

Multiple Hepatic Abscesses Due to *Klebsiella pneumoniae*: A Case Report

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Abstract

A hepatic abscess is a suppurated cavity caused by microorganisms that invade the liver parenchyma through the bile ducts, bloodstream, or contiguous spread. Among the pyogenic causes of hepatic abscesses, *Klebsiella pneumoniae* is one of the most common. We present an uncommon case of a patient with two pyogenic hepatic abscesses. We discuss the patient's initial presentation, longitudinal imaging review, and treatment approach, especially in the setting of multiple abscesses. This case highlights an uncommon clinical course that demonstrates clinical deterioration with signs of inadequate drainage with the use of a single catheter drain for two pyogenic abscesses, and clinical recovery following placement of two additional separate drains, one for each abscess.

Categories: Radiology, Internal Medicine, Gastroenterology

Keywords: best practice, ct-guided drainage, klebsiella pneumoniae (kp), liver abscess aspiration, pyogenic liver abscess (pla)

Introduction

The annual incidence of liver abscess is approximately 2.3 cases per 100,000 people [1]. Complications may include sepsis, empyema, and peritonitis [2]. Liver abscesses can be classified into several infectious categories, including pyogenic, amoebic, parasitic, and fungal abscesses [1]. Among the pyogenic causes, *Klebsiella pneumoniae* has emerged as an important pathogen. A 2018 study at a hospital in China reported that *K. pneumoniae* accounted for up to 80.3% of liver abscess cases in adults, with a median age of 52 years [3]. Similarly, a study at the Naval Medical Center San Diego in the United States analyzed 18 cases between 1999 and 2003 and identified *K. pneumoniae* as an emerging common cause of pyogenic liver abscess [4]. *K. pneumoniae* is a Gram-negative, non-motile, rod-shaped bacterium characterized by a polysaccharide capsule. In patients with multiple liver abscesses, drainage can be technically challenging and may be ineffective in some cases [5]. Multiple pyogenic liver abscesses are associated with substantial mortality and are relatively infrequently reported in the literature [6]. A 1997 study conducted at a hospital in Taiwan involving 483 patients found that mortality was significantly higher among patients with multiple pyogenic liver abscesses than among those with a single abscess (22.1% versus 12.8%, respectively) [7].

Here, we describe a complex case of multiple liver abscesses associated with *K. pneumoniae* infection. The treatment strategy involved a combination of drainage procedures and antibiotic therapy.

Case Presentation

On hospital day 1 (HD1), a 36-year-old Hispanic man presented to the emergency department of a small community hospital with a three-day history of constant, moderate-to-severe right upper quadrant (RUQ) abdominal pain that worsened with forward flexion of the trunk. Associated symptoms included nausea, a sore and dry throat, and fever. The patient denied vomiting, diarrhea, constipation, shortness of breath, numbness, headache, ear pain, or nasal congestion. He reported occasional alcohol consumption, approximately four beers per month, and denied any history of tobacco or illicit drug use. He had immigrated to the United States from Guatemala three years earlier. His medical history was negative for liver disease, diabetes mellitus, and hypertension. On admission, his temperature was 39.9 °C (103.8 °F), blood pressure was 119/67 mmHg, pulse rate was 143 beats/min, and respiratory rate was 22 breaths/min. Lung auscultation revealed clear breath sounds without wheezes, rales, or rhonchi. Cardiac examination revealed tachycardia without rubs, murmurs, or gallops. Abdominal examination demonstrated RUQ tenderness without rebound tenderness. The abdomen was nondistended, and Murphy's sign was negative. The skin was warm and dry, without rashes, irritation, or discoloration. The results of the comprehensive metabolic panel, complete blood count, and other relevant laboratory investigations are presented in Table 1. Notable findings included elevated liver enzymes and total bilirubin (aspartate aminotransferase (AST), 274 U/L; alanine aminotransferase (ALT), 231 U/L; alkaline phosphatase, 243 U/L; and total bilirubin, 2.4 mg/dL), hypoalbuminemia (2.4 g/dL), and elevated blood urea nitrogen (BUN) and creatinine levels (20 mg/dL and 1.44 mg/dL, respectively). The lactate level was elevated at 3.2 mmol/L. Electrolyte abnormalities included hyponatremia (sodium, 132 mEq/L) and hypokalemia (potassium, 3.0 mEq/L). Complete blood count abnormalities included mild anemia (hemoglobin, 12.7 g/dL), thrombocytopenia (127 K/μL),

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lymphopenia (0.3 K/ μ L), and circulating metamyelocytes.

Result	Value	Normal range
Sodium	132 mEq/L	136-146 mEq/L
Potassium	3.0 mEq/L	3.5-5.0 mEq/L
Chloride	99 mEq/L	95-105 mEq/L
Anion gap	11 mEq/L	3-11 mEq/L
Glucose	155 mg/dL	70-100 mg/dL
BUN	20 mg/dL	7-18 mg/dL
Creatinine	1.44 mg/dL	0.50-1.30 mg/dL
Calcium	8.4 mg/dL	8.5-10.1 mg/dL
Total protein	6.9 g/dL	6.0-7.8 g/dL
Albumin	2.4 g/dL	3.4-5.0 g/dL
Total bilirubin	2.4 mg/dL	0.2-1 mg/dL
Alkaline phosphatase	243 U/L	26-137 U/L
AST	274 U/L	15-37 U/L
ALT	231 U/L	0-65 U/L
INR	1.1	0.9-1.1
Lactate	3.2 mmol/L	0.4-2.0 mmol/L
Lipase	22 U/L	0-160 U/L
WBC	5.5 K/ μ L	4.0-11 K/ μ L
RBC	4.14 million/ μ L	4.3-5.9 million/ μ L
Hemoglobin	12.7 g/dL	13.5- 18.0 g/dL
MCV	89 fL	80-100 fL
MCH	30.7 pg/cell	25-35 pg/cell
MCHC	34.3%	31-36%
RDW	12.0%	11.5-14.5%
Platelet count	127 K/ μ L	150-400 K/ μ L
Abs neutrophil	3.3 K/ μ L	2.0-8.0 K/ μ L
Abs neutrophil bands	1.1 K/ μ L	0.0-1.4 K/ μ L
Abs lymphocyte	0.3 K/ μ L	1.0-5.1 K/ μ L
Abs metamyelocyte	0.2 K/ μ L	Not present
SARS-COV-2 NAA	Negative	Negative
Influenza A and B RNA	Negative	Negative
Strep group A rapid	Negative	Negative

TABLE 1: Comprehensive metabolic panel, complete blood count, and specimen results on hospital day 1 (HD1)

BUN: blood urea nitrogen, AST: aspartate aminotransferase, ALT: alanine aminotransferase, INR: international normalized ratio, WBC: white blood cell count, RBC: red blood cell count, MCV: mean corpuscular volume, MCH: mean corpuscular hemoglobin, MCHC: mean corpuscular hemoglobin concentration, RDW: red cell distribution width, Abs: absolute, SARS-CoV-2 NAA: severe acute respiratory syndrome coronavirus 2 nucleic acid amplification.

Abdominal computed tomography (CT) revealed two multicystic lesions in the liver. The larger lesion measured $9.3 \times 8.3 \times 8.1$ cm and was located in the inferior right hepatic lobe. The smaller lesion, measuring $5.5 \times 5.5 \times 5.2$ cm, was located anterior to the larger lesion in the right hepatic lobe (Figure 1). Cultures were obtained, and broad-spectrum antibiotic therapy was initiated with intravenous (IV) metronidazole 500 mg every eight hours and piperacillin/tazobactam 3.375 g every six hours. The patient also received oral acetaminophen 1,000 mg and ibuprofen 600 mg for symptom management. In the emergency department, he developed mild-to-moderate hypotension, with systolic blood pressure falling below 100 mmHg. Fluid resuscitation was initiated with 1,770 mL of lactated Ringer's solution, along with an IV norepinephrine infusion at 5–9 $\mu\text{g}/\text{min}$, titrated to maintain a mean arterial pressure (MAP) of 60 mmHg. Norepinephrine was subsequently tapered, and vasopressin was initiated at 0.4 units/min, with titration to the same MAP target. The patient was then transferred to a tertiary care hospital and admitted to the intensive care unit (ICU).

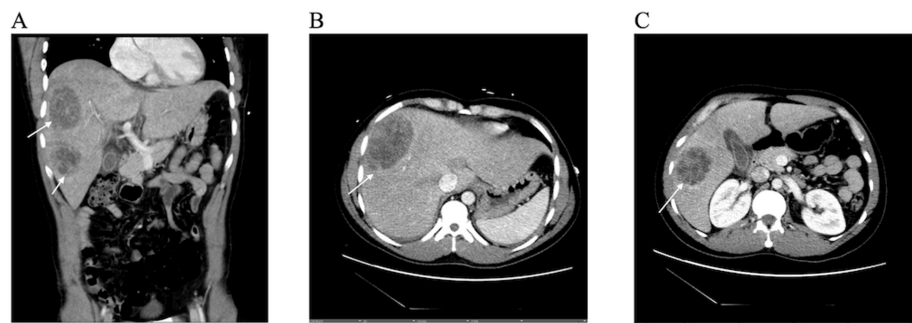


FIGURE 1: Contrast-enhanced abdominal CT obtained on hospital day 1 (HD1), demonstrating two pyogenic liver abscesses in the right hepatic lobe (arrows). The larger abscess measures $9.3 \times 8.3 \times 8.1$ cm and is located in the inferior right hepatic lobe, while the smaller abscess lies anterior to the larger lesion and measures $5.5 \times 5.5 \times 5.2$ cm

(A) Coronal image showing the craniocaudal relationship of the two collections. (B, C) Axial images demonstrating the two discrete right-lobe collections.

CT: computed tomography, HD1: hospital day 1.

On HD2, blood cultures were positive for *K. pneumoniae*. The antimicrobial susceptibility results are presented in Table 2. The patient's blood pressure improved to 100/60 mmHg, prompting a reduction in fluid resuscitation and vasopressor support. However, later that day, his clinical condition deteriorated. He developed worsening tachycardia (heart rate, 144 beats/min), tachypnea (respiratory rate, 55 breaths/min), hypotension (blood pressure, 90/63 mmHg), and fever (101.7 °F). His white blood cell count was 9.7 K/ μL (reference range, 4.0–11.0 K/ μL). Urgent CT pulmonary angiography was performed to evaluate for pulmonary embolism; no evidence of pulmonary embolism was identified (Figure 2). Given the patient's clinical deterioration, the antibiotic regimen was changed from piperacillin/tazobactam to meropenem, and the care team proceeded with CT-guided percutaneous drainage of the liver abscesses. Because of the proximity of the two collections, a single percutaneous drain was placed to access both abscesses in an attempt to drain them simultaneously. Purulent material was obtained during the initial aspiration. Subsequent culture of the drained material also grew *K. pneumoniae*.

Antimicrobial susceptibility	Interpretation
Ampicillin/sulbactam	Sensitive
Cefazolin	Sensitive
Cefepime	Sensitive
Cefoxitin	Sensitive
Ceftriaxone	Sensitive
Levofloxacin	Sensitive
Meropenem	Sensitive
Piperacillin/tazobactam	Sensitive
Trimethoprim/sulfamethoxazole	Sensitive

TABLE 2: *Klebsiella pneumoniae* antimicrobial susceptibility on HD2

Note: Antimicrobial susceptibility results were interpreted according to the Clinical and Laboratory Standards Institute (CLSI) breakpoints.

HD2: hospital day 2.



FIGURE 2: CT angiography on HD2, with no evidence of pulmonary embolism

CT: computed tomography, HD2: hospital day 2.

The patient initially demonstrated clinical improvement, with decreased RUQ abdominal pain, a respiratory rate of 25 breaths/min (reference range, 12-20 breaths/min), a heart rate of 98 beats/min (reference range, 60-100 beats/min), and a temperature of 99.5 °F (reference range, 96.8-99.5 °F). On HD3, chest radiography revealed a moderate right pleural effusion (Figure 3). On HD4, the patient's white blood cell count increased from 9.7 to 16.7 K/ μ L (reference range, 4.0-11.0 K/ μ L), and his fever recurred, with a temperature of 102.56 °F. Repeat CT imaging demonstrated an increase in the size of both liver abscesses. The larger abscess measured 12 $\times$ 7 $\times$ 12 cm, while the smaller measured 7 $\times$ 6 $\times$ 8 cm (Figure 4). Given the patient's clinical deterioration and the enlargement of both abscesses, inadequate drainage was considered the likely cause of

treatment failure. The patient therefore returned to interventional radiology, where two additional drains were placed, one in each abscess, bringing the total number of hepatic drains to three. From D5 to D7, the patient's white blood cell count and temperature progressively improved and returned to normal ranges. On D8, testing for *Echinococcus* antibodies yielded a negative result. Later that day, the patient was clinically stable and was transferred back to the community hospital for continued IV antibiotic therapy and monitoring. On HD10, chest radiography demonstrated a reduction in the size of the right pleural effusion (Figure 5). On HD18, the patient was discharged with a four-week course of oral levofloxacin and metronidazole. This regimen was selected to provide continued antimicrobial coverage following treatment of the *K. pneumoniae* infection and to provide coverage for potential concurrent anaerobic infection.

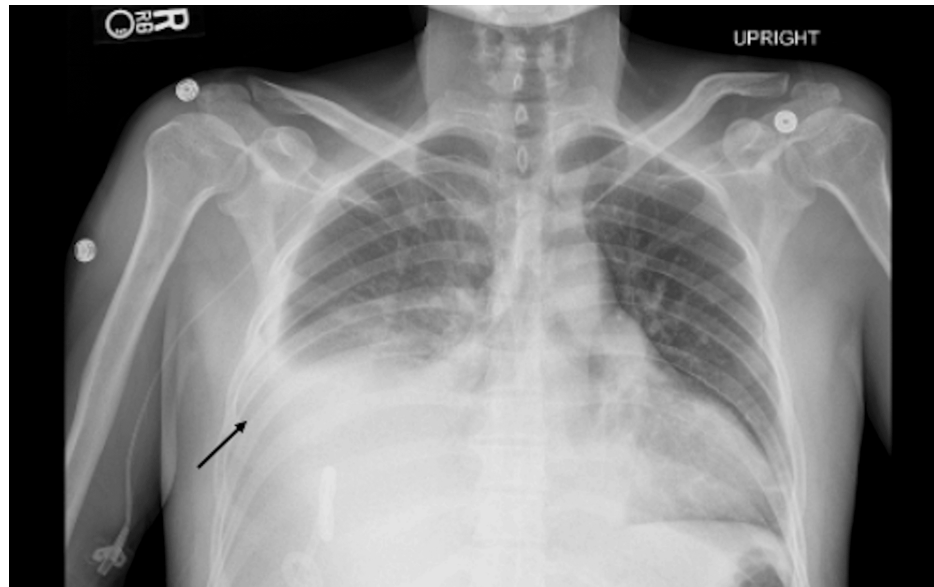


FIGURE 3: Upright frontal chest radiograph on HD10 demonstrating blunting of the right costophrenic angle (black arrow), consistent with a right pleural effusion

HD10: hospital day 10.

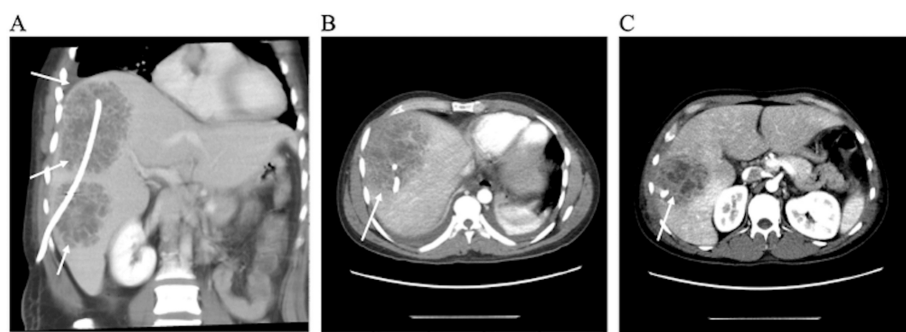


FIGURE 4: Abdominal CT scans on HD4, three days after the first drainage procedure, showing abscesses, hepatomegaly, and pleural effusions (arrows). The larger abscess measures 12 x 7 x 12 cm, and the smaller abscess measures 7 x 6 x 8 cm, indicating an increase in size

(A) Coronal image showing the craniocaudal relationship of the two collections and the catheter traversing through both abscesses. (B, C) Axial images demonstrating two discrete right-lobe collections with a catheter through them.

CT: computed tomography, HD4: hospital day 4.

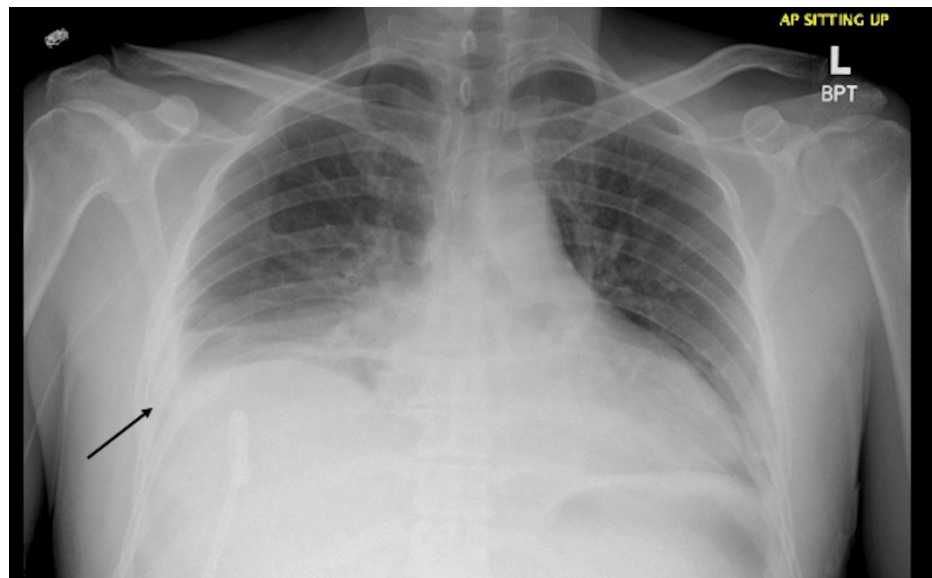


FIGURE 5: Follow-up upright frontal chest radiograph on HD10 illustrating a decreased right pleural effusion (arrow)

HD10: hospital day 10.

On HD48, the patient underwent an abscessogram, a radiological procedure in which contrast material is aseptically injected through an abscess drain to assess for residual cavities. No residual cavity was identified, and the drains were subsequently removed. A follow-up CT scan on HD54 demonstrated a reduction in the size of the two abscesses to $6.0 \times 3.0 \times 6.9$ cm and $3.3 \times 2.2 \times 5.2$ cm, respectively, with no significant residual fluid collection (Figure 6). Towards the end of the oral antibiotic course, the patient reported decreased pain and improved appetite. He gradually regained strength, and his weight began to return to baseline. After nearly two months of antibiotic therapy, the treating surgeon assessed the patient as having made a full clinical recovery.

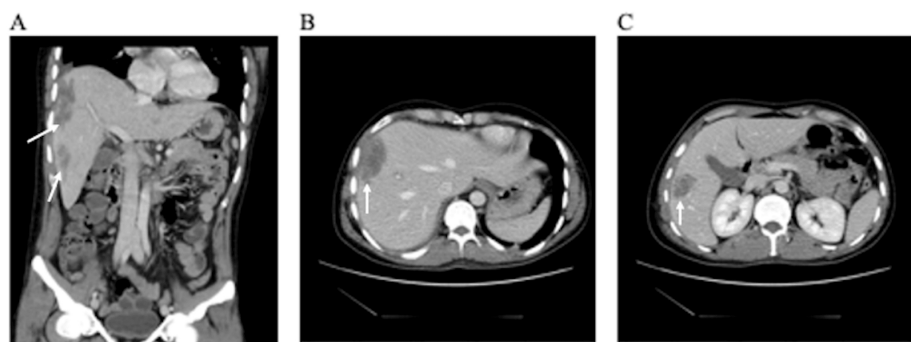


FIGURE 6: Follow-up CT scans on HD54 after the removal of the hepatic drain. The larger abscess measures $6.0 \times 3.0 \times 6.9$ cm, and the smaller abscess measures $3.3 \times 2.2 \times 5.2$ cm

(A) Coronal image showing the craniocaudal relationship of the two collections. (B, C) Axial images demonstrating two discrete right-lobe collections with a catheter through them. The arrows highlight the abscesses.

CT: computed tomography, HD54: hospital day 54.

Discussion

Hepatic abscess is a potentially life-threatening condition with multiple possible etiologies [8]. Given the patient's fever and abdominal pain at presentation, followed by the development of sepsis, an infectious cause was strongly suspected. Pyogenic and amoebic infections are the most common causes of liver abscesses, whereas parasitic and fungal infections are less frequently reported [1]. Imaging studies are

central to the detection and characterization of hepatic abscesses, while blood and abscess cultures are essential for identifying the causative organism.

Pyogenic liver abscesses can be caused by a variety of bacteria, with *K. pneumoniae*, *Escherichia coli*, and *Enterococcus* species among the commonly reported pathogens [9]. Patients typically present with abdominal pain, intermittent fever, sweating, vomiting, weight loss, and malaise. When multiple abscesses are present, as in this case, the clinical presentation may be more acute [10]. CT plays a critical role in identifying and localizing pyogenic liver abscesses, which can exhibit a range of morphological appearances, from fluid-filled lesions with smooth margins to poorly defined masses [11]. *K. pneumoniae* liver abscesses may appear as solid or multiloculated lesions and can occur as either single or multiple abscesses [12]. The initial CT scan in our patient demonstrated two multiloculated liver abscesses (Figure 1), a finding compatible with *K. pneumoniae* infection but not specific to this organism. Microbiological confirmation through culture is therefore essential to establish the causative pathogen [13]. In this case, both blood and abscess cultures confirmed *K. pneumoniae* infection.

Appropriate source control is a fundamental component of managing pyogenic liver abscesses. The combination of drainage and antibiotic therapy has been associated with favorable outcomes in most patients [14]. Although drainage is an essential component of treatment for many large or complex abscesses, inadequate drainage may result in persistent infection and clinical deterioration [15]. Antimicrobial susceptibility testing should guide antibiotic selection for *K. pneumoniae* infections, with the route of administration determined by the severity of illness, susceptibility results, and clinical response [16]. One previous study recommended initial treatment with a third-generation cephalosporin plus metronidazole or piperacillin/tazobactam, with carbapenem therapy recommended when infection with extended-spectrum beta-lactamase (ESBL)-producing *K. pneumoniae* is suspected or confirmed [17].

In our patient, empirical antibiotic therapy was initiated with IV metronidazole and piperacillin/tazobactam. Meropenem was subsequently administered because of clinical deterioration while culture results were pending. Subsequent culture and antimicrobial susceptibility testing demonstrated susceptibility to piperacillin/tazobactam, meropenem, and levofloxacin, among other agents. These findings suggest that documented antimicrobial resistance was unlikely to explain the patient's deterioration. Instead, the enlargement of both abscesses following initial drainage raised concern for inadequate source control. This interpretation is consistent with the subsequent clinical improvement after two additional drainage catheters were placed, although the contribution of drainage cannot be separated from that of ongoing antibiotic therapy and other supportive care. In patients with multiple liver abscesses, placement of multiple drainage catheters may facilitate adequate evacuation of separate collections [18]. Furthermore, percutaneous drainage has been reported to achieve outcomes comparable to surgical drainage, with shorter hospital stays, including in patients with multiple abscesses [19].

K. pneumoniae liver abscess can be associated with an invasive syndrome characterized by metastatic infection beyond the liver, including central nervous system involvement, necrotizing fasciitis, and endophthalmitis. A study from the United States reported extrahepatic metastatic complications in 24% of patients with *K. pneumoniae* liver abscesses [20]. These manifestations have been associated with hypervirulent strains, including those exhibiting a hypermucoviscous phenotype [20]. Features associated with hypervirulent *K. pneumoniae* include the ability to cause severe infection in otherwise healthy individuals, involvement of unusual anatomical sites, and metastatic dissemination. Hypermucoid colonies on agar and a positive string test may provide supporting evidence, although these findings alone do not definitively establish hypervirulence [21]. The absence of a known history of chronic illness in our patient raised the possibility of infection with a hypervirulent strain. However, no extrahepatic metastatic complications occurred during his clinical course, and the hypervirulent status of the isolate remains undetermined because neither molecular characterization nor string testing was performed.

A meta-analysis of *K. pneumoniae* liver abscesses without metastatic infection found that 78% involved the right hepatic lobe and 85.4% presented as single abscesses [22]. Although the abscesses in our patient were also located in the right lobe, their multiplicity represents a less common presentation. The same meta-analysis reported that most patients underwent percutaneous catheter drainage, frequently received cephalosporins or beta-lactam/beta-lactamase inhibitor combinations, and had an overall treatment success rate of 98.8% across treatment approaches [22]. One published case described a patient with a single multiloculated *K. pneumoniae* liver abscess who deteriorated after percutaneous drainage and subsequently required partial laparoscopic liver resection [23]. Reports describing clinical deterioration associated with inadequate drainage of multiple *K. pneumoniae* liver abscesses remain limited. Our case illustrates a similar clinical challenge: the patient deteriorated after initial drainage using a single catheter to access two abscesses, but subsequently improved following the placement of two additional catheters, alongside continued antibiotic therapy and supportive management. This case highlights the importance of reassessing source control when clinical deterioration or persistent infection occurs after initial drainage, particularly in patients with multiple large or complex liver abscesses.

Conclusions

Hepatic abscesses are purulent cavities with potentially dangerous complications; thus, it is vital to optimize

the treatment approach through source control to minimize complications. This case highlights that a single drainage catheter can result in inadequate drainage of multiple liver abscesses and that targeted separate catheter drainage should be considered when adequate decompression is not achieved. We further emphasize the importance of close monitoring to identify signs of inadequate drainage and react promptly.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Andrew W. Haddad, Adil E. Wakil

Drafting of the manuscript: Andrew W. Haddad, Adil E. Wakil

Critical review of the manuscript for important intellectual content: Andrew W. Haddad, Adil E. Wakil

Acquisition, analysis, or interpretation of data: Adil E. Wakil

Disclosures

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