

Cirrhotic Patient with Spontaneous Bacterial Empyema: Case and Review of Literature

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Abstract

Background: Spontaneous Bacterial Empyema (SBEM) is a type of pre-existing hepatic hydrothorax that becomes infected. It is defined as pleural fluid with a polymorphonuclear cell (PMN) count > 500 cells/mm³ or a positive culture with a PMN cell count > 250 cells/mm³ without parapneumonic effusion. SBEM is an under-recognized marker of decompensated liver cirrhosis and is associated with high morbidity and mortality. Its diagnosis requires chest imaging, thoracentesis is crucial and should be performed for every patient with pleural effusion and evidence of infection.

The principal causative agents are gram-negative bacteria, especially *Escherichia coli* and *Klebsiella pneumoniae*. The probable mechanism of the development of SBEM is the transmigration of infected fluid from the peritoneal space to the pleura. There are no clear guidelines regarding the diagnostic criteria for and management of SBEM. The lack of such a consensus can render the therapeutic choice difficult.

There is evidence that, except in the rare case of frank pus in the pleural space, chest drainage is not recommended, because it predisposes one to prolonged fluid and protein loss, electrolyte abnormalities and renal failure.

Case Report: We present a case of a cirrhotic patient with infected pleural spaces who was treated by chest tube drainage.

It is important to increase physicians knowledge of this clinical entity, because it often portends a poor prognosis. Prompt recognition and the institution of correct diagnosis per standardized criteria and therapeutic interventions are imperative.

Keywords: Spontaneous Bacterial Empyema; Cirrhosis; Chest Drainage

Introduction

Spontaneous bacterial empyema (SBEM) is a type of pleural effusion with a polymorphonuclear (PMN) count > 250 cells/uL with a positive culture or a pleural fluid PMN count > 500 cells/uL with a negative culture, on exclusion of parapneumonic infections [1] (Table 1).

The term "empyema" is derived from the Greek words "pyon", meaning pus and "empyein", meaning pus-producing. Thoracic empyema has been recognized as a serious problem for centuries. In approximately 500 BCE, Hippocrates recommended treating empyema by

Serum/pleural albumin gradient >1.1 g/dL
Negative pleural fluid culture with polymorphonuclear leukocyte count > 500 cells/mm ³
Positive pleural fluid culture with polymorphonuclear leukocyte count > 250 cells/mm ³ and exclusion of parapneumonic infections

Table 1: Definition of spontaneous bacterial empyema.

open drainage. The treatment of this disease remained unchanged until the middle of the 19th century. In 1876, Hewitt described a method of closed drainage of the chest in which a tube was placed into the empyema cavity to drain. Flaum described the first case of SBEM in 1976 [2]. SBEM is an under-recognized and underdiagnosed complication of cirrhosis and is associated with high morbidity and mortality. However, this moniker has not accepted by the entire medical community and there is no consensus definition of this disease [3,4].

Its pathogenesis remains unknown, differing from that of empyema secondary to pneumonia. A probable mechanism for the development of SBEM is a direct bacterial spread from the peritoneal cavity [1,5-8]. Other mechanisms of infection of the pleural fluid have been suggested by several case reports in which ascites or spontaneous bacterial peritonitis (SBP) is not present [9-11]. A combination of several factors could be responsible such as suppression of hepatic of reticuloendothelial system, bacterial overgrowth and translocation, low levels of C3 and C4 and low ascitic fluid opsonic activity [1,7].

A diagnosis requires chest imagining to exclude the presence of pneumonia and diagnostic thoracentesis.

Fifty percent of SBEM fluids are transudative despite a positive culture; the common pathogens that are isolated from pleural diffusion are *E. coli*, *K. pneumonia* *Streptococcus* species, *Enterococcus* species and *Pseudomonas* [9]. Some groups have been used the phrase “spontaneous bacterial pleuritic” instead of “SBEM” [11]. However, SBEM has been used in most reports.

There are no clear guidelines regarding the management of SBEM. The principal treatment consists of IV antibiotics and albumina, drainage is generally contraindicated, because patients with cirrhosis experience protein loss and electrolyte imbalances and are predisposed to renal failure and secondary infection [12,13]. We present a case of a cirrhotic patient with infected pleural spaces who was treated by chest tube drainages.

Case Report

A 41-year-old female, smoker with liver cirrhosis secondary to alcoholism, Child-Pugh class C, was admitted to the emergency department for fever, dyspnea and chest pain. She had a history of bleeding esophageal varices and ascites, requiring therapeutic paracentesis and had never developed spontaneous bacterial peritonitis. On physical examination she was tachycardic and had fever and decreased breath sounds bilaterally with no crackles or rhonchi. The abdomen was mildly distended with slight right upper quadrant tenderness. She had also developed bilateral extremity edema.

On admission, her body temperature was 38°C, blood pressure was 100/70 mm Hg, heart rate was 100/min, rhythmic and breathing rate was 22/min. A mild systolic murmur was noted at the right parasternal margin. The arterial blood gas analysis showed a pattern of hypoxic-hypocapnic respiratory failure (pH: 7.50, PaO₂: 50 mmHg; PaCO₂: 30 mmHg). The neurological evaluation was normal. Oxygen therapy was started.

The laboratory test results were notable with regard to anemia with hemoglobin 10.9 g/dL thrombocytopenia 115,000/mm³, leukocytosis 12.55 k/ul with 74% neutrophils prothrombin time-international normalized ratio 1.94, total protein 6.0 g/dL, albumin 2.6 g/dL, total bilirubin 3.6 mg/dL, aspartate aminotransferase 33 IU/L, alanine aminotransferase 25 IU/L and alkaline phosphatase 240 U/L. Further evaluation revealed a negative viral hepatitis panel, HIV, viral infections (CMV, EBV, herpesvirus) and autoimmune panel.

Blood cultures and urinalysis were negative for infection. Chest radiography showed bilateral pleural effusion, confirmed on chest CT, without consolidations (Figure 1); the thoracic ultrasonography revealed bilateral loculated pleural spaces. The abdominal ultrasonography showed a small amount of ascites, not amenable to paracentesis. The ecocardiography was normal. Ceftriaxone was administered as empiric therapy.

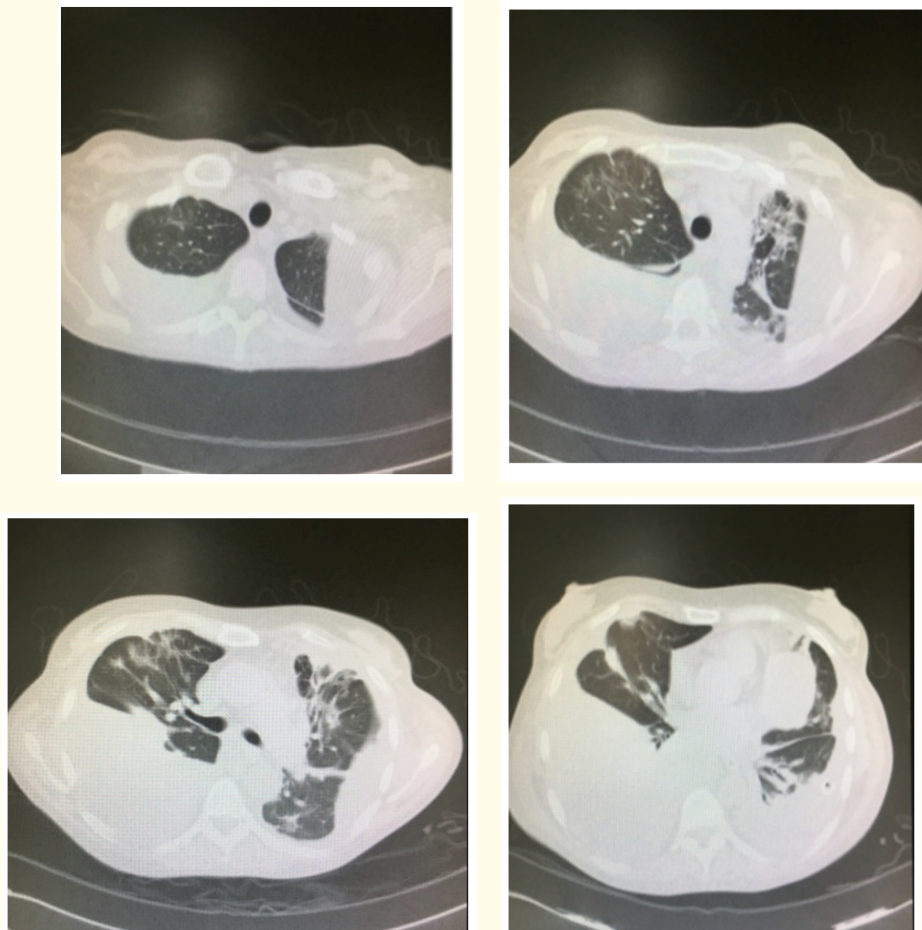


Figure 1: Chest CT on admission.

Thoracentesis was performed with the appearance on sero-sanguinous fluid: serum/pleural albumin gradient was 1.8 g/dL, PMN count was 350 cell/m³, pH was 6.90, glucose was 190 mg/dL and the fluid culture was positive for *Klebsiella oxytoca*.

Antibiotic susceptibility testing was performed to evaluate drug sensitivity and resistance. As a result, the patient was treated with carbapenems (meropenem 2gr x 3/daily) and ciprofloxacin 400 mg bid. Due to the low pH, complex appearing pleural space (bilaterally loculated) and concern for inadequate control with antibiotics alone, we proceeded with 2 chest tube drainages: after 5 days of drainage and intravenous therapy with antibiotics her clinical conditions improved (i.e the leuckocytosis resolved) (Figure 2).

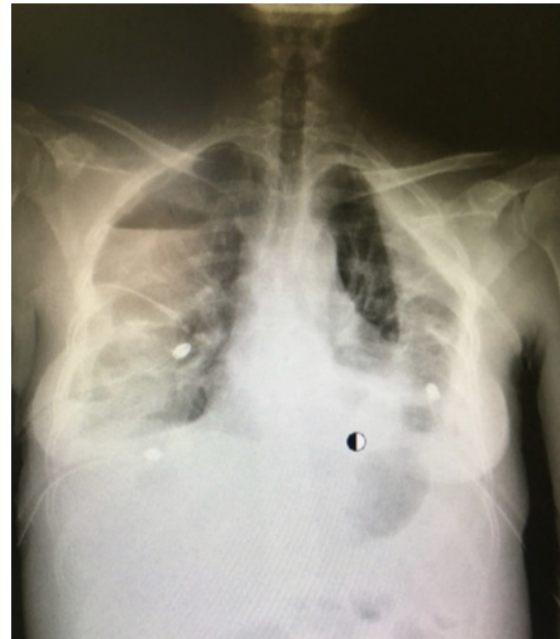


Figure 2: Chest radiography after insertion bilateral drainages.

The pleural catheters were removed after 7 and 10 days respectively, The patient was discharged home on 4 weeks of antibiotics, without oxygen supplementation and the repeat chest CT showed improvement (Figure 3).

Discussion

SBEM is an under-recognized complication of cirrhosis, with a similar pathogenesis as spontaneous bacterial peritonitis, as a result of impaired reticuloendothelial phagocytic activity. In 40% of cases, SBEM can occur in the absence of ascites [14]. The actual incidence of SBEM might be higher than reported; it is estimated that it occurs in 5% to 12% of patients with cirrhosis and 13% to 16% of patients with hepatic hydrothorax [15].

SBEM can develop with SBP through trans-diaphragmatic spread, or without SBP through hematogenous spread [16]. Cirrhosis is an immunocompromised state that increases a patient's susceptibility to the development of spontaneous bacterial infections and various infections from uncommon pathogens [17].

Regarding liver cirrhosis, the major causative organisms of all bacterial infections are Gram-negative bacteria, whereas Gram-positive bacteria constitute approximately 20% versus 3% for anaerobic bacteria only [11,18].

Physicians avoid performing thoracentesis in cirrhotic patients due to the risk of complications.

A diagnosis of SBEM is established if the pleural fluid cultures are positive and the polymorphonuclear count is > 250 cells/ μL without the presence of pneumonia. The patient in this case report met both these criteria. The imaging evaluation by CT scan and thoracic ultrasonography showed the presence of bilaterally loculated pleural effusion.

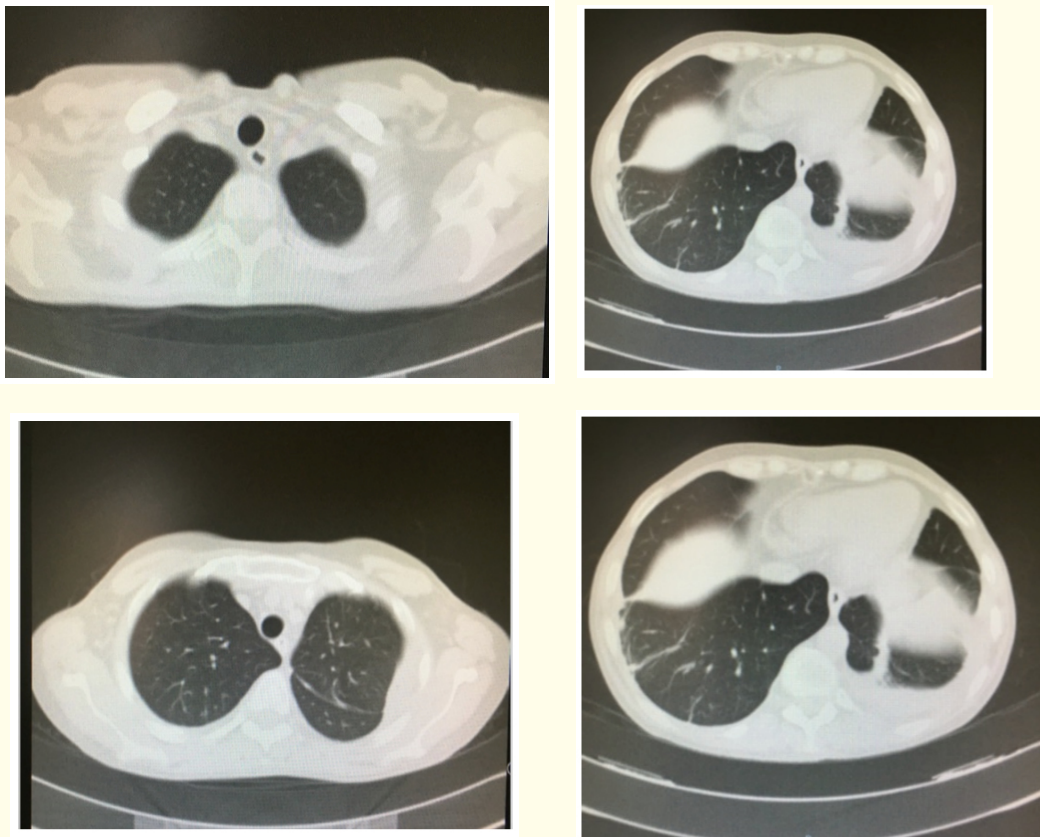


Figure 3: Chest CT on discharge.

In 1995, Light proposed a classification system for empyema classification, according the following biochemical properties: pH 7,0 or glucose < 40 mg/dL, positive culture or gram stain, or frank pus. SBEM is defined as pleural fluids having transudate properties: there are no classical criteria for empyema [19].

The pleural fluid culture, in our case, was isolated a Gram-negative strain (*Klebsiella oxytoca*).

There are no clear guidelines regarding its management, but most studies have uniformly proven that SBEM can be successfully treated with only antibiotics [1,20]. The antibiotics of choice is a third-generation cephalosporin such as ceftriaxone and cefotaxime, which should be initiated immediately [20]. There is no consensus regarding the use of chest tube insertion (important in the management of empyema); in fact it seems to be frequently contraindicated, because it predisposes one to prolonged fluid and loss of protein, electrolyte abnormalities and secondary infections [12,21]. In our case due to the low pleural fluid pH and complex appearing pleural space we decided to treat the patient with 2 chest tube drainages. The clinical condition of the patient after this procedure improved quickly. SBEM is associated with high mortality rates of between 20% and 38%, independent predictors of this are admission to the intensive care unit and initial antibiotic treatment failure [22]. Our case resolved only on combining antibiotics and chest tube insertions: for this reason the correct stratification of patients with SBEM is needed [23].

Conclusion

SBEM is an uncommon, often underdiagnosed condition in patients with cirrhosis.

There are no clear guidelines regarding its diagnostic criteria and management. The lack of such a consensus can lead to uncertainty in the treatment. Prompt recognition and of the correct diagnosis per standardized criteria and therapeutic interventions are imperative. Further studies should clarify the judicious use of chest tube drainage in cirrhotic patients with SBEM.

Conflict of Interests

All authors declare that they have no competing interests.

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