CASE REPORT

Empyema caused by *Clostridium bifermentans*: A case report

Safa Edagiz MD1, Phil Lagace-Wiens MD1,2, John Embil MD3, James Karlowsky PhD1,2, Andrew Walkty MD1,2,3

A case of pneumonia with associated empyema caused by *Clostridium bifermentans* is described. *C bifermentans* is an anaerobic, spore-forming, Gram-positive bacillus. This organism is infrequently reported as a cause of infection in humans, and older publications tended to regard it as nonpathogenic. However, in more recent reports, *C bifermentans* has been documented as a cause of septic arthritis, osteomyelitis, soft tissue infection, abdominal infections, brain abscess, bacteremia and endocarditis. The present case is the third reported case of empyema caused by *C bifermentans*, and it serves to further define the spectrum of illness due to this uncommon organism.

Key Words: *Clostridium bifermentans*; Empyema; Pneumonia

CASE PRESENTATION

A 60-year-old man with a medical history significant only for an anxiety disorder presented to a community hospital in Winnipeg, Manitoba with a four-day history of increasing fatigue, weakness, cough and shortness of breath. The patient also complained of sharp right-sided pleuritic chest pain, as well as right upper quadrant abdominal pain associated with deep breathing. He denied nausea and vomiting. A review of systems was otherwise negative. The patient was a heavy smoker and reported occasional alcohol consumption. He was noted to be febrile, with an oral temperature of 39.2°C. He was edentulous. On examination, the patient was clinically stable. The patient was edentulous. On respiratory examination, decreased air entry was noted in the right lower and middle lobes. Bronchial breath sounds were noted at the right lung base, and crepitations were heard with auscultation over the rest of the right lung. The abdomen was tender to palpation in the right upper quadrant. The remainder of the physical examination was unremarkable. Laboratory investigations performed on presentation demonstrated an elevated total leukocyte count (17.8×10^9 cells/L) with a neutrophil predominance (neutrophil count 16.12×10^9 cells/L). Blood cultures (aerobic and anaerobic) were negative. On chest radiography, a right-sided pneumothorax was evident, with areas of pulmonary consolidation and loculated pleural fluid was apparent (Figure 1). The patient underwent a noncontrast computed tomography (CT) scan of the abdomen to rule out a subdiaphragmatic abscess in view of the right upper quadrant abdominal pain. No intra-abdominal abnormality was noted; however, the assessment did confirm a right-sided hydro pneumothorax, with areas of pulmonary consolidation and loculated pleural fluid.

The patient was admitted to hospital. A chest tube was placed, and empirical antimicrobial therapy with a combination of levofloxacin and metronidazole was initiated. A sample of pleural fluid was submitted to the microbiology laboratory for further analysis. No polymorphonuclear cells or bacteria were observed on Gram stain. The aerobic culture did not demonstrate any bacterial growth following 72 h of incubation. However, after 48 h of incubation, a large Gram-positive spore-forming bacillus was recovered on anaerobic culture. The organism was subsequently identified as *Clostridium bifermentans* using a Vitek™ 2 ANC card (bioMérieux, Canada). Antimicrobial susceptibility testing was performed by E-test (bioMérieux, Canada), with minimum inhibitory concentrations interpreted according to 2012 Clinical and Laboratory Standards Institute breakpoints for anaerobic bacteria (1). The isolate was susceptible to amoxicillin-clavulanate, cefotin, clindamycin, meropenem, metronidazole and penicillin.

On the third day postadmission, the patient continued to complain of significant dyspnea and chest pain. A CT scan of the chest was performed with contrast and this demonstrated a right main pulmonary artery embolus. The patient clinically deteriorated and ultimately required admission to the intensive care unit. His antimicrobial therapy was changed to a combination of piperacillin-tazobactam and levofloxacin, and heparin was initiated as treatment for the pulmonary embolus. Fifteen days postadmission, the patient underwent a thoracotomy and decortication of the right lung. Empyema fluid obtained at the time of surgery was submitted to the microbiology laboratory. *C bifermentans* was once again recovered on anaerobic culture. Postoperatively, antimicrobial therapy with piperacillin-tazobactam alone was continued.

Following surgery, the patient experienced intermittent low-grade fevers (approximately 38°C) and ongoing hypoxia requiring 2 L of supplemental oxygen. Antimicrobial therapy with piperacillin-tazobactam alone was continued.

The patient failed to improve and a repeat chest CT scan was performed which demonstrated a right pneumothorax, with areas of pulmonary consolidation and loculated pleural fluid. Antimicrobial therapy with piperacillin-tazobactam, metronidazole and cefotin was initiated. A repeat chest CT scan, performed following 72 h of incubation. However, after 48 h of incubation, a large Gram-positive spore-forming bacillus was recovered on anaerobic culture. The organism was subsequently identified as *Clostridium bifermentans* using a Vitek™ 2 ANC card (bioMérieux, Canada). Antimicrobial susceptibility testing was performed by E-test (bioMérieux, Canada), with minimum inhibitory concentrations interpreted according to 2012 Clinical and Laboratory Standards Institute breakpoints for anaerobic bacteria (1). The isolate was susceptible to amoxicillin-clavulanate, cefotin, clindamycin, meropenem, metronidazole and penicillin.

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Following surgery, the patient experienced intermittent low-grade fevers (approximately 38°C) and ongoing hypoxia requiring 2 L of supplemental oxygen. Antimicrobial therapy with piperacillin-tazobactam alone was continued. The patient continued to show clinical improvement and was discharged home after a total hospital stay of 43 days.
and right lower lobe consolidation (black arrow). More than a true aerobes with the ability to form endospores (2,3). There have been documented as a cause of pleuropulmonary infection, including Clostridium perfringens, Clostridium sordellii, Clostridium sporegerm, Clostridium paraputrefaciens, Clostridium difficile, Clostridium septicum, Clostridium cadaveris and Clostridium tetani (19-23). C. bifermentans has only been reported as a cause of pulmonary infection/empyema in two other publications (24,25). Jonsson and Hurst (25) described a 60-year-old woman who presented with fever, cough and pleuritic chest pain. A large pleural effusion was demonstrated on chest radiography. Cultures of the pleural fluid grew C. bifermentans and Bacillus cereus. The patient improved following thoracotomy with decortication and appropriate antimicrobial therapy. Misra and Hurst (25) reported a 41-year-old woman who presented with cough, hemoptysis and pleuritic chest pain. A lung scan performed on admission was consistent with pulmonary emboli and the patient was treated with heparin. She subsequently deteriorated in hospital, with repeat chest radiography demonstrating pulmonary infiltrates and a pneumothorax that appeared to communicate with a cavitary lesion in the chest. C. bifermentans was recovered from blood and pleural fluid cultures. The patient succumbed to complications of the illness (25).

In both of the previously published cases of C. bifermentans empyema as well as the current case, it is unclear whether infection occurred secondary to hematogenous spread, inhalation or aspiration of the organism, although inhalation was favored in the report by Jonsson et al (24). The case presented here is similar to the case described by Misra and Hurst (25) in that the infection occurred in the setting of a pulmonary embolus. Given the reported low virulence of C. bifermentans, it is tempting to speculate that tissue injury/infection secondary to a pulmonary embolus may have predisposed our patient to develop this infection. A septic embolus would also be possible as a mechanism of infection, although blood cultures were negative. Unfortunately, the lack of an infused chest CT scan on presentation prevents determination of whether the pulmonary embolus was present at the start of the illness or whether it occurred in hospital once the infection was already established. Alternatively, the infection may have occurred secondary to aspiration, although the patient did not have any risk factors for aspiration specifically identified. It should be noted that the possibility of polymicrobial infection could not be completely excluded because all pleural fluid and tissue specimens were obtained after the start of antimicrobial therapy. Thus, the patient remained on broad-spectrum antimicrobials during his stay in hospital. The etiology of the pneumothorax in the present case also remains uncertain, as is its association (if any) with the development of infection. With the history of smoking, it is possible that our patient did, in fact, have underlying pulmonary disease, and this may have been a predisposing factor for the pneumothorax and/or the empyema.

CONCLUSION
The present report describes a case of pneumonia/empyema caused by C. bifermentans. Infections due to C. bifermentans are infrequently reported, potentially due to the relatively low virulence of this organism. Older publications tended to regard C. bifermentans as nonpathogenic (4,6). However, in more recent reports, this organism has been documented as a cause of septic arthritis, osteomyelitis, soft tissue infection, abdominal infections, brain abscess, bacteremia and endocarditis (7,9-18). The present article describes the third reported case of empyema caused by C. bifermentans, and serves to further define the spectrum of illness due to this uncommon organism.
REFERENCES