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Metagenomic Second-generation Sequencing and Clinical Analysis of Severe Pneumonia Caused by Chlamydia Psittaci

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Abstract

Parrot hot chlamydia pneumonia is caused by parrot chlamydia para (Chlamydia psittaci) infection of a lung disease, this study reported a patient with fever cough with headache, using metagenomic second generation sequencing technology and combined with birds contact history of parrot hot chlamydia after severe pneumonia, describe the characteristics of patient cases and by consulting the latest relevant literature at home and abroad, make treatment plan, give moxifloxacin improved after treatment.

Keywords

Parrot fever; Chlamydia parsitaris; Severe pneumonia

Introduction

Psittacosis [1] is a zoonotic infectious disease caused by Chlamydia psittaci. It is usually transmitted through the respiratory tract via contact with Chlamydia psittaci aerosols or secretions, with birds being the primary epidemiological hosts [2,3]. Chlamydia psittaci (EB) is a Gram-negative, obligate intracellular bacterium that is transmitted between mammals and birds [4]. Chlamydia psittaci infects the lungs through direct interaction with surface microvilli, causing pneumonia [5,6]. A 2022 study in China used combinatorial molecular techniques to identify the pathogen in cases of severe community-acquired pneumonia, and found that 6.8% of patients were infected with Chlamydia psittaci [7]. Clinically, the onset of the disease is usually sudden, and in addition to fever, myalgia, nausea, vomiting, diarrhea, and cough, headache is considered the most prominent symptom. In addition, the disease can affect multiple organs and systems, including the nervous system, digestive system, and hematopoietic system. Clinically, the main treatment for psittacosis is tetracycline antibiotics (such as doxycycline) or fluoroquinolones (such as fluconazole) [8]. In addition, for patients diagnosed with psittacosis pneumonia, certain isolation measures may be required to prevent the spread of the pathogen to others [5]. This study reports the diagnosis and treatment of a case of severe pneumonia caused by Chlamydia psittaci infection, aiming to provide assistance for future related research and clinical treatment.

1. Case Data

The patient, a 64-year-old female, was admitted on October 15, 2023, with the chief complaint of "intermittent fever with cough, sputum, and headache for 10 days." She reported developing fever 10 days prior after fatigue, with a

Note: The article was originally published in *International Journal of Clinical Research*, and this is an authorized translation of it.

maximum temperature of 40.5℃, accompanied by cough, yellow, sticky sputum, and general muscle aches and weakness. Physical examination revealed: temperature (T) 38.5 ℃, heart rate (HR) 90 bpm, respiratory rate (RR) 20 breaths /min, blood pressure (BP) 120/80 mmHg; she was alert, with normal heart sounds and a regular rhythm; coarse breath sounds and audible moist rales in both lungs. A chest CT scan performed at a local hospital on October 10, 2023, showed: infectious lesions in the left lobe and right middle and lower lobes; calcification in the right upper lobe; and a small amount of pleural effusion on the left side. On October 14, 2023, our hospital's emergency department blood routine test and nucleated red blood cell count showed: White blood cell (WBC) 9.86×10⁹/L; Neutrophils () 8.63×10⁹/L; Hemoglobin: 114.00g/L; Platelet count 229.00×10⁹/L; C-reactive protein (dry calcification) >90.0mg/L; Interleukin 636.200pg/ml; Procalcitonin 0.42ng/mL; Serum amyloid A 256.29mg/L. Partial pressure of carbon dioxide (pCO_2) mmHg; Partial pressure of oxygen (pO_2) 64.8mmHg; Preliminary diagnosis: "Pulmonary infection".

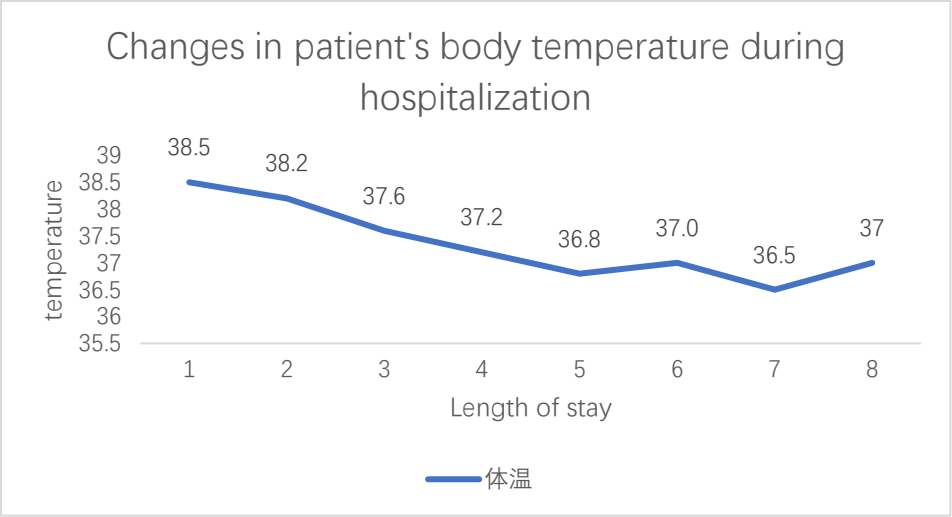

Figure 1. Patient's temperature record during hospitalization.

Treatment Course: After admission, the patient underwent further examinations, including a chest CT scan (October 15, 2023) (Figure 2): 1. Large patchy consolidation in the right upper lobe, suggestive of an infectious lesion (possibly lobar pneumonia). 2. Multiple patchy, flocculent, and nodular exudates in the right upper and lower lobes and left lower lobe, suggestive of an infectious lesion. 3. Bilateral pleural effusion, complicated by distal discoid atelectasis in both lower lobes. Bedside echocardiography: Aortic sclerosis; Laboratory tests: N-terminal B-type natriuretic peptide pre-test 553.00 ng/L; Emergency urine sediment quantitative analysis + emergency urine ten-item analysis: urine glucose positive (2+); blood glucose lactate (drying): glucose 11.11 mmol/L. Based on the patient's physical signs and auxiliary examination results, the patient was given 0.40g of moxifloxacin hydrochloride sodium chloride injection intravenously (moxifloxacin is a broad-spectrum quinolone drug with strong activity against Gram-positive bacteria, broad activity against Gram-negative aerobic bacteria, and good antibacterial activity against anaerobic bacteria and most atypical pneumonia pathogens). Due to the patient's obesity (BMI: 30), VTE risk score of 2, and elevated blood glucose, classifying them as a high-risk group for venous thrombosis, prophylactic enoxaparin sodium injection 0.40ml was administered subcutaneously, and glycated hemoglobin was rechecked. For the patient's elevated D-dimer and other coagulation indicators, a bilateral lower extremity vascular ultrasound was performed. Treatment included nebulized inhalation of 1mg of Prozac + 4ml of sodium chloride injection; and symptomatic treatment such as cough suppression and expectoration with 100ml of 0.9% sodium chloride injection (prepared intravenously) + 30mg of ambroxol hydrochloride injection. On October 16, 2023, an electronic bronchoscopy was performed (see Figure 3). All bronchi were patent, but the mucosa of the left upper lobe bronchus and left lower lobe bronchus was congested, leading to a diagnosis of "bronchial inflammation." A biopsy of the anterior end of the right upper lobe was performed, and the lavage fluid was sent for cytological examination and a brush sample for tuberculosis testing. After admission, laboratory tests for six upper respiratory tract nucleic acids and nine respiratory pathogens, as well as tuberculosis smear examination, were all normal. On October 17, 2023, the bronchial aspirate microbiological examination showed "no fungal growth." On October 18, 2023, the bronchoalveolar lavage fluid

mNGS result showed the detection of *Chlamydia psittaci*, with a sequence number of 97 and a relative abundance of 0.03%. Further questioning revealed that the patient had been raising parrots for over five years. Considering the confirmed diagnosis of "Chlamydia psittaci pneumonia," the patient was placed in single-room isolation for treatment. On October 19, 2023, the patient's body temperature returned to normal, and the cough and sputum production improved compared to the previous day, indicating that the anti-infective treatment was effective. The current anti-infective treatment was continued. On October 20, 2023, a follow-up chest CT scan (see Figure 4) showed multiple patchy and nodular exudates in both lungs, with partial consolidation in the upper lobe of the left lung, suggestive of an infectious lesion, an improvement compared to the scan on October 14, 2023. Bilateral pleural effusion decreased. Before discharge, all infection indicators were normal, meeting the discharge criteria. The confirmed discharge diagnosis was: 1. Severe pneumonia (upper left, lower left); Chlamydia psittaci infection. The patient was discharged on October 23, 2023.

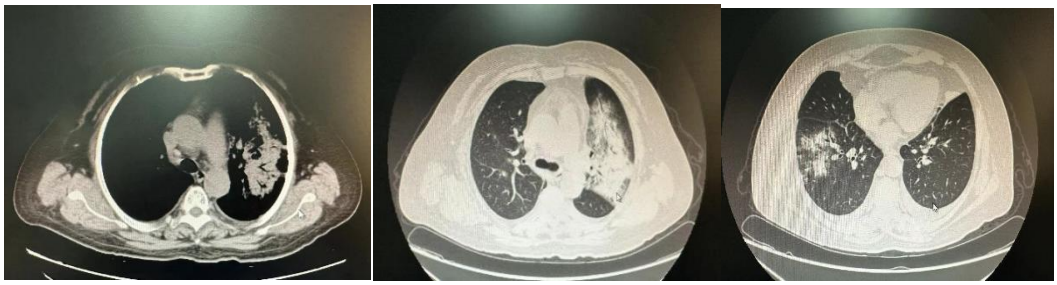

Figure 2. Chest CT image of the patient upon admission on October 15, 2023.

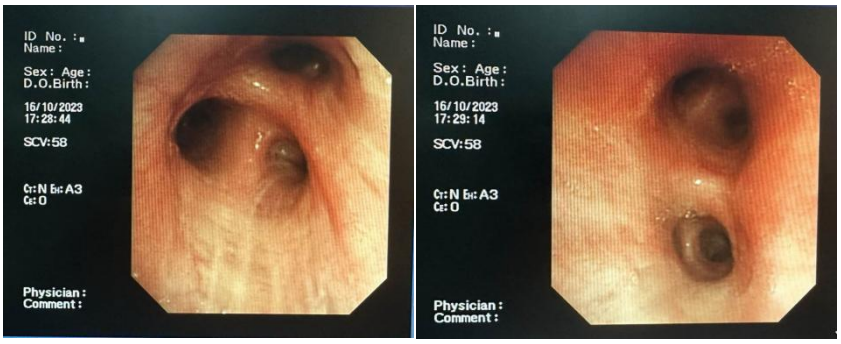

Figure 3. Bronchoscopy image of the patient on October 16, 2023.

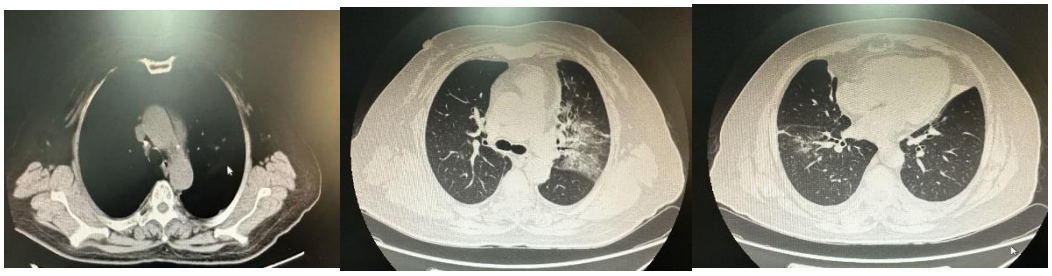

Figure 4. Chest CT scan image from a follow-up examination on January 20, 2023.

2. Discuss

An infectious disease caused by Chlamydia psittaci. The severity of human psittacosis ranges from mild flu-like symptoms to life-threatening severe pneumonia [9]. Because psittacosis pneumonia is not common in clinical practice and Chlamydia psittaci is not commonly used in traditional microbiological diagnosis, human psittacosis is often underestimated, underdiagnosed, and misdiagnosed [10]. Patients infected with Chlamydia psittaci usually have an acute onset, presenting with chills, headache, sore throat, and other discomfort. Typical clinical manifestations include atypical pneumonia, dry cough, small amount of sticky sputum, sometimes rusty sputum. Severe cases can involve the cardiovascular and nervous systems, manifesting as myocarditis, endocarditis, meningitis, and

encephalitis [11, 12]. Imaging examinations show single or multiple consolidation shadows in the lungs. Laboratory examinations show: mild increase in white blood cells, significantly increased C-reactive protein, significantly increased D - dimer level and procalcitonin level, and electrolyte disturbances [4, 13]. Metagenomic sequencing refers to high-throughput sequencing of the entire pathogen genome in a specific environmental sample. This method can quickly, accurately and efficiently obtain the genomic information of the entire pathogen population [14]. Metagenomic sequencing does not depend on the isolation and culture of pathogens and can obtain information on pathogens with low abundance or even trace amounts in the environment [15]. In recent years, metagenomic sequencing has been increasingly applied to medical research and clinical diagnosis, such as infection type diagnosis, identification of resistance genes and prevention and control of infectious diseases [16]. Therefore, metagenomic sequencing has also become the clinical gold standard for diagnosing Chlamydia psittaci. The first-line treatment for Chlamydia psittaci pneumonia in the guidelines is quinolone antibiotics or tetracycline antibiotics, and the duration of treatment is usually 10 to 14 days [10].

In this study, the patient had a 5-year history of keeping parrots. In addition to characteristic pneumonia symptoms such as fever, cough, and sputum, the patient also experienced persistent headache and generalized muscle pain. The patient's physical examination and various auxiliary examinations were consistent with a diagnosis of "community-acquired symptomatic pneumonia." A bronchoalveolar lavage fluid mNGS report dated October 18, 2023, indicated a positive result for *Chlamydia psittaci*, therefore, moxifloxacin, a quinolone antibiotic, was selected for treatment. The patient 's own symptoms were also an important indicator for observing treatment efficacy. After symptomatic treatment with moxifloxacin, the patient's headache, cough, and muscle pain significantly improved. Auxiliary examinations are also essential evaluation indicators; imaging examinations allow us to directly observe the patient's physical condition. From the lung imaging findings, post-treatment lung CT showed a significant reduction in bilateral pleural effusion, and the infectious lesions were significantly improved compared to before treatment.

There are very few reports on psittacosis-related chlamydia pneumonia at home and abroad, partly because its incidence is very low, and partly because it is difficult to diagnose, with a high rate of misdiagnosis and missed diagnosis [17]. In our patients, only psittacosis chlamydia was found in the mNGS of bronchoalveolar lavage fluid, with a sequence length of 97. Some articles have reported that psittacosis chlamydia can not only cause lung infection when it invades the human body, but can also spread in the patient's body, leading to fulminant systemic disease [18]. Some literature has also reported that psittacosis chlamydia first enters the reticuloendothelial cells of the liver and spleen to proliferate, and then enters the lungs and other organs through the bloodstream [19]. Therefore, human psittacosis is a systemic infection that mainly affects the respiratory system. After our patients were diagnosed with psittacosis chlamydia pneumonia, their physical signs, auxiliary examinations and lung CT findings improved after symptomatic treatment. Quinolones and tetracycline antibiotics are the first-line drugs for the treatment of psittacosis chlamydia pneumonia. A retrospective study [20] reported that 41 patients with severe psittacosis were treated with quinolone drugs, of whom 29 failed the initial treatment, but 6 patients improved after quinolone monotherapy. These results indicate that quinolone drugs are effective in treating psittacosis and can be used to treat severe psittacosis pneumonia. However, it should be noted that some patients may have drug resistance and treatment failure. According to Kong et al. [9], two patients with severe psittacosis pneumonia did not respond to initial treatment with moxifloxacin, but improved after switching to tigecycline. This finding suggests that tigecycline can be used as an alternative treatment for severe psittacosis pneumonia.

In summary, Chlamydia psittaci pneumonia is a serious infectious disease with diverse and nonspecific clinical symptoms. mNGS pathogen detection is a promising method. In clinical practice, when encountering patients with high fever, cough, and headache, the possibility of Chlamydia psittaci pneumonia should be considered. If possible, mNGS pathogen detection should be performed as soon as possible to prevent the patient's condition from worsening, to facilitate the implementation of a correct and specific treatment plan, to shorten the course of the disease, and to improve prognosis.

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