

Empyema caused by *Clostridium perfringens*

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Pleuropulmonary diseases caused by Clostridial species infections are rare, but have a mortality rate of up to 30%. Furthermore, older people are at greater risk of developing invasive clostridium infections, and the majority of reported cases of clostridium empyema have been attributed to iatrogenic trauma or aspiration. The authors report a case of spontaneous empyema caused by *Clostridium perfringens*. A 72-year-old woman was admitted to Kangwon National University Hospital for empyema. The patient had no history of trauma, a dental procedure, or aspiration, and was treated using empirical antibiotics and by drainage of pleural fluid. Bacteria species that cause empyema are usually not detected, but on the 4th day of admission, *C. perfringens* was isolated from the pleural space. The patient was continuously treated with antibiotics for *C. perfringens* and drainage, and was discharged 25 days after admission with almost a fully recovered status. Increased awareness of *Clostridium* species infection in the elderly is needed to ensure appropriate treatment.

Keywords: Empyema; *Clostridium perfringens*

INTRODUCTION

Clostridium species are anaerobic, gram-positive rods capable of forming endospores. They can cause diseases such as, antibiotic-associated colitis, food-borne botulism, and clostridial myonecrosis [1]. However, cases involving infection of pleuropulmonary structures by clostridial species are uncommon [2], and most of the cases reported have been caused by necrotizing pneumonia with plural involvement probably associated with invasive procedures or penetrating chest injuries [3,4]. Although, spontaneous pneumonia and pleural infections related to clostridial species have been described in the medical literature, no documented case of empyema due to *Clostridium perfringens* has been previously issued in Korea. We report on a rare case of empyema caused by *C. perfringens* infection and unrelated to any iatrogenic cause or injury in a 72-year-old woman.

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CASE

A 72-year-old woman was referred to Kangwon National Hospital after 3 days of coughing, fever, and malaise. Her medical history included hypertension, bilateral L5-S1 radiculopathy, and stomach wedge resection 3 years previously that provided no evidence of gastrointestinal stromal tumor. The patient had no history of tuberculosis or any other pulmonary disease, and had not undergone any recent medical procedure.

Physical Examination: The patient had left-sided chest pain upon coughing. Her pulse rate was 110 beats/minute, blood pressure 130/80 mmHg, respiratory rate 22/minute, and temperature 37.8°C. Oxygen saturation was 91%. Sounds from the left lung field were decreased, and the results of her chest examination were compatible with left-sided pleural effusion, with dullness to percussion and decreased breath sounds over the entire left lateral and posterior aspects of the chest. A chest roentgenogram confirmed these physical findings. An oral examination resulted in no specific finding, which was confirmed by dental consultation.

Laboratory findings: A complete blood cell count revealed a white blood cell count of $27.4 \times 10^3/\mu\text{L}$, hemoglobin 10.6

g/dL, and a platelet count of $403 \times 10^3/\mu\text{L}$ (88% neutrophils and 6% lymphocytes). C-reactive protein was >38 mg/dL, and blood urea nitrogen was 36.4 mg/dL, creatinine 1.2 mg/dL, albumin 2.6 g/dL, alkaline phosphatase 10^4 U/L, aspartate aminotransferase 19 U/L, and alanine aminotransferase 17 U/L. Arterial blood gas analysis showed PaO₂ 95.7 mmHg, PaCO₂ 48.8 mmHg, and oxygen saturation was 96.4%. Urinalysis was positive for ketone 1 and protein 1, and showed pyuria of 1-4. Electrocardiography revealed a normal sinus rhythm.

Diagnostic thoracentesis yielded 60 mL of pus with an odor characteristic exudate, and a leukocyte count of $10,080/\mu\text{L}$ (with 55% neutrophils), glucose 18 mg/dL, lactic dehydrogenase 52,720 IU/L, and protein 4.1 g/dL with a low pH of 6.3. Gram-staining of a non-centrifuged sample showed many (>10) white blood cells, moderate (5-10) gram-positive rods, and a few (1-5) gram-positive cocci.

Radiologic findings: Chest X-ray showed increased opacity in the left lower lung field and blunting of the costophrenic angle, suggesting pleural effusion (Fig. 1). Chest computed tomography (CT) showed loculated pleural effusion and passive atelectasis in the left upper and lower lung fields (Fig. 2), but no evidence of other increased opacities of lung parenchyma suggestive of pneumonia.

Hospital course: Upon diagnosis of empyema, the patient was initially treated by intravenous hydration, oxygen therapy, and empirical antibiotics (ceftriaxone plus metronidazole). Additionally, 2 pig-tail catheters were inserted to drain the effusion. On hospital day 2, because the patient's fever had worsened and she complained of pleuritic chest pain, video-assisted thoracoscopic surgery was performed. During surgery, after dissecting thickened and adhesive pleura, a foul-smelling fluid sac was found in posterior pleura; 1,000 mL of a puru-

lent fluid was drained and the remaining cavity was irrigated. On hospital day 4, *C. perfringens* was identified in this fluid, and treatment with antibiotics for *C. perfringens*, which was sensitive to clindamycin ensued. A total of 930 mL of empyema was removed over the following few days, during which the fever and chest pain eased and pulse and respiratory rates decreased. Serial chest roentgenograms demonstrated continuous clearance of the effusion without parenchymal consolidation (Fig. 3). The patient was discharged with almost a fully recovered status at 25 days post-admission.

DISCUSSION

We present a rare case of empyema caused by *C. perfringens* infection unrelated to an iatrogenic cause or injury. The case shows that *C. perfringens* should be considered a potential causative organism, during the diagnosis and treatment of empyema.

The clostridium genus is composed of anaerobic, gram-posi-



Fig. 1. Chest radiograph showing increased opacity in the left lower lung field.

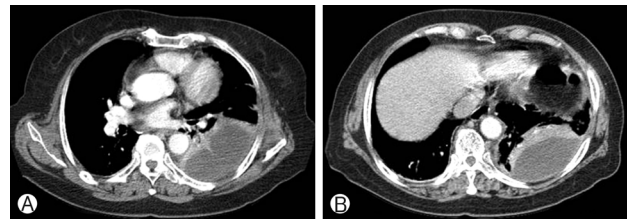


Fig. 2. Chest computed tomography scan showing loculated pleural effusion and passive atelectasis in the left upper (A) and left lower (B) lung fields.



Fig. 3. Chest radiograph showing the near clearance of effusion.

tive rods that are capable of forming endospores. *Clostridium* species are commonly found in soil and marine sediments and in human and animal intestinal tracts [5]. They can cause diseases that are toxin-mediated, such as, antibiotic-associated colitis and food-borne botulism, invasive infections, such as, bacteremia or clostridial myonecrosis, or other suppurative infections caused by the production of histotoxins and enzymes that devastate soft tissues [6]. Although *Clostridium* species rarely infect pulmonary structures, they can infect oral microflora or the aspiration of stomach contents [1]. Furthermore, *C. perfringens* may infect the pleural space in association with iatrogenic causes or injuries [7]. Empyema is a condition caused by the collection of pus in the pleural space, and the pre-dominantly associated microorganisms are *Streptococcus milleri*, *Staphylococcus aureus*, and *Enterobacteriaceae* [6]. *C. perfringens* rarely cause empyema because clostridia species are present in normal gastrointestinal flora [6]. Open wound contamination by *Clostridium* and anaerobic cellulitis are major mechanisms of clostridial infection, but recent trauma, chest surgery or other invasive procedures, and underlying lung disease are risk factors of clostridial empyema [8]. However, spontaneous empyema due to *C. perfringens* is extremely rare, and thus, few cases have been reported in the literature [9]. A laboratory-based surveillance of nearly 1 million residents in Alberta, Canada over 3 consecutive years failed to identify any case of *C. perfringens* empyema [7].

A review of the literature revealed that the risk of contracting an invasive *C. perfringens* infection, including empyema, increases with age [9]. Clostridium infections of the pulmonary system have a mortality rate of 30%, but proper antibiotics and drainage lower the risk of mortality [2]. Similar to other forms of empyema, treatment methods for clostridial empyema include drainage and appropriate antibiotics, and in cases of *C. perfringens* infection a combination of penicillin and clindamycin is used.

Our patient was unique in some respects. First, the disease developed spontaneously without intestinal damage, and the patient was not immunocompromised or susceptible to infection. Second, the only risk factor in our patient was old age, which has been reported to markedly increase the risk of acquiring invasive *C. perfringens* [7]. Furthermore, our patient had no history of underlying lung disease, chest trauma,

pulmonary embolism, tuberculosis, diabetes, subdiaphragmatic infections, or aspiration, or of having undergone a procedure on her pulmonary structure. In addition, there was no significant preceding intra-thoracic abnormality, as confirmed by chest X-ray and CT, and no aspiration event occurred during hospitalization. These findings support the notion that an advanced age increases the risk of contracting an invasive *C. perfringens* infection.

In conclusion, we report a rare case of clostridium empyema, in which the only identified risk factor was age. Clinicians and microbiologists should be aware of the details of clostridium empyema to ensure the disease is adequately treated. Mortality due to pleuropulmonary *C. perfringens* infections can be as high as 30%, but appropriate antibiotics and drainage reduce this risk [2]. The described case cautions that increased awareness of *C. species* infection is necessary in the elderly.

REFERENCES

1. Mandell GM, Bennett JE, Dolin R. Mandell, Douglas, and Bennett's principles and practice of infectious diseases. 7th ed. Philadelphia: Churchill Livingstone/Elsevier; 2010. p. 1303-8.
2. Patel SB, Mahler R. Clostridial pleuropulmonary infections: case report and review of the literature. *J Infect* 1990;21:81-5.
3. Spagnuolo PJ, Payne VD. Clostridial pleuropulmonary infection. *Chest* 1980;78:622-5.
4. Kim TN, Lee YH, Chung JC, Kim CS. Clinical study of empyema thoracis. *Yeungnam Univ J Med* 1986;3:87-94.
5. Streifler J, Pitlik S, Dux S, Garty M, Rosenfeld JB. Spontaneous bacterial pleuritis in a patient with cirrhosis. *Respiration* 1984; 46:382-5.
6. Maskell NA, Batt S, Hedley EL, Davies CW, Gillespie SH, Davies RJ. The bacteriology of pleural infection by genetic and standard methods and its mortality significance. *Am J Respir Crit Care Med* 2006;174:817-23.
7. Jackson S, Gregson DB, McFadden S, Laupland KB. Clostridium perfringens pleuropulmonary infection and septic shock: case report and population-based laboratory surveillance study. *Scand J Infect Dis* 2003;35:883-6.
8. Palmacci C, Antocicco M, Bonomo L, Maggi F, Cocchi A, Onder G. Necrotizing pneumonia and sepsis due to Clostridium perfringens: a case report. *Cases J* 2009;2:50.
9. Albuquerque A, Macedo G. Spontaneous bacterial empyema in a cirrhotic patient due to Clostridium perfringens: case report and review of the literature. *Gastroenterol Hepatol* 2013;36: 69-71.