et al. to be Published in the *Journal of Acute Care*)

It is with great enthusiasm that I introduce this comprehensive position statement on the use of ultrasound in the intensive care unit (ICU). Ultrasound has evolved into an indispensable tool for intensivists, transforming critical care practices through its precision, noninvasive nature, and real-time diagnostic capabilities. This document, meticulously crafted by a distinguished panel of experts, represents a significant milestone in advancing the application of bedside ultrasound as both a diagnostic and therapeutic modality in the management of critically ill patients.

The recommendations presented here are grounded in robust evidence and reflect the collective expertise of multidisciplinary contributors. They encompass a wide range of applications—from transcranial Doppler for neuromonitoring to advanced echocardiographic techniques for hemodynamic assessment—underscoring the versatility of ultrasound in addressing the complexities of critical care across diverse clinical scenarios. These guidelines aim to standardize practices while inspiring further innovation and integration of ultrasound into everyday workflows.

Much like the stethoscope in earlier generations, ultrasound is becoming an essential extension of the clinician's skill set. The stethoscope introduced auscultation as a cornerstone of bedside examination, and ultrasound is poised to replace it in many scenarios due to its superior diagnostic capabilities and dynamic imaging potential. As Narula and colleagues¹ (Narula et al., 2018) aptly suggested, ultrasound is becoming the "fifth pillar" of bedside physical examination, alongside inspection, palpation, percussion, and auscultation. This transition reflects its ability to provide real-time, actionable insights that surpass traditional methods (Solomon & Saldana, 2014).²

Education and training in ultrasound have undergone significant advancements to meet this growing demand. Today, the journey begins as early as medical school, where ultrasound education is now an integral part of the curriculum (Bahner et al., 2014).³ This foundation is then expanded during residency and fellowship programs across specialties such as anesthesiology, critical care medicine, emergency medicine, pediatrics and obstetrics & gynecology. Additionally, hands-on workshops at national and international conferences ensure that practitioners refine their skills and remain proficient in the latest ultrasound techniques.

Artificial intelligence (AI) is playing an increasingly pivotal role in enhancing ultrasound's diagnostic capabilities. AI algorithms are now capable of analyzing ultrasound images with remarkable accuracy, offering preliminary findings akin to how EKGs are interpreted automatically. As Topol⁴ (Topol, 2019) highlighted, AI's integration into medical diagnostics is not only improving efficiency but also ensuring a higher level of diagnostic precision. Soon, ultrasound readings will be automatically generated and reviewed by clinicians for confirmation, streamlining workflows and reducing diagnostic variability.

Ultrasound's transformative role extends beyond adult critical care. In pediatric critical care and pediatric emergency medicine, it is vital for managing conditions such as septic shock, congenital cardiac anomalies, and respiratory distress, offering rapid, noninvasive diagnostic support. In obstetrics, ultrasound plays a pivotal role in maternal and fetal care. It aids in procedures like amniocentesis and chorionic villus sampling, and in the evaluation of critical conditions such as placental abruption, preeclampsia, and fetal growth restriction (Abramowicz, 2013).⁵ These diverse applications underscore ultrasound's indispensability across patient populations and clinical scenarios.

The significance of this position statement lies not only in its detailed recommendations but also in its forward-looking vision. By combining clinical experience, research insights, and technological advancements, this document provides a resource that will enhance patient outcomes and elevate the standard of care delivered in ICUs and beyond. Its multidisciplinary approach, incorporating perspectives from experts across critical care, pediatrics, emergency medicine, and obstetrics, underscores the universal applicability and importance of ultrasound in modern medicine.

I commend the authors and contributors for their dedication and foresight in creating this valuable resource. It is my hope that these recommendations will inspire clinicians across all specialties to explore the transformative potential of ultrasound. Together, we can continue to innovate, collaborate, and improve patient care worldwide.

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