

Point-of-Care Ultrasonography for Primary Care Physicians and General Internists

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Abstract

Point-of-care ultrasonography (POCUS) is a safe and rapidly evolving diagnostic modality that is now utilized by health care professionals from nearly all specialties. Technological advances have improved the portability of equipment, enabling ultrasound imaging to be executed at the bedside and thereby allowing internists to make timely diagnoses and perform ultrasound-guided procedures. We reviewed the literature on the POCUS applications most relevant to the practice of internal medicine. The use of POCUS can immediately narrow differential diagnoses by building on the clinical information revealed by the traditional physical examination and refining clinical decision making for further management. We describe 2 common patient scenarios (heart failure and sepsis) to highlight the impact of POCUS performed by internists on efficiency, diagnostic accuracy, resource utilization, and radiation exposure. Using POCUS to guide procedures has been found to reduce procedure-related complications, along with costs and lengths of stay associated with these complications. Despite several undisputed advantages of POCUS, barriers to implementation must be considered. Most importantly, the utility of POCUS depends on the experience and skills of the operator, which are affected by the availability of training and the cost of ultrasound devices. Additional system barriers include availability of templates for documentation, electronic storage for image archiving, and policies and procedures for quality assurance and billing. Integration of POCUS into the practice of internal medicine is an inevitable change that will empower internists to improve the care of their patients at the bedside.

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Point-of-care ultrasonography (POCUS) is a safe and rapidly evolving diagnostic modality. Traditionally, ultrasonography has been used by imaging specialists, such as radiologists and cardiologists; however, it is now utilized by health care professionals from nearly all specialties. Technological advances have improved portability and miniaturization of equipment, allowing ultrasound imaging at the bedside to make timely diagnoses and guide procedures. Over the past several years, there has been emerging interest in the routine use of POCUS to potentially expedite and provide cost-efficient, high-value care.¹

This technology has been touted as the “visual stethoscope” of the 21st century.^{2,3} The stethoscope, developed 200 years ago, is the classic icon for the traditional diagnostic physical examination and is still the most widely used tool to examine patients at the bedside. It is interesting to note, however, that the stethoscope is truly a “stethophone” because

it allows only listening to the human body (steth = chest, phone = sound), rather than truly looking inside the body (scope = to look in). However, as true “scopes,” portable ultrasound devices can generate high-quality images revealing the structure and function of organs.⁴ The traditional bedside physical examination has been on the decline within internal medicine for several years for various reasons.⁵⁻⁹ This increase in ambiguity in diagnosis is potentially unsettling to internal medicine physicians who see a variety of complex presentations and want to “do no harm.” Globally, medical education still emphasizes teaching traditional physical examination; however, no patient outcomes data justify application of physical examination techniques learned for commonly encountered clinical conditions. As an example, little data exist regarding an evaluation of central venous pressure using jugular venous distention in a morbidly obese patient. Moreover, many



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important cardiopulmonary abnormalities that are easily and rapidly detected by POCUS, such as pericardial fluid, left ventricular (LV) systolic dysfunction, and pleural effusion, are often missed by traditional physical examination. It is conceivable that patients' increasingly complex medical conditions, physicians' declining physical examination skills, and society's expectation for higher standards of medical care are all leading to increased utilization of POCUS for more accurate bedside assessments of patients.

POCUS can immediately narrow the differential diagnosis by building on clinical information revealed by the history and physical examination^{10,11} and refine clinical decision making for further work-up and treatment.¹² Recent studies have found that clinical management involving the early use of POCUS accurately guides diagnosis, significantly reduces physicians' diagnostic uncertainty, and also changes management and resource utilization.¹³ From a patient perspective, "very low" discomfort was reported during POCUS of the heart, lungs, and deep veins, and most patients agreed to be evaluated with POCUS in an emergency department.¹⁴ Additionally, use of POCUS in the emergency department has been reported to improve patient satisfaction and short-term health care resource utilization.¹⁵⁻¹⁷

LITERATURE REVIEW AND CLINICAL APPLICATIONS

POCUS can be helpful in a variety of common clinical conditions by quickly identifying abnormalities that may not be revealed by a traditional physical examination.² For instance, consider the evaluation of a patient presenting with unexplained dyspnea. In these patients, POCUS of the lungs can rapidly detect pleural effusions, pulmonary edema (B lines, a type of comet tail artifact),¹⁸ pneumonia (consolidation with dynamic air bronchograms),¹⁹ or pneumothorax (absence of pleural sliding and presence of a lung point sign).²⁰

Other conditions readily detected with POCUS include abdominal aortic aneurysms,²¹ deep venous thromboses,²² and peritoneal free fluid.²³ Central venous pressure can be estimated by assessing the inferior vena cava (IVC) or internal jugular vein size and collapsibility.²⁴ Focused cardiac

ultrasonography can expeditiously assess global LV and right ventricular function and detect the presence of a pericardial effusion.²⁵ Other common POCUS applications include vascular, musculoskeletal, sinus, ocular, nerve, thyroid, gallbladder, liver, spleen, renal, testicular, and bladder imaging (Figure 1).

Several medical and surgical subspecialties have adopted POCUS protocols to rule in or rule out certain conditions using an algorithmic approach. Common protocols include BLUE (Bedside Lung Ultrasound in Emergency) for acute respiratory failure,²⁶ FAST (Focused Assessment with Sonography in Trauma) for peritoneal free fluid,²⁷ RUSH (Rapid Ultrasound for Shock and Hypotension) for shock,^{28,29} and CLUE (Cardiovascular Limited Ultrasound Examination) for heart failure.³⁰ These protocols offer a logical POCUS workflow for specific clinical scenarios and provide a foundation to integrate POCUS findings into clinical decision making.

POCUS is not simply a diagnostic algorithm but rather a tool used by a skilled clinician at the bedside to guide clinical decision making in real time. Although almost any diagnostic evaluation can be aided by POCUS (Figure 1, Table), we will describe 2 common patient scenarios to highlight the impact of POCUS on efficiency, diagnostic accuracy, resource utilization, radiation exposure, and patient satisfaction.

CASE 1

A 41-year-old man with hypertension, type 2 diabetes mellitus, and asthma presented to the outpatient clinic with worsening shortness of breath. The shortness of breath had begun abruptly while the patient was at work in a cabinet woodworking shop. He had been evaluated in an urgent care clinic 1 week before presentation and treated with a short course of corticosteroids and inhaled albuterol. His symptoms improved initially but subsequently worsened. He reported frequent ankle swelling that had recently increased. A review of systems revealed loud snoring at night but no angina, orthopnea, paroxysmal nocturnal dyspnea, recent travel/immobilization, or infectious symptoms.

Traditional Physical Examination

Traditional physical examination revealed the following:

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