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CASE REPORT

Severe Pneumocystis Carinii Pneumonia in a Non-HIV-Infected Pregnant Woman

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SUMMARY

Background: **Pneumocystis carinii pneumonia (PCP) is an opportunistic pulmonary infectious disease. It is extremely rare in non-HIV-infected pregnant women.**
Methods: **Appropriate laboratory tests, Next Generation Sequencing, Extracorporeal Membrane Oxygenation (ECMO).**
Results: **A 25-year-old pregnant woman with gestational diabetes and no HIV infection presented with fever, cough, and hypoxemia. Through chest imaging, gene sequencing of bronchoalveolar lavage fluid, and serological testing, she was diagnosed with severe PCP. The patient received invasive mechanical ventilation, VV-ECMO, sulfamethoxazole/trimethoprim and caspofungin treatment, after which her condition improved significantly.**
Conclusions: **Pregnant women with diabetes mellitus who are not infected with HIV and present with fever and hypoxemia as the primary symptoms should be vigilant for PCP.**
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KEYWORDS

pneumocystis carinii pneumonia, gestational diabetes mellitus, hypoxemia

CASE REPORT

Pneumocystis carinii pneumonia (PCP) is a conditionally pathogenic pneumonia caused by Pneumocystis jirovecii, closely associated with host immune deficiency, such as in individuals infected with the human immunodeficiency virus (HIV) [1]. Compared with HIV-positive patients, HIV-negative patients have a higher mortality rate and poorer prognosis [2]. The mortality rate of critically ill PCP patients without HIV in the intensive care unit (ICU) is as high as 75.6% [3]. PCP is extremely rare in pregnant women who are not infected with HIV, and there are currently no highly effective and accurate diagnostic methods available.

The patient is a 25-year-old woman who is pregnant for the first time and has no previous births. She was admitted to the Obstetrics Department of the North China University of Science and Technology Affiliated Hospi-

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tal on September 29, 2024, due to intermittent cough for one week, wheezing for one day, and vaginal bleeding for over 4 hours. The patient developed a dry cough one week ago after being exposed to cold weather. She had a small amount of white, sticky phlegm and felt tired, but did not have a fever and did not seek medical treatment. One day before admission, she experienced wheezing after physical activity. Her symptoms improved slightly after resting and receiving oxygen. Four hours ago, the patient experienced a small amount of bloody vaginal discharge accompanied by irregular contractions. She had a 9-month history of "gestational diabetes mellitus" but did not regularly take hypoglycemic drugs or monitor blood glucose. Prenatal examination: Fundal height 32 cm, abdominal circumference 115 cm, LOA, fetal heart rate 140 beats/minute, cephalic presentation, partially engaged, irregular uterine contractions palpable. Considered to be a 38 + 6-week intrauterine pregnancy with cephalic presentation with threatened abortion. Due to cephalopelvic disproportion and the umbilical cord being wrapped around the neck twice, vaginal delivery was deemed high-risk. An emergency low-segment cesarean section was performed under spinal anesthesia, and the infant was delivered successfully. During surgery, the patient's blood oxygen saturation dropped to around 80%. Due to the patient's small jaw, which made for a difficult airway, tracheal intubation failed, and an emergency tracheotomy was performed to switch to invasive mechanical ventilation in the ICU. Physical examination: Heart rate 125 beats/minute, invasive blood pressure 100/62 mmHg (norepinephrine 0.5 μg/kg/minute), SpO_2 85%. Mechanical ventilation (PCV mode, PEEP 12 cmH_2O, FiO_2 100%), bilateral lungs with audible wet rales. Abdominal compression bandage applied, with one abdominal drainage tube retained, draining a small amount of bloody fluid. Blood gas analysis: pH 7.392, PCO_2 30.0 mmHg, PO_2 70 mmHg, clac 3.4 mmol/L, P/F 70 mmHg (FiO_2 100%). Negative for novel coronavirus nucleic acid testing, negative for influenza A virus antigen, negative for influenza B virus antigen, negative for EB virus capsid antigen IgM antibody, negative for Mycoplasma pneumoniae IgM antibody, Chlamydia pneumoniae IgM antibody negative, human respiratory syncytial virus IgM antibody negative, Coxsackievirus B group IgM antibody negative, adenovirus IgM antibody negative, human parainfluenza virus IgM antibody negative, HIV antibody negative. GM test negative, fungal (1,3)-β-D-glucan detection (G test) 61.75pg/mL (< 31.25 pg/mL). Complete blood count: White blood cells 15.3 x 10^9/L, platelets 174 x 10^9/L, neutrophil count 12.88 x 10^9/L, hemoglobin 101 g/L. Blood Biochemistry: Albumin 24.7 g/L, Creatinine 71 μmol/L, Lactate Dehydrogenase 519 U/L, Blood Glucose 15 mmol/L. Procalcitonin (PCT) 11.51 ng/mL. Brain Natriuretic Peptide 1,096.5 pg/mL. Echocardiogram findings: trace pericardial effusion. Chest X-ray findings: diffuse exudative lesions in both lungs, left pleural effusion (Figure 1). Left pleural drainage was performed. Pleural fluid analysis showed white blood cell count of 9 x 10^6/L, biochemical analysis: total protein 27 g/L, lactate dehydrogenase 664 U/L, indicating transudate. The patient remained hypoxemic with oxygen saturation < 100 mmHg despite adequate sedation, analgesia, and muscle relaxation. She was diagnosed with severe pneumonia complicated by severe acute respiratory distress syndrome. Additionally, the patient had undergone a caesarean section and had contraindications for prone positioning. Therefore, venous-venous extracorporeal membrane oxygenation (VV-ECMO) therapy was initiated (rotation speed 2,500 rpm, blood flow rate 3.5 - 4.0 L/minute, gas flow rate 3.0 - 4.0 L/minute). The patient had a high fever, with a maximum temperature of 39.8°C, no chills, and negative blood cultures. She was administered meropenem (1 g 3/day) combined with tigecycline (50 mg 2/day) for infection control, methylprednisolone succinate (40 mg 2/day), intermittent fiberoptic bronchoscopy examinations, intravenous immunoglobulin (20 g/day) to enhance immunity and other supportive treatments. Three days later, a re-examined chest X-ray showed improvement (Figure 2). Vasoactive drugs were discontinued, and methylprednisolone succinate was reduced to 40 mg/day. However, the patient remained febrile with a maximum temperature of 38°C. Repeated PCT was 2.69 ng/mL and lactate dehydrogenase 481 U/L. The metagenomic next-generation sequencing results of the patient's bronchoalveolar lavage fluid (BALF) were as follows: Klebsiella pneumoniae (sequence number: 9840), Acinetobacter baumannii (sequence number: 5001), Pneumocystis jirovecii (sequence number: 12440). The patient was diagnosed with severe PCP. Tigecycline was discontinued and meropenem was continued for antimicrobial therapy. Sulfamethoxazole/trimethoprim (0.4 g:80 mg) was added 1.6 g 4/day combined with intravenous cefoperazone 50 mg 1/day (initial dose 70 mg) for infection control. Ten days later, the patient had no fever, and blood gas analysis showed oxygenation fluctuating between 250 - 280 mmHg. Meropenem and methylprednisolone sodium succinate were discontinued, ECMO was removed, and treatment with sulfamethoxazole/metronidazole combined with intravenous capreomycin treatment. Seven days later, lactate dehydrogenase levels were 204 U/L, and chest X-ray showed significant improvement (Figure 3). Capreomycin was discontinued, and sulfamethoxazole/trimethoprim therapy continued. The tracheostomy tube was removed, and the patient was transferred to the obstetrics department for further treatment.

DISCUSSION

PCP is commonly found in HIV-infected individuals, solid organ transplant recipients, hematopoietic stem cell transplant recipients, patients with hematological malignancies, and patients with rheumatic connective tissue diseases receiving immunosuppressive therapy

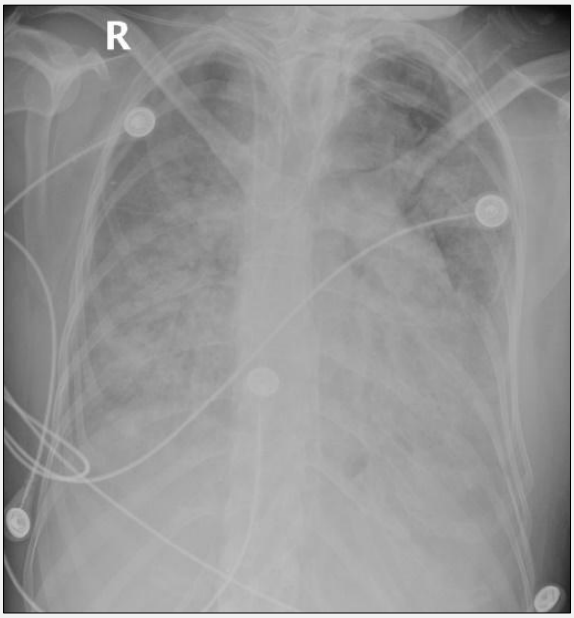

Figure 1. Diffuse exudative lesions in both lungs.

Figure 2. The exudative lesions in both lungs have slightly absorbed compared to before.

Figure 3. The exudative lesions in both lungs have basically been absorbed.

[1]. It is rare in HIV-negative pregnant women. The patient is HIV-negative and has gestational diabetes. Poor glycemic control in pregnant women with diabetes is a key factor driving immune dysfunction [4], such as inhibiting neutrophils and the mononuclear phagocyte system, and reducing the ability of macrophages to recognize and clear pneumocystis [5]. Levels of tumor necrosis factor-α (TNF-α) and interleukin-6 (IL-6) are significantly reduced in pregnant women [6], and these pro-inflammatory factors play a central role in activating antifungal immune responses. In addition, hyperglycemia directly inhibits T lymphocyte proliferation and differentiation, reducing Th1 immune responses while proportionally increasing Th2 humoral responses [7], thereby weakening antigen presentation capacity against pneumocystis and promoting its growth and reproduction. Consequently, poor glycemic control and decreased immunity in patients with gestational diabetes may lead to the development of PCP. PCP patients often present with non-specific clinical symptoms such as fever, dry cough, and shortness of breath, which are frequently misdiagnosed as respiratory infections. Additionally, pregnant women may be concerned that certain tests or treatments could have adverse effects on themselves or their unborn infants, leading them to delay hospitalization until their condition worsens. The patient presented with an acute onset and rapid progression of the disease, accompanied by shock. Chest imaging was extremely poor, the pathogen was unknown, and invasive mechanical ventilation and ECMO support were required. The condition was complex and critical. G-test and inflammation-related markers lacked specificity. Ultimately, Pneumocystis jirovecii was identified through mNGS of bronchoalveolar lavage fluid, confirming the diagnosis and guiding further treatment, leading to the patient's recovery. However, mNGS cannot distinguish between infection and colonization [8], so it must be combined with other clinical features of PCP for comprehensive assessment. Compared with HIV patients, non-HIV patients have shorter symptom duration, shorter time to progression to respiratory failure, more common shock [9], and higher mortality [10]. Therefore, how to efficiently and accurately diagnose and treat PCP, especially in non-HIV-infected pregnant women, remains a challenge for clinicians. The radiation dose to the fetus from a chest CT scan is very low because it does not involve direct irradiation, but rather indirect radiation. The maximum estimated radiation dose to the fetus from a chest CT scan is less than 1 mGy, with an average of 0.22 mGy. Therefore, chest CT is safe for the early diagnosis of PCP during pregnancy [11]. Currently, there are few studies on the application of ECMO in critically ill PCP patients. In this case, the pregnant woman survived the critical period through VV-ECMO treatment, providing evidence for the application value of ECMO in non-HIV critically ill PCP patients.

CONCLUSION

Severe PCP in non-HIV pregnant women is relatively rare. The clinical manifestations are non-specific. Clinicians need to comprehensively judge the risk factors of PCP in patients, and combine laboratory results (G test and LDH levels), chest imaging, and BALF mNGS to confirm the diagnosis and give treatment as early as possible. For patients with extremely poor oxygenation, ECMO should be performed as early as possible to reduce mortality.

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Ethical Approval:
This study was approved by the ethics committee of North China University of Science and Technology Affiliated Hospital. All procedures performed in the studies were in accordance with the ethical standards. Informed consent was obtained.

Declaration of Interest:
No conflicts of interest.

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