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POLISH GYNECOLOGY
GINEKOLOGIA POLSKA
ORGAN POLSKIEGO TOWARZYSTWA GINEKOLOGICZNEGO
THE OFFICIAL JOURNAL OF THE POLISH GYNECOLOGICAL SOCIETY

ISSN: 0017-0011

e-ISSN: 2543-6767

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DOI: 10.5603/gpl.100177

Article type: Review paper

Submitted: 2024-04-09

Accepted: 2024-05-28

Published online: 2024-09-10

REVIEW PAPER / OBSTETRICS

Severe novel coronavirus infection in late pregnancy: a case report

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ABSTRACT

This study reported the diagnosis, treatment and perinatal outcome of a novel coronavirus infection patient at 29^{+6} weeks pregnancy. The patient case came to the hospital with persistent fever and cough for 6 days. Patient's chest CT diagnosis showed double pneumonia, and viral infection was considered. Blood gas analysis revealed type I respiratory failure, and a throat swab nucleic acid test confirmed the novel coronavirus infection (critical type). After 13 days of isolation and supportive treatment, the patient recovered and was discharged from hospital after two consecutive negative nucleic acid tests. After discharge, the patient delivered a baby girl successfully by cesarean section on March 16, 2023. The newborn weighing 2050 g, with an Apgar score of 9–10 points /1–5 minutes. The newborn was transferred to the neonatology department for hospitalization and discharged 10 days later. The patient and her baby were followed up for nearly 1 year. Both mother and daughter were in good health.

Keywords: severe type of novel coronavirus infection; pregnancy; virus; pneumonia; infant; follow-up visit

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CASE DATA

Basic data

Patient case: female, 32 years old, company staff. The patient presented to the hospital on January 22, 2023 with persistent fever and cough.

Six days before admission, the patient had persistent fever without obvious cause, and the highest temperature of the patient reached 39℃. The patient's obvious symptoms are cough, sputum, dry cough, chest tightness, choking, obvious after activity, cannot sleep at night, with fatigue and muscle pain. The patient had no abdominal pain, diarrhea, chills, chest pain, hemoptysis, palpitation, or edema of both lower limbs. When patients take "acetaminophen tablets" treatment, body temperature can be reduced to normal, but normal body temperature can only be maintained for 4 hours, and then the fever may return. The patient was admitted to Weifang Maternal and Child Health Hospital on January 22, 2023. Chest CT plain scan in hospital showed double pneumonia, self-tested positive for novel coronavirus antigen, and then took "Nirmatrelvir (150 mg, 2 tablets)/Ritonavir (100 mg, 1 tablets)" for treatment. The patient underwent further treatment in the emergency department of our hospital and the blood oxygen saturation was measured at 89%, and the blood gas analysis results show that PH 7.49 PCO_2 28 mm Hg, PO_2 58 mm Hg% FiO_2 21%. Emergency Department diagnosed "severe pneumonia and type I respiratory failure" and admitted the patient to the Respiratory and Critical Care Medicine Department.

Previous history: Previous good health.

Basic inspection: The test results show that body temperature 36.5℃, pulse 116 times/min, respiration 16 times/min, blood pressure 118/59 mm Hg. The patient had clear consciousness, breathless appearance, normal thorax, quiet sound on percussion,

low respiratory sound on auscultation, audible moist rales on both lungs. Further examination showed that the heart boundary of the patient was not large, the heart rate was 116 beats/min, regular heart rhythm, the sound of the heart beat was low and dull, and no abnormal murmurs were heard in each valve area, and there was no edema in both lower limbs, and bilateral pathological signs were negative.

Medical pathological examination

January 22, 2023: the novel coronavirus nucleic acid was positive.

January 30, 2023 and February 1, 2023: the nucleic acid of the novel coronavirus was negative.

January 22, 2023: D dimer, 1.77 μg/mL.

January 22, 2023: Blood routine, blood images, and indicators of fast C-reactive protein. The blood routine examination results are shown in Table 1; C-reactive protein results showed 91.7 mg/L, exceeding the normal index; the results of blood imaging showed that the leukocytosis under the microscope was mainly classified as neutral granulation.

January 22, 2023 to January 28, 2023: Interleukin-6 tests were performed daily and the results were shown in Table 2.

January 23, 2023: Erythrocyte sedimentation rate index: 65 mm/h.

January 23, 2023: Electrocardiogram showed sinus tachycardia.

January 31, 2023: Chest orthograph bedside photography, imaging results combined with the doctor's diagnosis to consider double pneumonia (Fig. 1).

Admission diagnosis

Combined with the results of various auxiliary examinations, the patient was diagnosed as: Severe pneumonia; Novel coronavirus infection (critical type); Viral pneumonia; Bacterial pneumonia; Type I respiratory failure. In addition, the patient was 29^{+6} weeks pregnant.

Hospitalization

Routine treatment: The patient was admitted to Respiratory intensive care unit (RICU) in our hospital on January 22, 2023, and given patients continuous Electrocardiograph (ECG) oximetry monitoring and high flow humidifying oxygen therapy.

Drug treatment: The specific drug treatment methods (drug dosage and duration) are shown in Table 3.

Treatment outcome

The patient's clinical symptoms gradually improved one week after admission, and the oxygen concentration and oxygen flow rate of the patient's high-flow oxygen intake decreased from 60% oxygen concentration and 40 L/min at admission to 37% oxygen concentration and 30 L/min. At the same time, the oxygen and index of the patient gradually increased after hospitalization (Fig. 2).

Imaging examination showed that the patient's bedside chest radiograph and chest CT gradually improved absorption of double pneumonia (Fig. 3).

Follow-up visit

The patient was discharged from the hospital on February 4, 2023, with no obvious chest tightness, breath-holding, cough or sputum, and two consecutive nucleic acid tests were negative. Then a patient case delivered a baby girl by cesarean section on March 16, 2023. The baby girl weighed 2050 g with an Apgar score of 9–10 points /1–5 minutes. After delivery, the baby girl was transferred to the neonatal department for observation and treatment for 10 days before discharge. At present, the telephone follow-up for nearly one year, the prognosis of both the baby girl and her mother are well.

DISCUSSION

Susceptibility of pregnant women to novel coronavirus

Pregnant women are more susceptible to various viruses infection due to weakened immune function, changes in physiological adaptability and increased

physical burden [1–3] . For example, in pregnant women, the diaphragm rises, the respiratory mucosa becomes congested and edema, and the oxygen consumption increased, which not only affects the respiratory movement of the pregnant women's lungs, but also makes them more tolerant to hypoxia, making them more susceptible to respiratory pathogens and developing into severe pneumonia [4–7]. Therefore, pregnant women may have an increased chance of developing severe infections compared to non-pregnant women of the same age. In addition, due to psychological factors of pregnant women [8], such as concerns about mother-to-child transmission, limited drug treatment during pregnancy or the effects of drugs on the fetus [9], pregnant women often do not receive timely treatment after illness. At present, it is generally believed that pregnancy may aggravate the clinical course of novel coronavirus infection and may also lead to aggravation of the disease [10 –12]. Also, a study suggests that pregnant women with COVID-19 are at higher risk of complications during pregnancy and their newborns are more likely to be sent to the neonatal intensive care unit (NICU) and born prematurely [13].

Identification of severe disease in pregnancy with novel coronavirus infection

Because of women during pregnancy are generally younger, and most of them do not have underlying diseases, and their conditions are relatively stable, there are fewer severe patients at this stage, and critical cases are rare. Therefore, when we receive pregnant patients, we must accurately identify and actively deal with the disease of patients. Pregnant patients in the third trimester may have the following symptoms, examples include hypoxemia, progressive exacerbation of respiratory distress, deterioration of tissue oxygenation indicators (oxygen saturation, oxygenation index), progressive increase of lactic acid, progressive decrease of peripheral blood lymphocyte count, and progressive increase of inflammatory factors such as interleukin-6, C-reactive protein, and ferritin [14 –16]. If a patient develops the above symptoms, medical workers should be alert to the possibility of deterioration and progression to severe disease [17].

Chest low-dose X-ray and CT examination are important bases for evaluating lung injury in patients infected with COVID-19 [18, 19]. Under perfect radiological protection conditions, low dose X-ray or CT examination of the chest can be performed in the second and third trimester of pregnancy. A study has shown that in the third trimester of pregnancy complicated with COVID-19, timely termination is recommended for patients with term or rapid progression of lung lesions, and termination has a good outcome for the mother and child [20, 21].

Pregnancy with novel coronavirus infection medication precautions

However, the safety and effectiveness of some drugs for mother and child has not been proven, thus the risk should be fully informed when using to ensure that it will not affect the health of the mother and the baby. At present, numerous studies and clinical data show that antiviral drugs can effectively reduce the risk of infected patients with mild to moderate COVID-19 evolving into severely infected patients [22, 23]. The National Health Commission of China recommended oral antiviral drugs including Nirmatrelvir /Ritonavir combination package, Azvudine and Molnupiravir in the Diagnosis and Treatment Protocol for Novel Coronavirus Infection [24]. However, the main cause of death in patients with severe COVID-19 pneumonia is multiple complications caused by lung damage [25, 26]. In addition, interleukin-6 receptor antagonist monoclonal therapy with tocilizumab (TCZ) has shown potential therapeutic efficacy in patients with COVID-19 [27]. However, currently available data on TCZ in pregnant women are limited and insufficient to determine whether there is a drug-related risk of major birth defects and miscarriage. Therefore, for pregnant women with novel coronavirus infection, the use of TCZ should be carefully considered, and the situation of the pregnant women and the fetus should be closely monitored.

Attention to the mental health of women during pregnancy

During the treatment of this patient, we found that pregnant women infected with the novel coronavirus may have psychological problems, such as insomnia, anxiety (including panic attacks), depression, hypochondria, compulsion, *etc*. [28, 29]. Thus, screening and intervention of maternal psychological symptoms should be standardized. For high-risk pregnant women with a history of depression or anxiety and a family history of mental illness, obstetricians can cooperate with psychologists to provide online or offline pregnancy education to pregnant women, introducing pregnancy-related knowledge, examination contents at different gestational weeks, and precautions during childbirth. According to the specific conditions of the pregnant women, timely multi-disciplinary hierarchical diagnosis and treatment should be carried out in psychological specialist clinics and obstetric outpatient clinics. Pregnant women with mild psychological disorders, non-drug intervention should be given in time in combination with gynecological and psychological specialists. Pregnant women with moderate to severe psychological disorders can be hospitalized in specialized wards and specialized hospitals, and the psychological diagnosis and treatment mode of multidisciplinary teams can be initiated, and non-drug intervention and/or drug intervention comprehensive treatment can be given [30, 31]. Drug intervention should refer to the classification of psychiatric drugs in pregnancy and follow the principle of individuation [32].

In summary, the clinical characteristics and prognosis of pregnant women with novel coronavirus infection may not be worse than that of the general population. And in most cases, maternal and fetal and neonatal outcomes observed in the third trimester appear to be favorable. However, the pathogenesis of novel coronavirus infection and its long-term effects on mother and their infants still need further study. It is hoped that the diagnosis and treatment experience of this case can provide reference for the subsequent diagnosis and treatment of related cases.

Article information and declarations

Author contributions

JL carried out the research design and conception; ZY analyzed and interpreted the data regarding; BW performed the examination of sample; NY and BW contributed essential reagents or tools; JZ and ZY authors wrote and revised the manuscript. All authors read and approved the final manuscript.

Ethics statement

The experimental procedures were all in accordance with the guideline of the Ethics Committee of Weifang People's Hospital and has approved by the Ethics Committee of Weifang People's Hospital. This study complies with the Declaration of Helsinki.
A signed written informed consent was obtained from each patient.

Availability of data and materials

The data used and analyzed can be obtained from the corresponding author under a reasonable request.

Funding

None.

Acknowledgements

Not applicable.

Conflict of interest

The authors declare that they have no competing interests.

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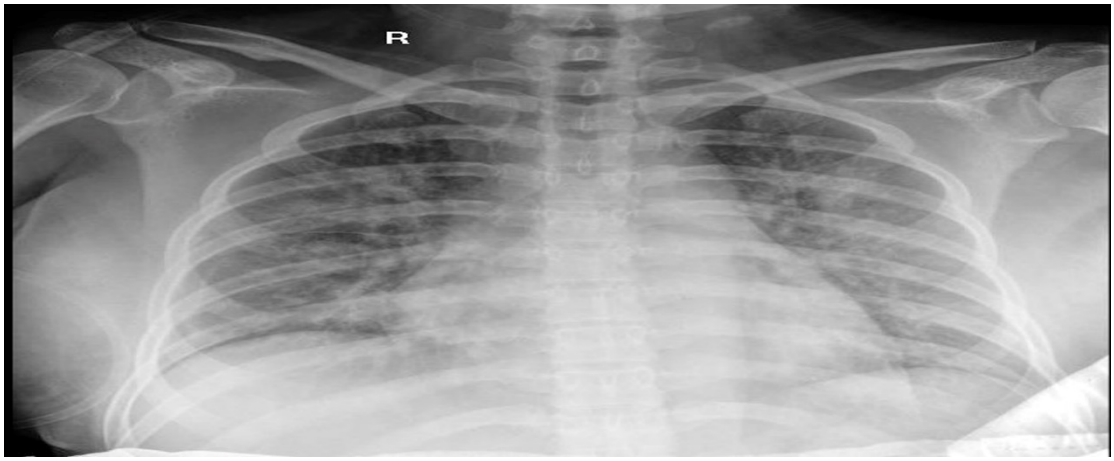

Figure 1. Bedside photography of patient's chest in front position

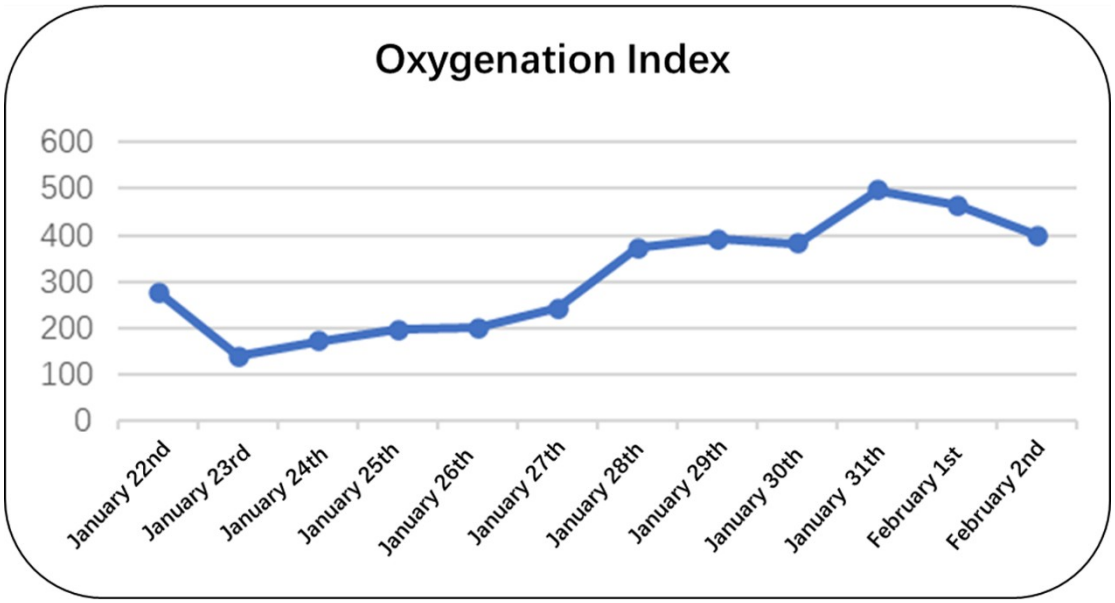

Figure 2. Blood oxygen indexes after hospitalization

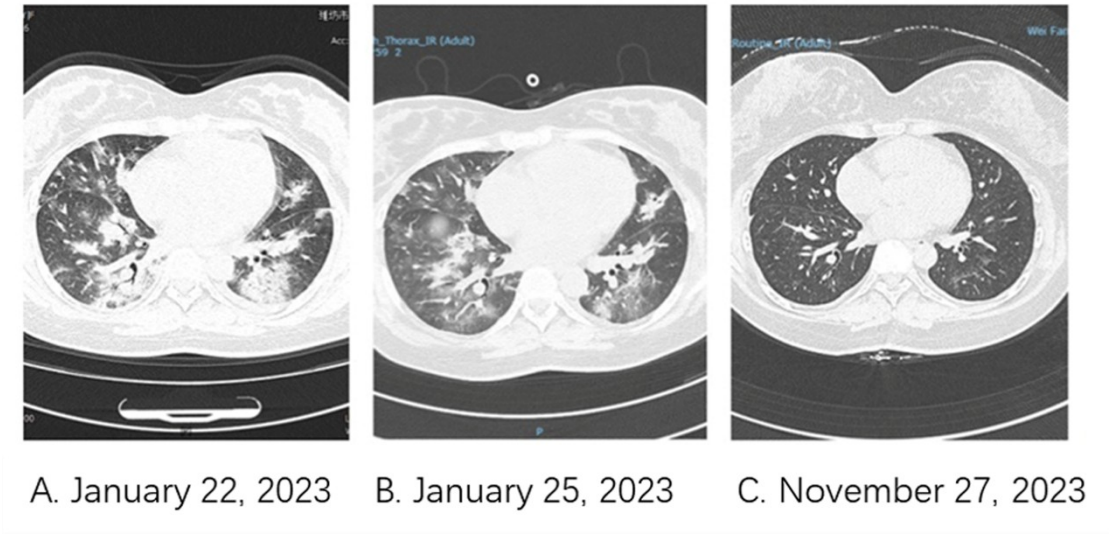

Figure 3. Chest CT of patient on different dates

No.	Project Name	Result	Units
1	Leukocyte Count	13.02	10^{9}/L
2	Lymphocyte ratio	3.7	%
3	Monocyte ratio	1.3	%
4	Neutrophil ratio	95	%
5	Eosinophilic cell ratio	0.0	%
6	Neutrophil ratio	12.37	10^{9}/L
7	Lymphocyte absolute value	0.48	10^{9}/L
8	Eosinophils absolute value	0.0	10^{9}/L
9	Erythrocyte count	3.53	10^{12}/L
10	Hemoglobin	113	g/L
11	Hematokrit	33.7	%

Table 1 Blood routine examination

Table 2. Interleukin-6 test results

No	Date	Result	Units
1	January 22, 2023	203.4	pg/mL
2	January 23, 2023	66.46	pg/mL
3	January 24, 2023	28.69	pg/mL
4	January 25, 2023	17.05	pg/mL
5	January 27, 2023	16.49	pg/mL
6	January 28, 2023	54.85	pg/mL
7	January 29, 2023	39.42	pg/mL
8	January 31, 2023	24.63	pg/mL

Table 3. Drug therapy

Date (2023)	Medicine	Medicine classification	Medicine dosage	Continuous days
January 22	Cefotaxime	Anti-infection	3.0g, twice/day	13
January 22	Nirmatrelvir/ Ritonavir	Antiviral	150 mg, 2 tablets/100 mg, 2 tablets, twice/day	5
January 22, January 26—February 4	Methylprednisolone sodium succinate	Hormone	40 mg, once/day	10
January 23—January 24	Dexamethasone	Hormone	5 mg, once/12h	2
January 22	Budesonide	Nebulization	2 mg, once/12h	13
January 22	Low molecular heparin	Anti-freezing	4250 IU, once/day	13
January 23	Tocilizumab		400 mg, once/day	1
January 24	Human serum albumin		20 g, once/day	10
January 24	Gamma globulin		5 g, once/day	10