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Case report

Effective pharmacotherapy for lung abscess in a patient with alcoholism

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1. Introduction

Alcohol-related diseases are among the most burdensome diseases worldwide [1], and alcohol abuse is a leading risk factor for lung abscess [2]. Immunosuppressed patients, including patients with alcoholism, are frequently infected with aerobic pathogens, particularly *Klebsiella pneumoniae*, that cause bacterial lung abscess. Consequently, these patients experience increased morbidity and mortality. Lung abscess is a continuous process of necrosis of pulmonary parenchyma, which may be caused by a range of pathogens, but mostly due to bacterial infection. Lung abscess is also called necrotizing pneumonia or lung gangrene. Most community-acquired bacterial lung abscesses are caused by anaerobic pathogens, however in Taiwan, *Klebsiella pneumoniae* is the most commonly isolated pathogen and diabetes mellitus is an important risk factor [2]. Effective antibiotic therapy is the best means of reducing treatment duration and managing medical costs. However, prompt prescription of effective antibiotics to alcoholic patients with lung abscess remains a challenge.

2. Case report

A 39-year-old Taiwanese male painter had a history of alcohol consumption (approximately 90 units of alcohol per week for more than 6 years) and smoking (30 pack-years), but no illicit drugs use. Initially, he was brought to our hospital on 31 August 2018 with hemoptysis, yellowish thick sputum, a retrosternal burning sensation, and a 2-month history of progressive cough. No fever, chest pain, dyspnea, or tarry stool was found. He denied any previous medical history and he also denied previous travel history. At the emergency department, physical examination revealed a heart rate of 102 beats per minute, blood pressure of 133/82 mm Hg, respiratory rate of 20 breaths per minute, oxygen saturation of 89% on room air, and temperature of 37.0° Celsius. There was no lymphadenopathy or splenomegaly. There were left lower lung crackles on chest auscultation, and the neurological examination was normal. A chest radiograph showed a cavitary lesion in the left lower lung area (Fig. 1A). Chest high-resolution computed tomography revealed a cavitary mass with air–fluid level over the left upper and lower lobes (Fig. 1E); therefore, lung abscess was diagnosed. For community acquired pneumonia, these are many types of pathogens which could induce pneumonia with parenchymal cavitary lesion, including Gram negative bacteria such as *Klebsiella pneumoniae* and *Haemophilus influenzae*, Gram positive bacteria such as *Staphylococcus aureus* including methicillin-resistant *Staphylococcus aureus* (MRSA) and *Streptococcus pneumoniae*, atypical bacteria such *Mycoplasma pneumoniae* and *Legionella pneumophila*, pulmonary tuberculosis, fungal infection, and parasite infection. The patient was admitted to our ward on 31 August 2018. The initial white blood cell (WBC) count was 10.33 × 1000/μL, C-reactive protein was 97.8 mg/L, and eosinophilic percentage was about 0.8%. Based on the laboratory data, bacterial infection was suspected. In addition, due to previous alcoholism history, Gram negative bacterial infection was highly suspected, especially *Klebsiella pneumoniae* [2]. According to 2019 American Thoracic Society (ATS) and Infectious

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Diseases Society of America (IDSA) for pneumonia treatment guide suggestion [3], β-lactam with fluoroquinolone combination therapy is considered as a standard regimen for severe inpatient pneumonia. In our patient, the chest CT revealed lung abscess lesion over the left upper and lower lobes. Lung abscess is a relatively more severe pattern of pneumonia. In addition, the patient had used to drink alcohol for a long time, and immunocompromised status should be considered. According to ATS & IDSA guideline, combined treatment with Curam (amoxycillin + clavulanate potassium) and levofloxacin should be suitable in this situation.

Therefore, we prescribed intravenous amoxicillin 1000 mg/clavulanic acid 200 mg every 8 hours and levofloxacin 750 mg per day for initial treatment. The serum mycoplasma IgM titer was 0.443 OD ratio which excluded mycoplasma infection. In addition, three sets of tuberculosis acid fast stains showed negative results on 04 September 2018 afternoon, and therefore pulmonary tuberculosis infection was excluded. The sputum culture report became available on 03 September 2018, and confirmed *Klebsiella pneumoniae* infection, which was sensitive to all of the antibiotics except ampicillin. Besides, chest radiograph on 6 September 2018 showed persistent cavitary lesion with newly developed peripheral infiltration at left lower lung field (Fig. 1B). Therefore, we changed the antibiotics from amoxicillin/clavulanate to inhaled colimycin (colistin base 2MU (66.8 mg) = 2.0 MIU colistimethate sodium (CMS) (160 mg/vial)) every 8 hours [4], but we

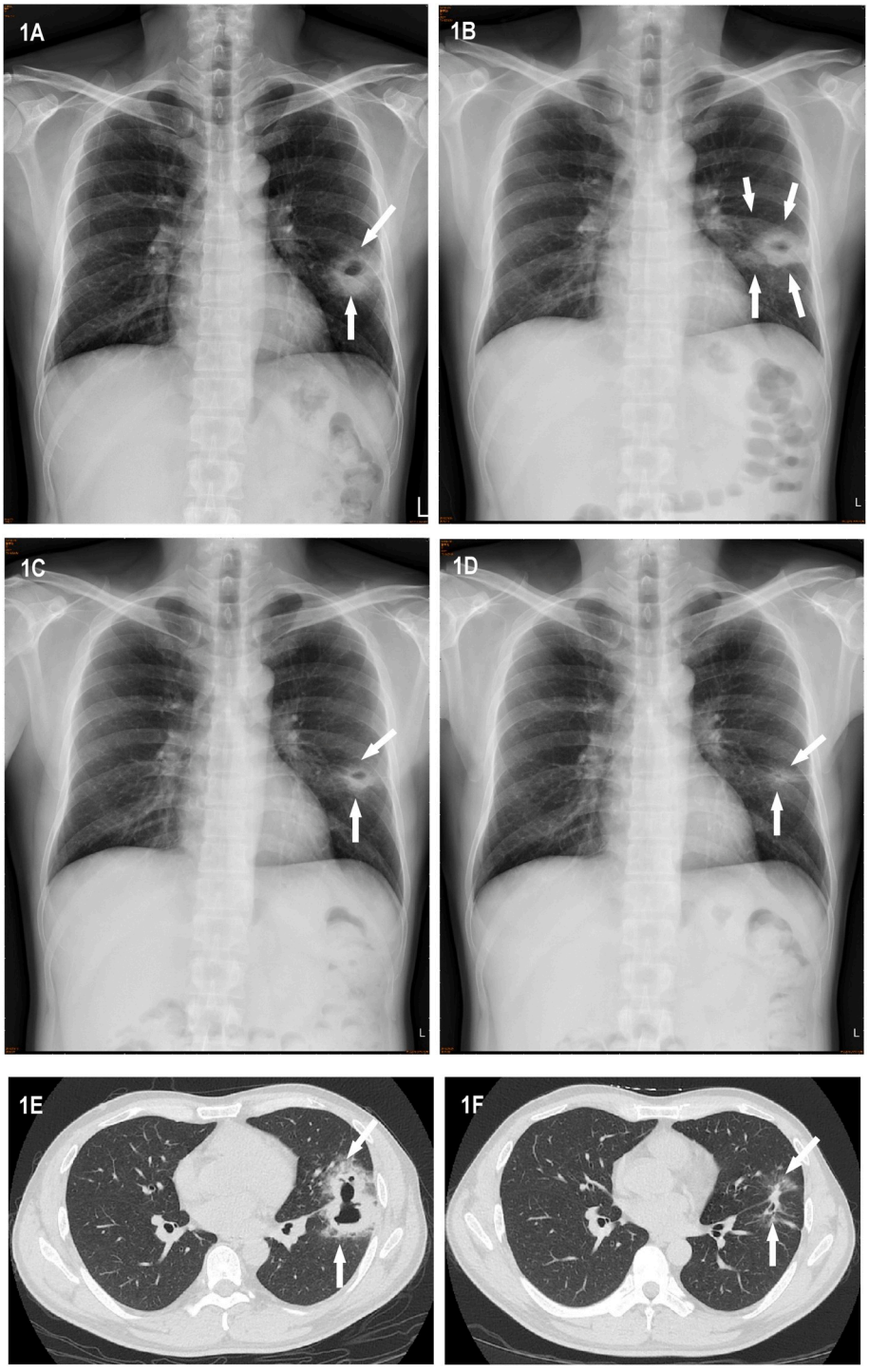

Fig. 1. Imaging study from an alcoholic patient with lung abscess between on admission and after discharge.
Panel 1A shows the result of chest radiograph when admission on 31 August, 2018, a cavitary lesion in the left lower lung field.
Panel 1B shows the result of chest radiograph on 6 September, 2018, a cavitary lesion with peripheral infiltration at left lower lung field.
Panel 1C shows the result of chest radiograph on 13 September, 2018, both of the cavitary lesion and peripheral infiltration at left lower lung field were improved.
Panel 1D shows the result of chest radiograph after 21 days of treatment with inhaled colimycin and intravenous levofloxacin when discharge on 29 September, 2018, a residual lesion noted in the left lower lung field.
Panel 1E shows the result of chest high-resolution computed tomography when admission on 31 August, 2018, a cavitary lesion involved both left upper and lower lobes of lung.
Panel 1F shows the result of chest high-resolution computed tomography after discharge on 19 October, 2018, cavitary lesion dramatically improved.

retained levofloxacin as a synergistic agent for severe pneumonia treatment. The patient's chest radiograph on 13 September 2018 showed both the cavitary lesion and peripheral infiltration at left lower lung field had improved one week after change of antibiotics (Fig. 1C), and the lung lesions were almost completely resolved after four weeks of treatment (Fig. 1D and F).

3. Discussion

Lung abscess is a cavitary lesion that contains lung tissue necrotic debris and fluid and is caused by severe microbial infection, mostly due to bacterial infection. Other etiologies, such as malignancies, rheumatologic diseases, and miscellaneous diseases, should be excluded prior to confirmation of diagnosis. Based on symptom duration ($\geq$or $<$ 4–6 weeks), lung abscesses can be divided into acute and chronic diseases. Primary abscesses (60%) result from existing lung parenchymal processes, often related to aspiration of oral material, poor oral hygiene, dental diseases, alcoholism, drug addiction, or poor consciousness. Secondary abscesses typically result from different infectious processes, such as vascular emboli and rupture of extrapulmonary abscesses into the lung [5]. Immunosuppressed individuals, such as patients with alcoholism, are frequently infected with aerobic pathogens, especially *K. pneumoniae*, that induce bacterial lung abscess; such patients thus experience increased morbidity and mortality [2]. Primary lung abscess can be treated with broad-spectrum antibiotics, and the corresponding mortality rate is less than 10%. However, secondary lung abscess has a far poorer prognosis and a relatively high mortality rate, which may be as high as 75%, even with adequate antibiotics therapy. External drainage of lung abscess was performed in 11%–21% of patients after failure of antibiotics therapy [6], and approximately 10% of patients with lung abscess required surgical intervention [7]. Due to poor drug concentration at the lung abscess site, typical antibiotics, including intravenous colistin, are used for at least 4–6 weeks, particularly in complicated cases. Therefore, it is important to shorten hospital days, reduce admission cost, increase treatment efficacy, and avoid pig-tail drainage or surgical intervention in patients with lung abscess. Inhaled colistin is not only effective against multidrug-resistant Gram--negative bacterial infections [8] such as those induced by K. pneumonia, but is also beneficial in minimizing systemic exposure and toxicity [4,9,10]. The pharmacokinetic and pharmacodynamic profile of aerosolized Colistin has already been well established [11]. Studies have revealed a high drug concentration in sputum after use of inhaled colistin CMS (2 MIU), with peak lung tissue concentrations significantly higher in the lung parenchyma after nebulization therapy [9,10]. The drug concentration in epithelial lining fluid (ELF) is critical for treatment efficiency. In rat animal models, about 1800 times higher drug concentration was found in bronchoalveolar lavages following inhaled colistin than in unbound plasma following intravenous dripping, after 2 hours [12]. However, for hospital acquired pneumonia, inhaled colistin combined with systemic antibiotics should be considered [13]. A study for antibiotics effect on *Pseudomonus aeruginosa* within the first 4 h of growth showed that the synergistic effect between levofloxacin and imipenem is 55.3% and levofloxacin and colistin is 90.9% [14]. Another study also showed a synergistic or additive effect between colistin and levofloxacin in vitro and in vivo against colistin-susceptible A. baumannii strains [15]. Aerosolized colistin therapy as an adjunct to systemic treatment appears promising [16], and shows less toxicity than previously reported [17], such as neurotoxicity and nephrotoxicity. Therefore, we retained levofloxacin for a synergistic effect rather than intravenous colistin.

4. Conclusion

Patients with alcoholism are frequently infected with aerobic pathogens, particularly *Klebsiella pneumoniae*, that cause bacterial lung abscess. Our patient is relatively immunosuppressed due to long term alcoholic consumption. He had developed a lung cavitary lesion over the left upper and lower lobes, this degree of lesion to the surrounding tissue is impossible for successful abscess drainage, and antibiotic penetration is greatly reduced due to extensive fibrosis. Adequate and effective antibiotics treatment is very important. We suggest that adding inhaled colistin as soon as possible is crucial for the management of Gram-negative bacteria (GNB) lung abscess.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.rmcr.2020.101061.

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