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Diagnosis of upper gastrointestinal perforation complicated with fistula formation and subphrenic abscess by contrast-enhanced ultrasound: A case report

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Abstract

BACKGROUND

Gastrointestinal perforation complicated by subphrenic abscess is a surgical emergency. Its diagnosis relies mainly on X-ray or computed tomography (CT), while the value of ultrasound, especially contrast-enhanced ultrasound (CEUS), has been underestimated.

CASE SUMMARY

A 37-year-old man presented with fever and edema of the lower extremities for 10 d. He had a history of laparoscopic repair of gastroduodenal perforation 6 mo prior. His first-time intravenous CEUS indicated a diagnosis of subphrenic abscess. He received antibiotic therapy and ultrasound-guided percutaneous drainage of the abscess. However, second-time intravenous CEUS revealed an unsatisfactory therapeutic effect. Intracavitary CEUS was proposed, and this examination detected communication between the abscess and the stomach. Upper gastrointestinal perforation complicated by fistula formation and subphrenic abscess was diagnosed with the help of CEUS. Abdominal CT and esophagogastroduodenoscopy confirmed the diagnosis. The patient recovered after the perforation was repaired by surgery.

CONCLUSION

Intravenous and intracavitary CEUS provides helpful information for the diagnosis of upper gastrointestinal perforation complicated by fistula formation and subphrenic abscess.

Key Words: Contrast-enhanced ultrasound; Gastrointestinal perforation; Fistula; Abscess; Diagnosis; Case report

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Core Tip: Gastrointestinal perforation complicated by subphrenic abscess is a surgical emergency that is diagnosed mainly by X-ray or computed tomography. We present a case diagnosed with upper gastrointestinal perforation complicated by fistula formation and subphrenic abscess, with the rare application of intravenous and intracavitary contrast-enhanced ultrasound (CEUS). This case highlights that CEUS provides helpful information for diagnosis, with the advantages of bedside availability, real-time application, convenience, economical aspect, and lack of radiation.

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INTRODUCTION

Gastrointestinal perforation is a common surgical emergency. Due to leakage of alimentary contents into the peritoneal cavity, most cases are associated with high mortality and morbidity. Classic subdiaphragmatic air on chest X-ray may be absent, and computed tomography (CT) is a more sensitive investigation tool for stable patients[1]. Most of the reported cases present X-ray or CT findings of gastrointestinal perforation[2-4], while few of them have demonstrated the crucial role of ultrasound and contrast-enhanced ultrasound (CEUS) for gastrointestinal perforation diagnosis[5, 6]. Here, we report a case of upper gastrointestinal perforation complicated by fistula formation and subphrenic abscess, in which both intravenous CEUS (IVCEUS) and intracavitary CEUS (ICCEUS) were applied and provided the key clue for diagnosis. We present the following case in accordance with the CARE reporting checklist.

CASE PRESENTATION

Chief complaints

A 37-year-old man presented with fever and edema of the lower extremities for 10 d.

History of present illness

The patient had a history of laparoscopic repair of gastroduodenal perforation 6 mo prior.

History of past illness

There was no history of past illness.

Personal and family history

There was no personal and family history.

Physical examination

No physical examination was performed.

Laboratory examinations

Laboratory testing showed elevations in leukocyte count, neutrophil ratio, and C-reactive protein level ($9.61 \times 10^9/L$, 77.6%, and 23.1 mg/L; reference value, $3.5-9.5 \times 10^9/L$, 40%-75%, and < 5 mg/L, respectively).

Imaging examinations

B-mode ultrasound revealed a 6.0 cm \times 3.0 cm right subphrenic mass with a heterogeneous echo (Figure 1). The mass displayed a large-scale nonenhancement area with slightly enhanced septa inside for the first IVCEUS (Figure 2). Right subphrenic abscess was diagnosed. The patient received antibiotic therapy and ultrasound-guided percutaneous drainage of the abscess. Nine days after treatment, second-time IVCEUS

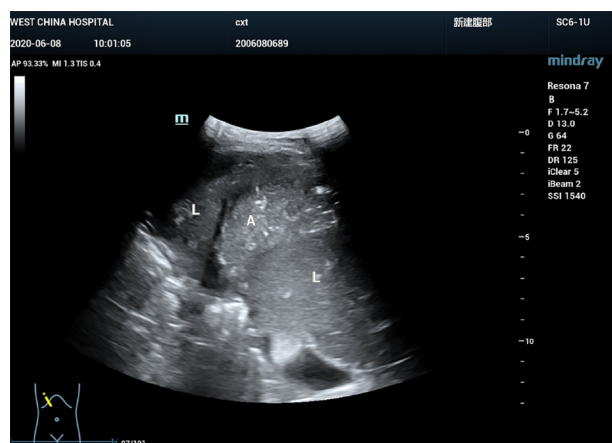


Figure 1 B-mode ultrasound displayed a right subphrenic mass with heterogeneous echo. L: Liver; A: Abscess.

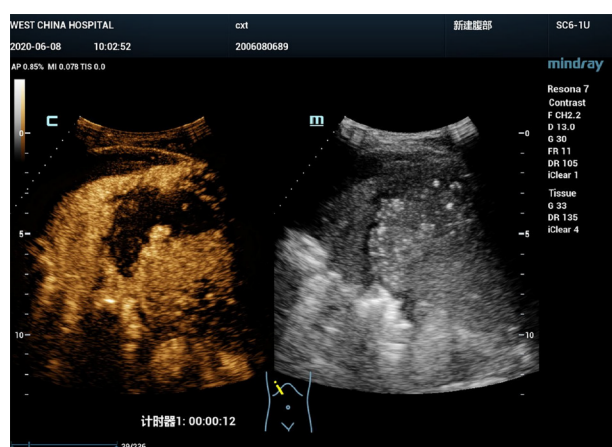


Figure 2 First-time intravenous contrast-enhanced ultrasound showed that the right subphrenic mass (6.0 cm × 3.0 cm) presented a large-scale non-enhancement area with slightly enhanced septa inside.

was performed to evaluate the therapeutic effects. No significant change in abscess size occurred after treatment (before treatment, 6.0 cm × 3.0 cm; after treatment, 6.0 cm × 1.7 cm) (Figure 3). However, the drainage volume from the catheter was 100-200 mL each day. In this situation, ICCEUS was proposed. SonoVue (0.2 mL) and 20 mL of saline were injected *via* the drainage tube. Enhancement was observed from the drainage tube to the stomach through the early to late phase (Figure 4 and Video), which indicated communication between the abscess and stomach. Esophago-gastroduodenoscopy (Figure 5) was performed to confirm the diagnosis of duodenal bulbar perforation.

FINAL DIAGNOSIS

Both ICCEUS and esophagogastroduodenoscopy indicated a diagnosis of duodenal bulbar perforation.

TREATMENT

The patient received another 2 wk of antibiotic therapy, drainage of the subphrenic abscess, and jejunum enteral nutrition. The perforation was repaired by surgery. Intervention adherence of the patient was good according to daily medical records.

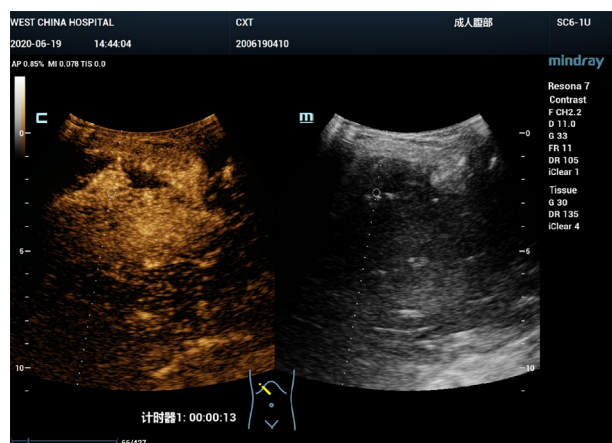


Figure 3 Second-time intravenous contrast-enhanced ultrasound demonstrated that the right subphrenic mass (6.0 cm × 1.7cm) showed a similar enhancement pattern to the first-time contrast-enhanced ultrasound.

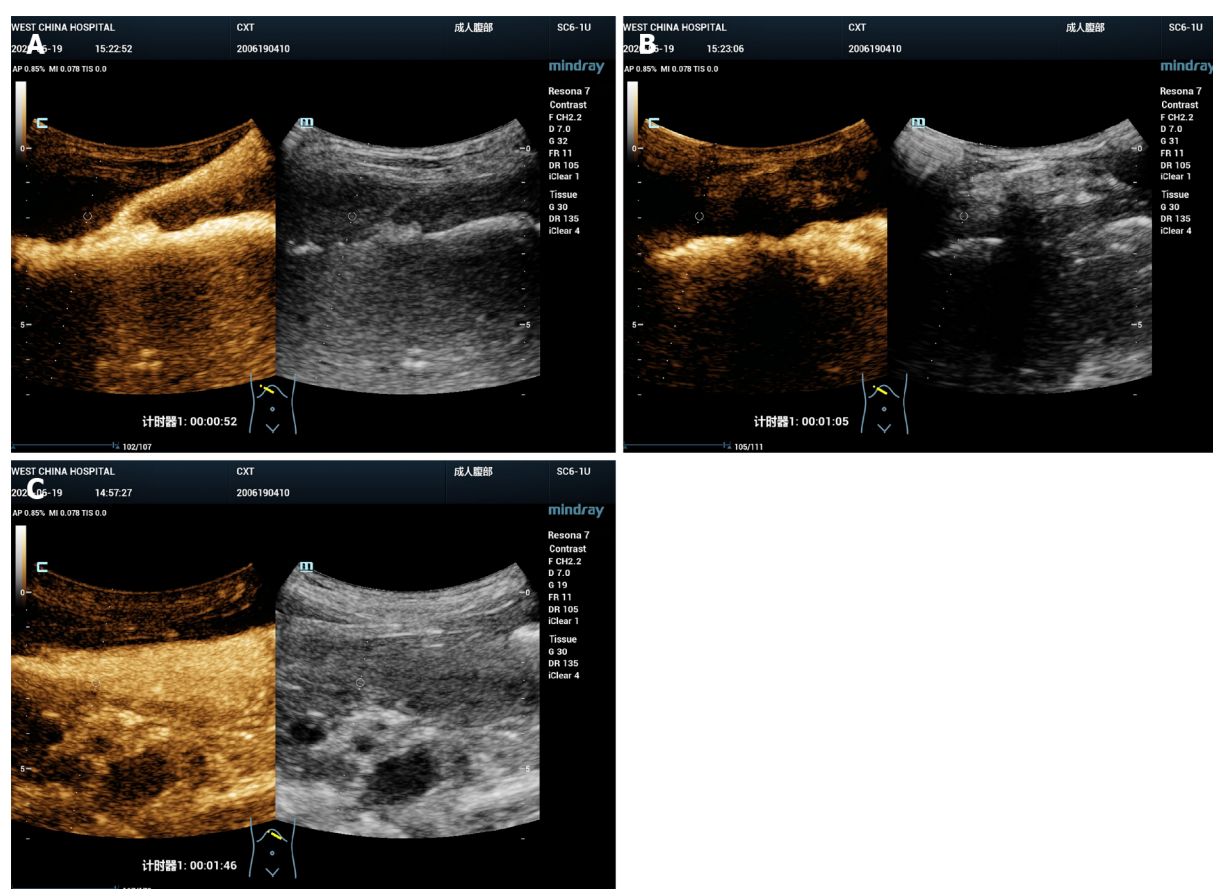


Figure 4 Imaging examinations. A: Intracavitary contrast-enhanced ultrasound (ICCEUS) displayed the process of ultrasound contrast agent (UCA) injection through the drainage tube to the abscess at 52 s; B: At 65 s, ICCEUS revealed a passage connecting the right abscess and left stomach; C: At 106 s, the stomach was filled with UCA on ICCEUS.

OUTCOME AND FOLLOW-UP

No adverse or unanticipated events were recorded during the in-hospital days.

DISCUSSION

CEUS includes intravenous or intracavitary administration of ultrasound contrast agents. IVCEUS helps characterize the enhancement pattern of the focal lesion itself.

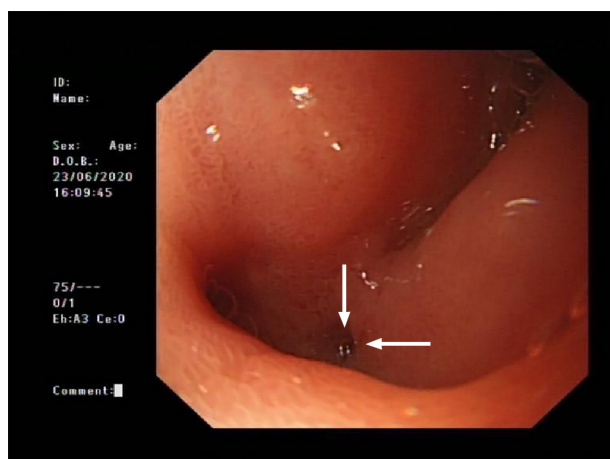


Figure 5 Esophagogastroduodenoscopy showed the perforation site (white arrow) located at the duodenal bulb.

ICCEUS allows identification of the needle or catheter position, delineation of any cavity or duct, and improved tracking of a fistula. Reported detection and classification of fistulas by ICCEUS include vesico-intestinal fistulas, anal fistulas, and rectovaginal fistulas[6]. In this case, the patient had a history of laparoscopic repair of gastroduodenal perforation 6 mo prior. Recurrent gastroduodenal perforation caused a right subphrenic abscess *via* a fistula, which has seldom been reported through literature review[7,8]. This type of fistula is characterized by a large volume of digestive fluid leakage, including gastric and intestinal fluids, which are relatively corrosive and may lead to complicated intra-abdominal infection[9]. It was noted by the ultrasound doctor that the relatively large drainage volume (100-200 mL each day) mismatched the relatively small and unchanged size of the abscess based on the findings of two-time IVCEUS. Therefore, ICCEUS was proposed, and a fistula between the subphrenic abscess and upper gastrointestinal tract was diagnosed by ICCEUS, which illuminated the way for further diagnosis and treatment. According to a previous study[10], the sensitivity, specificity, and accuracy of the diagnosis of gastrointestinal fistulas by ICCEUS were 72.7%, 95.0%, and 83.3%, respectively. It can improve the ability to diagnose post-surgical gastrointestinal fistulas as a novel technique and may also play an important role in interventional treatment and follow-up. The patient appreciated the help of CEUS, and the subsequent corresponding treatment was effective from his perspective.

However, ultrasound has its own pitfalls. It is strongly operator-dependent and not suitable for obese patients or those with subcutaneous emphysema. Although the accuracy in detecting the perforation site between CT and CEUS has not been compared, ultrasound may be particularly useful in cases where the radiation burden needs to be limited, notably in children and pregnant women.

CONCLUSION

In summary, CEUS may be used as a problem-solving tool for the diagnosis of gastrointestinal perforation complicated by fistula and/or abscess formation due to its lack of radiation, capability for real-time imaging of various planes, and availability at the bedside.

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