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Case Report

Fungal pneumonia manifesting as cavitary lesions in a critically ill elderly patient

Wei Yang[1]*, Yixin Ma[1]*, Jieyu Wang[1], Yun Li[1], Yaxin Zhang[1], Tong Zhang[1]

[1] *Department of Geriatric Medicine, Xuanwu Hospital, Capital Medical University, Beijing, China*

* Both Authors contributed equally to this work.

Abstract

Elderly patients with fungal pneumonia experience higher mortality and are more likely to be misdiagnosed. The diagnosis and treatment of fungal pneumonia in elderly patients is challenging. We herein present a clinical case of pulmonary fungal infection (PFI) manifesting as cavitary lesions in an 85-year-old male with multiple organ failure. Broad-spectrum antibiotics showed unsatisfactory result in this case. Computed tomography (CT) of the chest showed multiple pulmonary cavities with gas-fluid levels in the right upper and middle lobe, and patchy blurred shadows in the lower lobe. The diagnosis of fungal pneumonia was made after ruling out other causes of fever. The patient showed good response to anti-fungal treatment. Physicians must consider the possibility of fungal pneumonia in elderly patients who do not respond to antibiotic treatment after exclusion of immune response, tumor, tuberculosis, and other systemic infections.

Key words: elderly; fungal; pneumonia; cavity.

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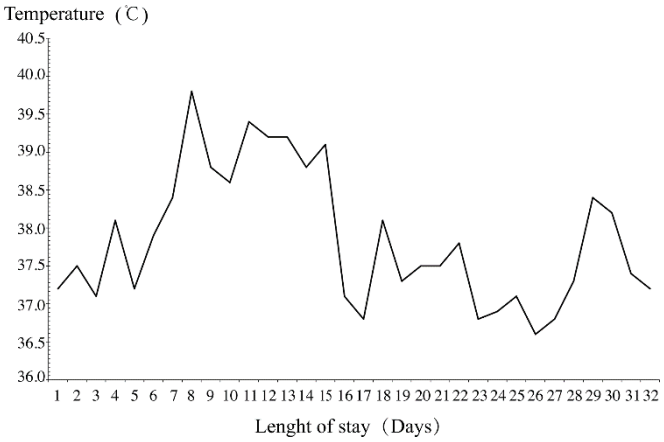
Introduction

Pneumonia is a leading cause of death in the elderly population [1]. Elderly patients with fungal pneumonia experience higher mortality and are more likely to be misdiagnosed than their younger counterparts [2]. We herein present a clinical case of pulmonary fungal infection manifesting as cavitary lesions in a critically ill elderly patient with multiple organ failure. Since the diagnosis and therapy of fungal pneumonia in elderly patients are very challenging, we aim to draw the attention of physicians to PFI in elderly patients manifesting as cavitary lesions.

Case Presentation

An 85-year-old man was admitted to the hospital with acute cerebral infarction and a history of intermittent fever since 2 months. The patient had a medical history of diabetes, coronary heart disease, pulmonary tuberculosis, and rectal carcinoma with metastasis. He had received chemotherapy for rectal carcinoma; however, the therapy was terminated due to intolerance. *Pseudomonas aeruginosa* and *Stenotrophomonas maltophilia* were found in the sputum culture. The patient had been treated with broad-spectrum antibiotics for pneumonia including moxifloxacin (MXF), etimicin, meropenem (MEM), vancomycin (VA), linezolid (LNZ), fluconazole (FLU), ciprofloxacin (CIP), and piperacillin-tazobactam sodium (TZP) based on the antimicrobial susceptibility tests. However, the body temperature continued to persist between 38°C and 39.8°C during hospitalization after antibiotic treatment (Figure 1). The fever lasted for more than 20 days, and the patient showed progressive symptoms of cough and altered consciousness. Laboratory tests revealed white-blood cell count (WBC) of $17.23*10^9$/L, neutrophil percentage (N %) 95.4%, C-reactive protein (CRP) 238.0 mg/L, and procalcitonin (PCT) 0.466 ng/mL. Multiple attempts to identify the pathogen were unsuccessful, including tests for acid-fast bacilli, tuberculin, autoantibodies, 1,3-β-D glucan antigen (G test), and galactomannan antigen (GM test). No positive results were found on urine and stool culture. Arterial blood gas analysis showed respiratory failure (type 1). The patient developed multiple organ failure including heart, liver, and kidney dysfunction, deep venous thrombosis and gastrointestinal bleeding. Computed tomography of the chest showed multiple pulmonary cavities with gas-fluid levels in the right upper and middle lobe, and airspace opacity and patchy blurred shadows in the

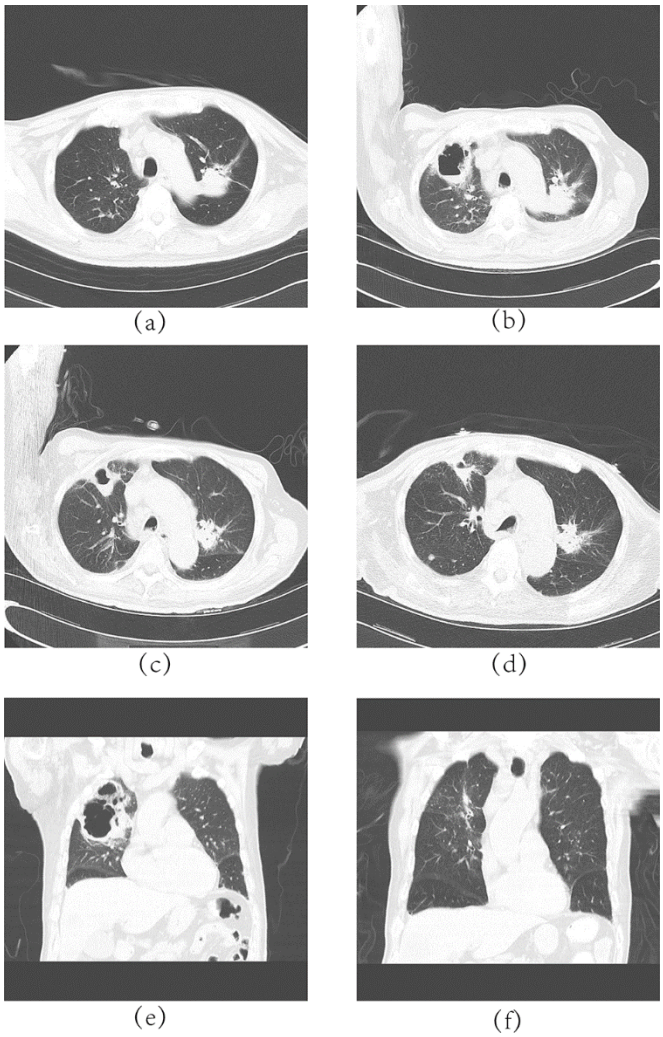
Figure 1. Changes of body temperature.



lower lobe (Figure 2). The patient did not receive deep venous catheterization or catheters during hospitalization.

This elderly patient had multiple underlying diseases and did not respond to broad-spectrum antibiotic therapy. The patient was confined to bed for a long time. He had cancer metastatic lesions in multiple organs and diabetes mellitus, which made him susceptible to fungal infections. Fungal pneumonia in this case was a diagnosis of exclusion which was made after ruling out fever caused by immune response, tumor, tuberculosis, and other systemic infections. During hospitalization, no acid-fast bacilli were found in sputum. Tuberculosis antibody, T-SPOT, and tuberculin test were all negative. There were no specific imaging findings of tuberculosis such as diffuse bronchial foci and satellite foci on chest CT scan. The patient's condition continued to deteriorate despite the use of linezolid. Therefore, tuberculosis-related fever was excluded. The negative results of anti-cardiolipin antibody, anti-neutrophil cytoplasmic antibody, and anti-nuclear antibody spectrum excluded immune-related diseases. There was no possibility of catheter-related infection. Similarly, culture of urine and feces excluded urinary system or digestive system infection. The diagnosis of fungal infection was made based on CT findings, clinical manifestations, and the response to anti-fungal treatment according to the EORTC-MSG [3] criteria 2008. Therefore, CIP, tazocin, and caspofungin were used to treat pneumonia. Symptomatic treatment including oxygen therapy, anti-cough therapy, anticoagulation therapy, cholesterol-lowering therapy, and hemostatic therapy were also administered. Mechanical ventilation was not used during the treatment. The patient showed good response to treatment. Blood gas analysis, and liver and kidney function were restored to normal. Heart and pulmonary function were remarkably improved. Levels of WBC, N%, CRP and PCT decreased significantly. The dimensions of lung cavity lesions on chest CT were markedly reduced. However, the patient still had low-grade fever after treatment for 2 months. *Pseudomonas aeruginosa* and *Enterobacter cloacae* were isolated in a recent sputum culture. Cefepime (FEP), amikacin (AMK), and oral voriconazole (VOR) were prescribed as anti-infective therapy.

Figure 2. Chest Computed tomography images during hospitalization.



(a) The axial planes of chest CT scan image showing a single conglomerate shadow of the left upper lobe on admission. (b) During the infection process, new patchy shadows and cavity formation can be seen in the upper and middle lobes of the right lung, the conglomerate shadow of the left upper lobe remains unchanged. (c) After using Caspofungin therapy, the disease of right lung was obviously shrinked. (d) With sequential treatment of Voriconazole, the foci of right lung was gradually absorption. (e) The coronal planes of Figure 2 (b). (f) The coronal planes of Figure 2 (d).

Discussion

Here, we presented a critically ill elderly patient with fungal pneumonia manifesting as cavitary lesions. The patient was admitted to the hospital with acute cerebral infarction and had a history of multiple diseases. Pneumonia, multiple organ failure, deep venous thrombosis, and gastrointestinal bleeding were diagnosed. There are several contradictions to treatment as multiple diseases occurred at the same time. The treatment prescribed based on antimicrobial susceptibility test is frequently not effective. The aim of this case report is to discuss the diagnosis and treatment of fungal infection with pulmonary cavity lesions.

Cavitary lesions are one of the most commonly observed pathological changes in pulmonary diseases; these may be caused by infection, tumor, or pulmonary vascular diseases [4]. Several pathogens can cause pulmonary infection including bacterial, fungal, and acid-fast bacilli. In our patient, the diagnosis of PFI was based on medical history, clinical characteristics, and CT findings. Our patient was bedridden for a long time after a cerebrovascular accident. His self-care ablity, self-cough ability, and swallowing function were significantly impaired. Long-term treatment with broad-spectrum antibiotics and cachexia caused by malignant tumor greatly increased the opportunity of invasive fungal infection (IFI) [5-7]. Elderly patients may exhibit atypical symptoms of pneumonia or the symptoms may be masked by other co-morbid conditions. Currently, histopathological biopsy is the gold standard for the diagnosis of invasive pulmonary fungal infection (IPFI) [8,9]. However, the poor condition of elderly patients makes it difficult to perform histopathological tests. Suspicious IPFI is defined as presence of at least one susceptibility factor and at least one clinical feature of pulmonary infection. The patient showed good response to anti-fungal treatment, which was also the evidence of fungal infection.

Several studies have demonstrated the value of G test and GM test for establishing a diagnosis of invasive fungal infection [10-12]. False-negative results of G test can be seen with preventive use of amphotericin B and triazole, bacterial infection caused by cryptococcus or zygomycetes, and in case of localized lesions [13]. Both G test and GM test were negative in our patient. The specificity and sensitivity of G test and GM test in elderly population is not clear. In the present case, the negative results of G test and GM test may be attributable to the immunocompromised condition and anti-fungal treatment. The result may be related to the fact that the inflammatory exudate from fungal infection was confined to the lungs. In addition, preventive treatment with triazole antibiotics may also impact galactomannan antigen levels.

Typical imaging signs such as aspergillus ball or new moon were not seen in chest CT. There was no evidence of fungal pathogen in this case. However, several susceptible factors were identified in this case and tuberculosis, tumor, and immune factors were excluded. Broad-spectrum antibiotics covering all drug-resistant bacteria and anaerobic bacteria had been used to treat the patient for a long time. To summarize, our patient qualified the criteria for suspicious IPFI. The condition of the patient greatly improved after administration of caspofungin and the peak temperature showed a gradual decrease. Levels of WBC, N %, and serum levels of CRP and PCT were markedly decreased. The dimensions of lung cavity lesions on chest CT were significantly reduced. The efficacy of anti-fungal treatment was an additional proof for the diagnosis of fungal pneumonia in this elderly patient.

The diagnosis of fungal infection in this case was challenging as there was no direct evidence of fungal infection. No positive results were found in pathogenic detection tests, G test, or GM test. The patient had several underlying diseases and multiple organ failure, which made the case even more complicated. Eventually, the diagnosis of PFI was established by exclusion and based on the response to anti-fungal therapy. The immunocompromised patient had a history of multiple underlying diseases and had received long-term fluconazole treatment, which are risk factors for fungal infection. In this case, pulmonary cavitary lesions were caused by bacterial and fungal infection. The most likely pathogen was mold [14,15]. Multiple treatment strategies including preventive treatment, empirical therapy, preemptive treatment, and target treatment can be used for fungal infection. Empirical therapy is recommended for unidentified pathogen and broad-spectrum anti-infective drugs with fewer side effects can be useful in this circumstance. The efficacy of voriconazole and caspofungin against candida and aspergillus was shown to be comparable to that of amphotericin B with fewer unexpected side effects [16-18]. In our case, caspofungin was chosen because of its low hepatotoxicity [19].

Conclusions

In conclusion, although fungal infection rarely results in multiple cavitary lesions in the lungs in the elderly population, physicians must consider the possibility of fungal pneumonia in elderly patients who do not respond to antibiotic treatment after exclusion of

immune response, tumor, tuberculosis, and other systemic infections.

Authors' contributions

YW is the guarantor and designer of this project. MYX was mainly responsible for the diagnosis and treatment of this patient. WJY, LY and YW played the role of guidance and supervision in the course of treatment of this case. MYX and ZT collected relevant data in the case. YW, MYX drafted and edited the submitted article. they also participated in the analysis of the case report. All authors provided final approval of the version to be published. All authors contributed toward drafting and critically revising the paper and agree to be accountable for all aspects of the work.

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Corresponding author

Wei Yang
Department of Geriatric Medicine, Xuanwu Hospital, Capital Medical University, NO.45 Changchun Street, Beijing 100053, China
Tel: +86-13811491528
Fax: +86-13811491528
Email: yangw_79@163.com

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