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CASE REPORT

Case Report of Severe *Chlamydia psittaci* Pneumonia Treated with Omadacycline

Yan Chen[1], Jiahuan Tong[2], Jianfeng Wang[2]

[1]Department of General Practice, the First Affiliated Hospital of Zhejiang Chinese Medical University (Zhejiang Provincial Hospital of Chinese Medicine), Hangzhou, 310018, People's Republic of China; [2]Department of Respiratory Diseases, the First Affiliated Hospital of Zhejiang Chinese Medical University (Zhejiang Provincial Hospital of Chinese Medicine), Hangzhou, 310018, People's Republic of China

Correspondence: Jianfeng Wang, Department of Respiratory Diseases, the First Affiliated Hospital of Zhejiang Chinese Medical University, 54 Youdian Road, Shangcheng District, Hangzhou, 310018, People's Republic of China, Email 2001m@163.com

Abstract: The clinical severity of *Chlamydia psittaci* infection ranges from asymptomatic to severe pneumonia. Diagnosis poses challenges due to its similarity to other respiratory infections. Treatment includes tetracyclines, macrolides, and fluoroquinolones, with limited evidence on the efficacy of omadacycline. We report a case of an 86-year-old male with severe psittacosis treated with omadacycline, resulting in significant improvement. This highlights the necessity for further research on omadacycline's role in psittacosis treatment.

Keywords: *Chlamydia psittaci*, omadacycline, pneumonia

Introduction

Psittacosis, also known as avian chlamydiosis or parrot fever, is a zoonotic disease caused by *Chlamydia psittaci* infection, affecting both humans and animals. While the pathogen primarily infects birds such as parrots and pigeons, it can also affect humans, leading to a wide range of severity from asymptomatic infection to severe pneumonia requiring mechanical ventilation.[1] Formerly considered rare, psittacosis is increasingly prevalent, comprising approximately 1% of community-acquired pneumonia (CAP) cases and 2.3% of severe CAP cases.[2,3] The mortality rate for psittacosis patients admitted to the ICU can be as high as 15%.[4] Due to its diverse clinical presentations and resemblance to other respiratory infections, diagnosis often poses challenges.

Treatment options for psittacosis include tetracyclines, macrolides, and fluoroquinolones. Omadacycline, a novel 9-aminomethylcycline derivative of minocycline, belongs to the tetracycline family and exhibits broad-spectrum antibacterial activity, including against Chlamydia. Omadacycline exhibits in vitro activity against Chlamydia pneumoniae comparable to that of tetracyclines, macrolides, and fluoroquinolones. It can achieve high concentrations in plasma, epithelial lining fluid, and alveolar cells, suggesting its potential effectiveness in treating pulmonary infections caused by Chlamydia pneumoniae.[5] However, there is currently a lack of extensive clinical data and systematic evaluation regarding the use of omadacycline in psittacosis treatment.[6] Therefore, this case report aims to describe the clinical course of a psittacosis patient and evaluate the efficacy of omadacycline in treating severe *Chlamydia psittaci* pneumonia.

Case Presentation

On February 23, 2024, an 86-year-old male patient was admitted to the hospital due to a 5-day history of fever. The patient had a medical history of hypertension and atherosclerosis. Before admission, the patient discovered a dead pigeon on the balcony. Upon admission, the patient had a peak temperature of 39.7°C and a heart rate of 160–180 beats per minute. Wet rales were auscultated in the right lung. Chest CT revealed multifocal inflammation in the right lung with slight pleural effusion on the right side and minimal perirenal effusion (Figure 1). Blood gas analysis indicated type I respiratory failure. The patient underwent a series of tests and examinations after admission. Biochemical tests revealed abnormal liver

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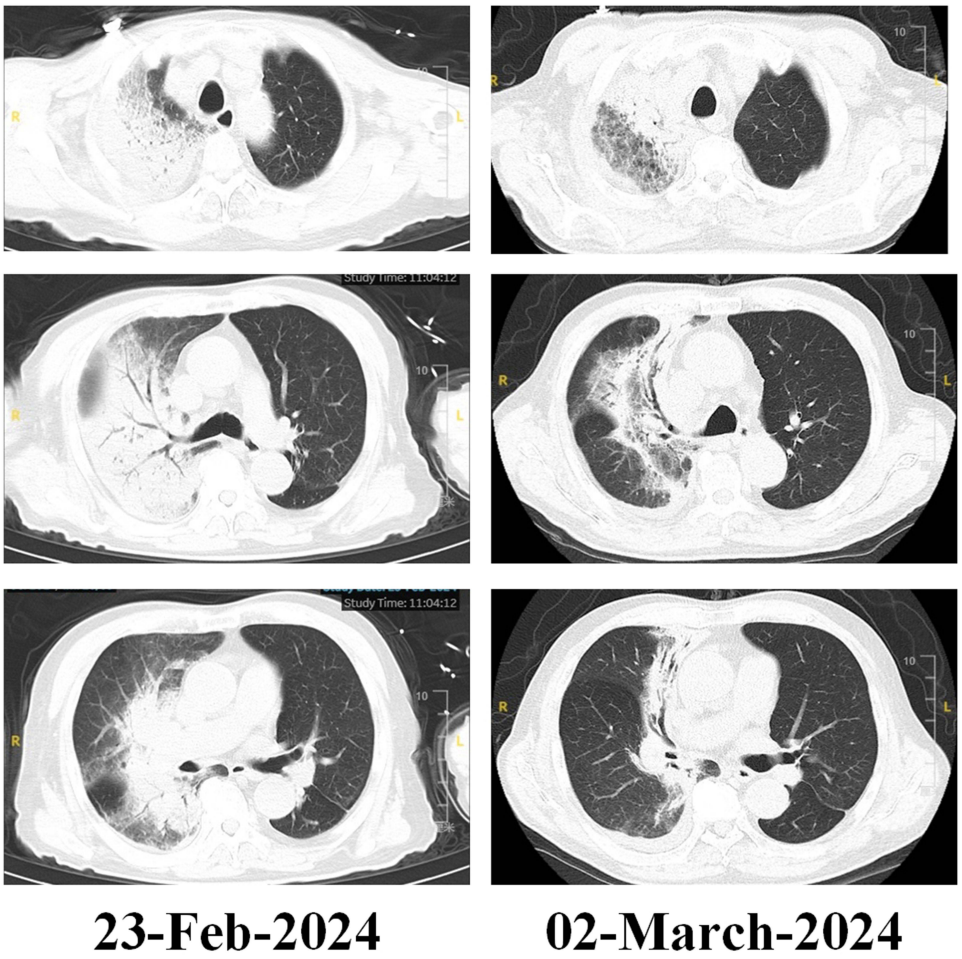

Figure 1 On February 23, 2024, the patient underwent a chest CT scan upon admission, revealing consolidation with the air bronchogram sign in the right upper, middle, and lower lobes of the lung. Subsequent follow-up imaging on March 2, 2024, showed a significant reduction in infectious lesions in the right lung.

function and severe hypoalbuminemia: total protein 49.8g/L↓, albumin 23.3g/L↓, aspartate transaminase 113U/L↑, alanine transaminase 74U/L↑, creatine kinase 519U/L↑, lactate dehydrogenase 344U/L↑, cholinesterase 2940U/L↓. Blood routine tests showed significantly elevated levels of high-sensitivity C-reactive protein and procalcitonin: white blood cell count 7.3*10^9/L, neutrophil percentage 86.8%↑, high-sensitivity C-reactive protein 164.78mg/L↑, procalcitonin 2.810μg/L↑. Serological tests for pneumonia, novel coronavirus nucleic acid, influenza virus, adenovirus, respiratory syncytial virus, and sputum culture were all negative. After admission, the patient underwent bronchoscopy, and metagenomic next-generation sequencing (mNGS) of bronchoalveolar lavage fluid from the right lower lung showed 9922 sequences of *Chlamydia psittaci*, leading to the final diagnosis of psittacosis-induced pneumonia.

The patient was administered 200 mg of omadacycline intravenously on the day of admission, followed by daily 100 mg intravenous omadacycline for antimicrobial therapy starting the next day. Additionally, the patient received supportive treatments including oxygen therapy via mask and nasal cannula, as well as mucolytics and bronchodilators for symptomatic relief. The patient experienced severe arrhythmias and was treated with adenosine injection, digoxin, and sustained-release metoprolol with cardiology assistance. Furthermore, during hospitalization, the patient developed deep vein thrombosis in the left posterior tibial vein and intramuscular vein of the left lower limb, requiring comprehensive treatment including gastric and liver protection, anticoagulation, and electrolyte supplementation.

Following comprehensive treatment, the patient's symptoms significantly improved, with no apparent chest tightness, dyspnea, fever, or chills. Inflammatory markers and liver function gradually returned to normal. A chest CT re-examination

one week after admission showed significant resolution of lung inflammation (Figure 1). The patient was discharged smoothly after 11 days of hospitalization and remained stable during outpatient follow-up.

Discussion

In this case report, the patient is an 86-year-old elderly male with underlying conditions such as hypertension and atherosclerosis, which may increase the risk of developing severe pneumonia after infection with *Chlamydia psittaci*. The patient's main symptoms were fever and dyspnea, requiring oxygen mask support for breathing. Auxiliary examination results showed that the patient had severe inflammatory response, respiratory failure, arrhythmias, liver function impairment, coagulation abnormalities, and lower limb venous thrombosis. While these findings are consistent with the clinical manifestations of severe psittacosis infection, they are not specific to psittacosis. The difficulty in distinguishing psittacosis pneumonia from other bacterial pneumonias based on clinical presentation inevitably leads to delays in treatment while awaiting serological results, which could significantly increase the severity and mortality rates of psittacosis.[7] If the pathogen is not accurately identified promptly after admission, elderly patients like the 86-year-old in this case may require ICU intervention or even face fatal outcomes due to treatment delays.

Chlamydia psittaci, a obligate intracellular pathogen, manifests in psittacosis with complex and variable clinical presentations that are often atypical, leading to underestimated incidence rates and diagnostic challenges. Traditional diagnostic methods for psittacosis pneumonia include pathogen isolation and identification, immunofluorescence assay, indirect hemagglutination inhibition test, complement fixation test, enzyme-linked immunosorbent assay (ELISA), routine PCR, and quantitative fluorescence PCR. However, due to limitations of these traditional detection methods, negative results are common in clinical practice, resulting in diagnostic and treatment delays.[8] Metagenomic next-generation sequencing (mNGS), as an emerging pathogen diagnostic technology, offers a method to directly extract all microbial DNA from clinical specimens without the need for culture. Diagnosis of psittacosis requires whole-genome sequencing of *Chlamydia psittaci* from respiratory, blood, or sputum specimens.[9] Additionally, bronchoalveolar lavage fluid (BALF) may be the most appropriate clinical sample for genomic diagnosis of severe pneumonia due to its higher bacterial load compared to sputum or blood.[10] In this case, the patient was diagnosed with *Chlamydia psittaci* through mNGS of BALF, providing a basis for clinical treatment.

The preferred treatment for psittacosis is tetracycline antibiotics, with other effective options including macrolides and quinolones, administered for at least 2 weeks.[11] Macrolides have poor efficacy in treating severe psittacosis pneumonia and generally require combination therapy with other drugs. Moxifloxacin has limited efficacy in severe cases, possibly due to the low intracellular activity of quinolones against *Chlamydia psittaci*. Doxycycline, mostly available in oral formulations in most hospitals, may have inadequate absorption in critically ill patients with gastrointestinal dysfunction.[12] In China, critically ill CAP patients typically receive fluoroquinolones or tetracyclines as initial empirical antibiotic therapy, with few patients receiving macrolides alone. There is no significant difference in efficacy between patients initially treated with fluoroquinolones, sequentially treated with tetracyclines, or treated with a combination of fluoroquinolones and tetracyclines.[13]

Omadacycline has been proven to exhibit excellent antibacterial efficacy against Chlamydia, surpassing doxycycline. Furthermore, there is no need to adjust the dosage of omadacycline in patients with hepatic or renal impairment.[14] The metabolic characteristics of omadacycline make it particularly suitable for elderly patients with severe infections and multiple organ dysfunction.[15] Fang et al reported a case of severe *Chlamydia psittaci* pneumonia complicated by multiple organ failure, in which the patient's condition improved following treatment with omadacycline.[16] Xu et al also reported a case where a patient with severe *Chlamydia psittaci* pneumonia complicated by Guillain-Barré syndrome was successfully treated with omadacycline and discharged without complications.[17] Wang Deng et al treated 16 patients with severe *Chlamydia psittaci* pneumonia and ARDS using omadacycline, of which 14 fully recovered and 2 died.[18] While instances of using omadacycline to treat severe *Chlamydia psittaci* pneumonia are still limited, further accumulation of related treatment experience is necessary.

In the present case, the patient rapidly recovered from a severe condition after initiating omadacycline treatment, with chest CT scans showing significant resolution of lung inflammation after one week. The timely use of omadacycline not only prevented further deterioration but also effectively shortened the hospital stay, alleviating the burden on the patient.

This case demonstrates the excellent efficacy of omadacycline in treating psittacosis. However, as a novel antibiotic, its use in treating psittacosis is limited, and there is currently a lack of extensive clinical data and systematic evaluations. Therefore, further clinical research and data are still needed.

Conclusion

Omadacycline, as a novel member of the tetracycline class, has shown certain advantages in treating *Chlamydia psittaci* infections. However, due to the limited number of instances of omadacycline being used to treat psittacosis and the lack of extensive clinical data and systematic evaluations, its use should still be approached with caution. Further clinical research and data are needed in the future.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethical Approval

The samples analyzed in this study were collected following standard procedures of the hospital laboratory. Our research strictly adhered to the principles outlined in the Declaration of Helsinki and received ethical approval from the Ethics Committee of Zhejiang Provincial Hospital of Traditional Chinese Medicine, China. Patients also provided consent for the publication of the research results.

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Disclosure

The authors declare that this study was conducted without any commercial or financial relationships that could be construed as potential conflicts of interest.

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