

CASE REPORT

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Bloodstream infection and pneumonia caused by *Chlamydia abortus* infection in China: a case report

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Abstract

Background: *Chlamydia abortus* is generally considered to cause abortion, stillbirth, and gestational sepsis in pregnant women, but it's rare in bloodstream infection and pneumonia.

Case presentation: We present details of a patient with bloodstream infection and pneumonia caused by *Chlamydia abortus*. Both blood next-generation sequencing (NGS) and sputum NGS indicate *Chlamydia abortus* infection. The patient received intravenous infusion of piperacillin sodium and tazobactam sodium (4.5 g/8 h) and moxifloxacin (0.4 g/d) and oral oseltamivir (75 mg/day). Within one month of follow-up, the patient's clinical symptoms were significantly improved, and all laboratory parameters showed no marked abnormality. However, chest computer tomography (CT) showed the inflammation wasn't completely absorbed. And we are still following up.

Conclusions: *Chlamydia abortus* can cause pneumonia in humans. NGS has the particular advantage of quickly and accurately identifying the infection of such rare pathogens. Pneumonia is generally not life-threatening, and has a good prognosis with appropriate treatment. However, *Chlamydia* infection can lead to serious visceral complications which clinicians should pay attention to.

Keywords: Bloodstream infection, Pneumonia, *Chlamydia abortus*, Case report

Background

Chlamydia consisting of thirteen classified chlamydial species and three candidate species [1] which widely parasitizes mammals and birds and easily infects the mucosa. The *Chlamydia* infection leads to epidemiologically and clinically important diseases both in humans and animals [2], in which the most common pathogens are *Chlamydia psittaci*, *Chlamydia trachomatis*, and *Chlamydia pneumoniae*.

Chlamydia abortus is a kind of zoonotic pathogen, which has been reported to infect a variety of animals

including goats, sheep, yaks, pigs, horses, rabbits, guinea pigs, mice, and farmed fur animals [3–9]. Besides, *Chlamydia abortus* is also the causative pathogen of abortion [10], stillbirth, gestational sepsis [11–13], and pelvic inflammatory disease in humans [14]. Nevertheless, only one case of pneumonia associated with *Chlamydia abortus* has been reported worldwide [15]. Here, we describe a case of pneumonia caused by *Chlamydia abortus*, including clinical characteristics, signs, laboratory examination, imaging performance, diagnosis, and therapy. As we know, this is the first report of pneumonia in humans caused by *Chlamydia abortus* in China.

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Case presentation

A 66-year-old man was admitted to hospital with a fever, generalized weakness, cough, wheezing, headache, dizziness, nausea, and vomiting, with a history of hepatic malignancy and three interventional surgeries.

On physical examination, the patient's body temperature was 39.7 °C, and wet rales could be heard in the right lung. Relevant laboratory tests indicated type I respiratory failure, hyponatremia, pancytopenia, hypoproteinemia, elevated C-reactive protein (CRP), increased ferritin, and slightly elevated D-dimer, total bilirubin and glucose (Table 1). Arterial blood gas analysis (no oxygen inhalation) showed the following: pH 7.46; PaCO₂ 37.2 mmHg; PaO₂ 51.2 mmHg; blood lactate 2.3 mmol/L. Analysis of serology from multiple enzyme-linked immunosorbent assays was negative for IgM to legionella pneumophila serotype I, adenovirus, respiratory syncytial virus, mycoplasma pneumoniae antibody, influenza A, influenza B, and parainfluenza. No pathogenic bacteria were found in sputum and pharyngeal swab culture. There was no growth of aerobic and anaerobic bacteria in

the blood culture for five days. The acid-fast staining of sputum was negative three times. The chest CT showed multiple honeycomb changes in both lungs, especially the right lung (Fig. 1).

The patient was diagnosed with pneumonia, type I respiratory failure, pleural effusion, hepatic malignancy, hyponatremia, hypochromic microcytic anemia, and hypoproteinemia on admission. Next, the patient was treated with intravenous infusion of piperacillin sodium and tazobactam sodium (4.5 g/8 h) and moxifloxacin (0.4 g/day) and oral oseltamivir (75 mg/day), supplemented with amino acids, fat emulsion, and gamma globulin, improving the symptom of respiratory failure via oxygen inhalation.

Although relevant laboratory tests and chest CT have been performed, no pathogen was found. The patient was in critical condition with continuous high fever and respiratory failure. We performed peripheral blood NGS and sputum NSG for pathogen detection on the second and sixth days of admission, respectively. The results of NGS suggested a high possibility of *Chlamydia abortus* (Tables 2, 3). Giving that *Chlamydia* infection is usually mixed infection, treatment was continued with piperacillin sodium and tazobactam sodium in combination with moxifloxacin [16]. Delightedly, the symptoms of the patient were improved significantly after three days. However, the patient developed a significant decrease in platelets and hemoglobin on the seventh day during the treatment (platelet counts 47*10⁹/L, hemoglobin 68 g/L, red blood cell counts 3.5*10¹²/L). It was probably caused by the infection, but hematological diseases could not be excluded. Subsequently, the patient's above-mentioned indicators were significantly improved after transfusing with 2u of suspended leukocyte-poor red blood cells. At the 10th day during the treatment, reexamined chest CT showed multiple reticular blurred shadows in both lungs, bilateral pleural thickening, and arc-shaped low-density shadows in both thoracic cavities, indicating interstitial pneumonia and bilateral pleural effusion (Fig. 2). At the 16th day during the treatment, high-sensitivity CRP (12.24 mg/L) and procalcitonin (0.231 ng/mL) were improved, but anemia and hypoproteinemia still existed, and arterial blood gases showed PO₂ 56 mmHg and PO₂ 43 mmHg.

Soon afterwards, the patient was transferred to the infectious disease hospital for further treatment with positive antibodies specific to hepatitis B and syphilis. After admission, the patient was treated with intravenous infusion of piperacillin sodium and tazobactam sodium (4.5 g/8 h) and moxifloxacin (0.4 g/day) for 16 days, with oral oseltamivir for 7 days. Subsequently, the patient was instructed to take moxifloxacin (0.4 g/day) and clarithromycin (0.25 g/12 h) within two weeks of discharge. The patient complained of no cold, fever,

Table 1 Initial maternal laboratory results

Variable	Reference range	Result
Hemoglobin (g/dL)	12.0–16.0	9.8
White-cell count (per mm ³)	4000–10,000	9780
Platelet count (per mm ³)	100,000–300,000	116,000
Absolute lymphocyte count (per mm ³)	800–4000	260
C-reactive protein (mg/dL)	0.00–1.00	16.07
Procalcitonin (ng/mL)	< 0.05	2.67
D-dimer (µg/mL)	0.00–1.00	4.05
Ferritin (ng/mL)	30–400	1242
CPK (U/L)	50.0–310.0	58
Glucose (mmol/L)	3.9–6.1	6.39
Creatinine (µmol/L)	57–111	65.3
Blood urea nitrogen (mmol/L)	3.6–9.5	7.58
Total bilirubin (µmol/l)	0.00–21.00	30.8
Aspartate aminotransferase (U/L)	15.0–40.0	53.4
Alanine aminotransferase (U/L)	9.0–50.0	29.7
Sodium (mmol/L)	137.0–147.0	131.1
Potassium (mmol/L)	3.5–5.3	4.87
Chloride (mmol/L)	99.0–110.0	95.4
Total protein(g/L)	65–85	48.7
Albumin(g/L)	40–55	24.9
Globulin(g/L)	20–40	23.8
Arterial blood gases		
pH	7.35–7.45	7.461
PCO ₂	35–45	37.2
PO ₂	83–108	51.2
HCO ₃	18.0–23.0	26.6
BE	– 2.0 to 3.0	2.7

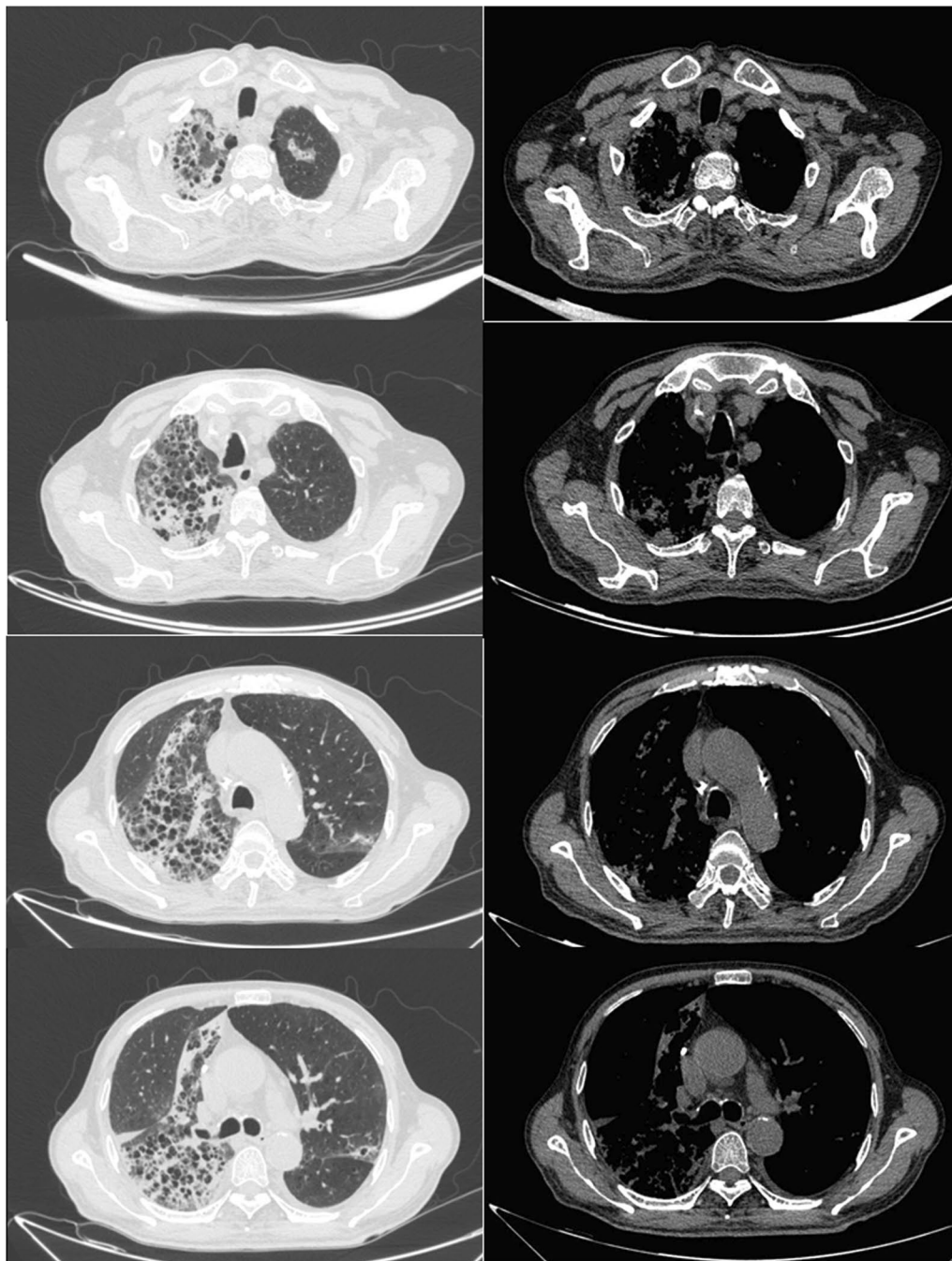


Fig. 1 Multiple grid-shaped blurred shadows are seen in both lungs, especially in the right lung

headache, dizziness, muscle soreness, cough, expectoration, chest distress or asthma. Laboratory tests showed white blood cell count $4.98 \times 10^9/L$, hypersensitive CRP 7.94 mg/L, creatinine $66 \mu\text{mol/L}$, alanine aminotransferase 31 U/L, and aspartate aminotransferase 26.1 U/L. Chest CT showed remarkable improvement of interstitial inflammation and emphysema in both lungs (Fig. 3).

Discussion and conclusions

Chlamydia abortus infection is usually reported in pregnant women, beginning with influenza-like illness and progressing to thrombocytopenia and coagulation dysfunction, often leading to fetal death.

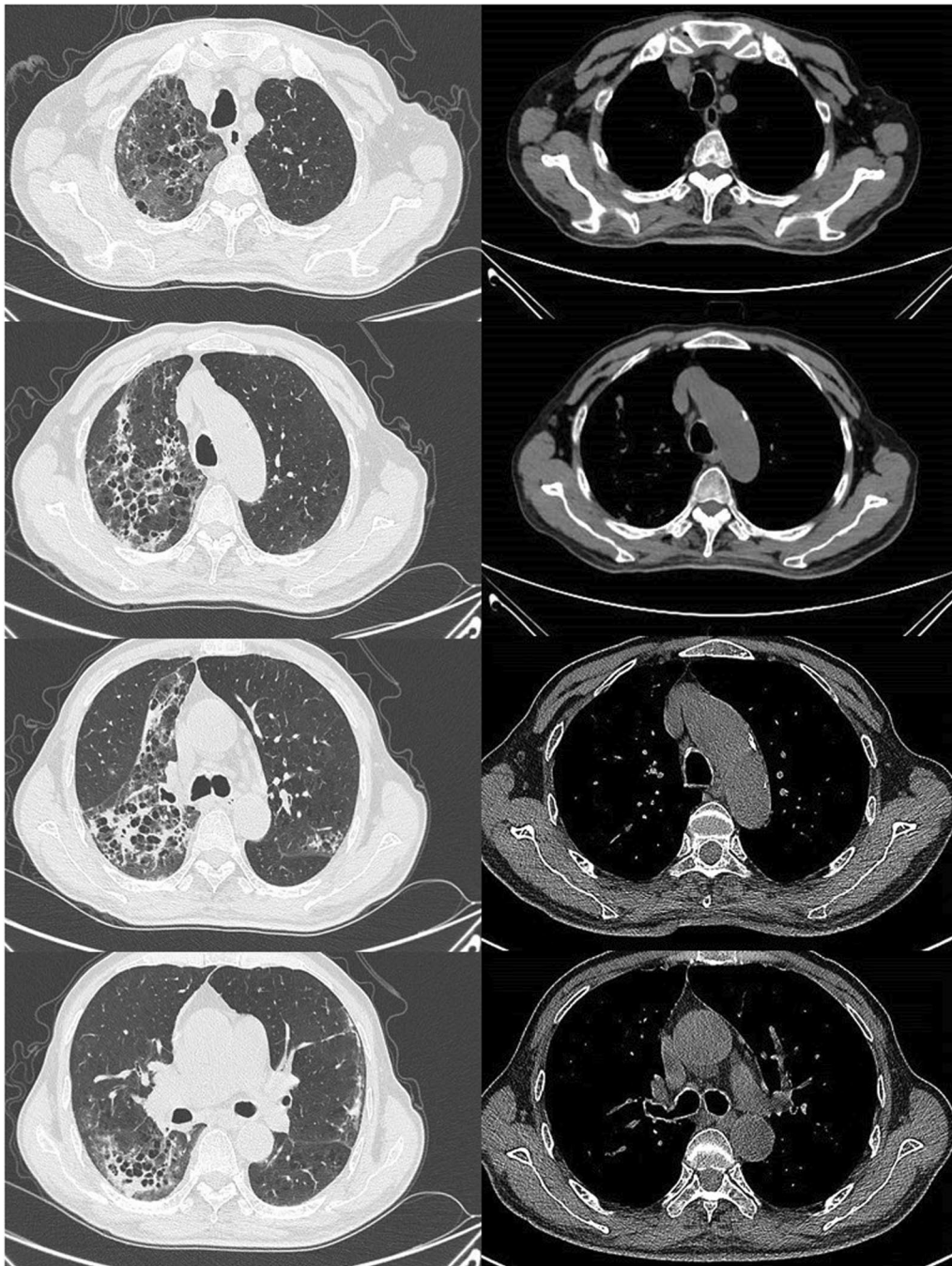


Fig. 2 Multiple reticular blurred shadows in both lungs, bilateral pleural thickening

So far, only two cases of extra-gestational manifestations of *Chlamydia abortus* infection have been reported in humans [14, 15].

Chlamydia abortus is excreted through the urine, feces, milk, amniotic fluid, placenta, aborted fetus and other routes of sick animals. Most reported human infections result from direct contact between pregnant women

and infected animals. Also, several cases describe indirect contact through visiting or living on or near farms affected by endemic abortion, which suggests that clinicians should particularly pay attention to people who have been in contact with animals from infected herds.

At present, the *chlamydia abortus* infection is mainly diagnosed by PCR according to literatures. In this case

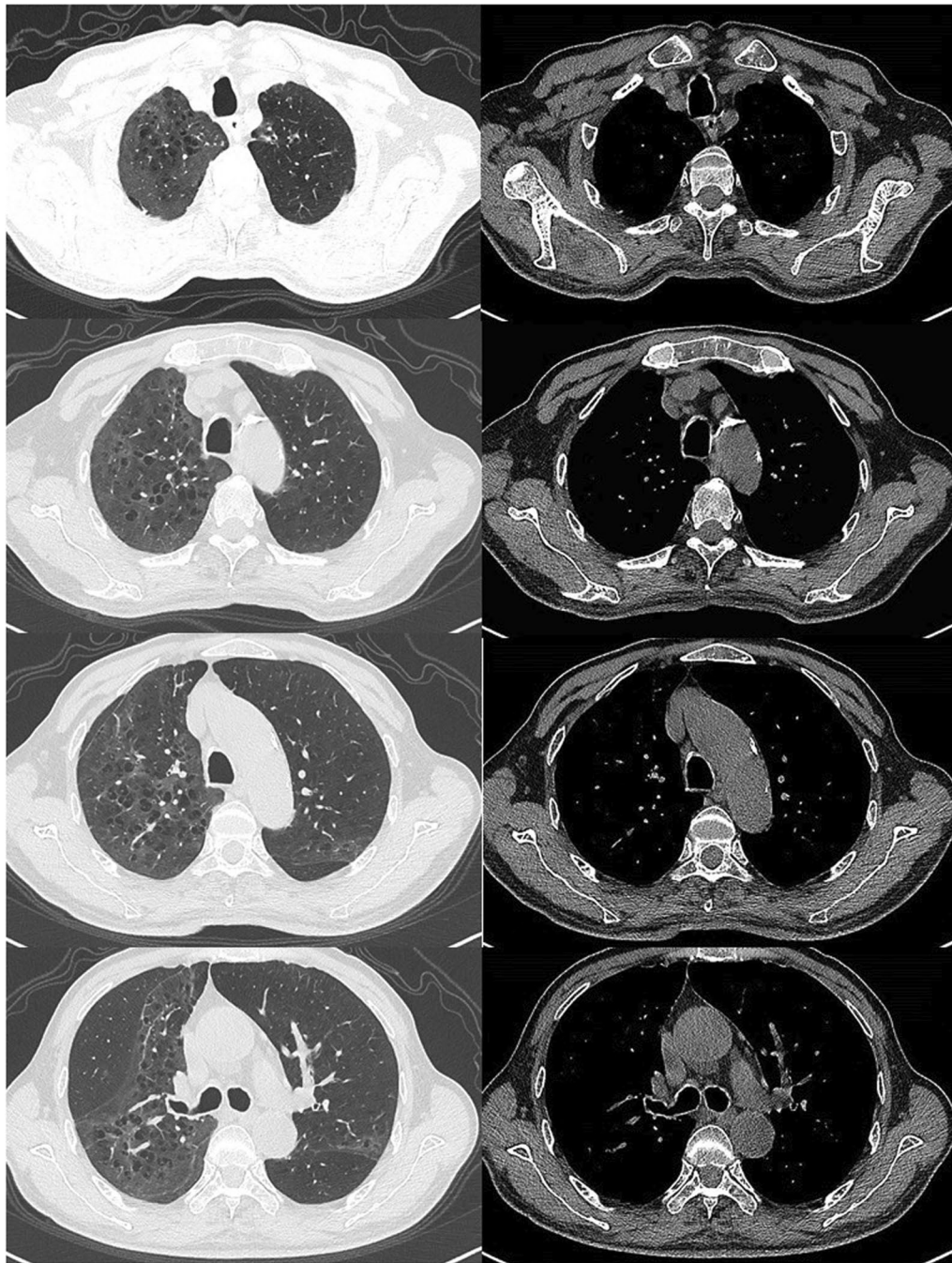


Fig. 3 Multiple grid-shaped blurred shadows were observed in both lungs, which were obviously absorbed

report, NGS clears the diagnosis of *chlamydia abortus* infection. The blood NGS result showed the patient's bloodstream infection caused by *chlamydia abortus*, but other pathogens could not be ruled out to cause pneumonia. Therefore, we performed NGS of sputum and confirmed that *chlamydia abortus* is the pathogen of pneumonia in this patient.

NGS, also known as high-throughput sequencing, which can perform sequencing for all nucleic acids in a sample [17, 18]. NGS is characterized by fast detection speed, high accuracy, low cost, wide coverage and huge output [19]. It can theoretically detect all pathogens of clinical samples and is especially suitable for atypical, rare, and new pathogens. In 2014, Wilson et al. applied

Table 2 Next generation sequencing results in peripheral blood

Mycoplasma/Chlamydia/Rickettsia					
Genus			Species		
Name	Sequence number	Relative abundance %	Name	Sequence number	Relative abundance %
<i>Chlamydia</i>	754	98.18	<i>Chlamydia abortus</i>	618	80.47

Table 3 Next generation sequencing results in sputum

Mycoplasma/Chlamydia/Rickettsia					
Genus			Species		
Name	Sequence number	Relative abundance %	Name	Sequence number	Relative abundance %
<i>Chlamydia</i>	75	13.54	<i>Chlamydia abortus</i>	64	11.55

NGS to detect *leptospirosis* in cerebrospinal fluid samples of children, which is the first application of NGS in the diagnosis of infectious diseases [20]. Subsequently, unbiased metagenomic next-generation sequencing (mNGS) has revolutionized our ability to discover emerging pathogens, especially newly identified viruses. Miao et al. reported the largest retrospective study on the detection of pathogens of infectious diseases by mNGS in China. The study included a total of 511 samples and reported the sensitivity and specificity of mNGS were 50.7% and 85.7%, respectively, which were significantly higher than that of traditional testing methods, especially in the detection of pathogens such as *Mycobacterium tuberculosis*, viruses, fungi, and anaerobic bacteria. Additionally, the result of mNGS is hardly affected by prior antibiotic exposure [21].

Chlamydia can cause serious visceral complications after systemic infection, which is worthy of the attention of clinicians [12, 22]. In this case report, the patient was immunocompromised due to the history of liver malignancy and exhibited symptoms of respiratory failure, pleural effusion, hyponatremia, hypochromic microcytic anemia and hypoproteinemia after *chlamydia abortus* infection, which urged clinicians to confirm the diagnosis as soon as possible and actively intervene. On the basis of literature [23], preferred moxifloxacin combined with piperacillin sodium and tazobactam sodium because the *chlamydia* infections were mostly mixed. The patient's clinical symptoms and inflammation indicators were significantly improved

after two weeks of treatment. After discharge, the patient was instructed to continue on clarithromycin and moxifloxacin. A one-month follow-up showed that the patient's clinical symptoms were significantly improved and there was no significant abnormality in all laboratory parameters. But chest CT showed the inflammation was not completely absorbed, indicating imaging recovery of pneumonia may take several months. We are still following up.

Abbreviations

NGS: Next-generation sequencing; CT: Computer tomography; CRP: C-reactive protein; mNGS: Metagenomic next-generation sequencing.

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Not applicable.

Authors' contributions

TMG, BH, WJW and GZF designed the study. LPH, MJL, JLH, CWZ and LXX collected the data. CJZ prepared the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

Not applicable.

Declarations

Ethics approval and consent to participate

The treatment of the patient was performed under the tenets of the Declaration of Helsinki.

Consent for publication

The patient in this study provided written informed consent for the publication of the clinical details and images.

Competing interests

The authors declare that they have no competing interests.

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