Case Report

It Is Always Early with Point-of-Care Ultrasound

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Received 20 December 2019; Revised 14 March 2020; Accepted 23 March 2020; Published 6 April 2020

Academic Editor: Chiara Lazzeri

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A 56-year-old male was admitted to the emergency department for acute pulmonary edema and septic shock, yet no clear source of infection was noted upon physical examination. Due to his unstable condition, bedside ultrasound was performed. A heterogeneous mass in the liver was noted; hence, a tentative diagnosis of liver abscess was made. The abscess was confirmed by abdominal magnetic resonance imaging. Drainage of the abscess was attempted and guided by early ultrasound. This case highlights that point-of-care ultrasound, when performed by an ultrasound-capable critical care physician, can significantly decrease the time to diagnosis for septic patients.

1. Case File

A 56-year-old male presented to our hospital’s emergency department complaining of acute shortness of breath and 1 week of malaise. He complained of nausea and vomiting in that period, with mild abdominal pain, but no diarrhea, cough, chest pain, or dysuria. He was known to have diabetes mellitus requiring insulin, hypertension, an old myocardial infarction followed by left anterior descending artery and right coronary artery stenting with borderline impaired systolic function 6 months prior, and dyslipidemia.

Upon examination, he had a Glasgow Coma Scale of 15, was shivering, hypotensive (mean arterial blood pressure 40 mmHg), tachycardic (140 beats per minute), tachypneic (34 breaths/min), hypoxic (peripheral oxygen saturation 82% on room air), and febrile (temperature of 38.9°C). An arterial blood gas on 6 L/min of oxygen through a BiPAP machine revealed a compensated acute metabolic acidosis, with a pH of 7.404, pCO2 15 mmHg, pO2 101 mmHg, HCO3 15.4 mmol/L, and lactate 4 mmol/L. The patient was in a hyperosmolar state with high blood sugar 30 mmol/L and normal blood ketones. He was admitted to the critical care unit upon diagnosis of acute pulmonary edema and suspicion of sepsis. The Rapid Assessment of Dyspnea with Ultrasound protocol [1] was immediately started and showed depressed systolic function of the left ventricle, with cardiac index 2 mL/min/m², and ultrasound of the chest showed severe bilateral ultrasonic B lines suggestive of acute pulmonary edema. Clinically, there was still no obvious source of infection: he had a bilateral pulmonary crepitant and there was no abdominal or costovertebral angle tenderness.

The patient’s blood pressure was still low after dobutamine infusion followed by noradrenaline infusion and controlled intravenous fluid with insulin infusion; because the patient continued to be unstable, a bedside ultrasound examination for critically ill patients was performed to further look for a source of infection. Ultrasound revealed a heterogeneous mass seen in segments IV (at the level of the left portal vein of the left lobe), VIII and V (at the level of the right portal vein of the right liver lobe), and I (caudate lobe) of the liver with no obvious intrahepatic biliary dilatation. The largest mass measured 10 × 7 cm (Figure 1). A thickened wall of the gall bladder with gall stones and biliary mud was also seen suggestive of acute cholecystitis. A liver abscess was suspected. An abdominal magnetic resonance imaging scan was then performed, which confirmed the abscess with no obvious intrahepatic biliary dilatation; the mass measured 9.5 × 9.3 × 9.5 cm of volume 435 cc seen predominately involving segments IV and I (Figure 2). Piperacillin-tazobactam and metronidazole had already been administered. Urgent
percutaneous ultrasound-guided drainage of the hepatic abscess revealed a thick purulent material, and then, with the help of the interventional radiologist, cholecystostomy was performed the next day; cultures later isolated *Enterococcus avium*. Cholecystostomy was performed because the patient was considered a high surgical risk for cholecystectomy. Abscess drainage and appropriate antibiotic therapy led to steady improvement, both clinically and on repeated imaging exams. The patient was discharged 2 weeks later with a stable condition, and laparoscopic cholecystectomy was performed 6 weeks later.

2. Discussion

Early recognition of septic shock and the initiation of appropriate antibiotics is the cornerstone treatment [2]. The optimal timing of source control is unknown but guidelines suggest no more than 6 to 12 hours after diagnosis since survival is negatively impacted by inadequate source control [3]. POCUS helps not only in the early identification of the source of infection but also in early interventions such as drainage or removal of the infectious source. However, because of the hemodynamic instability of septic shock patients [1], it is reasonable to carry out diagnostic and interventional ultrasound-guided procedures bedside.

Liver abscesses are the most common type of visceral abscess, and its risk factors include diabetes mellitus, underlying hepatobiliary or pancreatic disease and regular use of proton-pump inhibitors [4]. Ultrasound, computed tomography (CT), and magnetic resonance imaging are the diagnostic modalities typically used for identifying liver abscesses [5]. There is usually a delay of 1 week between the onset of symptoms and diagnosis, as most abscesses are nonspecific, and there are multiple occult sources of infection, such as silent gall bladder diseases and diverticulitis [6].

Streptococci, including *Enterococcus avium*, were the most common pathogen of pyogenic liver abscess in the United States [7]. Enteric gram-negative bacilli, particularly *K. pneumoniae*, are commonly identified pathogens in Asia and suggested an association with underlying colorectal cancer with a prevalence of colorectal cancer among pyogenic liver abscess patients 2.3 to 3.2 percent in long-term follow-up [8].

Percutaneous cholecystostomy in acute cholecystitis is indicated as the initial treatment, combined with antibiotics, for patients who are at high surgical risk such as being septic or critically ill [9]. Early cholecystostomy (<24 hours from symptom onset) was associated with a lower complication rate and a shorter hospital stay [10].

Identifying the source of infection can be challenging, yet important for managing the patient. A stepwise, structured POCUS approach helps to do so in a minimal amount of time.

Point-of-care ultrasound, in the hands of a critical care physician, significantly decreases the time to diagnosis for septic patients, potentially decreasing the time to source control.

**Disclosure**

The research was performed as part of the employment of the authors in Kuwait Oil Company.

**Conflicts of Interest**

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Authors’ Contributions**

Zouheir I Bitar wrote the article, Tamer Mohamed Zaalouk and Ossama S. Maadarani shared in the discussion, and Ragab Desouky Elshabasy is in the collection of data and revision of the manuscript.
Acknowledgments

Our working website is http://www.kockw.com, Kuwait Oil Company, Ahmadi Hospital.

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