An Uninfected Preterm Newborn Inadvertently Fed SARS-CoV-2–Positive Breast Milk

Licia Lugli, MD, Luca Bedetti, MD, Laura Lucaccioni, MD, William Gennari, MD, Chiara Leone, MD, Gina Ancora, MD, Alberto Berardi, PhD

There are increasing concerns regarding coronavirus disease, caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Approaches to breastfeeding and the management of neonates born to pauci-symptomatic mothers with coronavirus disease vary worldwide, although some scientific societies across Europe and the United States have emphasized the benefits of breastfeeding, even with expressed breast milk. Because SARS-CoV-2 has been, thus far, only exceptionally detected in breast milk, the risk of disease transmission has remained hypothetical.

We herein report the case of a healthy preterm newborn who was inadvertently fed SARS-CoV-2–positive breast milk. Two different samples, collected with and without strict hygiene precautions, were both confirmed to be SARS-CoV-2 positive. However, the newborn was not infected, supporting the protective role of breast milk. Furthermore, in this report, we highlight the difficulties in the practical management of a neonate whose breastfeeding mother was confirmed as positive for SARS-CoV-2 after delivery.

Coronavirus disease (COVID-19), which is caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has led to an unprecedented global pandemic that affects individuals across all age groups. Information on the perinatal aspects of COVID-19 is still scarce, and the management of an infant born to a SARS-CoV-2–positive mother who is asymptomatic or has mild symptoms, as reported in previous studies, is controversial. Recommendations from different scientific societies worldwide on breastfeeding and maternal–infant contact are variable: some recommend nonseparation of the mothers from their own neonates and breastfeeding, whereas others recommend a more precautionary approach. These measures, based on the available data, rely on the different perceptions of the risk of transmission from maternal respiratory secretions, relevance of early maternal–child bonding, and, finally, the risk-to-benefit ratio of breastfeeding. However, despite these concerns, researchers in only two studies, thus far, have demonstrated the presence of SARS-CoV-2 in breast milk sample, although knowledge and information regarding this recent disease is continuously being updated.

We report the case of a healthy preterm newborn who was inadvertently breastfed SARS-CoV-2–positive breast milk but did not become infected. Although specific institutional protocols for neonates whose mothers are suspected or confirmed to have COVID-19 were in place, this newborn was ineligible for those protocols, because the maternal medical history until the delivery was unremarkable. The maternal infection was unexpected.


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Address correspondence to Licia Lugli, Unità Operativa di Terapia Intensiva Neonatale, Azienda Ospedaliero-Universitaria Policlinico di Modena, Via del Pozzo 71, 41125 Modena, Italy. E-mail: lugli.licia@policlinico.mo.it

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and became apparent in the postpartum period. This case report can provide insights into the benefits of breastfeeding and highlight the difficulties in the practical management of neonates when the breastfeeding mother is unexpectedly confirmed to be positive for SARS-CoV-2.

CASE REPORT
A female infant was delivered by emergency cesarean delivery because of placental abruption, at 32 weeks' gestation, to an apparently healthy North African 33-year-old woman with an unremarkable familial and obstetric history. The birth weight was 1614 g, and the cranial circumference and birth length were 30 and 41 cm, respectively. The Apgar score was 3, 6, and 7 at 1, 5, and 10 minutes, respectively, after birth. The newborn was intubated at birth and received surfactant at ∼2 hours of life for respiratory distress syndrome. Soon after, the neonate was extubated and underwent noninvasive mechanical ventilation until day 3 of life. The newborn was fed with donor human or expressed breast milk and reached the full enteral feeding on day 9.

After delivery, the mother occasionally entered the ward until day 3, always wearing the face mask and gown as standard NICU precaution. On postpartum day 3, the mother was discharged from the hospital, but she developed sore throat and asthenia a few hours after discharge. Because she was no longer able to visit the NICU, a small volume of fresh expressed breast milk was carried to the hospital by a family member, and it was given to the newborn on days 3 and 6 of life.

Nine days after delivery, the mother returned to the hospital for a follow-up visit and brought the breast milk expressed at home (without precautions for SARS-CoV-2–infected mothers). This fresh breast milk was given to the newborn (8 feedings of 28 mL each). On clinical examination, the mother was febrile (temperature 37.5°C) and a nasopharyngeal swab tested positive for SARS-CoV-2 by real-time reverse transcriptase polymerase chain reaction (RT-PCR). She was then sent home for self-isolation. The next day, the fresh expressed breast milk, which had been given to the newborn, tested positive for SARS-CoV-2 by RT-PCR, and the breast milk was immediately discontinued. In laboratory methods for SARS-CoV-2 RT-PCR, nucleic acids were extracted from 0.2 mL milk by using the ELITe InGenius instrument (ELITechGroup S.p.A. Turin, Italy) and were subjected to amplification by RT-PCR. GeneFinder Covid-19 Plus Real Amp Kit, which detects E, RdRp, and N genes, was used (OSANG Healthcare Co, Ltd, Korea).

Another independent breast milk sample was collected under strict precautions (eg, surgical mask, hand and breast hygiene before and after milk collection, gloves) for research purposes on day 9 after delivery, after knowing the result of the maternal nasopharyngeal swab. This sample also tested positive for SARS-CoV-2 after storing at −80°C for 30 days. The cycle threshold values for the polymerase chain reaction runs were 38/45 and 37/45 for the first and second expressed breast milk samples, respectively.

Although inadvertently fed with SARS-CoV-2–positive breast milk, the infant did not develop COVID-19 symptoms. The infant had normal findings on chest radiograph and blood gas analysis, and the nasopharyngeal and stool swabs tested negative for the virus on days 8, 10, and 18 of life (Simplexa COVID-19 Direct kit, detecting ORF1ab and S genes, with the Liaison MDX instrument was used). The sera samples of the neonate tested negative for immunoglobulin G and immunoglobulin M antibodies on day 25 of life. The strict limitations applicable to the movement of COVID-19 contacts by an Italian ministerial decree hindered the transport (from home to the hospital) and retesting of the breast milk before refeeding. Therefore, the infant was fed milk from the donor human bank until hospital discharge on day 32 of life. Because two nasopharyngeal swabs of the mother had tested negative, breastfeeding was restarted.

DISCUSSION
There are diverse approaches to the breastfeeding and management of neonates in the COVID-19 recommendations from China, Europe, and the United States as well as in international guidelines. To avoid any risk of transmission, a Chinese expert consensus statement on the perinatal and neonatal management for the prevention and control of the SARS-CoV-2 infection suggests routine separation of the newborn from the infected mother, even if the maternal symptoms are mild. Furthermore, the statement suggests discontinuation of breastfeeding for infants born to a mother with confirmed or suspected COVID-19. This is because the transmission of SARS-CoV-2 cannot be firmly ruled out.

Researchers in a Chinese study has demonstrated the presence of SARS-CoV-2 in a breast milk sample from a woman with COVID-19. However, the authors provide no information on feeding the infant with SARS-CoV-2–infected breast milk and the infant’s health status. More recently, German investigators detected SARS-CoV-2 RNA in milk samples from one of two SARS-CoV-2–infected breast milk and the infant’s health status. More recently, German investigators detected SARS-CoV-2 RNA in milk samples from one of two SARS-CoV-2–infected nursing mothers. Detection of viral RNA in milk coincided with mild COVID-19 symptoms and a SARS-CoV-2–positive diagnostic test of her newborn. Although the mother had been wearing a surgical mask since symptom onset and followed safety precautions when handling or feeding...
the neonate, whether the newborn was infected by breastfeeding or other modes of transmission remains unclear.\textsuperscript{11}

We report on a preterm newborn who was fed SARS-CoV-2–positive breast milk and who did not become infected. The neonate was admitted to the NICU and fed by healthy nurses; because the mother occasionally entered the ward only after delivery, the risk of SARS-CoV-2 transmission through droplets or contact was limited.

Furthermore, because two different samples, collected on the same day either without or with strict precautions, both tested positive for SARS-CoV-2, the breast milk was likely to be actually SARS-CoV-2 infected, rather than simply contaminated by respiratory droplets from the mother.

Nevertheless, the infant remained healthy and had no evidence of SARS-CoV-2 infection, perhaps because of the protection conferred by fresh breast milk. Indeed, in most maternal viral infections, the continuation of breastfeeding is in the best interest of the infant and the mother because infection transmission through breast milk is rare despite the demonstration of virus in the breast milk in some cases.\textsuperscript{12}

A limitation of this study is the lack of a precise quantitative viral load assessment to understand the actual risk of transmission. Although a rough estimate, Ct runs indicated a low viral amount in both expressed breast milk specimens. The breast milk was not cultured (because cell cultures were unavailable) and we do not know if the virus was in the replication phase.

Furthermore, we could not collect any data on the presence of specific antibodies in breast milk. Therefore, any assumption of their protective role remains hypothetical. Finally, the newborn’s intake of the definitely SARS-CoV-2–positive milk was likely limited to a small amount (~200 mL), because the breast milk that was administered on the previous days was not tested.

**CONCLUSIONS**

This is the first report of a preterm neonate who was fed SARS-CoV-2–positive breast milk and remained uninfected. Although human milk may be a vehicle of SARS-CoV-2, neonates may not necessarily become infected. The management of SARS-CoV-2–infected mothers and their newborns poses several problems for the appropriate management of neonates and their mothers, especially when the infection is unexpected.

**ABBREVIATIONS**

COVID-19: coronavirus disease
RT-PCR: reverse transcriptase polymerase chain reaction
SARS-CoV-2: severe acute respiratory syndrome coronavirus 2

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