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Pre-hospital ultrasonography screening for biliary disease in remote settings

IMAGING

CASE REPORT

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ABSTRACT

Screening ultrasound, including Point of Care Ultrasonography (POCUS), is widely utilized for rapid clinical guidance in diverse healthcare settings. In this case report, a 34-year-old male with recurrent biliary colic symptoms underwent a Basic Emergency Service ultrasound, revealing a 13 mm gallbladder calculus and signs of inflammation, and was promptly referred to the hospital for further evaluation and treatment. Medical specialist confirmation at the hospital underscored the significance of early detection through POCUS. Despite inconclusive laboratory results, the detailed ultrasound assessment provided a comprehensive understanding, emphasizing the tool's value in averting complications. Thus, screening ultrasound played a pivotal role in justifying the hospital referral, showcasing its vital role in healthcare, especially in resource-limited settings. The judicious use of POCUS can lead to superior outcomes, avoiding unnecessary referrals for non-emergent cases.

KEYWORDS

cholecystitis, cholecystectomy, emergency, gallstone, screening ultrasound

Introduction

Screening ultrasound or Point of Care Ultrasonography (POCUS) is designed to provide quick and efficient clinical guidance by addressing straightforward and objective queries. This valuable diagnostic tool is routinely employed on an international scale, not only by specialized physicians but also by radiographers, sonographers, and other healthcare professionals with appropriate theoretical and practical training [1]. The inclusion of ultrasound in several emergency medical protocols, including biliary pathology is a well-documented reality in the medical literature [2]. Despite its efficiency, it is crucial to recognize the inherent barriers of POCUS. The lack of understanding of the evidence base for this imaging modality and undue confidence in traditional clinical examination are notable challenges [3]. Rising concerns about patient injuries due to inappropriate use by inexperienced practitioners underscore the importance of proper training and preparedness to mitigate potential misdiagnoses and subsequent treatment errors that could worsen outcomes or even prove fatal [4].

Therefore, this case report aims to provide an understanding of POCUS practice and its contextual effectiveness. The primary goal is to illustrate how POCUS facilitates early detection, emphasizing its pivotal role in justifying hospital referrals and preventing

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complications. The broader implications underscore the significant impact of POCUS in resource-limited settings, where timely and accurate diagnoses can profoundly influence patient outcomes.

Case report

A 34-year-old male sought assistance at a basic emergency service (BES) for the fourth time within a month, grappling with recurrent symptoms indicative of biliary colic. Biliary colic, characterized by abdominal pain typically caused by obstruction from stones in the cystic duct or common bile duct within the biliary tree, poses a considerable health challenge. Affecting 20% of the Western population, gallstones significantly impact healthcare logistics and economics, a trend expected to escalate with the increasing prevalence of obesity and metabolic diseases [5]. Cholecystectomy stands out as a prevalent treatment for gallstone-related conditions. In this case, despite prior episodes and appropriate medication, the patient's clinical symptoms persisted, prompting continued medical attention.

In the current episode, the patient denied fever and vomiting. Upon Manchester triage assessment at BES, he was categorized as "yellow" (urgent), displaying an abdominal pain rating of 5 on a scale of 0–10. He was also afebrile and had a blood pressure reading of 124/76 mmHg. During the physical examination conducted by the BES emergency physician, the patient, while generally in good condition, exhibited tenderness upon abdominal palpation, particularly in the right lower abdomen, with a positive vesicular Murphy's sign. Following a thorough medical history and physical examination, the physician requested a focused abdominal screening ultrasound. Simultaneously, simple blood tests were administered, all of which returned normal results, and a SARS-CoV-2 test came back negative. It is important to note that BES's blood analyses are restricted to assessing the erythrocyte series, white blood cell series, and platelets. This limitation makes the differential diagnosis of hepatic, pancreatic, or biliary pathologies more challenging.

During the ultrasound examination at BES partially depicted in Fig. 1, a positive sonographic Murphy's sign was also observed. The screening ultrasound unveiled the presence of a gallbladder (GB) with non-homogeneous content, featuring a 13 mm calculus situated in the infundibular region, casting a distinct posterior acoustic shadow and echogenic content possible related to biliary sludge. Additionally, the gallbladder wall exhibited an approximate thickness of 6.6 mm (as shown in Fig. 1), and there were areas of heightened echogenicity within the hepatic parenchyma. There was no evidence of free fluid in the upper recesses, and the remaining organs appeared normal. Upon a comprehensive analysis of the patient's clinical symptoms, in conjunction with the ultrasound findings, which notably

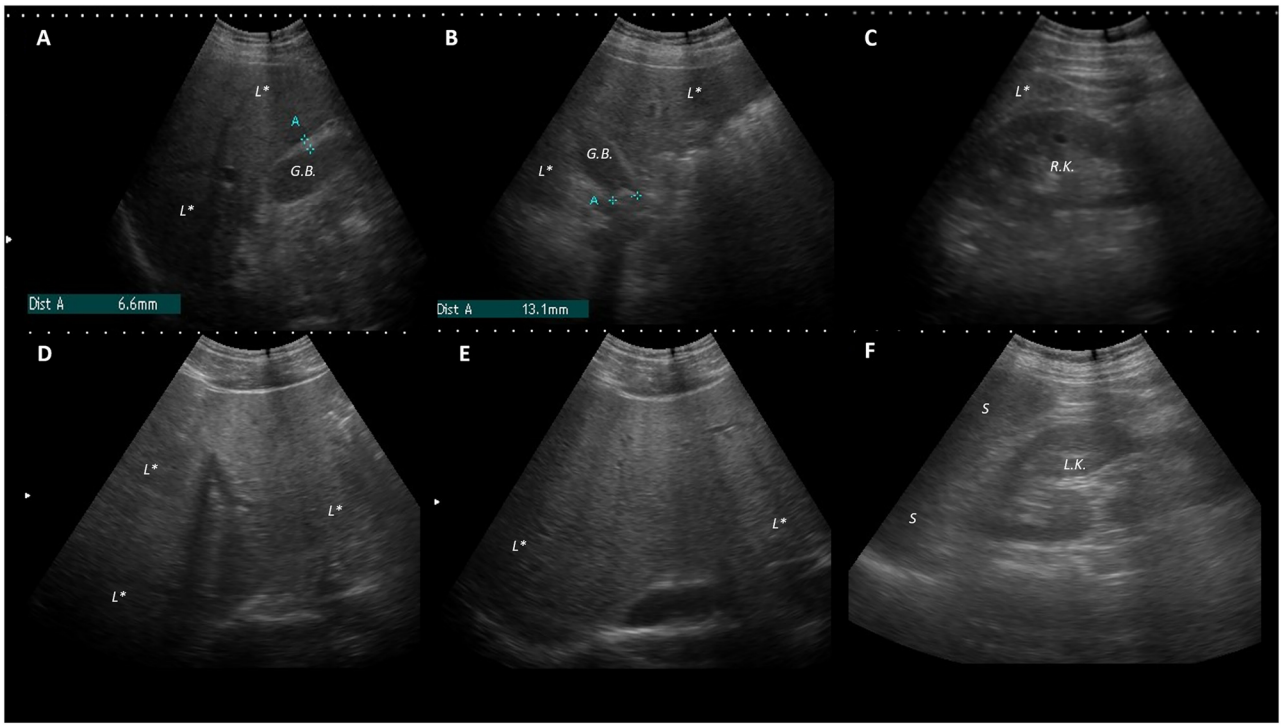

Fig. 1. **A and B** – Recurrent liver section (L*) where the gallbladder (GB) is visible, indicated by blue, with a measurement of the GB wall thickness at 6.6 mm in **A**. In **B**, marked in blue, there is a measurement (calliper A) of 13.1 mm representing an infundibular calculus with a posterior acoustic shadow. **C** – Represents the hepatorenal recess without alterations, where (L*) represents the lowermost portion of the liver and R.K. represents the right kidney in a longitudinal approach. **D** and **E** – Represent recurrent liver sections (L*) where areas of the hepatic parenchyma appear more echogenic, indicating some degree of lipid infiltration. **F** – Represents the splenorenal recess without alterations, where S represents the spleen and L.K represents the left kidney in a longitudinal section

revealed the presence of a calculus in the GB's infundibular region and an increased wall thickness, the possibility of an inflammatory process within the GB was strongly considered [6]. Thus, patient received a combination of medications, including analgesics, antispasmodics, antacids, antiemetics, magnesium-based pain relief, and non-steroidal anti-inflammatory drugs. Supported by this data, the patient was promptly referred to the referral hospital (RH).

Upon arrival at the RH, the patient was directly sent for Surgery Department for further evaluation, where comprehensive blood tests were requested along with an abdominal ultrasound in the Imaging Department. The blood test results indicated that all parameters were within normal ranges, including AST (Aspartate Aminotransferase), ALT (Alanine Aminotransferase), Amylase, Lipase, and Bilirubin's, except for C-reactive protein (CRP), which exhibited an elevated level of 18 mg L^{-1} (normal range: 0.7–0.8 mg L^{-1}). The partially transcripted ultrasound report executed by a Radiologist, as shown in Fig. 2, concluded: "*…identifying a non-mobile 13 mm calculus in the isthmic region, and wall stratification of the gallbladder is observed. The ultrasound findings are consistent with acute inflammatory changes indicative of acute cholecystitis…*". The patient initiated antibiotic therapy, broad-spectrum injectable, non-steroidal analgesics, and opioid pain relief.

The patient continued to be under hospital care and was observed for laparoscopic cholecystectomy scheduled for the day following admission to the RH. Fortunately, both the surgery and the subsequent hospitalization proceeded without any complications, leading to the patient's discharge to their home on the fourth day of hospitalization.

Discussion

The ultrasound findings in the BES were corroborated by the imaging department of the RH, emphasizing the reliability of POCUS in detecting gallbladder pathologies. The specialist's interpretation enriched the perspective, evident in precise language in examination reports. POCUS enabled the BES physician to identify a gallbladder calculus and wall thickness alterations, supporting a provisional diagnosis of possible cholecystitis. Increased echogenicity in hepatic parenchyma areas was also noted. Notably, cholecystitis can manifest without an elevated white blood cell count [7], rendering BES laboratory tests inconclusive. On the contrary, specific RH laboratory tests allowed the exclusion of hepato-pancreatic and biliary etiology and detect elevated CRP. Although the elevation of CRP is a reliable marker of ongoing inflammation, it can be nonspecific regarding its etiology. However, the literature indicates that severe gallbladder inflammations associated with organ dysfunction are often linked to significantly elevated levels of CRP [8]. The radiologist evaluated isthmic calculus immobility, gallbladder wall thickening [9], and hepatic parenchyma changes [10], excluding intrahepatic biliary dilatation and pancreatic and peritoneal commitment.

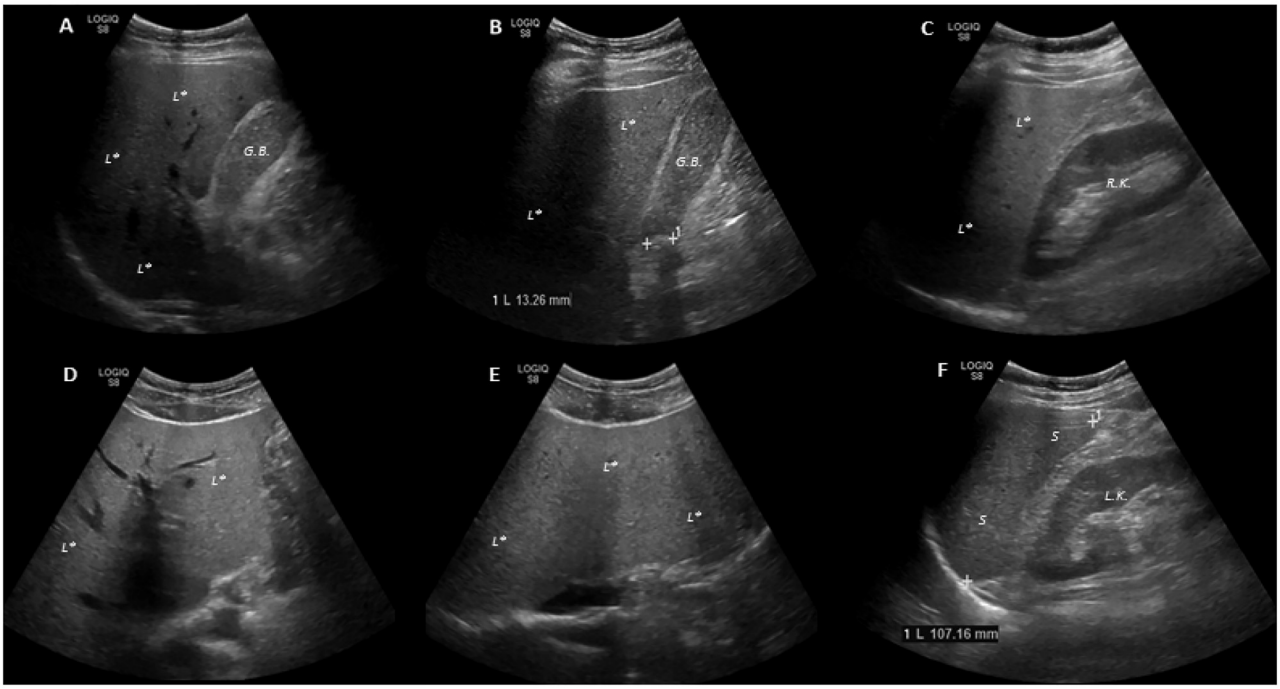

Fig. 2. **A and B** – Recurrent liver section (L*) where the gallbladder (GB) is visible, containing non-pure content (biliary sludge) and stratification of the GB wall. In **B**, between white cursors at position 1, there is a measurement of a calculus in the vesicular isthmic region, measuring 13.26 mm. **C** – Represents the normal hepatorenal recess, where (L*) corresponds to the lowermost portion of the liver and R.K. represents the right kidney in a longitudinal section. **D and E** – Represent recurrent liver sections (L*) where areas of the hepatic parenchyma appear more echogenic, indicating moderate hepatic steatosis. **F** – Represents the splenorenal recess without alterations, where S corresponds to the spleen, measuring 107 mm along the splenic length and L.K. represents the Left Kidney

While existing literature underscores the effectiveness and concordance of ultrasound findings between radiologists and other healthcare professionals conducting abdominal POCUS [11, 12], it's important to recognize that the primary objective of screening ultrasound in the BES is not to establish definitive diagnoses [13]. Many patients who eventually develop cholecystitis have a history of prior biliary colic episodes. Therefore, the early detection of an acute or chronic inflammatory condition of the GB and its prompt management holds significant value. This proactive approach can potentially avert recurrent hospital emergencies, subsequently curbing the associated healthcare expenditures and sparing patients from the anguish of complications that may arise [5].

Conclusion

The information provided by the screening ultrasound was pivotal in directing the patient to the referral hospital, particularly during the challenging backdrop of a pandemic, where every specialized care referral demanded meticulous justification. While this case report underscores the positive impact of screening ultrasound on healthcare delivery, it's essential to acknowledge certain limitations, including the retrospective nature of this study and the imperative for larger-scale investigations to validate POCUS's effectiveness in similar contexts. Future research should delve into clinical uses of POCUS, contributing to establishing their best practices for emergency patient management. The authors maintain a steadfast belief in screening ultrasound's potential to transform healthcare delivery, particularly in resource-limited settings. Its judicious application holds the promise of reducing unnecessary referrals for non-emergent cases, thereby fostering superior outcomes for both patients and the broader healthcare system.

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Conflict of interest: The authors declare no conflict of interest.

Ethical statement: All examinations were requested by the attending physician at the BES in an emergency setting, and as such, this case should be considered within that context. No patient or institutional data was recorded in compliance with general data protection laws. The patient was informed about the objectives, goals, and purposes of the study and provided consent to participate. The primary aim was to demonstrate the value and effectiveness of the screening ultrasound technique in remote settings. This study adhered to ethical guidelines for scientific research, including the Helsinki Declaration and current national data protection legislation.

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