Breast Milk-fed Infant of COVID-19 Pneumonia Mother: a Case Report

Yuanyuan Yu

The Fourth Affiliated Hospital Zhejiang University School of Medicine <https://orcid.org/0000-0003-3106-7112>

Jian Xu (✉ xuj@zju.edu.cn)

The Fourth Affiliated Hospital Zhejiang University School of Medicine <https://orcid.org/0000-0002-0307-3198>

Youjiang Li

The Fourth Affiliated Hospital Zhejiang University School of Medicine

Yingying Hu

The Fourth Affiliated Hospital Zhejiang University School of Medicine

Bin Li

The Fourth Affiliated Hospital Zhejiang University School of Medicine

Case Report

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Abstract

In China, mothers with confirmed or suspected COVID-19 pneumonia are recommended to stop breastfeeding. However, the evidence to support this guidance is lacking. This report analyzes the case of a mother who persisted breastfeeding her baby when both were diagnosed with confirmed COVID-19 pneumonia. SARS-CoV-2 nucleic acid was not detected in the breast milk, and antibodies against SARS-CoV-2 were present in detected in the mother's serum and milk. There was no evidence of mother-to-child transmission of the virus through breastfeeding. This case report demonstrates that breastfeeding may even be useful for improving the recovery of the infant without exacerbating disease severity.

Background

In early December 2019, a new coronavirus named SARS-CoV-2 broke out in Wuhan, China, affecting the susceptible population and causing a highly infectious COVID-19 pneumonia (1). With cases now confirmed in multiple countries and mortality of 3.5% (2), COVID-19 has been declared by WHO as a global public health emergency (3). SARS-CoV-2 spreads primarily through droplets and close contact. According to the recommendations of experts and decision of authorities in China (4,5), patients with confirmed or suspected COVID-19 pneumonia should stop breastfeeding until recovery. However, it is uncertain whether SARS-CoV-2 can be present in breastmilk. A recent report of nine cases of pregnant women has shown that there is no evidence of vertical transmission (3). Here, we document for the first time a case of breastfeeding an infant by a SARS-CoV-2 infected mother and describe the clinical presentation, diagnosis, treatment, and prognosis. To assess the safety of breastfeeding and the protective effects of breast milk on infants, the presence of SARS-CoV-2 nucleic acid was determined in serum, breast milk, nasopharyngeal swabs, and feces, and IgM and IgG antibodies against SARS-CoV-2 were assessed in serum and breast milk.

Case Study

The patient was a 32-year-old female, mother of a 13-month-old boy who was breastfed since birth. On January 20, 2020, the patient and her son had a family meal with relatives who returned to Yiwu from Wuhan for the Spring Festival. After two weeks, the patient had nasal congestion, and her son had a fever with a peak temperature of 38.4°C, dry cough, and nasal congestion. Two days after the onset (February 2, 2020), tests for SARS-CoV-2 nucleic acid performed at the Fourth Affiliated Hospital, Zhejiang University School of Medicine, were positive in both the mother and the son, whereas the patient's husband had a negative result. The results were confirmed by the Yiwu Center for Disease Control and Prevention. The patient suffered from postpartum depression, feeling deeply anxious, and insisting on staying with her child. At the same time, the husband asked for accompanying his wife and son due to concerns about the patient's mental health. To respect the wish of the patient and her family, and after consultation with psychiatrists, the family was treated in the same negative-pressure isolation ward.

On admission, the mother had a symptom of nasal congestion, but without rhinorrhea, cough, sputum, fever, or fatigue. The physical examination revealed a body temperature of 36.4°C, respiratory rate of 18 breaths per minute, a pulse of 90 beats per minute, blood pressure of 102/74 mmHg, and oxygen saturation of 98% while breathing ambient air. Lung auscultation indicated no abnormalities. The results of a routine blood test, chest X-ray, C-reactive protein, and liver and kidney function were normal. Respiratory virus antigen quadruplet test (influenza A and B virus, respiratory syncytial virus, adenovirus) and the nucleic acid test for influenza A and B virus were negative. The patient received atomized inhalation of recombinant human interferon α -2b 5 million International Unit (IU) in 2 ml sterilized water twice a day as the antiviral treatment and traditional Chinese medicine as a supplemental therapy. She continued breastfeeding every day. The symptom of nasal congestion improved on day 1 after admission, and white blood cell count declined to $2.7 \times 10^9/L$, while the lymphocyte count was $0.9 \times 10^9/L$. The nasopharyngeal swab specimens were positive for SARS-CoV-2 nucleic acid, but the serum was negative. On day 2 after admission, the symptoms of nasal congestion disappeared, and afterward, the patient was free of symptoms such as nasal congestion. The body temperature and oxygen saturation without oxygen inhalation were monitored and remained within the normal range, and the patient was in stable condition. On day 3 after admission, the plain chest CT scan indicated the presence of density-increased patchy consolidation and ground-glass shadow in the lower lobe of the right lung, and viral pneumonia was considered (Figure 1A). Subsequently, on day 9 after admission, white blood cell and lymphocyte counts returned to a normal level, and liver and kidney function and myocardial enzyme spectrum continued to be normal. During the period of hospitalization, the serum, milk and feces specimens tested negative for SARS-CoV-2 nucleic acid, but the nasopharyngeal swabs were repeatedly positive. Chest CT scan showed that the inflammatory exudation in the lungs became gradually absorbed (Figure 1B, 1C). On days 8 and 24 after admission, the breastmilk tests yielded a positive result for SARS-CoV-2 IgG and negative for IgM. Similarly, the serum was positive for SARS-CoV-2 IgG and negative for IgM on days 15 and 19. After 27 days of treatment, the patient was discharged since three consecutive nasopharyngeal swabs were negative for SARS-CoV-2 nucleic acid. The major laboratory results of the patient are listed in Table 1.

The patient's 13-month-old son continued to have a fever, occasional dry cough, and nasal congestion at admission to the hospital. The physical examination revealed a body temperature of 37.6°C, respiratory rate of 23 breaths per minute, a pulse of 105 beats per minute, blood pressure of 95/56 mmHg, oxygen saturation of 99% while breathing ambient air, and weight of 10 kg. There was no abnormality in lung auscultation. During the hospitalization, antiviral treatment with atomized inhalation of recombinant human interferon α -2b 1.5 million International Unit (IU) in 2 ml sterilized water was performed twice a day for 8 days. On the day of admission, lymphocyte count decreased to $2 \times 10^9/L$, and white blood cell count was $3.7 \times 10^9/L$. Serum tested negative for SARS-CoV-2 IgG and IgM. On day 1 after admission, the temperature returned to the normal value, and remained normal thereafter, but occasional dry cough and runny nose continued. On day 3 after admission, feces and nasopharyngeal swab specimens were positive for SARS-CoV-2 nucleic acid, and plain chest CT scan suggested ground-glass shadows in both lungs (figure 2D). On day 5 after admission, the cough of the child was essentially relieved, while

occasional runny nose persisted. At that time, the counts of white blood cells and lymphocytes were $6.9 \times 10^9/L$ and $5.1 \times 10^9/L$, respectively. The child became free of symptoms since on the 6th day after admission. On day 13, the serum was negative for SARS-CoV-2 nucleic acid, but positive for SARS-CoV-2 IgG and IgM. Nasopharyngeal swabs and feces specimens repeatedly tested positive for SARS-CoV-2 nucleic acid. On day 27 of the hospital stay, when the child tested negatively two consecutive times for SARS-CoV-2 nucleic acid in nasopharyngeal swabs and feces and chest CT indicated that the ground-glass shadows in the lungs were essentially absorbed (figure 2F), the child was discharged. The major laboratory results of the child are listed in table 2.

Discussion

SARS-CoV-2 spreads mostly through droplets and close contact, and patients and asymptomatic carriers are the potential sources of infection (6,7). In the case presented here, the mother and her son came in close contact with a relative who developed fever two weeks later and was confirmed COVID-19. This family meeting caused an infection of at least eight persons. Based on the current data, the incubation period of COVID-19 pneumonia is 1–14 days, with an average of 3–7 days. The patients mainly present with clinical symptoms such as fever, seldom dry cough, fatigue, nasal congestion, runny nose, sore throat, and diarrhea. Most patients had a good prognosis, and children had relatively mild symptoms. Among 450 early patients reported in the literature, there were no cases of children less than 15 years of age (8). One reason for this finding could be associated with the presence of milder symptoms in children resulting in not listing them among confirmed cases. Clinically, patients occasionally present with a decreased or normal count of white blood cells, particularly lymphocytes. Typically, a chest CT scan shows multiple patchy opacities under the pleura, which subsequently progress to ground-glass opacities. In the current report, the incubation period was 12 days, and clinical manifestations, laboratory results, and imaging findings were consistent with general clinical features of COVID-19. Previous research found that the time from the onset of symptoms to recovery ranges from 12 to 32 days, but the test for SARS-CoV-2 nucleic acid is positive one week after discharge (9). In the case reported here, the time from the onset of illness to discharge was as long as 29 days. During the hospitalization, the result of the test for SARS-CoV-2 nucleic acid changed from negative to positive, indicating that the isolation of patients has to be continued after their discharge to reduce the spread of the disease.

Some viruses in the mother infect her offspring through breast milk (10). Similarly to SARS-CoV-2, hepatitis C and Ebola viruses belong to the RNA viruses. It has been documented that a small number of hepatitis C and Ebola viruses can be detected in breast milk, raising the possibility that breastfeeding may result in mother-to-child transmission of the virus (11,12). There is no evidence supporting the possibility that SARS-CoV-2 can cross the blood-milk barrier and enter breast milk. Recently published data on nine pregnant women indicate that there is no SARS-CoV-2 in the colostrum (3). In the presented case, the tests for the presence of the SARS-CoV-2 nucleic acid in the mother's serum and milk were performed multiple times with consistently negative results, further confirming that the possibility of mother-to-child transmission was very small, and breast milk is safe for indirect feeding of infants.

Breast milk provides not only a variety of nutrients for growth and development of an infant but also many bioactive ingredients, including antibodies, to provide the protection against pathogenic microorganisms early in life (13). When pathogenic microorganisms invade the body, the organism mobilizes an immune response. IgM is the earliest antibody produced in the initial humoral immune response, often described as the vanguard of the anti-infection defense mechanisms. The presence of IgM antibodies indicates the recent incidence of infection and is used for its early diagnosis. IgG antibodies protect the organism from an attack by a homotypic virus. Therefore, the IgG antibody is a sign of immunity or resistance. SARS-CoV-2 exhibits species similarity to SARS-CoV. Research on antibodies against the SARS virus (14) demonstrated that SARS-CoV IgM and IgG can be detected in the serum from the second week onwards. At week 3, IgG can be detected with a 100% sensitivity and remains at a high level. IgM peaks at the acute stage of the disease, at approximately 3 weeks, and then disappears at week 12. IgG reaches its highest concentration at week 12, and maintains a high level for a long time, providing protection of patients from the recurrence of SARS. The plasma of convalescent SARS patients can effectively treat severe acute SARS patients, suggesting that SARS-CoV IgG and/or IgM antibodies may represent passive immune antibodies capable of providing a protective effect against the invasion of the SARS virus its consequences. Importantly, the production of a specific IgG persists for a long time. A follow-up study in China found that SARS IgG continues to be present for at least 3 years, indicating that the organism can maintain immunity for a long time (15). Circulating antibodies can diffuse into the mother's milk and be delivered to the offspring, providing them a bringing passive immunity. A case was previously reported (16) of a pregnant woman that was infected with SARS at 19 weeks of gestation but subsequently recovered. SARS-CoV antibody was present in her blood samples taken on days 12 and 19 after disease onset. She delivered a healthy baby at 38 weeks, and the SARS-CoV nucleic acid was not detected in maternal and neonatal serum, nasopharyngeal swabs, placenta, umbilical cord blood, and amniotic fluid. However, the antibody against SARS-CoV was detected in maternal serum, umbilical cord blood, and breast milk (16). In the case presented here, the patient's milk was positive for SARS-CoV-2 IgG and negative for IgM on day 10 after the onset, and the same result was obtained on day 26. On day 15, the child's serum was positive for SARS-CoV-2 IgG and IgM, and it was initially postulated that the time of antibody production in children might be delayed in comparison with adults. A protective antibody can be passed by breastfeeding from the mother to the offspring, promoting the cure of the children's diseases.

Conclusions

In summary, this is the first report of a case of breastfeeding an infant by a SARS-CoV-2 infected mother. Observational studies suggest that breastfeeding is safe. When a mother and her infant are diagnosed COVID-19, direct breastfeeding not only does not exacerbate the severity of the disease but may afford passive immune protection to the infant. When the mother is confirmed COVID-19, we recommend only indirect breastfeeding to avoid transmission of the virus through the respiratory route. A follow-up study will address the issue of detecting the level of SARS-CoV-2 IgG to assess the best time window for breastfeeding.

Declarations

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Availability of data and materials

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Author information Affiliations

Department of Obstetrics and Gynecology, The Fourth Affiliated Hospital, Zhejiang University School of Medicine, Yiwu, Zhejiang 322000, China

Yuanyuan Yu, Yingying Hu, Jian Xu

The Clinical Laboratory of the Fourth Affiliated Hospital, Zhejiang University School of Medicine, Yiwu, Zhejiang 322000, China

Youjiang Li

The department of infectious diseases, The Fourth Affiliated Hospital, Zhejiang University School of Medicine, Yiwu, Zhejiang 322000, China

Bin Li

Contributions

Li B evaluated and examined the patient. Li YJ took part in samples collection. Hu YY and Yu YY took part in data collection. Yu YY and Xu J drafted and prepared the manuscript. All authors read and approved the final manuscript.

Corresponding author Correspondence to Jian Xu.

Ethics declarations

Ethics approval and consent to participate

This study was reviewed and approved by the Medical Ethical Committee of The Fourth Affiliated Hospital, Zhe Jiang University School of Medicine (approval number K20200025). Written informed consent was obtained from enrolled patient.

Consent for publication

A written consent was given by the patient for publication of her case.

Competing interests

The authors declare no competing interests.

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Tables

Table 1. Clinical laboratory results of the mother

Measure	d1	d8	d9	d15	d18	d19	d22	d24	d25
White blood cell count (3.5-9.5×10 ⁹ /L)	2.7	NT	4.0	2.9	NT	3.9	NT	NT	5.3
Lymphocyte count (1.1-3.2×10 ⁹ /L)	0.9	NT	1.2	0.8	NT	1.1	NT	NT	1.0
C-reactive protein concentration (0-6mg/L)	0.1	NT	NT	1.0	NT	1.9	NT	NT	NT
SARS-CoV-2 test									
Nasopharyngeal swab	+	NT	+	NT	-	+	-	-	-
Feces	NT	NT	NT	NT	NT	-	NT	NT	NT
Serum	-	NT	NT	-	NT	-	NT	NT	-
Breast milk	-	-	NT	-	-	NT	NT	NT	NT
SARS-CoV-2 antibody									
Serum IgG	NT	NT	NT	+	NT	+	NT	NT	NT
Serum IgM	NT	NT	NT	-	NT	-	NT	NT	NT
Breast milk IgG	NT	+	NT	NT	NT	NT	NT	+	NT
Breast milk IgM	NT	-	NT	NT	NT	NT	NT	-	NT

d1, first day after admission; NT, not tested; "+", Positive; "-", Negative.

Table 2. Clinical laboratory results of the child

Measure	d0	d3	d5	d13	d23	d25	d27
White blood cell count (4.0-12.0×10 ⁹ /L)	3.7	NT	6.9	9.6	NT	NT	NT
Lymphocyte count (0.7-4.9×10 ⁹ /L)	2.0	NT	5.1	6.4	NT	NT	NT

C-reactive protein concentration	1.5	NT	NT	0.1	NT	NT	NT
(0-6mg/L)							

SARS-CoV-2 test

Nasopharyngeal swab	NT	+	+	+	+	-	-
Feces	NT	+	NT	+	+	-	NT
Serum	NT	NT	NT	-	NT	NT	NT

SARS-CoV-2 antibody

Serum IgG	-	NT	NT	+	NT	NT	NT
Serum IgM	-	NT	NT	+	NT	NT	NT

d0, the day of admission; NT, not tested; "+", Positive; "-", Negative.

Figures

Figure 1

A-C: Chest CT plain scans of the mother

Figure 2

D-E: Chest CT plain scans of the child