

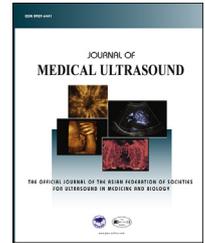


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CASE REPORT

Acute Cholecystitis Detected by Serial Emergency Department Focused Right Upper Quadrant Ultrasound



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Abstract Acute cholecystitis is a common etiology of acute right upper quadrant pain in patients presenting to the emergency department (ED). The use of ED-focused right upper quadrant ultrasound (RUQ US) is becoming more widely utilized to evaluate abdominal pain thought to be hepatobiliary in nature. We describe a case series of two patients with acute cholecystitis detected by serial ED-focused RUQ US. Case 1: A woman presented to the ED with epigastric pain of acute onset. She was initially found to have a mild leukocytosis and cholelithiasis detected by ED-focused RUQ US. Seventy-five minutes later, the patient had a repeat bedside ultrasound by the same sonographer that showed visual evidence of acute cholecystitis that was later confirmed by surgical pathology. She was treated operatively. Case 2: A man with known cholelithiasis presents to the ED with acute-onset RUQ pain. Initial RUQ ultrasound performed by the Department of Radiology (University of Colorado Hospital) was equivocal, showing cholelithiasis with a mildly thickened wall and no pericholecystic fluid. A repeat ED-focused RUQ ultrasound 5 hours later showed increased wall thickness and pericholecystic fluid. The patient was subsequently taken for same-day cholecystectomy. This case series demonstrates the dynamic and progressive nature of acute cholecystitis detected by ED-focused RUQ US. It also highlights how serial bedside ultrasonography can reduce harm, appropriately triage patients with hepatobiliary disease and lead to reductions in overall morbidity. © 2016, Elsevier Taiwan LLC and the Chinese Taipei Society of Ultrasound in Medicine. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Conflicts of interest: None.

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Introduction

In the United States, an estimated 20 million people suffer from cholelithiasis and ~120,000 patients undergo cholecystectomy for acute cholecystitis each year [1]. The use of traditional physical examination and laboratory data in combination fail to be sufficiently sensitive or specific to detect and diagnose acute cholecystitis amidst nonsurgical conditions such as cholelithiasis, choledocolithiasis, or a number of other causes of right upper quadrant (RUQ) pain [2]. Right upper quadrant ultrasonography is one of the most common emergent ultrasound examinations performed in the United States because it is accurate, inexpensive, and noninvasive. It is often the initial diagnostic imaging modality used in the emergency department (ED) to evaluate acute RUQ pain although little is known regarding the onset of visible changes within the gallbladder parenchyma after symptoms begin.

Several investigators have shown that bedside ED-focused RUQ ultrasound (US) is accurate for gallstone-related biliary disease with a combined sensitivity of 90–96%, specificity of 88–96%, positive predictive value of 88–99%, and negative predictive value of 73–96% [3,4]. In addition, this bedside exam may decrease the length of stay for ED patients compared with those undergoing traditional ultrasonography performed by radiology [5,6]. For these reasons, ED-focused RUQ US is becoming more widely used for rapid and accurate diagnosis of acute cholecystitis.

In many clinical scenarios, it is imperative that emergency physicians repeat vital components of their workup to determine the need for treatment, hospital admission, specialty consultation, or operative intervention. Focused ED US is one of the core components of ED evaluation that can be useful in determining if the patient is appropriate for safe ED discharge.

This is a case series of two patients with rapidly progressive sonographic evidence of acute cholecystitis as detected by serial ED-focused RUQ US recorded over a several-hour period. These repeat exams changed the individual patient's hospital course from expectant management to same-day surgical intervention thus reducing morbidity.

Case 1

A 22-year-old female presented to the ED with the chief complaint of abdominal pain. The patient reported 1 day of constant, sharp epigastric pain that radiated to the mid-back and was associated with nausea and nonbloody, non-bilious vomiting. She rated her initial pain at 9/10. The patient denied diarrhea, dysuria, and had no relief of symptoms with ibuprofen and bismuth subsalicylate. Review of systems was negative for fever, chills, chest pain, and shortness of breath. Past medical and surgical history was unremarkable, although she was 2 months postpartum status post an uncomplicated spontaneous vaginal delivery. Social history was negative for alcohol, tobacco, or illicit drugs. Vital signs revealed a temperature of 36.6°C, a heart rate of 90 beats/min, a blood pressure of 115/90 mmHg, a respiratory rate 16/min, and an oxygen saturation of 96% on

room air. Physical examination revealed a well-developed, well-nourished female in no apparent distress. Cardiovascular examination was unremarkable. Abdominal examination revealed a positive Murphy's sign, but was otherwise soft, without rebound or guarding. There was no costovertebral angle tenderness. Skin examination was without jaundice or surgical scars.

The patient had an IV established and was given 4 mg morphine, 4 mg ondansetron, and 1 L of normal saline. An ED-focused RUQ US was performed at 8:51 AM, 43 minutes after initial provider contact. This examination (Figure 1) showed the presence of cholelithiasis, a gallbladder wall thickness of 2.2 mm, and no pericholecystic fluid. Laboratory data revealed the following: white blood cells (WBC) 14,000 cells/uL, hemoglobin 14.1 g/dL, total bilirubin 0.4 mg/dL, direct bilirubin 0.1 mg/dL, alkaline phosphatase 106 U/L (45–145), aspartate aminotransferase (AST) 17 U/L, and alanine aminotransferase (ALT) 32 U/L. At 10:00 AM the patient had repeat vital signs that were unchanged. She was feeling improved (pain score 3/10) and tolerated an oral challenge. Given the constellation of information, the patient was diagnosed with biliary colic and prepared for ED discharge.

Prior to discharge, the patient had a second ED-focused RUQ US for the unique purpose of storing images into the picture archiving and communications system (PACS). The same sonographer, an attending physician, and director of ultrasound at our institution, performed this second ultrasound. This exam occurred at 10:05 AM, ~75 minutes after the initial ultrasound was performed. This subsequent study revealed pericholecystic fluid, and a 6.8 mm-thick gallbladder wall (Figure 2). These findings were suggestive of acute cholecystitis. Upon acquisition of these images, the patient was sent for a consultative RUQ ultrasound by the Department of Radiology (University of Colorado Hospital). This exam occurred at 11:54 AM. The radiologist's impression included cholelithiasis with sonographic evidence of acute cholecystitis (Figure 3).

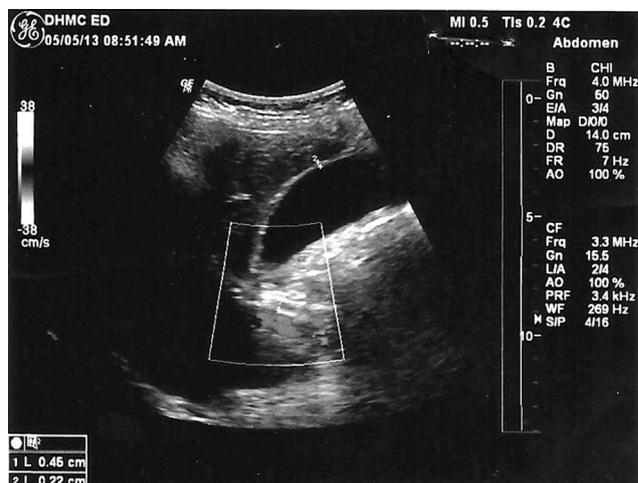


Figure 1 ED-focused RUQ US of the gallbladder in long axis. The common bile duct measurement is 4.5 mm and gallbladder wall thickness is 2.2 mm. ED = emergency department; RUQ US = right upper quadrant ultrasound.



Figure 2 ED-focused US shows gallbladder wall thickness of 6.8 mm in addition to pericholecystic fluid. ED = emergency department; US = ultrasound.

The patient was subsequently taken to the operating room and had a laparoscopic cholecystectomy performed by general surgery, later confirmed to be acute cholecystitis by pathologic examination.

Case 2

A 30-year-old male presented with the chief complaint of RUQ pain. The patient reported pain that was 10/10 that had woke him from sleep 2 hours earlier associated with vomiting once. He denied lower abdominal pain, testicular pain, dysuria, fever, or chills. He had good relief of pain

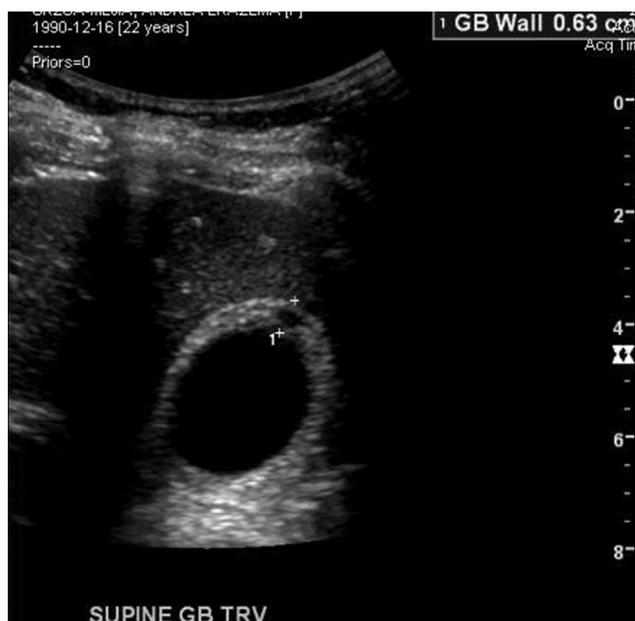


Figure 3 Radiology performed ultrasound of the gallbladder in short axis. Gallbladder wall thickness measured at 6.3 mm with presence of pericholecystic fluid.



Figure 4 Radiology performed imaging showing cholelithiasis with a stone in the gallbladder neck.

with fentanyl administered by paramedics during transport to the ED. He had no history of prior abdominal surgeries but had been seen at an outside ED 1-week prior and diagnosed with cholelithiasis. Social history was positive for alcohol and tobacco. Vital signs revealed a temperature of 35.9°C, a heart rate of 65 beats/min, a blood pressure of 169/109 mmHg, a respiratory rate 16/min, and an oxygen saturation of 99% on room air. Physical examination revealed a well-developed, well-nourished male in no apparent distress but holding his hands over his RUQ. Cardiovascular examination was unremarkable. Abdominal examination revealed a positive Murphy's sign, but was otherwise soft, without rebound or guarding. Testicular exam was unremarkable. Skin examination was without jaundice or surgical scars.

A Department of Radiology (University of Colorado Hospital) ultrasound was ordered and completed at 7:03 AM,



Figure 5 ED-focused RUQ US showing gallbladder in long-axis with stone in gallbladder neck, thickened wall and newly developed pericholecystic fluid. ED = emergency department; RUQ US = right upper quadrant ultrasound.

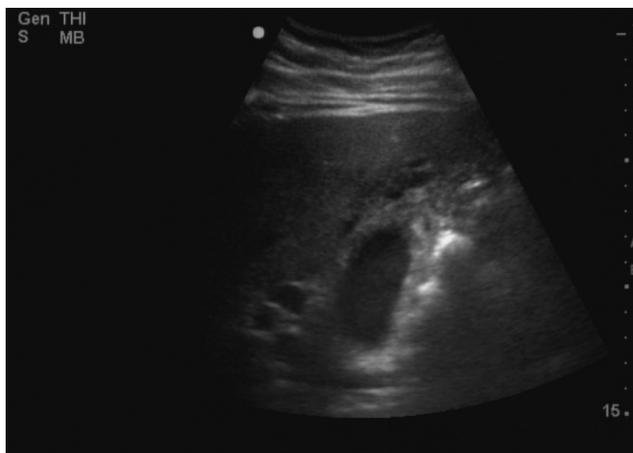


Figure 6 ED-focused RUQ US showing gallbladder in short-axis with dilated common bile duct, thickened wall, and pericholecystic fluid. ED = emergency department; RUQ US = right upper quadrant ultrasound.

18 minutes after initial provider contact. This examination showed the presence of cholelithiasis with an immobile stone in the gallbladder neck (Figure 4), with a mildly thickened gallbladder wall measured at 4.19 mm and a common bile duct diameter of 8.29 mm, with no evidence of pericholecystic fluid. The radiology interpretation was equivocal for acute cholecystitis.

Laboratory data revealed the following: WBC 7900 cells/uL, hemoglobin 15.4 g/dL, total bilirubin 0.7 mg/dL, direct bilirubin 0.1 mg/dL, alkaline phosphatase 63 U/L (45–145), AST 18 U/L, and ALT 30 U/L, and lipase of 41 U/L.

At 8:10 AM the patient was evaluated by the surgical service. The patient was admitted to the surgical service for symptomatic management. Repeat vital signs showed the patient remained afebrile.

While awaiting admission, a repeat ED-focused RUQ ultrasound was performed for educational purposes. This exam, performed at 12:14 PM, nearly 5 hours after the patient's initial ultrasound, showed development of pericholecystic fluid, in addition to a dilated common bile duct and thickened gallbladder wall (Figures 5 and 6). The patient was subsequently taken to the operating room later that day by the surgical service for emergent cholecystectomy.

Discussion

We present two cases of rapidly progressive acute cholecystitis detected by ED-focused RUQ US during a single ED visit over a short time frame. To our knowledge, there are no previous reports that describe the use of serial abdominal ultrasound examinations in the ED to determine the presence or progression of acute cholecystitis.

Previous studies have shown that emergency physicians can reliably detect the presence of gallstones with 96% sensitivity using ultrasound [3]. ED-focused RUQ US performed by emergency attending and resident physicians can yield similar diagnostic results with regards to acute cholecystitis when compared with radiology-performed

studies (sensitivity 87% vs. 83%, specificity 82% vs. 86%), respectively [5]. Although operator-dependent, these data suggest that an emergency physician can make an accurate assessment regarding RUQ US findings at the bedside.

This case series has notable implications for any practicing emergency physician who utilizes repeat testing to make or reinforce their medical decision-making. The use of serial abdominal examinations is a frequent part of the reevaluation process of a patient with abdominal pain when a clear diagnosis is not apparent or is progressive in nature [7]. In Case 1, the use of serial ultrasound examinations detected the presence of acute cholecystitis by documenting a changing appearance of the gallbladder over a 75-minute time period and led to change in patient care from ED discharge to operative intervention. In Case 2, the patient was taken to the operating room later that day as opposed to a watch-and-see approach with an initially equivocal radiology-performed ultrasound. As most episodes of acute cholecystitis develop over 12–24 hours, the time of patient presentation to the ED and the timing of serial RUQ US exams may be important for diagnosis and appropriate patient disposition [8].

Recently, Jafari et al [9] published a case report that demonstrated evidence of dynamic changes in the common bile duct (CBD) using ultrasound in a patient with choledocolithiasis. Over a 5-hour period, they detected a change in CBD diameter from 17 mm to 4 mm. Given these findings, they concluded that CBD measurements can fluctuate significantly with partially obstructing gallstones and that repeated RUQ ultrasound has the capability to detect such changes. Our study suggests that sonographic markers of acute cholecystitis such as the presence of a thickened gallbladder wall or pericholecystic fluid can also fluctuate over a short time course during a single ED visit. It also highlights how serial bedside ultrasonography can reduce harm and appropriately triage patients with hepatobiliary disease and lead to reductions in overall morbidity.

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