

CASE REPORT

A rare but lethal hepatic infection: Emphysematous hepatitis – Case report and literature review

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Clinical Pearls

• Unique Features of the Case:

A rare, rapidly fatal case of emphysematous hepatitis in a 67-year-old man with poorly controlled type 2 diabetes. CT showed extensive intrahepatic gas without a drainable abscess, and cultures grew *E. coli* and *Enterobacter hormaechei*.

• Primary Lesson for Clinicians:

In diabetic patients with sepsis and intrahepatic gas on CT, emphysematous hepatitis should be considered. Early diagnosis, broad-spectrum antibiotics, glycemic control, and urgent drainage or surgery are essential.

ABSTRACT

Emphysematous hepatitis (EH) is a rare and often fatal liver infection characterized by gas within the hepatic parenchyma without abscess formation. Diabetes mellitus and gastrointestinal malignancies are the main predisposing factors. Prompt diagnosis and aggressive treatment are essential due to its fulminant course. A 67-year-old male with uncontrolled type 2 diabetes and a long smoking history presented with abdominal pain, nausea, vomiting, dyspnea, and altered consciousness. Laboratory tests revealed elevated liver enzymes, hyperbilirubinemia, severe hyperglycemia, and increased inflammatory markers. Abdominal CT showed a gas-containing lesion in the left hepatic lobe without fluid collection. Due to rapid clinical deterioration, emergency surgical resection was performed. Despite postoperative intensive care and meropenem therapy, the patient died six hours after surgery. Cultures grew *E. coli* and *Enterobacter hormaechei*. Only 19 EH cases have been reported to date. Most patients are elderly and have diabetes. Diagnosis relies on CT imaging, which reveals intrahepatic gas without abscess. Pathogenesis may involve anaerobic bacterial fermentation and microcirculatory impairment in diabetic patients. Despite antibiotics and drainage, mortality remains high. EH should be considered in diabetic patients with sepsis and intrahepatic gas on CT. Early diagnosis and immediate intervention—including antimicrobial therapy and drainage—are critical to improving survival.

Keywords: Acute hepatitis, emphysematous hepatitis, liver failure.

How to cite this article: Okut G, Ugur MA, Yildiz H, Takci H, Dogan SM. A rare but lethal hepatic infection: Emphysematous hepatitis – Case report and literature review. *Hepatology Forum* 2026; 7(3):296–301.

Received: May 29, 2025; **Revised:** October 31, 2025; **Accepted:** November 10, 2025; **Available Online:** June 30, 2026

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Introduction

Emphysematous hepatitis (EH) is a rare and often fulminant infection of the liver parenchyma characterized by gas formation in the absence of liquefied abscesses.^[1] Among the most well-established predisposing factors are diabetes mellitus and gastrointestinal malignancies.^[2,3] Computed tomography (CT) is the gold standard imaging modality for diagnosis. Since the first case was reported, only a limited number of cases have been described in the literature (Table 1).^[1–19] Given its rapid progression and potential to cause sepsis and multiorgan failure, prompt diagnosis and treatment are crucial. In this report, we aim to present a case of EH, outlining its etiology, diagnostic process, and treatment in the context of previously reported cases.

Case Report

A 67-year-old male presented to the emergency department with a two-day history of abdominal pain, nausea, and vomiting. In the last six hours prior to admission, he had developed shortness of breath and altered mental status.

His medical history was notable for poorly controlled type 2 diabetes mellitus, and he had a 40-year history of smoking one pack of cigarettes per day. His daily medications included short- and long-acting subcutaneous insulin.

On arrival, his vital signs were as follows: body temperature 39°C (N: 36.5–37.5°C), blood pressure 110/70 mmHg (N: 120/80), heart rate 132 beats per minute (N: 60–100), respiratory rate 22 breaths per minute (N: 12–20), and oxygen saturation of 95% on room air. Physical examination revealed diffuse abdominal tenderness on palpation.

Initial laboratory findings were as follows: white blood cell count 5,700/mm³ (reference: 3,900–10,500), C-reactive protein 323 mg/L (reference: <5.0), creatinine 1.58 mg/dL (reference: 0.70–1.20), alanine aminotransferase 394 U/L (reference: <41), aspartate aminotransferase 1,056 U/L (reference: <50), total bilirubin 2.4 mg/dL (reference: <1.20), conjugated bilirubin 1.81 mg/dL (reference: <0.30), and blood glucose 511 mg/dL (reference: 82–115). Arterial blood gas analysis revealed a pH of 7.21, a base excess of –12.8 mmol/L, and a lactate level of 6.7 mmol/L. The Sequential Organ Failure Assessment (SOFA) score was calculated as 8.

Contrast-enhanced abdominal CT revealed a gas-forming lesion in the left hepatic lobe, almost completely replacing the lobe and partially extending to segments 5–8, without a fluid-filled abscess component (Fig. 1). The patient had no known history of hepatobiliary disease or prior abdominal surgery.

Although percutaneous drainage was initially considered, due to the rapid progression of his septic condition, surgical intervention was deemed more appropriate. The patient was started on empirical antibiotic therapy consisting of ceftriaxone 1 g and metronidazole 500 mg and was subsequently prepared for exploratory surgery and liver resection/drainage under intensive care monitoring.



Figure 1. Contrast-enhanced abdominal computed tomography revealed a gas-forming lesion in the left hepatic lobe, without a fluid-filled abscess component.

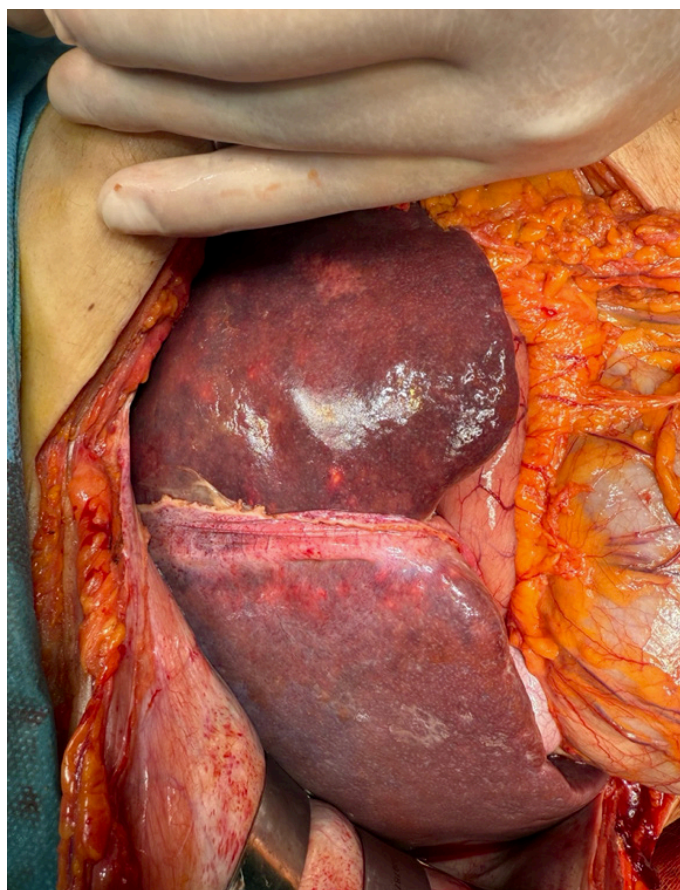


Figure 2. The affected hepatic tissue appeared darker in color compared to normal parenchyma.

A Makuuchi incision was performed to access the abdominal cavity, revealing approximately 500 mL of serous fluid. A sample was taken for microbiological analysis. For better visualization, cholecystectomy and mobilization of the left hepatic lobe were performed.

Intraoperatively, the affected hepatic tissue appeared darker in color compared to normal parenchyma (Fig. 2). During transection,

Table 1. Summary of reported cases of emphysematous hepatitis in the literature, including demographic characteristics, comorbidities, imaging findings, associated malignancies, treatment modalities, isolated pathogens, and clinical outcomes

References	Year	Sex	Age	DM	Imaging	Presence of malignancy	Treatment	Pathogen(s)	Outcome
Blachar ^[1]	2002	F	43	Yes	CT: Right hepatic lobe involvement	No	Antibiotics, CT-guided drainage	<i>Klebsiella pneumoniae</i>	Died
Lefourneau Guillon ^[2]	2010	M	53	No	CT: 8-cm, air-filled cavity located in the right lobe of the liver, centered on segment VIII	HC	Antibiotics	<i>Enterobacter cloacae</i> and <i>Clostridium perfringens</i>	Died
Chauhan ^[3]	2012	M	77	Yes	CT: Segments VI and VII of liver	No	Antibiotics, CT-guided drainage	n/a	Died
Kim ^[4]	2012	F	80	No	CT: Hepatic parenchymal emphysema measuring 6.3x4.4 cm in the segment 7-8 of the right liver	HC	Antibiotics, CT-guided drainage	<i>Clostridium perfringens</i> , <i>Escherichia coli</i>	Died
Nada ^[5]	2017	M	73	No	CT: Mottled gas opacity throughout the parenchyma of the right hepatic lobe	Pancreatic carcinoma liver and lung metastasis	Antibiotics	<i>Streptococcus mutans</i> , <i>Enterococcus faecalis</i>	Died
Ghosn ^[6]	2019	F	38	Yes	CT: Mixed collection containing air and debris spreading at the posterior aspect of the left lobe of the liver	No	Antibiotics, surgical drainage, percutaneous drainage	<i>Escherichia coli</i> , <i>Enterococcus faecium</i>	Survived
Azri ^[7]	2020	F	75	No	CT: Left lobe involvement	HC	Na	<i>Klebsiella pneumoniae</i> , <i>Escherichia coli</i> , <i>Enterococcus faecalis</i> , <i>Clostridium perfringens</i> , <i>Aeromonas ichthiosmia</i>	Died
Calderon ^[8]	2020	F	80	Yes	CT: A large amount of air within the liver parenchyma	No	Antibiotics	<i>Clostridium perfringens</i>	Died
Miranda ^[9]	2020	M	74	No	CT: An extensive area with gas within the right lobe of the liver (9.3cm)	No	Antibiotics	<i>Escherichia coli</i>	Died
Bofill ^[10]	2021	M	82	Yes	CT: A large area of gas in the right hepatic lobe	No	Antibiotics, CT-guided drainage	<i>Klebsiella pneumoniae</i>	Died
Estébanez-Ferrero ^[11]	2021	F	67	No	CT: A hypoattenuated area in the right hepatic lobe with abundant air in the hepatic parenchyma	No	Antibiotics, surgical drainage, percutaneous drainage	<i>Escherichia coli</i>	Survived
Francois ^[12]	2022	F	70	Yes	CT: A large (9 cm) air-filled cavity in the right liver lobe	No	Antibiotics, CT-guided drainage	<i>Escherichia coli</i> , <i>Streptococcus anginosus</i> and <i>Klebsiella oxytoca</i>	Survived
Porez ^[13]	2023	M	59	Yes	CT: Limited area in the liver containing multiple gas bubbles without enhancement wall nor collection, located in the right anterior segment dome (5.8x5 cm)	No	Antibiotics, USG-guided drainage, surgical drainage	<i>Klebsiella pneumoniae</i>	Survived
Bayer ^[14]	2023	M	79	Yes	CT: Periportal gas collection in liver segment 6 from 3-4 to 4 cm in diameter with well-described margins	No	Antibiotics, surgery	<i>Clostridium perfringens</i> , <i>Enterococcus faecium</i>	Survived

Table 1 (cont). Summary of reported cases of emphysematous hepatitis in the literature, including demographic characteristics, comorbidities, imaging findings, associated malignancies, treatment modalities, isolated pathogens, and clinical outcomes

References	Year	Sex	Age	DM	Imaging	Presence of malignancy	Treatment	Pathogen(s)	Outcome
Pan ^[15]	2023	M	48	Yes	CT: 6.6 × 5.5 × 5.3 cm air collection with some remaining parenchyma debris in the left liver lobe	No	Antibiotics, USG-guided drainage	<i>Klebsiella oxytoca</i>	Survived
Ayoub ^[16]	2024	F	77	Yes	CT: Multiple gas bubbles without enhancement wall nor collection, measuring 12 × 11.3 cm	No	Antibiotics	Multidrug-resistant <i>Escherichia coli</i>	Died
Tekinhatun ^[17]	2024	F	80	No	CT: Aerial views of the liver parenchyma covering approximately 50% of the right lobe	No	Antibiotics	<i>Escherichia coli</i>	Died
Al Khatib ^[18]	2025	F	70	No	CT: Pneumoperitoneum and transformation into emphysematous hepatitis at the metastatic site	Colon tumor, liver metastasis	Antibiotics, ileocecal resection and ileocolostomy, CT-guided drainage	<i>Clostridium septicum</i>	Died
Chen ^[19]	2025	M	57	Yes	CT: 8.6 cm by 6.5 cm area of gas in the right hepatic lobe, pneumoperitoneum	No	Antibiotics, CT-guided drainage	<i>Klebsiella pneumoniae</i> and carbapenem-resistant <i>Enterobacteriaceae</i>	Survived

HC: Hilal cholangiocarcinoma; DM: Diabetes mellitus; CT: Computed tomography.

the diseased tissue was noted to be spongy and hypoperfused. A non-anatomic liver resection was performed until healthy tissue margins were achieved. A tissue sample was taken from the necrotic liver parenchyma for microbiological analysis. Postoperatively, the patient was returned to the ICU intubated for stabilization.

Meropenem (3×1000 mg/day) was initiated postoperatively. Despite aggressive management, the patient succumbed to refractory acidosis and hypotension in the sixth postoperative hour.

Blood cultures grew *Escherichia coli*, tissue cultures yielded *Enterobacter hormaechei*, and abdominal fluid cultures demonstrated high levels of *Enterobacter hormaechei*. Both isolates exhibited resistance to amoxicillin-clavulanate and ampicillin, while remaining susceptible to ampicillin-sulbactam, cefazolin, ceftazidime, ceftolozane-tazobactam, ceftriaxone, cefuroxime, ciprofloxacin, gentamicin, imipenem, meropenem, piperacillin-tazobactam, and trimethoprim-sulfamethoxazole.

Discussion

EH is a rare condition characterized by gas collection in the liver parenchyma in the absence of a defined abscess cavity. Including the present case, only 20 cases have been reported to date.^[1–19] Early diagnosis and prompt intervention are essential to reduce the high mortality rate associated with its fulminant course.

Among the reported cases, 10 patients were male (50%), and 12 had diabetes mellitus. The age range was 38–82 years, with 70% of patients older than 60. Thirteen patients experienced a fatal outcome. Our patient was a 67-year-old male with a history of diabetes who died due to rapidly progressive refractory septic shock despite antibiotic therapy and surgical drainage.

The pathogenesis of EH remains unclear. Given the high prevalence of type 2 diabetes mellitus among reported cases, a plausible hypothesis involves anaerobic bacterial fermentation—producing gas composed of nitrogen (60%), hydrogen (15%), carbon dioxide (5%), and oxygen (5%) in a host with impaired immunity and altered microcirculation due to hyperglycemia.^[13] Diabetes-related microangiopathy may hinder the clearance of catabolic products, facilitating gas accumulation.

Another noteworthy observation is the presence of malignancies in approximately 25% of patients. This association appears to be multifactorial. Patients with malignant disease frequently exhibit impaired host immunity due to tumor-related metabolic stress, chemotherapy, corticosteroid exposure, or malnutrition, which may predispose to opportunistic hepatic infections. Moreover, hepatobiliary and metastatic tumors can cause ductal obstruction, microvascular compromise, and tumor necrosis, resulting in a hypoxic and glucose-rich microenvironment that facilitates anaerobic fermentation and gas production by organisms such as *Clostridium perfringens*, *Klebsiella pneumoniae*, and *Escherichia coli*.^[2,4,5,7,13] In addition, invasive procedures commonly performed in

patients with hepatobiliary malignancies (e.g., ERCP, biliary stenting, percutaneous drainage) may promote bacterial translocation into hepatic parenchyma.^[13] Of note, *C. perfringens* is particularly associated with malignancy-related cases, and its alpha toxin and perfringolysin O have been shown to impair neutrophil maturation, increase oxidative injury, and promote extensive tissue necrosis, thereby accelerating disease progression and contributing to the fulminant clinical course.^[20,21]

The clinical presentation of EH is often nonspecific, with fever and abdominal pain being the most common symptoms.^[5,10] Laboratory results typically show elevated inflammatory markers, liver enzymes, and bilirubin levels.^[2]

CT is the most reliable imaging modality for EH diagnosis, as it reveals the characteristic radiological features of the disease. CT not only helps define the localization and extent of the infection but also aids in excluding other intra-abdominal causes of pain and sepsis. In addition, it is crucial to distinguish hepatic gas from gas in other liver structures, such as bile ducts (e.g., post-ERCP), portal venous gas (e.g., bowel infarction), hepatic infarction secondary to hepatic artery thrombosis (e.g., after liver transplantation), or pyogenic liver abscesses.^[12]

Although mortality remains high, early diagnosis significantly improves outcomes. Surviving patients received aggressive treatment including antibiotics, percutaneous drainage, and/or surgical intervention. Three cases were treated with percutaneous drainage alone,^[12,15,19] one with surgery alone,^[14] and three with both surgical and percutaneous drainage.^[6,11,13] Although the absence of a drainable fluid collection may lead to the initial assumption that percutaneous drainage would be inadequate, recent reports suggest that early percutaneous drainage may be sufficient in selected cases, potentially avoiding surgery altogether.

In our case, however, due to the rapid clinical deterioration and the absence of a condition favorable for evaluation by interventional radiology or a reasonable expectation of success with percutaneous treatment, surgical drainage was prioritized as a faster and more definitive solution. Although recent literature suggests favorable outcomes with percutaneous drainage, surgical approaches are generally preferred in patients with impaired consciousness and unstable vital signs, as they are more likely to provide definitive results. Given the extreme rarity of emphysematous hepatitis and the limited number of reported cases, there are no well-defined criteria to guide the decision-making process between surgical and percutaneous drainage.

Conclusion

EH is a life-threatening condition if not diagnosed and treated promptly. CT is the gold standard imaging modality for diagnosis. Diabetes mellitus is a major predisposing factor, and optimal management involves a combination of broad-spectrum antibiotics, percutaneous or surgical drainage, and strict glycemic control.

Ethics Committee Approval: This is a single case report, and therefore ethics committee approval was not required in accordance with institutional policies.

Informed Consent: Written informed consent for publication of this case report and accompanying images was obtained from the patient's next of kin, as the patient was unable to provide consent due to his clinical condition and subsequently died during the postoperative period.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: This study received no funding.

Use of AI for Writing Assistance: The study did not use any artificial intelligence (AI)-based technologies (such as Large Language Models [LLMs], chatbots or image generators, including ChatGPT).

Author Contributions: Concept: GO, HT; Design: GO; Supervision: SMD, HT; Funding: HY; Materials: MAU; Data Collection and/or Processing: GO, HY, MAU; Analysis and/or Interpretation: SMD, GO; Literature Search: MAU, HY, HT; Writing: GO; Critical Review: SMD.

Peer-review: Externally peer-reviewed.

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