



Contrast-enhanced ultrasound for diagnosis and follow-up of complicated acute cholecystitis treated with percutaneous cholecystostomy: a case report

L. A. Natola¹ · A. Boccatonda² · D. Sacerdoti¹ · C. Serra²

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Abstract

Acute cholecystitis in patients with multiple comorbidities and advanced malignancy presents unique diagnostic and therapeutic challenges. Contrast-enhanced ultrasound (CEUS) has emerged as a valuable tool for diagnosing complicated cholecystitis and guiding interventional procedures. A 69-year-old male with locally advanced pancreatic head carcinoma, chronic ischemic heart disease, and COPD who developed complicated acute cholecystitis with pericholecystic abscess. CEUS confirmed the diagnosis and guided percutaneous cholecystostomy placement via a transperitoneal approach. Intracavitary CEUS through the drainage catheters was subsequently used to verify correct positioning, assess gallbladder perforation, evaluate cystic duct patency, and monitor treatment response. The patient showed progressive clinical and laboratory improvement, with successful resolution of the acute episode without requiring emergency surgery.

keywords Contrast-enhanced ultrasound · CEUS · Acute cholecystitis · Percutaneous cholecystostomy · Intracavitary CEUS

Introduction

Acute cholecystitis is a common abdominal emergency with complications occurring in approximately 20% of cases, including gangrenous cholecystitis and gallbladder perforation that significantly increase morbidity and mortality [1]. The severity of acute cholecystitis is classified according to the Tokyo Guidelines 2018 (TG18) into three grades based on clinical parameters and organ dysfunction, which guides

therapeutic decision-making [2]. While laparoscopic cholecystectomy remains the gold standard treatment, patients with severe comorbidities, advanced malignancy, or hemodynamic instability often represent prohibitively high surgical risk [3, 4].

Percutaneous cholecystostomy (PC) has emerged as an essential alternative treatment for acute cholecystitis in high-risk patients. The TG18 flowchart recommends PC for patients with severe acute cholecystitis who are not suitable candidates for early surgery based on Charlson Comorbidity Index (CCI) and American Society of Anesthesiologists Physical Status (ASA-PS) classification [5]. PC can serve either as a bridge to surgery after patient stabilization or as definitive palliative therapy in patients with limited life expectancy due to terminal illness.

Conventional ultrasound remains the first-line imaging modality for suspected acute cholecystitis, though it has limitations in detecting complications such as gallbladder perforation and gangrenous changes [6]. Contrast-enhanced computed tomography (CT) is currently considered the diagnostic gold standard for complicated cholecystitis [7]. However, CEUS has shown promise as a radiation-free, bedside alternative that can accurately identify gallbladder wall

✉ L. A. Natola
leonardoantonio.natola@univr.it

A. Boccatonda
andreaboccatonda@gmail.com

D. Sacerdoti
david.sacerdoti@univr.it

C. Serra
carla.serra@aosp.bo.it

¹ USD Liver Unit, Azienda Ospedaliera Universitaria Di Verona, Università Di Verona, Verona, Italy

² Unità Di Ecografia Interventistica Diagnostica e Terapeutica, IRCCS Azienda Ospedaliera-Universitaria Di Bologna, Bologna, Italy

perfusion defects associated with gangrenous cholecystitis and perforation [8, 9].

Recent literature has also demonstrated the value of intracavitary CEUS, whereby ultrasound contrast agent is injected through percutaneous drainage catheters to assess catheter positioning, evaluate duct patency, and monitor treatment response [10, 11]. This technique represents an evolution of CEUS applications in interventional procedures, providing dynamic functional information without ionizing radiation.

We present a case of complicated acute cholecystitis in a high-risk patient managed successfully with transperitoneal PC guided by both intravenous and intracavitary CEUS.

Case report

In October 2025 a 69-year-old male presented with acute right upper quadrant pain and fever. His medical background included locally advanced pancreatic head carcinoma diagnosed in June 2025 with portal vein infiltration, superior mesenteric vein thrombosis, and multiple collateral vessels. He was receiving systemic chemotherapy and had a biliary stent in situ. Additional comorbidities included chronic ischemic heart disease treated with percutaneous coronary intervention and drug-eluting stent placement in 2024, arterial hypertension, thoraco-abdominal aortic aneurysm treated with multistep endovascular repair between 2016 and 2024, and emphysematous COPD. His home medications included acetylsalicylic acid, rosuvastatin/ezetimibe, ramipril/hydrochlorothiazide, bisoprolol, pantoprazole, tamulosin, and umeclidinium/vilanterolo.

Emergency department evaluation revealed tenderness in the right upper quadrant with peritoneal signs and positive Murphy's sign. Laboratory findings showed leukocytosis (white blood cells $15,940/\text{mm}^3$), mild anemia (hemoglobin 8.8 g/dL), thrombocytosis (platelets $437 \times 10^9/\text{L}$), and markedly elevated inflammatory markers including C-reactive protein 23.75 mg/dL and procalcitonin 2.4 ng/mL. Total

bilirubin was 0.98 mg/dL with normal transaminases (AST 10 U/L, ALT 6 U/L).

Initial abdominal ultrasound with intravenous CEUS suggested acute cholecystitis (Fig. 1). Surgical consultation recommended medical management with antibiotics and clinical-laboratory monitoring, with reassessment at 72 h. Empiric antibiotic therapy with piperacillin-tazobactam was initiated, and the patient was admitted to the internal medicine ward.

After 48 h without clinical or laboratory improvement, contrast-enhanced CT was performed, which revealed complicated acute cholecystitis with perihepatic and pericholecystic fluid collection and signs of gallbladder wall ischemia suggestive of gangrenous changes (Fig. 2). The case met TG18 criteria for Grade II (moderate) acute cholecystitis based on marked local inflammation with pericholecystic abscess and elevated white blood cell count.

Given the lack of response to medical therapy and high surgical risk based on multiple comorbidities and advanced malignancy, surgical consultation recommended percutaneous drainage of both the gallbladder and pericholecystic collection. The patient was referred to our interventional unit for the procedure. Under ultrasound guidance, percutaneous cholecystostomy was performed using a transperitoneal approach with trocar technique (Fig. 3). Two pigtail drainage catheters were placed: an 8 French intracholecystic catheter and an 8 French pericholecystic/perihepatic catheter. The transperitoneal route was selected based on favorable anatomical access to the gallbladder fundus without interposed liver parenchyma.

Following catheter placement, fistulography with contrast medium was performed to assess catheter positioning and biliary anatomy (Fig. 4).

Microbiological evaluation included blood cultures drawn in two sets for aerobic and anaerobic organisms, which showed no growth. Rectal swab for multidrug-resistant organisms was negative. Bile culture grew *Enterococcus faecium* (Group D). Based on infectious disease consultation, teicoplanin was added to the existing antibiotic regimen. The patient's clinical and laboratory parameters showed

Fig. 1 Initial CEUS examination showing acute cholecystitis

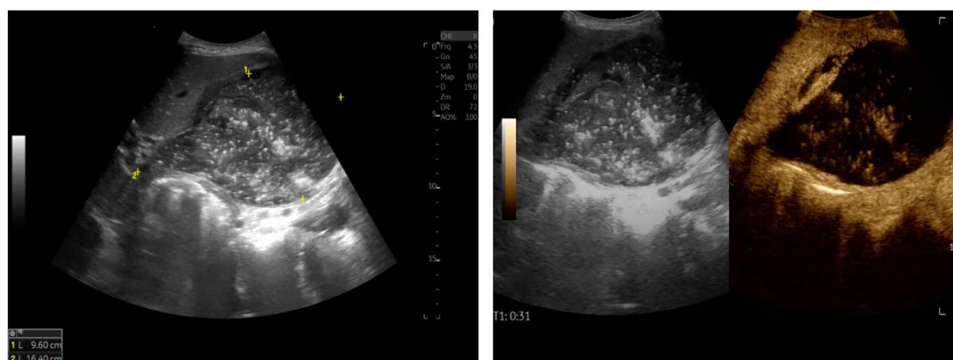


Fig. 2 Contrast-enhanced CT scan demonstrating complicated acute cholecystitis with perihepatic and pericholecystic fluid collection and gallbladder wall thickening

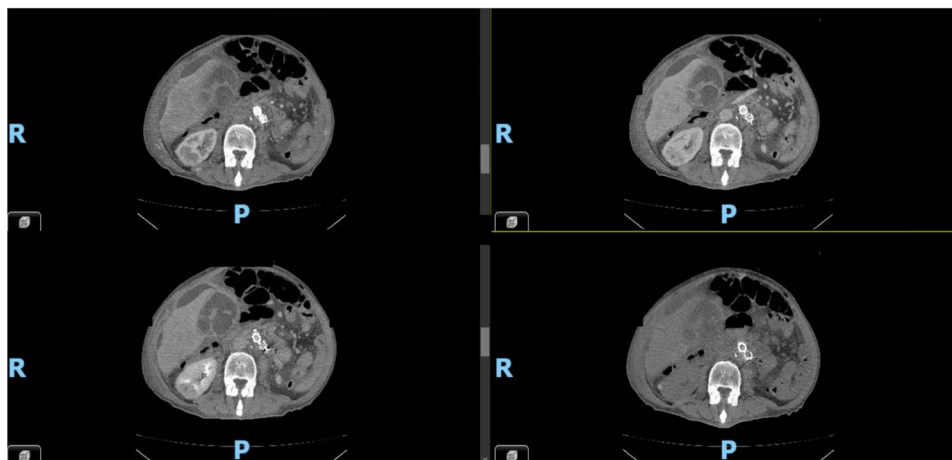


Fig. 3 Ultrasound-guided percutaneous cholecystostomy

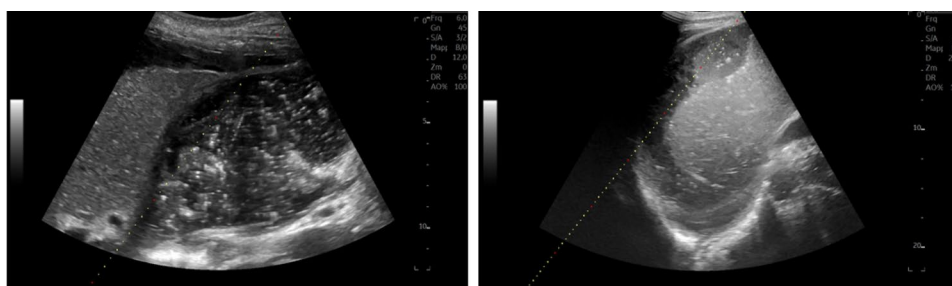
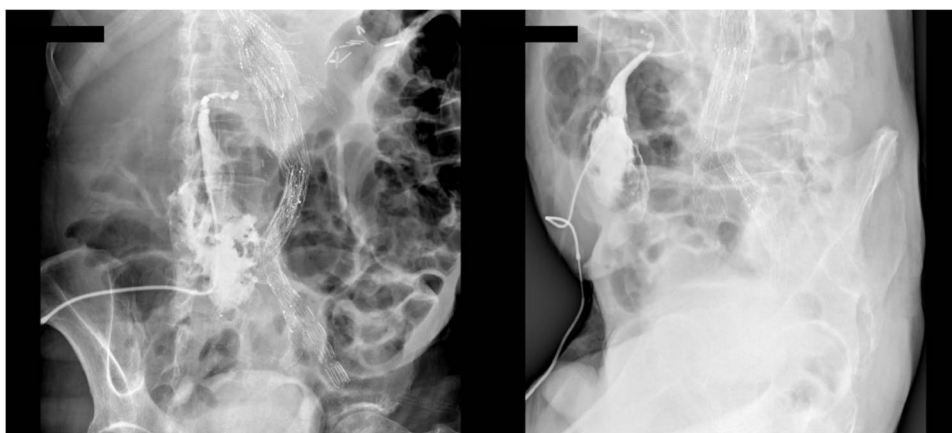


Fig. 4 Fluoroscopic fistulography demonstrating catheter position and biliary anatomy



progressive improvement over the following two weeks. Total bilirubin remained stable and transaminases showed only mild fluctuations with ALT (Table 1). Drainage output decreased to less than 100 mL daily.

Repeat contrast-enhanced CT on November 19th showed significant improvement in pericholecystic inflammation and reduction in fluid collection size (Fig. 5).

Follow-up ultrasound with intravenous CEUS on November 21st demonstrated marked improvement in gallbladder inflammation. Subsequently, intracavitary CEUS was performed by injecting ultrasound contrast agent (1 mL of SonoVue diluted in 10 mL sterile saline) through the

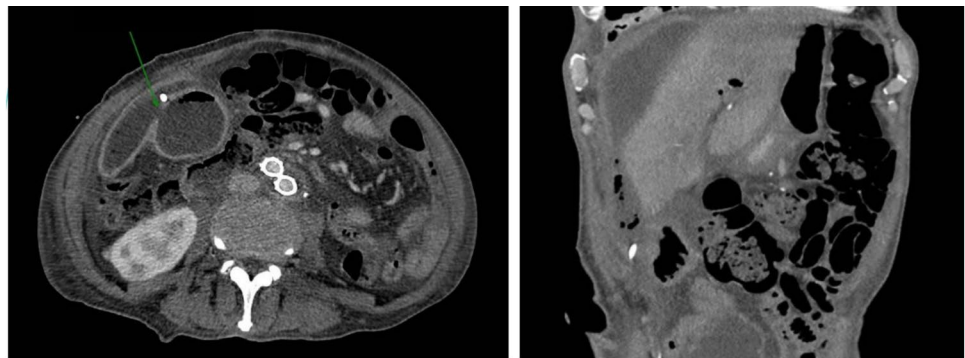
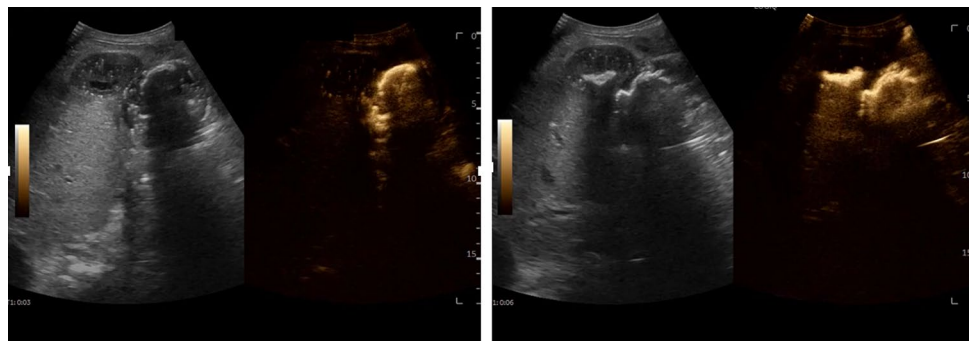
percutaneous drainage catheters (Fig. 6). This technique allowed confirmation of correct catheter positioning, assessment of gallbladder wall integrity, evaluation of cystic and common bile duct patency, and monitoring of residual collections.

Based on these findings demonstrating adequate drainage and improving inflammation, the drainage catheters were upsized to optimize decompression: the intracholecystic catheter from 8 to 12 French and the pericholecystic catheter from 8 to 10 French. Clinical and laboratory improvement continued following catheter upsizing (Table 2). Follow-up bile culture showed *Enterococcus faecalis* (Group D),

Table 1 Serial laboratory parameters during hospitalization

Date	WBC (10 ⁹ /L)	CRP (mg/dL)	Total bilirubin (mg/dL)	ALT (U/L)
11/05	24.35	38.85	0.79	11
11/06	25.27	34.55	0.62	9
11/07	22.45	24.50	0.70	8
11/10	20.99	20.50	0.71	10
11/11	21.60	19.98	0.68	19
11/13	19.21	22.10	0.71	33
11/15	21.88	19.73	0.74	27
11/18	16.14	17.20	0.80	16
11/19	16.32	16.17	0.91	5

sensitive to the ongoing antibiotic therapy. Antibiotic therapy was discontinued based on clinical resolution and normalized inflammatory markers. The patient was discharged on November 28th with drainage catheters in situ and scheduled for outpatient follow-up. Ultrasound examination on December 3rd confirmed appropriate catheter positioning and continued improvement. The patient maintained drainage catheters with scheduled ultrasound follow-up while awaiting subsequent oncological and surgical evaluation.

Fig. 5 Follow-up contrast-enhanced CT showing significant reduction in pericholecystic inflammation and fluid collection compared to initial CT. Green arrow: cholecystitic perforation**Fig. 6** Follow-up CEUS examination. Intracavitary CEUS performed through drainage catheters showing catheter positioning and the perforation of the gallbladder wall**Table 2** Laboratory parameters following catheter upsizing

Date	WBC (10 ⁹ /L)	CRP (mg/dL)	Total bilirubin (mg/dL)	ALT (U/L)
11/19	16.32	16.17	0.91	5
11/20	14.74	14.76	0.93	10
11/21 post-drainage	10.21	13.87	1.35	8
11/22	13.02	14.57	1.26	9
11/24	10.35	9.60	0.98	10
11/27	9.02	4.52	0.90	11
11/28 (discharge)	8.34	3.30	0.87	12

Discussion

CEUS enables real-time assessment of gallbladder wall perfusion, allowing identification of perfusion defects that indicate gangrenous cholecystitis or perforation. Ripollés and colleagues demonstrated CEUS sensitivity of 85–91% and specificity of 67.5–84.8% for diagnosing gangrenous cholecystitis, with wall enhancement defects serving as independent predictors of gangrenous changes [9]. Similarly, Kawai et al. reported 66.7% sensitivity and 100% specificity for CEUS detection of perfusion defects in gangrenous cholecystitis [12]. Recent evidence indicates that gallbladder wall thickening and pericholecystic fluid may not be evident on initial ultrasound, appearing on average four hours after symptom onset [13]. This finding supports the use of serial CEUS examinations to guide timing of intervention in equivocal cases.

A novel aspect of this case was the use of intracavitary CEUS, whereby ultrasound contrast agent was injected through the percutaneous drainage catheters. The EFSUMB guidelines recognize that injection of ultrasound contrast media into physiological or non-physiological cavities can aid in identifying catheter position, delineating cavities or ducts, and tracking fistulas [10]. Studies have shown that intracavitary CEUS allows verification of correct catheter positioning, assessment of communication between fluid collections, and determination of optimal timing for catheter removal [11]. In our case, intracavitary CEUS provided confirmation of appropriate intracholecystic and pericholecystic catheter placement, assessment of gallbladder wall integrity and potential perforation sites, evaluation of cystic duct and common bile duct patency, and monitoring of collection resolution. This advantage is particularly significant for serial monitoring in patients requiring prolonged catheter management.

With regard to the PC, it offers crucial therapeutic options for critically ill patients with acute cholecystitis who face high anesthesia risks. Published series demonstrate clinical response rates of approximately 85–97% for PC, with procedure-related mortality less than 1% [14, 15]. The procedure allows patients to recover from acute sepsis while maintaining the option for interval cholecystectomy once clinically stable. However, recurrence rates of acute cholecystitis in patients who do not undergo subsequent cholecystectomy range from 23 to 46% at 1–3 years [16]. Recent evidence emphasizes that PC should serve primarily as a bridge to surgery rather than routine definitive therapy. A large systematic review demonstrated that cholecystectomy was associated with significantly lower mortality compared to PC alone, with laparoscopic cholecystectomy showing particularly favorable outcomes [17]. However, in elderly high-risk patients

with limited life expectancy, PC may appropriately serve as definitive palliative treatment [18].

We elected to perform PC via a transperitoneal approach using trocar technique given favorable direct anatomical access to the gallbladder fundus. The choice between transperitoneal and transhepatic routes represents an important technical decision with implications for complications and patient outcomes. A meta-analysis of four studies found that although overall bleeding risk was low at 4.1%, it was significantly higher with transhepatic compared to transperitoneal approach (6.3% versus 1.6%, OR 4.02) [19].

Conclusion

This case demonstrates that CEUS is a safe, effective, and versatile imaging modality for diagnosing complicated gallbladder disease and monitoring interventional procedures. Intracavitary CEUS represents an emerging application that enhances procedural guidance and follow-up assessment without radiation exposure, offering particular advantages for serial monitoring in patients requiring prolonged catheter management.

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Data availability All data generated or analyzed during this study are included in this published article.

Declarations

Conflict of interest All authors declare that they have no conflicts of interest related to this manuscript. None of the authors have any financial relationships, consultancies, patent-licensing agreements, or other commercial relationships that might pose a conflict of interest in connection with the submitted work.

Ethical approval Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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