

The Emerging Role of Point-of-Care Ultrasound in Pediatric Emergency Medicine



Frank Myslik, MD ^a, Rodrick Lim, MD ^{a, b}, Naveen Poonai, MD ^{a, b, *}

^a Division of Emergency Medicine, London Health Sciences Centre, Western University, London, Ontario, Canada

^b Children's Health Research Institute, London Health Sciences Centre, London, Ontario, Canada

ABSTRACT

Keywords:
Point-of-care ultrasound
Pediatric
Emergency

Point-of-care ultrasound (POCUS) is the bedside assessment by ultrasound to quickly assess patients for both procedural and diagnostic purposes. Pediatric emergency physicians are finding more applications for it in patients, making it a necessary adjunct to physical examinations. Being aware of its current use and limitations is important to all members of the health-care team. This article will review common POCUS indications for pediatric patients in the emergency department in the areas of abdominal and pulmonary emergencies, musculoskeletal injuries, and urgent vascular access.

Copyright © 2018 by the Association for Radiologic & Imaging Nursing. Published by Elsevier Inc. All rights reserved.

Introduction

Point-of-care ultrasound (POCUS) in pediatrics is an exciting and rapidly evolving area. POCUS was first described over 30 years ago, and its use in acute care medicine has been supported by the American College of Emergency Physicians since 1990 (American College of Emergency Physicians, 1990). In 2001, the Accreditation Council for Graduate Medical Education mandated that all general emergency medicine residents in the United States attain competency in POCUS (Hockberger et al., 2001). Initially, POCUS was used to detect free fluid in abdominal trauma, assess the presence of pericardial fluid, detect intrauterine pregnancy, and detect aortic dilatation. POCUS is rapidly expanding over the last decade and is being used for numerous clinical scenarios such as musculoskeletal injuries, intraocular injuries, and imaging-assisted procedures

(Marin et al., 2016). Many medical disciplines are finding POCUS invaluable, including intensive care where it is used for both diagnostic and procedural guidance. POCUS provides physicians with real-time images that correlate with patients' symptoms and help guide management. It is accepted as a diagnostic tool in both adult and pediatric emergency departments (EDs) (Marin et al., 2016; Atkinson et al., 2014). In 2011, a North-American survey indicated that 95% of pediatric emergency fellowship programs provide training in POCUS (Hockberger et al., 2001).

Health-care professionals should be aware of POCUS and its current use in acute care settings. The aim of this review is to provide health-care professionals an overview of application of POCUS in children for abdominal and pulmonary emergencies, musculoskeletal injuries, and urgent vascular access.

Abdominal emergencies

Appendicitis

Appendicitis is the leading cause of emergent abdominal surgery in children (Buckius et al., 2012). The clinical diagnosis in young children can be particularly challenging as they may present without the classic symptoms and signs of appendicitis. Especially

Financial Disclosure: The authors have no financial relationships or other conflicts of interest related to this submission to disclose.

Conflicts of Interest: The authors have no conflicts of interest relevant to this article to disclose.

* Corresponding author: Naveen Poonai, Pediatric Emergency Department, Children's Hospital, London Health Sciences Centre, London, Ontario, Schulich School of Medicine and Dentistry, London, Ontario, 800 Commissioners Road East, London, Ontario N6A 5W9.

E-mail address: naveen.poonai@lhsc.on.ca (N. Poonai).

This activity has been submitted to Alabama State Nurses Association for approval to award contact hours. Alabama State Nurses Association is accredited as an approver of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

in young children, this delay in diagnosis can lead to perforation and serious infection. Prompt recognition and management is very important in children as missed appendicitis has a higher mortality rate than in adults (Barrett, Hines, Andrews, 2006). Although the diagnosis of appendicitis is often made based on the results of clinical and laboratory testing, patients may benefit from a bedside assessment using POCUS in which an earlier diagnosis can be made.

Ultrasound (US) performed and interpreted by radiology remains the most widely used imaging modality for the diagnosis of appendicitis in children (Zhang, Liao, Chen, Zhu, Byanju, 2017). It is recommended as an adjunct to the physical examination especially when classic signs of appendicitis are absent (Linam & Munden, 2012). However, US is typically performed by a technologist who generates images that are then interpreted by a radiologist, which can lead to significant operator variability in images and interpretations (Zhang et al., 2017). Although computerized tomography (CT) may be considered preferable because of its consistency regardless of operator, there is an increased awareness of the risk of ionizing radiation exposure in children which advocates against its use (Bertell et al., 2007). MRI has been found to be useful as it has high accuracy in diagnosis, avoids radiation exposure in children, and does not delay disposition from department (Martin, Mathison, Mullan, Otero, 2018). However, access and costs for this imaging remain as barriers in many centers (Ginde, Foianini, Renner, Valley, Camargo, 2008; Khaliq, Deyo, Duszak, 2015). Radiology-performed US has high operator variability, and its availability is limited to certain daytime hours in many health-care centers. Even when radiology-performed US is available overnight, there is a greater frequency of false diagnosis of appendicitis than from those performed in the daytime, which could be due to the experience level of the technologists and coverage by nonpediatric radiology specialists (Mangona et al., 2017). There are many centers that are covered by on-call trainees overnight which further can lead to misdiagnosis in after hours (Mangona et al., 2017; Stevens et al., 2008; Ruma et al., 2011). In fact, one of the primary limitations of US is the dependence on operator and variability in experience in those performing the scan (Zielke, Sitter, Rampp, Bohrer, Rothmund, 2001; Pohl, Golub R, Schwartz GE, Stein HD, 1998). As well, female pediatric patients and those presenting after hours who undergo a radiology-performed US have a significantly increased time to appendectomy compared with those who do not (Poonai et al., 2014).

In contrast, POCUS allows trained physicians to evaluate patients at the bedside without delay. Accuracy of emergency physicians trained to perform POCUS for appendicitis is comparable to radiologist-performed US (Benabbas, Hanna, Shah, Sinert, 2017). Moreover, the emergency physician has the benefit of interpreting

POCUS images in the context of their clinical findings, thereby assisting in making the diagnosis of appendicitis, showing the importance of having full access to the clinical findings of the patient (Lam et al., 2014). A recent meta-analysis showed that all non-radiology providers had a sensitivity and specificity of 91% when using POCUS for evaluation of appendicitis (Fields et al., 2017). For children presenting to the ED with findings suggestive of appendicitis, POCUS reduced ED length of stay, decreased the frequency of CT imaging, and decreased wait time to the operating room (Elikashvili, Tay, Tsung, 2014). These early results suggest that POCUS has the potential to improve and accelerate the care of children with appendicitis. However, as previously mentioned, operator variability and experience can influence scanning, highlighting the need for training in this area before integration into clinical practice and continuing maintenance of skill (Pohl, Golub, Schwartz, Stein, 1998).

Sonographic findings supportive of a diagnosis of appendicitis are similar between POCUS and radiology-performed US. These findings include a noncompressible blind-ended tubular structure in long axis in reference to the psoas muscle and iliac vessels as landmarks, with >6 mm diameter measured and increased wall thickness (Figure 1A–C). Appendicitis can be isolated to the tip of the appendix as well, making it important to visualize the entire structure. Secondary signs such as inflammation, appendicolith, hyperemia of the wall, or free fluid may also be seen and are supportive of the diagnosis (Marin et al., 2016; Chen, Wang, Hsu, Huang, Lin, 2000).

A negative diagnostic test, whether performed by POCUS or by radiology-performed US, is not sufficient to definitively rule out the diagnosis of appendicitis when clinical findings suggest otherwise (Benabbas et al., 2017). Therefore, it is important for clinicians to consult surgical services when the history and physical examination are strongly suggestive of appendicitis despite a normal US.

Intussusception

Intussusception is the most common abdominal emergency in children aged less than 2 years (Roskind, Kamdar, Ruzal-Shapiro, Bennett, Dayan, 2012). Intussusception has a yearly prevalence of roughly 30 cases per 100,000 live births and is the most common cause of intestinal obstruction in children aged below 3 years (Hryhorczuk & Strouse, 2009). The diagnosis of intussusception is often difficult to make because neither clinical signs and symptoms (Fullerton et al., 2017) nor X-rays can reliably establish the diagnosis (Roskind et al., 2012). US performed by an experienced radiologist has become the preferred imaging modality for patients with suspected intussusception because it has both high specificity and

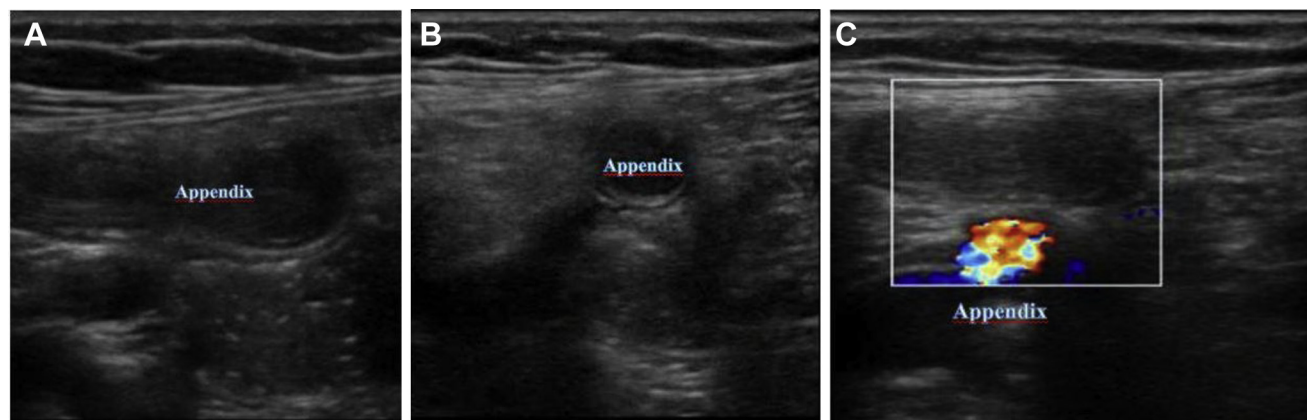


Figure 1. (A) Appendicitis—long access. Probe: linear; anatomic orientation: long access; depth: 6 cm. (B) Appendicitis—short access. Probe: linear; anatomic orientation: short access; depth: 6 cm. (C) Color Doppler showing blood flow in the iliac vessel. Probe: linear; anatomic orientation: long access; depth: 6 cm.

Download English Version:

<https://daneshyari.com/en/article/8956670>

Download Persian Version:

<https://daneshyari.com/article/8956670>

[Daneshyari.com](https://daneshyari.com)