

Use of Bedside Ultrasonography in Hospitalized Patients



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KEYWORDS

- Ultrasound • POCUS • Pocket-size ultrasound • Hospitalist • Medical education
- Procedural guidance

HOSPITAL MEDICINE CLINICS CHECKLIST

1. Point-of-care ultrasound (POCUS) is a portable ultrasonography examination that is both performed and interpreted by providers at the bedside.
2. The routine use of POCUS has led to improved patient safety, decreased lengths of hospital stay, higher detection rates of common disease, and decreased overall hospital costs.
3. The American Medical Association (AMA) affirms that ultrasonography is within the scope of practice of each appropriately trained hospital provider, but leaves training and education standards up to site medical staff.
4. POCUS is being used for many aspects of hospitalist practice, including procedural guidance, acute care triage, and rapid assessment of patients with acute cardiorespiratory decompensation.
5. The future of ultrasonography will be directed toward wide applicability, more formal training and guidelines, and standardized accreditation and billing procedures for reimbursement.

How common is bedside ultrasonography use among hospitalists?

Although diagnostic ultrasonography has been in use since the 1940s, internal medicine began adapting to this evolving technology in the early 1990s when

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point-of-care ultrasound (POCUS) dynamically changed the bedside evaluation of patients.¹ The most common application of ultrasonography in hospitalized patients among hospitalists is procedural guidance, most notably central venous catheter insertion.² According to a recent survey of both hospitalists and intensivists nationwide, 83% of reporting physicians apply ultrasonography guidance for this procedure.² Other common procedural-based ultrasonography applications for hospitalists include paracentesis and thoracentesis, with live-guidance ultrasonography use becoming increasingly frequent because this has been shown to decrease procedural complication rates and improve cost of care.³ POCUS is a portable ultrasonography examination that is both performed and interpreted by a provider at the bedside.⁴ With the introduction and evolution of smaller devices with improved technology, POCUS is becoming more prevalent and advantageous for hospitalist providers.⁵

How is bedside ultrasonography being used by hospitalists to manage acutely ill patients?

Since its clinical introduction in the 1940's, ultrasonography application has grown immensely, especially in the management of acutely ill patients.¹ In hospital medicine, POCUS is applied most commonly in the following domains: cardiac, pulmonary, abdominal, vascular, and procedural guidance.⁵ Point-of care cardiac applications include left ventricular (LV) function assessment, atrial size estimation, right ventricular function assessment, gross valvular abnormalities, and the presence of pericardial fluid. Several studies have shown hospitalist proficiency in estimating LV function, severe mitral regurgitation, and pericardial effusion presence with a short training session.⁶⁻⁸ Point-of-care pulmonary ultrasonography applications are unique, given that ultrasonography artifact is created when sound waves penetrate air-filled lungs. In 2008, Lichtenstein and Mezière⁹ showed that a directed lung ultrasonography protocol could be applied by skilled ultrasonographers to successfully diagnose (>90% accuracy) the most common causes for respiratory failure in patients admitted to intensive care units (**Fig. 1**). The most common point-of-care pulmonary ultrasonography applications are lung sliding to assess for pneumothorax, identification of artifacts known as B lines to assess for an interstitial pattern of disease such as acute pulmonary edema, consolidated lung to assess for pneumonia, and pleural effusion identification and ultrasonography guidance for thoracentesis. Several recent meta-analyses have shown lung and pleural ultrasonography to be highly accurate and more cost-efficient compared with traditional chest radiography in the diagnosis of pneumonia and acute pneumothorax.^{10,11} Abdominal POCUS applications include hydronephrosis evaluation in patients in acute renal failure, ascites evaluation and image-guided paracentesis, and liver and gallbladder disorder assessment. Vascular POCUS applications include inferior vena cava (IVC) and abdominal aortic aneurysm assessment, deep venous thrombosis evaluation, and both peripherally and centrally inserted intravenous line guidance. IVC assessment to estimate central venous pressure and fluid responsiveness is one of the most commonly used ultrasonography applications for novice hospitalist providers. Although the physiology of the IVC and central venous pressure can be complex and dynamic (and differ between spontaneously breathing patients and passively breathing patients), a general understanding of the principles here is helpful for hospitalists admitting acutely ill and hypotensive patients.^{12,13} Hospitalist providers can acquire these skills quickly; as Martin and colleagues¹⁴ showed in a recent study that hospitalists can accurately estimate and interpret IVC collapsibility for a bedside estimation of central venous pressure. Note that there is a paucity

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