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CASE REPORT

Chlamydia psittaci Infection Presenting Initially with Gastrointestinal Symptoms

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SUMMARY

Background: **Chlamydia psittaci (C. psittaci) is a pathogenic, gram-negative, aerobic, and obligate intracellular parasite. Humans are primarily infected by inhaling aerosols formed from the feces of infected birds. Previously reported cases of C. psittaci infection are rare. The lack of specific clinical manifestations of psittacosis and the limited detection sensitivity of traditional methods lead to inadequate or delayed diagnosis. In this case, the presence of C. psittaci was confirmed by next-generation sequencing (NGS) of bronchoalveolar lavage fluid.**
Methods: **Bronchoscopy, next-generation sequencing.**
Results: **After using bronchoscopy to obtain bronchoalveolar lavage fluid, NGS indicated the presence of C. psittaci. Therefore, anti-infective treatment was administered.**
Conclusions: **For patients with severe pneumonia, it is essential to perform bronchoscopy promptly. The etiological agent of the infection can be identified through NGS of bronchoalveolar lavage fluid obtained via bronchoscopy. Subsequently, appropriate anti-infective treatment should be initiated swiftly based on the specific identified pathogen.**
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KEYWORDS

C. psittaci, bronchoscopy, next-generation sequencing

CASE REPORT

A 66-year-old elderly man was admitted to the hospital mainly due to recurrent belching and diarrhea for 5 days. He reported that 5 days prior, he experienced recurrent belching and diarrhea without an obvious cause, accompanied by general fatigue, intermittent coughing, and occasional expectoration. During this period, he also had nausea and non-projectile vomiting. He visited a local hospital, but the treatment was ineffective. He did not experience chest pain, palpitations, or fever. A chest CT scan performed at our hospital showed bilateral pulmonary infections with partial pulmonary consolidation, predominantly in the right lower lobe. The patient had a history of hepatitis B virus infection for over 30 years. He stated that his condition was in remission and he was not currently on any medications. Upon admission, he had tachypnea, with a SPO_2 of 81%. Coarse breath

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sounds and moist rales were audible in both lungs. No other significant abnormalities were found on physical examination. After admission, the blood routine test results were as follows: RBC 5.36 x 10^{12}/L (reference range: 4 x 10^{12}/L - 5.5 x 10^{12}/L), HGB 110 g/L (reference range: 115 g/L - 150 g/L), PLT 104 x 10^9/L (reference range: 100 x 10^9/L - 300 x 10^9/L), WBC 12.59 x 10^9/L (reference range: 4 x 10^9/L - 10 x 10^9/L), NEU 12.11 x 10^9/L (reference range: 1.8 x 10^9/L - 6.3 x 10^9/L), LYM 0.26 ×10^9/L (reference range: 1.1 × 10^9/L - 3.2 x 10^9/L), MON 0.16 x 10^9/L (reference range: 0.1 x 10^9/L - 0.6 x 10^9/L). Meanwhile, the infection - related indicators were: hs-CRP 30.9 mg/L (reference range: 0 mg/L - 5 mg/L), PCT 6.673 ng/mL (reference range: 0 ng/mL - 0.05 ng/mL), IL-6 765.6 pg/mL (reference range: 0 pg/mL - 5.5 pg/mL), fibrinogen 5.43 g/L (reference range: 2 g/L - 4 g/L). The respiratory pathogen antibody test showed positive IgM antibodies against influenza B virus. The arterial blood gas analysis results were: PH 7.52, PO_2 90 mmHg, PCO_2 24 mmHg, HCO_3^- 19.6 mmol/L, with FiO_2 at 80%. The biochemical test results were: ALT 56 U/L (reference range: 9 U/L - 50 U/L), AST 111 U/L (reference range: 15 U/L - 40 U/L), ALB 25.2 g/L (reference range: 40 g/L - 50 g/L). There were no obvious abnormalities in myocardial enzyme tests, tumor markers, and sputum culture. Chest CT scan showed scattered patchy areas of increased density in both lungs, predominantly in the right lower lobe, and a small amount of bilateral pleural effusion. Initially, we considered the diagnosis of severe pneumonia. The patient was given non-invasive ventilator support for ventilation, moxifloxacin 0.4 g once a day for anti-infection, oseltamivir phosphate capsules 75 mg twice a day, and methylprednisolone sodium succinate 40 mg once a day for anti-inflammation. Since the infectious pathogen was not clearly identified, we performed a bronchoscopy. The NGS test result reported Chlamydia psittaci (C. psittaci). Finally, we diagnosed the patient with Chlamydia psittaci pneumonia and treated the patient with tigecycline 100 mg every 12 hours for anti-infection. Currently, the patient's condition has improved and the patient was discharged from the hospital. After discharge, the patient was given sequential anti-infection treatment with moxifloxacin and doxycycline.

DISCUSSION

C. psittaci infection is a global systemic zoonosis caused by the obligate intracellular bacterium C. psittaci. An increasing number of countries have reported a large number of laboratory-confirmed cases, which have resulted in substantial economic losses and raised public health concerns [1]. In 2012, a global meta-analysis of community-acquired pneumonia (CAP) revealed that C. psittaci accounted for 1.03% of CAP cases [2]. A recent multicenter study conducted in China highlighted the significance of C. psittaci as a pathogen for severe CAP, accounting for 7.3% of the total cases [3]. Additionally, some patients with psittacosis progress rapidly and may die without timely treatment. Due to its low incidence and the limited detection sensitivity of traditional methods, previously reported cases of C. psittaci infection were scarce. The NGS method has demonstrated its clinical utility in the field of microbiology, enabling more sensitive, rapid, and accurate detection of previously intractable, rare, and severe infections. This paper reports a case of severe psittacosis pneumonia. The case was diagnosed by NGS, and the patient's condition improved after treatment with tigecycline.

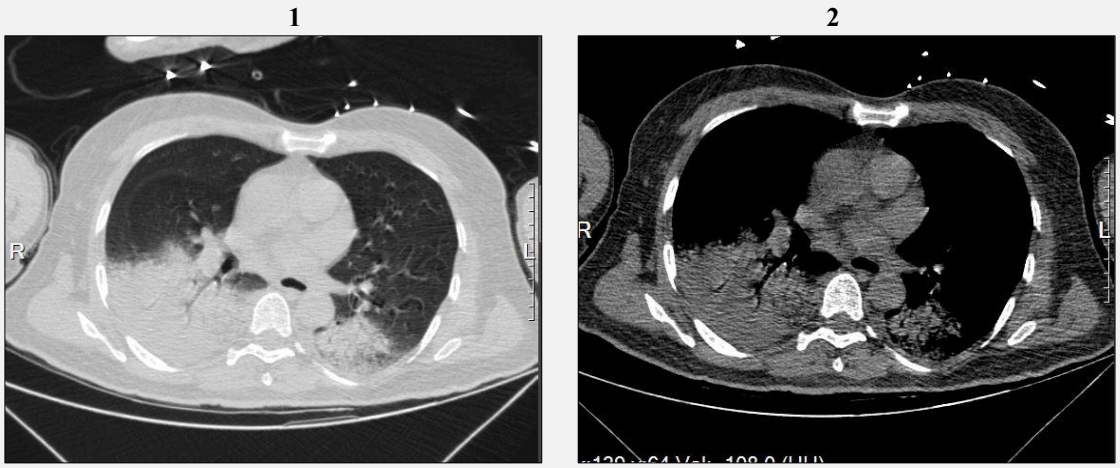
C. psittaci is a specific intracellular parasitic gram-negative bacterium that can cause infections in birds. C. psittaci is currently classified into 15 different outer membrane protein A (ompA) genotypes: A to F, E/B, WC, M56, 1V, 6N, Mat116, R54, YP54, and CPX0308 [4]. Genotypes A and E can infect humans. The lungs are the most commonly affected sites of infection. In some cases, they can lead to severe pneumonia and even death [5]. Contact with birds or poultry is the main risk factor for psittacosis. A study by Hogerwerf et al. showed that the incubation period of the infection is 1 to 2 weeks [6]. C. psittaci pneumonia belongs to atypical pneumonia. Suspected patients should first undergo pulmonary examinations. The radiological features show varying degrees of infiltration and consolidation, mainly in the lower lobes of the lungs. In severe cases, large consolidation shadows are often seen. Compared with other bacterial pneumonia, C. psittaci pneumonia lacks specific clinical manifestations, resulting in a relatively common possibility of misdiagnosis and missed diagnosis. Traditional microbial culture, serological testing, and PCR testing have obvious limitations, leading to a low detection rate of C. psittaci [7]. In recent years, thanks to its ability to rapidly detect various pathogenic microorganisms without the need for specific amplification, NGS has been widely used in the diagnosis of infectious diseases. It is the fastest and most accurate detection method for unknown pathogens.

C. psittaci infection typically presents with fever, headache, general malaise, and myalgia. It usually manifests as a dry cough, accompanied by dyspnea or chest tightness. Occasionally, it is associated with a slow pulse, splenomegaly, or non-specific rashes [8]. On auscultation of the lungs, there are often no specific findings, which may lead to an underestimation of the severity of the disease. The imaging features of psittacosis are not uniform. Studies have shown that pneumonia caused by C. psittaci has several distinct characteristics, typically presenting as varying degrees of infiltration and consolidation [9]. The most common of these features include patchy ground-glass opacities and large areas of confluent consolidation, which usually distribute along the lung segments. The disease starts from the upper lobes and progresses to the lung lobes, ultimately mainly affecting the lower lobes, and is occasionally accompanied by pleural effusion [10]. Compared with other cases of pneumonia, patients usually have a low white blood cell count and present a series of extrapulmonary mani-

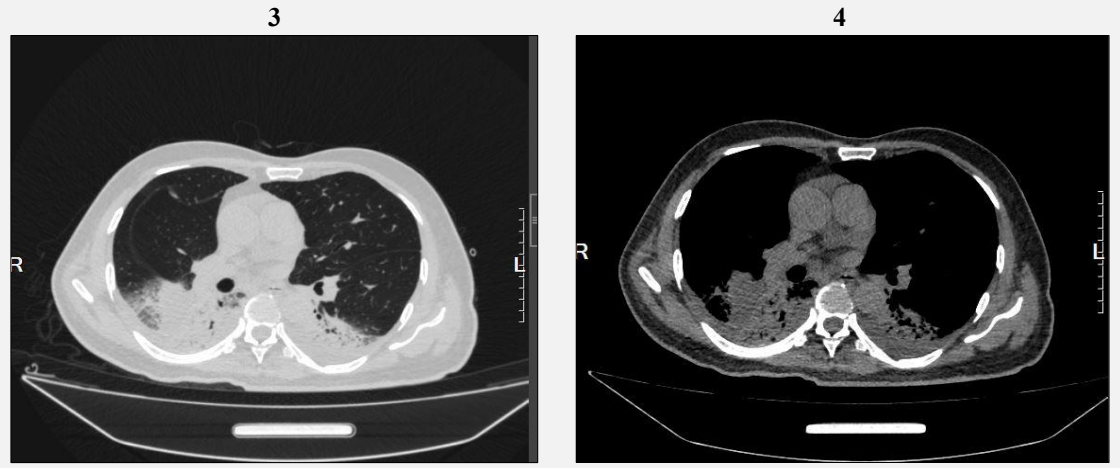
Table 1. NGS report.

Detection index	RPTM *	Copies/mL	Positive reference range	Qualitative results
Chlamydia psittaci	121027	$1.14 * 10^4$	≥ 1	Bacterial positive

*** RPTM: the number of sequences that are aligned with the target sequence of the pathogen. A higher value of this parameter indicates a stronger detection signal for the pathogen.**
NGS report: RPTM value (121027) confirms Chlamydia psittaci infection (positive ≥ 1).

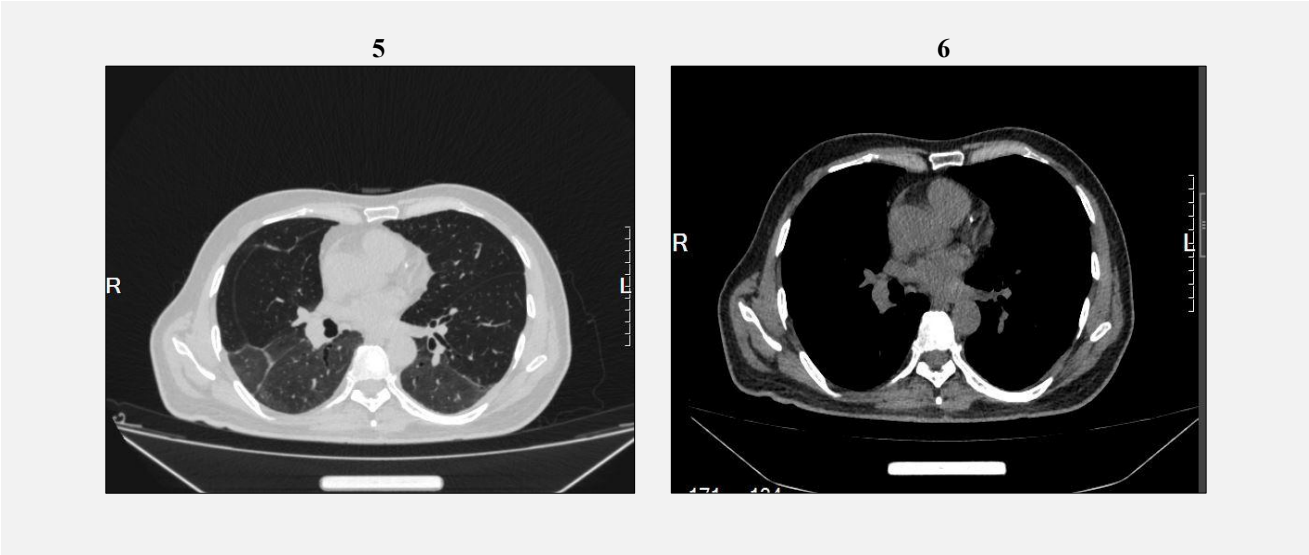


Figures 1 - 2. Chest CT scans show scattered patchy areas of increased density in both lungs, mainly in the right lower lobe, as well as a small amount of bilateral pleural effusion.



Figures 3 - 4. After one-week treatment with tigecycline at a dose of 100 mg every 12 hours, chest CT shows that the lesions in the left lower lobe have decreased compared with the previous scan and the density has slightly increased.

The lesions in the upper and lower lobes of the right lung have also decreased compared with before, and the bronchi are more clearly visualized than before.



Figures 5 - 6. A chest CT re-examination one month after discharge shows scattered patchy and flocculent areas of increased density in both lungs.

The lesions are not well-defined, and the infection has been significantly absorbed compared with before. No pleural effusion is seen in the thoracic cavity.

festations, including keratoconjunctivitis, gastrointestinal symptoms (vomiting, abdominal pain, and diarrhea), arthritis, jaundice, myocarditis, endocarditis, pyelonephritis, encephalitis, meningoencephalopathy, optic neuritis, and multiple organ failure [11]. In cases involving gastrointestinal damage, patients with psittacosis usually show significant liver involvement, characterized by elevated aminotransferase levels and hepatosplenomegaly. Some patients may initially present with gastrointestinal symptoms, mainly including discomfort such as nausea, vomiting, abdominal pain, and diarrhea. The patient in this case initially visited the doctor due to gastrointestinal symptoms. However, the chest CT showed infiltrative changes in the lungs and a small amount of pleural effusion, which was consistent with previous reports, indicating severe pulmonary inflammation. Laboratory tests also indicated elevated aminotransferase levels. However, these features were insufficient to confirm the infecting pathogen. Finally, the presence of C. psittaci infection was confirmed based on the results of NGS.

The prognosis of C. psittaci infection depends on the clinical severity, comorbidities, and the duration of treatment [2]. After appropriate antibiotic treatment, it is reported that the cure rate of psittacosis is as high as 94.23% [12]. According to data from the Centers for Disease Control and Prevention, if psittacosis is diagnosed early and treated appropriately, the mortality rate is less than 1% [13]. Meanwhile, traditional detection methods have certain limitations. Isolation and culture of pathogens are time-consuming and require high-level laboratory conditions, making them difficult to carry out routinely. Antibody titer monitoring is suitable for retrospective diagnosis and has low value for early diagnosis. Therefore, in the early stage of the disease, especially among critically ill patients, choosing NGS is the most promising method for comprehensive diagnosis of infections, especially for severe pneumonia in the ICU [14]. Tetracyclines are considered the first-line treatment drugs for C. psittaci. Usually, doxycycline or minocycline is used. Although the resistance rate of macrolide antibiotics is relatively high in China, macrolide antibiotics can be used as an alternative therapy for pregnant women and children. Fluoroquinolones have shown effectiveness in some patients. In addition, tigecycline and omadacycline are new-generation novel tetracycline antibiotics. Among them, tigecycline has a broad antibacterial spectrum and can be used for severe C. psittaci pneumonia, especially when patients are also infected with other bacteria. The study by Lei et al. showed that, compared with the conventional dose of tigecycline, a high dose of tigecycline (a loading dose of 100 mg followed by 100 mg every 12 hours) can effectively reduce the mortality rate and improve the cure rate of critically ill patients [15]. For this patient, after we confirmed the presence of C. psittaci through NGS, we promptly administered tigecycline at a dose of 100 mg every 12 hours for anti-infection treatment. Through this treatment, the patient's condition has improved significantly.

CONCLUSION

Our case indicates that when severe pneumonia is accompanied by gastrointestinal symptoms, it is necessary to be vigilant about the presence of special bacteria such as Chlamydia psittaci. If necessary, early bronchoscopy or percutaneous lung biopsy should be performed to make a definite diagnosis and formulate corresponding treatment plans in the early stage of the disease. This will ultimately reduce the morbidity and length of hospital stay and improve the quality of life.

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Ethical Approval:
This study was approved by the ethics committee of Zigong First People's Hospital. All procedures performed in studies were in accordance with the ethical standards. Informed consent was obtained.

Declaration of Interest:
No conflicts of interest.

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