BRIEF COMMUNICATION

Critically ill pregnant patient with COVID-19 and neonatal death within two hours of birth

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SYNOPSIS: COVID-19 may lead to a sharp decline in blood oxygen, can cause sudden changes in the fetal intrauterine environment, and could possibly result in neonatal death.

While most pregnant women with coronavirus disease 2019 (COVID-19) appear to experience a milder clinical course [1,2], the present report describes a critical case of COVID-19 in a pregnant woman. We discuss the identification, diagnosis, disease progression, and treatment outcome in a 31-year-old pregnant woman admitted to Xiaolan People's Hospital of Zhongshan at 35+2 weeks of pregnancy with no known comorbidity or history of chronic illness. Onset of symptoms in the patient began with a sore throat and dry cough for 4 days, followed by fever and dyspnea for half a day. The timeline of the patient's disease history and illness progression is shown in Figure 1. The patient experienced rapid aggravation of the disease. Emergency cesarean delivery was performed at the bedside, but the neonate died within two hours of birth (Fig. 2).

Although the patient had no history of chronic disease, the severity of COVID-19 increased rapidly—from dyspnea to acute respiratory distress syndrome and septic shock within 12 hours. The patient's condition worsened, with persistent decreases in white blood cell and lymphocyte counts. Inflammation indicators of C-reactive protein, procalcitonin, and interleukin 6 all increased significantly, whereas peripheral oxygen saturation level decreased progressively. Given these circumstances, white blood cell and lymphocyte counts of COVID-19 patients should be monitored closely. Changes in lymphocyte counts and oxygen saturation, blood gas analysis, and pulmonary inflammation imaging should be assessed as early biomarkers for predicting the prognosis of critically ill patients with COVID-19.

Infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) caused this pregnant patient to suffer multiple organ dysfunction, including heart, liver, and kidneys. Although the patient was managed using timely systematic treatment and salvage therapies, the neonate died within 2 hours of birth. This may be due to the rapid deterioration in maternal condition, which eventually led to the death of the neonate. This case may also suggest that COVID-19, which leads to a sharp decline in blood oxygen,

can cause sudden changes in the fetal intrauterine environment and possibly result in neonatal death.

The possible severe complications of SARS-CoV-2 infection may cause neonatal death because the inflammatory storm caused by the infection triggers a systemic immune response [3], which may also attack fetal organs. Biochemical examination of umbilical cord blood at birth revealed a marked increase in myocardial enzymes, suggesting that the fetal myocardium was severely damaged. Considering the severe hypoxia, the possibility of immune damage cannot be ruled out, which may have led to difficulty in resuscitation and eventual death of the newborn. Critical cases due to maternal hypoxia and unstable circulation may endanger the fetus for a short period of time and may cause fetal death in utero.

AUTHOR CONTRIBUTIONS

JL, YW, BL, SH, DC designed the study. JL, YW, TS, XP, MW, FH, LH were responsible for data collection and interpretation. YZ drafted the manuscript. JL, YW, BL, SH, DC made essential revisions.

CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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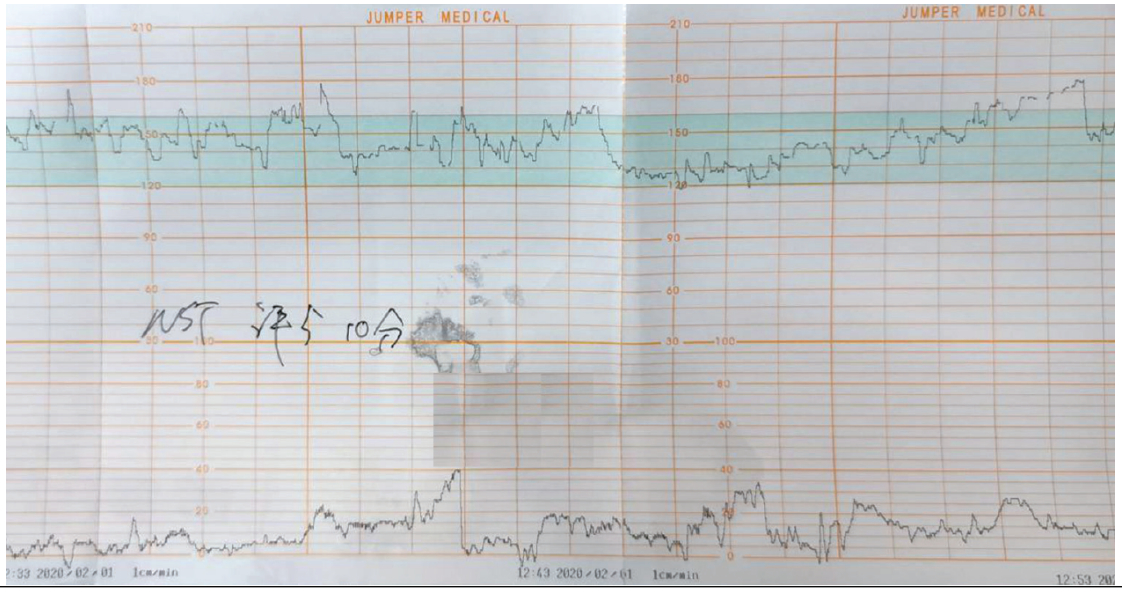
FIGURE LEGEND

Figure 1. Timeline of disease history and illness progression in a critically ill pregnant patient with COVID-19.

Figure 2. Fetal heart monitoring results and neonatal information on February 1, 2020.

Symptom onset	Sore throat, fever, dry cough, chest tightness, nasal congestion, nasal mucus since Jan. 28, 2020				Palpitations, dyspnea		Acute respiratory distress syndrome, DIC, septic shock, multiple organ dysfunction (heart, lung, liver, and kidney), sepsis cardiomyopathy																								
Lab tests	Blood routine, PCR testing for COVID-19 conducted Feb. 1, 2020				RT-PCR testing (+)		Lymphopenia, blood gas analysis with respiratory acidosis, PLT 57.00 (10^9/L), abnormal coagulation																								PCR testing (-)
Chest exam	CT reported left bottom with ground glass opacity, indicating novel coronaviral pneumonia on Feb. 1, 2020				Arrhythmias		Both lungs had low brightness and diffusely distributed ground-glass opacity. Heart ultrasound examination: pericardial effusion, arrhythmias																								Pulmonary fibrosis
Treatment type	Home isolation			O2 and supportive therapy	Antivirals, antibiotics, oxygen therapy	Glucocorticoid	Antivirals, antibiotics, oxygen therapy, and glucocorticoids, tracheal intubation ventilator assisted ventilation, continuous renal replacement therapies, sedation treatment, ECMO therapy with VV mode, immunity therapy, blood transfusion, traditional Chinese medicine, supportive therapy																								
Maternal outcomes	Gestation at 35w, para 2 by cesarean delivery (twice), no chronic disease history			Emergency cesarean delivery	Rescue treatment and supportive therapy		ICU stay																								
Fetal/ neonate outcomes	Fetus alive			Neonate died			With ECMO																							Infection ward	
	Date	Jan. 17-24	Jan. 25-31	Feb.1	Feb.2	Feb. 3-5	Feb. 6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Feb. 27	Feb. 28-Mar. 7	Mar. 8	Mar.9-13	Mar. 14-16	Mar. 17
	Disease history and progress	Travel to Hubei	Home isolation	Admitted to Xiaolan Hospital	Transferred to Zhongshan Second People's Hospital	ICU	Started ECMO																				Ended ECMO		Withdraw ventilator		Transfer to infection ward	Discharge

Figure 2. Fetal heart monitoring results and neonatal information on February 1, 2020.

Time	Laboratory tests and clinical outcomes
04:20	Fetal heart rate 160 beats per min at hospital.
09:00–09:25	Obstetrician conducted routine consultation. Baseline heart rate 155 beats per min.
10:25	Fetal heart rate 142 beats per min.
12:30–14:20	Started continuous fetal heart rate monitoring with good response. Fetal heart rate ranged from 110–130 beats per min.
14:30	Preparation for emergency cesarean delivery and installation of newborn resuscitation equipment.
14:30–15:55	Fetal heart rate ranged from 120–160 beats per min. 
15:55	Started general endotracheal anesthesia. Fetal heart rate 140 beats per min.
16:05	Emergency cesarean delivery conducted at the bedside.
16:13	Newborn delivery. Gender: male; birth weight: 2700 g; severe asphyxia.
16:14–16:22	Apgar score of 1 at 1 min. Neonatal heart rate 20 beats per min. after birth. Neonatal rescue team began rescue interventions. The team immediately started using a tracheal intubation ventilator, continuous high-frequency (90 beats/min), 100% oxygen positive artificial pressure ventilation, and performed high-frequency chest heart compression (120 per min). Thoracic undulations were

	good during ventilation. The umbilical vein channel was successfully established 3 minutes after birth; a dose of 1.5 mL of epinephrine 1:10 000 was given and injected every 5 minutes. Apgar score remained 1 at 4 and 10 minutes.
16:23–17:49	Neonatal rescue treatment continued. Laboratory tests of umbilical cord blood: white blood cell count 16.8×10^9/L; lymphocyte ratio 46.1%; blood gas analysis: PH=6.556, carbon dioxide partial pressure 58.7 mmHg, partial oxygen pressure 64.3 mmHg, residual alkali 33.9 mmol/L, lactic acid 7.9 mmol/L; cardiac enzymes: creatine kinase (CK1) 122 U/L, creatine kinase isoenzyme 584 U/L.
17:50	Doctors informed the parents about the neonate's critical condition and poor prognosis. The parents decided not to continue resuscitating the neonate.
18:10	Neonatal death was confirmed, and the parents declined an autopsy.