Clinical Infectious Diseases

BRIEF REPORT

A Case Report of Neonatal 2019 Coronavirus Disease in China

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In December 2019, the coronavirus disease (COVID-19) caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in China and now has spread in many countries. Pregnant women are a population susceptible to COVID-19 and are more likely to have complications and even progress to severe illness. We report a case of neonatal COVID-19 in China with pharyngeal swabs testing positive by real-time reverse-transcription polymerase chain reaction assay 36 hours after birth. However, whether the case is a vertical transmission from mother to child remains to be confirmed.

Keywords. COVID-19; SARS-CoV-2; novel coronavirus; pneumonia.

In December 2019, a pneumonia caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in Wuhan, Hubei Province, China. Since 2019 coronavirus disease (COVID-19) is highly contagious with a certain mortality rate, it was classified as a class B infectious disease and managed as a class A infectious disease in China in January 2020 [1]. China has taken strict infection control measures, isolated the exposed and suspected cases according to international standards, constantly updated the diagnosis and treatment process, and carried out public education [2].

SARS-CoV-2, along with severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV), belongs to the *Betacoronavirus* genus. In the past 20 years, SARS-CoV and MERS-CoV infected > 10 000 persons worldwide. The mortality rate of SARS-CoV infection is 10%, of which the mortality rate of SARS-CoV infection in pregnant women is 25%, and the mortality rate of MERS-CoV infection is up to 37% [3–6]. Pregnant women are a susceptible population of SARS-CoV-2 and are more likely to have complications and even progress to severe illness. There are not enough data to determine the effect of COVID-19 infection on the fetus. Whether COVID-19 has mother-to-child vertical transmission, and its short-term and long-term harm to offspring, is still unclear.

We report a case of neonatal COVID-19 infection in China with pharyngeal swabs testing positive by real-time reverse-transcription polymerase chain reaction (rRT-PCR) assay 36 hours after birth. However, whether the case is a vertical transmission from mother to child remains to be confirmed.

CASE PRESENTATION

The mother of the neonatal patient is a 34-year-old pregnant woman who lives near the Huanan Seafood Wholesale Market (about 1.2 km walking distance) in Wuhan. She has not been to the market during pregnancy and her family has no confirmed or suspected cases of COVID-19, but > 15 people had been diagnosed in the same community she lives in. She had a history of hypothyroidism for 4 years and has been treated with oral drugs, with no history of hypertension, diabetes, or heart disease. She had a termination of pregnancy in 2016 due to chromosomal abnormalities. She is allergic to penicillin and first-generation cephalosporins (positive in skin test).

At 8:00 PM on 1 February 2020, the pregnant woman (at 40 weeks' gestation) developed a small amount of vaginal bleeding and lower abdominal pain. Two hours later, she developed a fever (37.8°C) and presented to the Wuhan women and children's medical care center for medical advice. As she was febrile, she was referred to the fever clinic of Wuhan Tongji Hospital the next morning. Thoracic computed tomography (CT) scan showed ground-glass opacities in the left upper and lower lobes, indicating the possibility of viral pneumonia (Figure 1). Blood tests revealed lymphopenia (0.97×10^9 cells/L [normal, $1.1–3.2 \times 10^9$ cells/L]), neutrophilia (9.97×10^9 cells/L [normal, $1.8–6.3 \times 10^9$ cells/L]), and elevated high-sensitivity C-reactive protein level (11.5 mg/L [normal, < 1 mg/L]). She was hospitalized for suspected viral pneumonia.

On admission, her body temperature was 37.8°C and her blood pressure was 131/89 mm Hg, with a respiratory rate of 20 breaths per minute and heart rate of 96 beats per minute. She had no cough or sputum. Fetal heart rate was 136 bpm and fetal heart monitoring showed no abnormality. Emergency cesarean delivery was performed. Meconium-stained liquor was noted intraoperatively. At 8:45 AM, she delivered a baby boy weighing 3205 g. Apgar scores at 1 and 5 minutes were 8 and 9,

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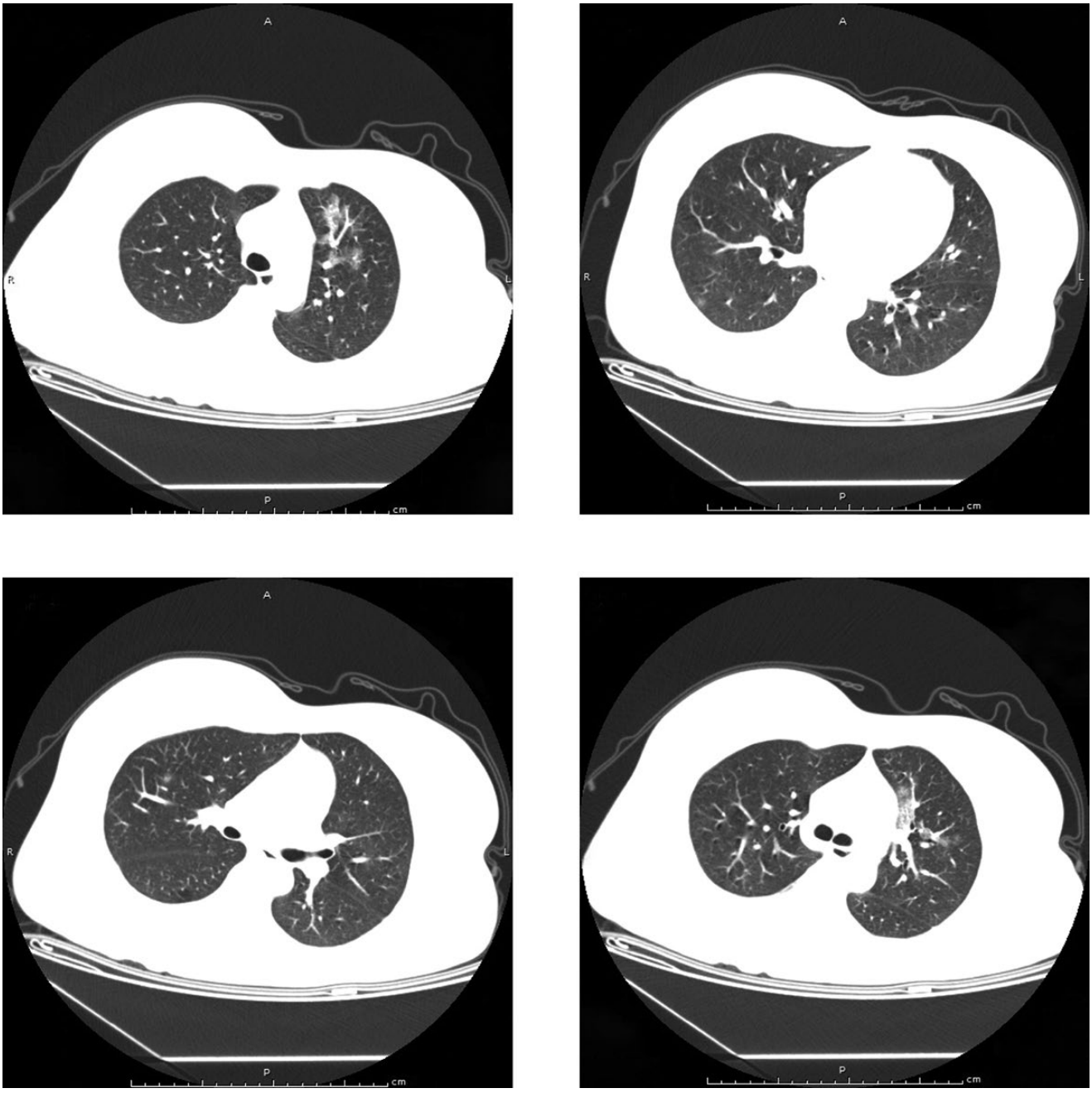

Figure 1. Chest computed tomography of the mother, obtained on 2 February 2020, showing signs of infection in the left upper and lower lobe, indicating the possibility of viral pneumonia, with limited emphysema in the right lower lobe and a little cord focus in the right middle lobe.

respectively. The infant had no moaning or spitting after birth. The skin was ruddy and the crying was loud. The mother had been wearing an N95 mask throughout the operation, and the baby had no contact with the mother after birth. The infant was transferred to the neonatology department 10 minutes after birth for close observation and the mother was transferred to the fever ward for isolation after surgery.

Half an hour after birth, the infant vomited once after feeding with formula, which we considered to be swallowing syndrome. After gastric lavage, the infant could be fed normally. Blood tests of the neonate revealed lymphopenia (2.43×10^9 cells/L [normal, $3–8 \times 10^9$ cells/L]), deranged liver function tests (aspartate aminotransferase 143 U/L [normal, ≤ 41 U/L]; total bilirubin 33.0 μmol/L [normal, ≤26 μmol/L]; indirect bilirubin 26.0 μmol/L [normal, ≤ 16.8 μmol/L]) and elevated creatine kinase level (479 U/L [normal, ≤ 41 U/L]). Intravenous penicillin G (150 000 U once daily, intravenous bolus) and vitamin K1 (1 mg once daily, intravenously) were given as antibiotic prophylaxis and to prevent coagulopathy, respectively.

The mother was well and afebrile during the immediate postoperative period. She had no cough or any other discomfort such as diarrhea, nausea, or vomiting. Her vital signs were stable with blood oxygen saturation of 99%. Antiviral treatment, including 40 μg of recombinant human interferon α1b atomized inhalation with 2 mL of sterilization injection water twice daily and ganciclovir (0.25 g every 12 hours, intravenously), was administered. Abipenem (0.3 g every 12 hours, intravenously) and moxifloxacin (0.4 g once daily, intravenously) were used for antiinfection. The mother had intermittent fever on the first postoperative day with the highest temperature up to 38.3°C. She was given methylprednisolone (20 mg intravenously). Her pharyngeal swab sampled for SARS-CoV-2 reported back as positive later that day. A pharyngeal swab specimen was collected immediately from the infant (36 hours after birth), along with the breast milk of the mother. We recommended the mother not to breastfeed and to empty the breast milk to avoid mastitis.

The mental response of the newborn was acceptable the first day after birth and his blood oxygen saturation stayed > 92% without supplemental oxygen. The laboratory results of the infant returned negative including *Legionella pneumophila*, *Chlamydia pneumoniae*, *Mycoplasma pneumoniae*, Q fever (*Rickettsia*), adenovirus, respiratory syncytial virus, influenza A virus, influenza B virus, and parainfluenza virus 1–3.

On 4 February, the second day after the surgery, the mother's vitals were stable and she was given methylprednisolone (40 mg once daily, intravenously). The neonate was well and his blood gas analysis showed pH 7.476↑, partial pressure of carbon dioxide 28.2 mm Hg↓, partial pressure of oxygen 116.0 mm Hg↑, bicarbonate 20.6 mmol/L↓, base excess 1.30 mmol/L, and peripheral oxygen saturation 98.4%. A complete set of pediatric virus results of the infant reported back as negative, including cytomegalovirus, rubella virus, *Toxoplasma gondii*, herpes simplex virus types 1 and 2, echovirus, parvovirus B19, Epstein-Barr virus, coxsackievirus A16, coxsackievirus B, measles virus, varicella zoster virus. The neonatal chest radiograph showed thickened lung texture with no abnormalities in heart and palate (Figure 2). The infant was given formula 25 mL every 3 hours and closely monitored.

On 5 February, the newborn's vital signs were stable with the blood oxygen saturation maintained > 90%, with no discomfort such as apnea or vomiting. The result of pharyngeal swab for SARS-CoV-2 was positive at 36 hours after birth. Combining all of the laboratory results with full discussion, we made a diagnosis that the infant was confirmed with SARS-CoV-2 infection. Since the neonatal department of Tongji Hospital did not have the isolation conditions for the diagnosed newborn, he was transferred to Wuhan Children's Hospital for further isolation later that day. After finding evidence of neonatal infection, we performed nucleic acid tests for SARS-CoV-2 on cord blood and placental specimens that we retained during the operation, and the results were negative. The mother's breast milk sample was negative for SARS-CoV-2 as well.

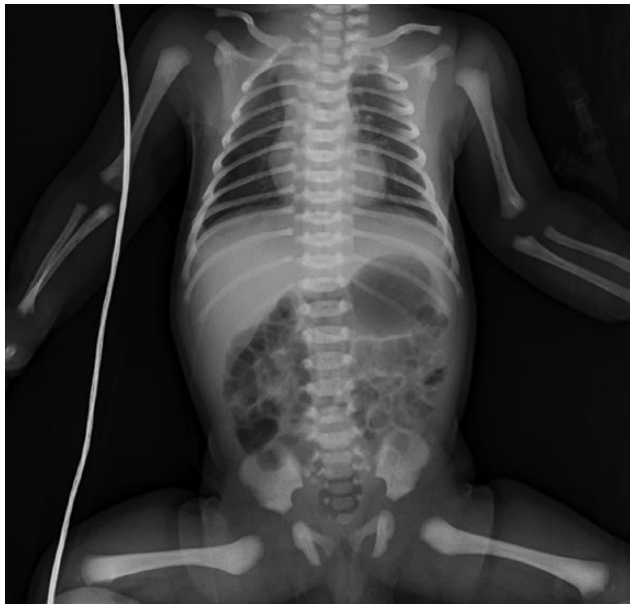

Figure 2. Chest radiograph of the newborn, obtained on 4 February 2020, showing thickened lung texture with no abnormalities in the heart and palate.

We followed up the newborn's condition after he was transferred to Wuhan Children's Hospital. He was well and afebrile with no cough or vomiting. He was closely monitored in isolation and no special treatment was given. Chest CT on 6 February showed high-density nodular shadow under the pleura of the posterior segment of the upper lobe of the right lung. Chest CT on 12 February showed that the upper lobe and lower lobe of the right lung were scattered with small pieces of patchy shadow. Chest CT on 17 February showed a few small pieces of patchy shadow in the upper lobe of the right lung, which were absorbed compared with the previous ones. On 17 February 2020, the nucleic acid tests of the pharyngeal and anal swabs for SARS-CoV-2 were negative. The newborn was discharged on 18 February 2020.

DISCUSSION

The severity of viral pneumonia in pregnancy is evidently related to physiological and immunological changes that result in a shift from cell-mediated to humoral-mediated immunity [7]. When pregnant women become infected with viral pneumonia, they are more likely to have complications and progress to severe disease [8]. A study in Hong Kong in 2004 showed that SARS during pregnancy is associated with high incidences of spontaneous miscarriage, preterm delivery, and intrauterine growth restriction [9]. Another study shows that pregnant women with pneumonia have an increased risk of developing low birth weight infants, preterm births, restricted fetal growth, and 5-minute Apgar score <7 compared to healthy pregnant women [10]. Although there have been no clinical or serological reports of SARS or MERS in neonatal infections in existing

studies [9, 11], evidence of vertical mother-to-child transmission in other respiratory viruses such as H1N1 and respiratory syncytial virus have been reported [12].

There have been several studies concerning the intrauterine vertical transmission potential of SARS-CoV-2 and its effects on newborns [13, 14]. All of the newborns of SARS-CoV-2–infected mothers in these cases were negative for nucleic acid test and 1 study showed that COVID-19 may have adverse effects on newborns, causing problems such as fetal distress, premature labor, respiratory distress, thrombocytopenia accompanied by abnormal liver function, and even death [14].

We report the first case of neonatal SARS-CoV-2 infection in China where the mother was confirmed with COVID-19. The clinical manifestations of the mother and the baby were both mild and the baby's prognosis was good. Whether the case is intrauterine vertical transmission or not remains controversial. The results of nucleic acid detection of cord blood and placenta in this case are negative, which do not support the diagnosis of intrauterine transmission, but the possibility of vertical intrauterine transmission of SARS-CoV-2 is not ruled out. The reasons are as follows: (1) When the viral load is not high enough, the detection rate of existing methods is limited and false negatives may occur. Therefore, the negative results of umbilical cord blood and placental nucleic acid during the operation do not exclude the possibility of false negatives. (2) According to the clinical manifestations, the pregnant woman first had fever symptoms at 10 PM on 1 February. However, the CT result after a few hours showed ground glass opacities in the left upper and lower lobes, suggesting that the pregnant woman may have been asymptomatic in the early stage. Since we lack the data of maternal viral load, there is no evidence whether the fetus had been infected with maternal viremia in utero before the mother had any clinical manifestation. (3) In addition to this case, neonatal infections have been reported in other provinces and cities in China [15]. The possibility of mother-to-child transmission of SARS-CoV-2 cannot be ruled out.

We also discussed whether the newborn was nosocomially infected. According to the No. 225 Management Guidelines for Obstetric Patients and Neonates Born to Mothers With Suspected or Probable SARS [16], we took strict measures to reduce the risk of infection. The male infant in the case reported was delivered by emergency cesarean under contact, droplet, and airborne transmission precautions [17]. The newborn had early clamping of the umbilical cord and early cleansing to remove maternal blood and amniotic fluid. Then he was transferred to an isolation room in the neonatal nursery shortly after delivery. The mother wore an N95 mask during the operation and had no close contact with the newborn. However, since we did not retain the specimens of the newborn's pharyngeal swabs shortly after birth, the first time we took samples of the newborn's pharyngeal swabs was 36 hours after birth. During this period, we cannot rule out the possibility of other contact transmission of newborn. In addition, it has been confirmed that SARS coronavirus was detected by RT-PCR in the maternal peritoneal fluid collected during cesarean delivery in 28 SARS patients [11], which reminds us that it is very important to shorten the delivery time and minimize the contact between fetus and maternal blood and body fluids during cesarean delivery.

CONCLUSIONS

Clinical data on COVID-19 in newborns are still very limited. Whether SARS-CoV-2 can transmit vertically through placenta, and its short-term and long-term harm to offspring, is still unclear. Therefore, it is important to keep all of the specimens of SARS-CoV-2–infected and suspected pregnant women and their newborns, including pharyngeal swabs, peripheral blood, placental tissue after delivery, amniotic fluid, cord blood, newborn pharyngeal swabs, and breast milk, for in-depth study and continuous follow-up observation in future generations.

Supplementary Data

Supplementary materials are available at *Clinical Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

Note

Potential conflicts of interest. The authors: No reported conflicts of interest. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest.

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