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CASE REPORT

Tapped Twice: A Case of a Rapidly Re-accumulating Hepatic Hydrothorax in a Patient with Spontaneous Bacterial Empyema

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Abstract

Hepatic hydrothorax (HH) is a complication of decompensated liver cirrhosis that only occurs in about 5–6% of cirrhosis patients, defined as a pleural fluid in the setting of known liver disease, with the absence of any other cardiopulmonary etiology. Infected HH is a rare complication, designated as spontaneous bacterial empyema (SBEM), found in only 13–16% of patients with HH. This case follows a patient with SBEM who developed a recurrent pleural effusion minutes after thoracentesis. Our patient is a 56-year-old female with a history of alcoholic cirrhosis with pleuritic pain found to have right-sided pleural effusion with decompensation. She had no ascites. She was initiated on antibiotics due to leukocytosis and underwent thoracentesis, revealing a sterile but exudative pleural effusion with high neutrophil count, confirming the diagnosis of SBEM. Despite initial symptom relief, her respiratory symptoms recurred within mere minutes of thoracentesis. Imaging showed reaccumulated right-sided effusion, and repeat thoracentesis showed a transudative effusion, suggesting HH. While she was in our care, we pursued expert consultation with gastroenterology and thoracic surgery; based on our shared clinical decision making, we agreed that definitive intervention with either indwelling catheter or intrapleural surgical options would cause more harm than good to our patient given her decompensated alcoholic cirrhosis. The patient was discharged with instructions for serial thoracentesis and close follow-up with gastroenterology to discuss next steps regarding her advanced and uncontrolled cirrhosis. We refer to this case to discuss HH and its rare complication of SBEM, as well as the management options for patients with these conditions.

Introduction

Hepatic hydrothorax (HH) is a complication of decompensated liver cirrhosis that only occurs in about 5–6% of cirrhosis patients, wherein cirrhotic patients accumulate a transudative pleural effusion in the absence of any other cardiopulmonary etiology.[1] When HH becomes infected, it is designated as spontaneous bacterial empyema (SBEM), diagnosed in patients with decompensated cirrhosis and evidence of pleural effusion showing polymorphonuclear cells (PMNs) >500 cells/mm^3 or culture positive effusion with PMNs >250 cells/mm^3, in the absence of another etiology to explain the effusion. This is a rare complication found in only 13–16% of patients with HH.[2] SBEM is treated similarly to spontaneous bacterial peritonitis: by empiric coverage with a third-generation cephalosporin, removal of fluid via thoracentesis, and management of the underlying decompensated cirrhosis, in hope of eventual liver transplantation.[3]

Our case is particularly interesting as our patient initially presented with SBEM. However, after antibiotics and initial thoracentesis, her pleural space rapidly reaccumulated with a now transudative HH, suggesting a unique underlying pleural pathology that we will investigate in this case report.

Case Description

A 56-year-old female with a history of liver cirrhosis, portal hypertension, and alcohol use disorder presented to the emergency department with two days of right-sided pleuritic chest pain associated with dry cough. The patient also

reported medication nonadherence and endorsed current alcohol use. She was hypoxic on room air, requiring supplemental oxygen via nasal cannula, and had a low-grade fever at 101.5 °F. A physical exam on admission showed jaundice and diminished lung sounds in the entire right lung field. Notably, she had no clinical signs of ascites. Her laboratory results were consistent with decompensated liver failure, with elevated total bilirubin of 9.1 mg/dL [normal range 0.1–1.2 mg/dL], low serum albumin of 2.5 mg/dL [3.4–5.4 g/dL], and elevated international normalized ratio (INR) of 2.2 [0.8–1.1]. A chest radiograph (CXR) showed right-sided pleural effusion with near complete white-out of the right lung field (**Figure 1**).

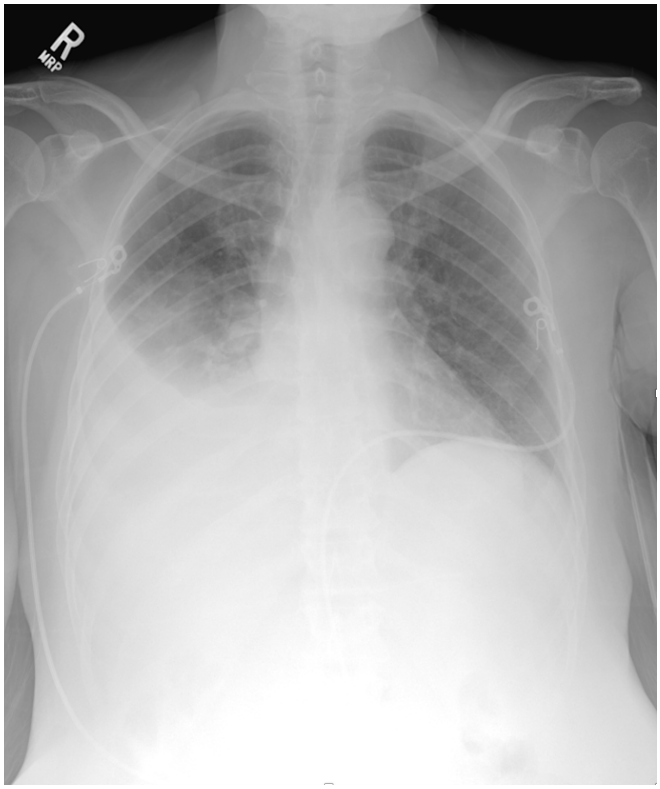

Figure 1. Initial CXR demonstrating large right-sided pleural effusion.

Early in the admission, our patient developed leukocytosis (white blood cell count [WBC] 14,000 cells/uL) and was subsequently started on broad-spectrum antibiotic coverage for suspected SBEM with ceftriaxone. She had no other signs indicating sepsis. She then underwent a thoracentesis for right-sided pleural effusion. Thoracentesis revealed 720 mL turbid, yellow fluid (**Table 1**). Fluid analysis revealed an exudative effusion, with a neutrophil count of 13,752 cells/L (90% neutrophils). Notably, during thoracentesis, the ultrasound probe was used to assess for abdominal ascites, of which there was only a clinically insignificant and non-tappable quantity on the pelvic floor.

After the thoracentesis, the patient had immediate relief of her dyspnea. However, within thirty minutes, she became dyspneic again, prompting further imaging by CXR, which demonstrated re-accumulation of the large right-sided pleural effusion (**Figure 2**). The following day, the patient had a repeat thoracentesis with removal of 1,000 mL clear, yellow fluid. This time, the fluid analysis demonstrated a transudative process, with a neutrophil count <10 cells/L, suggesting a diagnosis of hepatic hydrothorax (**Table 1**).

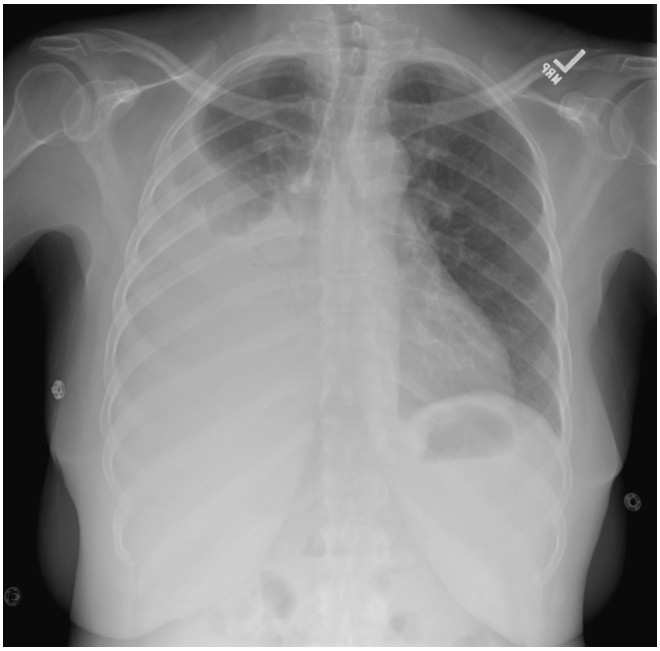

Figure 2. CXR demonstrating re-accumulation of large right-sided pleural effusion, taken within one hour of initial thoracentesis.

After the second thoracentesis, the patient once again had short-term relief of her symptoms, followed by recurrent dyspnea and right-sided effusion. The chart was reviewed in greater detail, which revealed that the patient had persistent, moderate, right-sided pleural effusion dating back to two years prior to admission (**Figure 3**). At this point, consultation was sought with thoracic surgery and gastroenterology for evaluation of definitive symptomatic management of her recurrent pleural effusion. While invasive measures, such as tube thoracostomy and pleurodesis, would be too invasive and posed high risk for a patient with acutely decompensated cirrhosis, non-surgical interventions, such as transjugular intrahepatic portosystemic shunt (TIPS), indwelling pleural catheter (IPC), or chest tube, were also not advised. This is because her history and presentation posed a high risk for reinfection, hepatic encephalopathy, bleeding, and other systemic complications, which will be discussed below.

Ultimately, the patient was discharged with weekly thora-

Table 1. Comparative fluid analysis between first and second thoracentesis.

	First thoracentesis	Second thoracentesis
Total cell count, cells/L	16,280	118
White blood cells, cells/L	15,280	118
Neutrophils, cells/L (%)	13,752 (90)	9 (7)
Red blood cells, cells/L	1,000	0
Pleural/serum lactate dehydrogenase	6.2	0.53
Lactate dehydrogenase, U/L	733	110
Serum-pleural ascites gradient	2.2	1.5
Gram stain, cytology, cultures	negative	negative

centesis appointments and close follow-up with hepatology, with hopes to discuss goals of care and cessation of alcohol abuse in hope of eventual liver transplantation. The patient was unfortunately lost to follow-up.

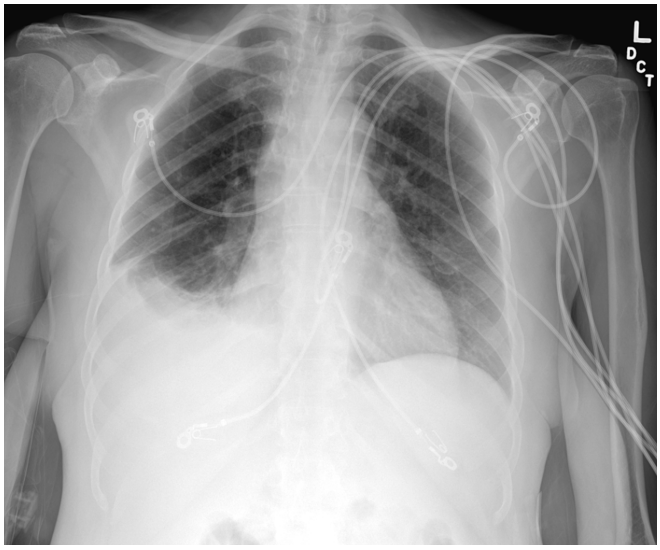

Figure 3. CXR demonstrating moderate-sized right-sided pleural effusion from an admission three years prior to presentation; per chart review, the patient reported no respiratory symptoms, and this was an incidental finding.

This publication was exempt from institutional review board evaluation as it is a case report; however, consent for participation and publishing was granted from the patient directly. All data and materials utilized in the manuscript can be made available on request.

Discussion

This case provides a great opportunity to review two hepatopulmonary processes that exist in a spectrum: HH and its infected form, SBEM. We utilize this case to review the different management options between these conditions, which made definitive management of our patient particularly tenuous.

HH is an uncommon complication of portal hypertension, as it occurs in only about 5–12% of patients.[1] HH is defined as a transudative pleural effusion of >500 mL in the setting of decompensated cirrhosis with portal hypertension, in the absence of any other cardiopulmonary etiology. The most cited mechanism of HH is the translocation of ascitic fluid across the diaphragm due to weaknesses along the diaphragmatic tendon, predominately on the right side.[4, 5] This is supported by mechanistic studies demonstrating the unidirectional flow of ascitic fluid from the positive pressure of the intra-abdominal cavity towards the negative pressure of the intrapleural cavity.[6, 7] Furthermore, the majority of patients with HH have concomitant ascites; one study demonstrated that almost 90% of patients with HH also had ascites.[8] However, the absence of ascites does not preclude the diagnosis of HH. When the rate of ascites production is equal to the rate of pleural absorption, HH may develop without ascites, as in our patient.[9, 10]

HH is medically managed with strict adherence to a low-sodium diet, diuresis, and if causing respiratory symptoms, therapeutic thoracentesis. Refractory, diuretic-resistant HH can be managed with TIPS, which has shown improvement of Child-Pugh Score and either resolution of HH or reduction in frequency of thoracentesis.[11, 12] Other procedural management options include tube thoracostomy with chemical pleurodesis to eviscerate the pleural space, but the limited data available for this treatment option suggest a high complication rate of up to 80%, including fever, sepsis, and hepatic encephalopathy.[8, 13] Studies evaluating complications and mortality are limited, but one small prospective study demonstrated almost 40% mortality in patients who had talc pleurodesis.[11] Chest tube placement was shown in one study to be highly inadvisable for patients with hepatic hydrothorax with liver cirrhosis because the massive fluid and electrolyte losses can lead to acute renal failure and mortality.[14] However, this study had a small sample size of 16 patients, and whether chest tube placement is considered

Table 2. Contraindications to transjugular intrahepatic portosystemic shunt (TIPS).

Absolute contraindications	Relative contraindications
Active bleeding diatheses including variceal bleeding	Portal vein thrombosis or other hepatic vein obstructions
Unrelieved biliary obstruction	Hepatocellular carcinoma or other hepatic malignancies
Elevated right heart pressure (*i.e.*, severe pulmonary hypertension, severe tricuspid regurgitation)	Hepatic encephalopathy
Congestive heart failure	Thrombocytopenia <20,000 cells/cm^3
Active sepsis or systemic infection	Severe coagulopathy (INR>5)
Multiple hepatic cysts	

Abbreviations: INR, International Normalized Ratio.

an absolute or relative contraindication for patients with HH is still controversial. HH is managed definitively with orthotopic liver transplantation, but this is not viable in patients with active alcohol use disorder, as in our patient.

When HH becomes infected, it represents a rare and difficult to manage complication called spontaneous bacterial empyema. The national incidence of SBEM is poorly studied as it is a rare condition that requires thoracentesis to definitively diagnose; several small single-center studies found an overall incidence of 1–2% among hospitalized patients with cirrhosis, and around 10–15% among patients with preexisting hepatic hydrothorax.[2, 15, 16] While SBEM is a misnomer, and there is no frank purulent drainage associated with SBEM, the condition is similar to true empyema in its high degree of mortality; one study cited an in-hospital mortality rate of 20% up to 40%.[2, 15] SBEM is clinically suspected in a patient with signs of decompensated hepatic cirrhosis, stigmata of infection with respiratory symptoms, and imaging showing pleural effusion with absence of pneumonia. SBEM is diagnosed in patients who have PMN >500 cells/L or positive pleural fluid culture with PMN >250 cells/L.[16] One proposed mechanism is the translocation of microbes from a spontaneous bacterial peritonitis (SBP) through the same weaknesses along the diaphragm as referenced above in HH. However, a prospective study that opposes this theory found that 43% of patients with SBEM did not have a concurrent SBP, similar to our patient.[2] A more plausible mechanism is the direct infection of a preexisting hepatic hydrothorax via transient bacteremia; one study demonstrated that patients with both negative ascitic and blood cultures still had positive pleural cultures.[17–19]

The most common organisms associated with SBEM are Enterobacteriaceae, and as such, empiric antibiotic coverage is provided with β-lactams, such as third-generation cephalosporins. In the majority of cases we found in our review of the literature, SBEM resolved with prompt empiric antibiotic coverage, diuresis, and low-sodium diet; however, multiple studies found that high mortality rates were associated with high Meld-Na (Model for End-Stage Liver Disease) score, positive pleural fluid culture, and initial antibiotic failure.[15, 17, 20]

In our patient's case, while she initially presented with SBEM as defined by the above clinical definition, she was promptly initiated on broad-spectrum antibiotics, diuresis, and a low-sodium diet even before a definitive diagnosis could be obtained with thoracentesis. While there is no literature clearly defining duration of treatment and timing of resolution of symptoms in SBEM, we believe that our prompt recognition and initiation of appropriate empiric therapy is what resulted in the wide discrepancy of the patient's first and second thoracenteses fluid analysis. Despite just one day between each thoracentesis, we suggest that it signified resolution of the exudative and infectious process into her more chronic and ever-present transudative HH. This is supported by resolution of her leukocytosis and defervescing, which would further suggest that an infectious or inflammatory process is resolving.

Causes of in-hospital mortality in SBEM patients included septic shock, hepatic failure, and esophageal variceal hemorrhage.[2] Like HH, chest tube placement may cause more risk than benefit in patients with SBEM due to a tendency towards massive fluid and electrolyte losses and associated high mortality. IPC placement may thus seem an attractive option; however, active pleural infection also contraindicates IPC use. One study similarly illustrated that there is a 10% risk of infection and a 2.5% mortality risk.[21] This can be explained by the fact that patients in immunocompromised states such as those in end-stage liver disease

are already at increased risk for infection. Another study showed even higher risk of negative outcomes with IPC use with an overall complication rate of 36% (n=22), of which 18% were the result of infectious complications.[22] Treatment options for our patient's symptoms are severely limited due to the concurrence of several pathologies at play. While serial thoracenteses should still be performed for symptomatic relief, this is simply a temporizing measure. The presence of HH makes chest tube placement dangerous due to massive fluid losses and high mortality. The presence of SBEM forbids the short-term use of IPC, given the high risk for recurrent infections. Furthermore, due to our patient presenting with sepsis, we believe that she had a contraindication to TIPS intervention. The absolute and relative contraindications to TIPS are further elaborated in **Table 2**. Even after resolution of SBEM, TIPS was deferred due to her persistent decompensation, as she continued to have HH, since it may lead to hemodynamic portosystemic shunting and hepatic encephalopathy.[23] This leaves orthotic liver transplantation as the truly definitive long-term treatment option, which proved a challenging goal of care discussion for our patient with active alcohol use disorder.

Conclusion

Hepatic hydrothorax is a rare complication of decompensated alcoholic cirrhosis, which may present with or without ascites, and presents as a transudative effusion in the absence of another explanation. An infected HH is referred to as spontaneous bacterial empyema, which is an even rarer complication; this complication should not be missed in a patient with pleural effusion, stigmata of infection, and decompensated alcoholic cirrhosis. These conditions pose treatment shortcomings and are associated with a high degree of mortality, especially if the cirrhosis is poorly controlled.

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