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SARS-CoV-2 Transmission Risk through Expressed Breast Milk Feeding in Neonates Born to COVID 19 Positive Mothers: A Prospective Observational Study

Akash Kumar Pandey[1*], Alka Shukla[1], Purushottam Lal[1]

1. Department of Paediatrics, Maharshi Vashishtha Autonomous State Medical College, District- Basti, Uttar Pradesh, India

ABSTRACT

Background: Mother-to-child transmission of Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2) has become a matter of great concern in post-partum wards and neonatal units. With little prior experience of this novel infection, there are contradictory findings in the literature regarding breastfeeding and rooming-in for newborns of mothers with COVID-19 disease. To assess the transmission risk of SARS-CoV- 2 in neonates who were fed expressed breast milk of COVID-19 positive mothers.

Methods: This prospective study included 16 neonates born to COVID-19 positive mothers. The neonates were nursed in a neonatal unit separate from their mother. Expressed breast milk was fed by health care givers ensuring proper safety measures. Nasal and throat swabs of neonates were tested twice for SARS CoV-2, firstly, at 48 h of life and secondly, before discharge.

Results: Pneumonia was present in 3 (20%) mothers, and C- reactive protein was raised in 9 (60 %) mothers. Birth weight was low in 8 (50%) neonates. Respiratory distress syndrome and meconium aspiration syndrome were present in two and one newborns, respectively. Nasal and throat swabs of all 16 newborns tested negative for SARS-CoV- 2 infection twice, at 48 h of life and before discharge.

Conclusion: Expressed breast milk feeding can be considered safe in neonates born to COVID-19 positive mothers. Even sick mothers with COVID-19 can continue to express breast milk after ensuring proper safety measures.

Keywords: Breastfeeding, COVID 19, Expressed breast milk, Lactation, Newborn, SARS-CoV-2

Introduction

Novel Corona Virus Disease 19 (COVID-19) was first identified in Wuhan, the capital city of Hubei province, China, in early December 2019. This disease was caused by the Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2) (1). During the subsequent months, the disease spread rapidly all over the world and was declared a global pandemic by the World Health Organization (2). Multiple cases of COVID-19 have been reported among pregnant women (3). The prevention of mother-to-child transmission of SARS-CoV-2 infection is now a matter of great concern in post-partum wards and neonatal units. With little prior experience of this novel infection, there are contradictory findings in the literature regarding breastfeeding and rooming-in for newborns of mothers with COVID-19 disease.

In the absence of consensus, multiple preventive strategies are randomly practiced based on individual judgments. They include routine separation of all neonates from SARS-CoV-2 positive mothers, avoiding direct breastfeeding or expressed breast milk feed, as well as the use of donor milk or formula feeds. World Health Organization (WHO) has recommended rooming-in and exclusive breastfeeding of neonates born to COVID-19 infected mothers. WHO considers that the benefits of breastfeeding substantially outweigh the potential risks of transmission (4). United Nations Children's Fund (UNICEF) recommends continuing breastfeeding with the

* *Corresponding author:* Akash Kumar Pandey, Department of Paediatrics, Maharshi Vashishtha Autonomous State Medical College, District- Basti, Uttar Pradesh, India. Tel: +919129998040; Email: akptheguy@gmail.com

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adoption of hygiene measures and discourages maternal-neonate separation (5). Royal College of Obstetricians & Gynecologists (RCOG) also recommends rooming-in and breastfeeding of neonates with SARS-CoV-2 infected mothers (6).

The recent edition of Centers for Disease Control (CDC), USA guidelines, recommended breastfeeding of neonates taking all possible precautions to avoid maternal-neonatal transmission of SARS-CoV-2. Rooming-in should be practiced maintaining a physical distance of ≥6 feet. Each mother should be given autonomy to decide between two options of rooming-in/ breastfeeding and mother-neonate separation during which expressed breast milk should be given to the newborn (7, 8). Nonetheless, a few recently published literature highly discourage direct or expressed breast milk feeding. The primary issue of concern is the transmission of the virus from an infected mother to neonate through respiratory droplets during the period of direct breastfeeding (9).

Chinese expert consensus has raised concern that expressed breast milk can act as a vehicle of mother-to-neonate transmission of SARS-CoV-2 and has recommended the use of donor milk (10). In light of limited safety information, the adverse impact of Remdesevir which passes into breast milk is also an issue of concern (11). The present study aimed to access the risk of SARS-CoV-2 transmission in neonates who were fed with expressed breast milk of mothers infected with SARS-CoV-2. This study can be of help to health care professionals in dealing with the dilemma of feeding such neonates.

Methods

This prospective observational study was conducted from 15th July 2020 to 15th October 2020 at Maharshi Vashishtha Autonomous State Medical College and associated tertiary care hospital, Basti, Uttar Pradesh, India. A number of 16 neonates, including one twin pair born to SARS-CoV-2 infected mothers, were entered into the current study. The neonates whose mothers were seriously ill or receiving the antiviral drug Remdesivir were excluded from the study. The option of either rooming-in or nursing in the neonatal unit was discussed with both parents. Informed written consent was taken from both parents before the commencement of the study.

Routine investigations, including complete blood count, C- reactive protein, and chest X rays were performed. The N95 facemasks and sterile hand gloves were worn by mothers in the labor room and operation theatre. After delivery room check-up and wrapping of newborns, mothers were given an opportunity to get familiarize with babies ensuring safe physical contact. The majority of parents were apprehensive about rooming-in due to possible mother-to-neonate transmission of SARS-CoV-2. It is worth noting that it was not feasible to maintain 6 feet distance between mother and newborn owing to full occupancy of hospital beds during the peak phase of the pandemic; therefore, the neonates were nursed in the neonatal unit.

Mothers washed their hands with alcohol-based instant hand sanitizer before expressing breast milk, and the use of N 95 facemask by mothers was ensured during breast milk expression. Breast milk was transported from the postpartum ward to the neonatal unit ensuring proper hygiene. Health caregivers fed expressed breast milk with a spoon taking proper safety measures against droplet transmission.

Nasal and throat swabs of neonates were taken twice, firstly, at 48 h of life, and secondly, before discharge. Swabs were examined by Truenat™ beta CoV test on Truelab™ workstation supplied by MolBio Diagnostic Pvt. Ltd. Goa, India. It is a two-step chip-based real time reverse-transcriptase polymerase chain reaction (RT-PCR) test. Step one comprises E gene screening assay (Truenat™ Beta CoV) for all COVID-19 suspected samples to be followed by step two for the RdRp-based confirmatory test (Truenat™ SARS CoV-2) in all E gene positives. Indian Council of Medical Research (ICMR) has validated the TruenatTM beta CoV test as a standard screening test for COVID-19 (12).

Results

In the present study, 14 (93.3 %) and 1 (6.6 %) mothers had singleton and twin pregnancies. Lower segment cesarean section was performed in 11 (73.3 %) cases, and 4 (26.6 %) neonates were born through vaginal delivery. Out of 15 mothers included in the study, 7 (46.6 %) cases were asymptomatic. Symptoms of upper respiratory tract infection were present in 5 (33.3%) mothers, and pneumonia was present in 3 (20%) mothers. Chest X-ray of these mothers revealed bilateral infiltrates, and they required oxygen supplementation through a non-re-breathing mask.

Total leucocyte count (TLC) and C- reactive protein were raised in 11(73.3%) and 9 (60 %) mothers, respectively. Platelet count was decreased in 8(53.3%) mothers. None of the mothers included in the study required invasive respiratory support,

Table 1. Maternal characteristics and mode of delivery

S. No.	Age	GA(Wks+ Days)	Maternal symptoms	Type of Delivery	TLC * (per Cu mm)	Platelet † (per Cu mm)	CRP& ‡ (mg/L)	Hospital stay (Days)
1	35	39+2	Asymptomatic	LSCS	15500	168000	5	8
2	23	37+4	Pneumonia	LSCS	15700	105000	105	9
3	22	38	Asymptomatic	LSCS	19600	139000	5	11
4	22	35+3	URTI	LSCS	12100	286000	6.3	11
5	25	39+6	URTI	LSCS	7700	78000	33	11
6	23	38+5	Asymptomatic	LSCS	9800	176000	4.1	10
7	24	40+4	Asymptomatic	NVD	8600	216000	4.9	15
8	25	37	URTI	NVD	18500	187000	12.5	7
9 §	35	33+2	Pneumonia	LSCS	6900	229000	36	9
10	25	33+3	Asymptomatic	LSCS	13800	137000	2.4	9
11	29	38+5	URTI	LSCS	10200	114000	11.9	10
12	25	39	Asymptomatic	NVD	10500	96000	5.4	9
13	26	37+3	Pneumonia	LSCS	13570	215000	11.9	10
14	29	37+6	URTI	NVD	15700	76000	18.6	10
15	32	38	Asymptomatic	LSCS	14000	83000	7.4	9

* Reference range (4000-11000), † Reference range (150000-400000), ‡ Reference range (0-6), § Twin pregnancy

and there was no referral or maternal mortality. The mean duration of hospital stay was obtained at 9.8±1.8 days (Table 1).

Neonatal outcome and morbidity

Birth weight was low in 8 (50%) neonates, and amniotic fluid was meconium stained in case of one neonate who required bag and mask ventilation for 1 min. Mild respiratory distress developed immediately after birth, and oxygen supplementation was required for 24 h. The sepsis screen was positive, and intravenous antibiotics were administered. Expressed breast milk was started on the second day of life after oxygen support was withdrawn. Chest X-rays of both twin neonates showed features of respiratory distress syndrome (stage 1), and both required continuous positive airway pressure support.

Expressed breast milk feeding was initiated on the third day of life. Twin neonates were fed formula milk compatible with low birth weight due to inadequate breast milk production. Expressed breast milk feeding was initiated on the first day of life in neonates who did not develop any complications after birth. The mean length of stay in the neonatal care unit was 7.7±1.8 days. Nasal and throat swabs samples of all 16 newborns were taken twice, at 48 h of life and before discharge. All samples tested negative for SARS-CoV-2 (Table 2).

Table 2. Neonatal outcome and morbidity

S. No.	Birth wt.	Complication	Intervention	Chest X-ray	Feeding	RT PCR 48 hrs	RT PCR at Discharge	Hospital stay (Days)
1	2.8	No	Routine care	Normal	EBM	Negative	Negative	7
2	2.6	No	Routine care	Normal	EBM	Negative	Negative	8
3	3.4	No	Routine care	Normal	EBM	Negative	Negative	8
4	2.0	Prematurity, LBW	Feeding support	Normal	EBM	Negative	Negative	8
5	2.2	LBW	Routine care	Normal	EBM	Negative	Negative	9
6	2.1	LBW,	Routine care	Normal	EBM	Negative	Negative	9
7	2.8	No	Routine care	Normal	EBM	Negative	Negative	13
8	2.4	LBW	Routine care	Normal	EBM	Negative	Negative	6
9*	1.7	Prematurity, LBW, Respiratory distress	CPAP support * 36 hrs, Fluids	Stage 1 RDS	EBM+ LBW formula feeds	Negative	Negative	7
10†	1.4	Prematurity, LBW, Respiratory distress, feeding difficulty	CPAP support *48 hrs, Routine care support	Stage 1 RDS	EBM+ LBW formula feeds	Negative	Negative	7
11	2.4	Prematurity, LBW	Routine care	Normal	EBM	Negative	Negative	9
12	2.8	Meconium aspiration syndrome, Respiratory distress	Oxygen support* 24 hrs	Mild infiltrate	EBM	Negative	Negative	6
13	2.6	No	Routine care	Normal	EBM	Negative	Negative	7
14	2.7	No	Routine care	Normal	EBM	Negative	Negative	8
15	2.1	LBW	Routine care	Normal	EBM	Negative	Negative	7
16	3.1	No	Routine care	Normal	EBM	Negative	Negative	5

LBW: Low Birth Weight, IUGR: Intra-Uterine Growth Retardation, EBM: Expressed Breast Milk, CPAP: Continuous Positive Airway Pressure, * Twin 1, † Twin 2

Discussion

World health organization and other authorities consider breast milk to be the most suitable and nutritious food for neonates (13). Breast milk contains lactoferrin, immunoglobulins, and growth factors, and it enhances various biological activities, such as antimicrobial and immunomodulatory activity. Breastfeeding promotes the development of infants' nervous systems; moreover, it reduces the risk of allergies and infectious diseases. It can also reduce the risk of breast and ovarian cancer for mothers (14).

Despite the widely accepted benefits of breastfeeding, it is contraindicated in some infectious diseases. Centers for Disease Control (CDC), USA, contraindicates direct or expressed breast milk feeding in mothers infected with Ebola virus (15). In the case of mothers infected with human immunodeficiency virus (HIV), CDC advises against breastfeeding (16, 17), while the WHO recommends breastfeeding if HIV-infected mothers are under antiretroviral therapy (18). HIV and Ebola virus have been confirmed to be transmitted via breast milk. CDC recommends suspending breastfeeding or expressing breast milk in mothers is infected with untreated brucellosis or active herpes simplex virus (19).

Expressed breast milk feeding is recommended in cases of untreated active tuberculosis or chickenpox during the active period when direct breastfeeding is contraindicated (20). The latest edition of US CDC management guidelines for lactating mothers infected with H1N1 recommends continuing breastfeeding with proper hygiene measures. Expressing breast milk and feeding by healthy caregivers have been recommended in very sick mothers. The antibodies and immunological factors present in mothers' breast milk can help protect their neonate from H1N1 (21).

A few recent studies have looked for evidence of SARS-CoV-2 in breast milk. In a retrospective study performed by Chen et al. in China on nine women with COVID-19 pneumonia during the third trimester of pregnancy, and SARS-CoV-2 was not detected in mother's breast milk (3). In a similar vein, Lei D et al. in China reported that nucleic acid tests of breast milk samples of four mothers tested negative for SARS-CoV-2 (22). In the third report from China, Chen Y et al. did not find any evidence of SARS-CoV-2 in breast milk (23). In another case report from Wuhan, China, Dong et al. reported a case of neonatal IgM positive for SARS-CoV-2; nonetheless, the breast milk was negative for the virus (24).

In the current study, expressed breastfeeding in 16 newborns did not result in SARS-CoV-2 transmission. Continuing expressed breast milk feeding ensured that neonates were not deprived of its innumerable benefits. Opting for expressed breast milk also averted the financial cost of formula feeding or donor milk. In long term, these mothers will gain the advantage of reduced risk of breast and ovarian cancer. Plasma C reactive protein level has been considered to be positively associated with the severity of COVID-19 (25). In the present study, C reactive protein was raised in nine mothers. Nonetheless, no transmission occurred in the neonates of these mothers, signifying that even mothers with high severity of the disease can continue to express breast milk if general condition permits.

Regarding the notable limitations of the study, one can refer to non-assessment of mother-infant rooming-in; therefore, we were not able to assess the risk of neonatal transmission through horizontal droplet transmission. Secondly, breast milk was not tested for the presence of a live virus or viable viral RNA. Thirdly, the mothers who received Remdesivir were excluded from the current study. Future investigation is required to examine the compatibility of Remdesivir with breast milk feeding. On the other hand, the strength of the present study lies in its prospective design. Moreover, a greater number of newborns were included in this study, compared to other recent studies. Furthermore, the current study was conducted during the pandemic peak when SARS-CoV-2 transmission was highest in India, while most studies have been carried out in the early stages of this pandemic.

Conclusion

As evidenced by the obtained results, expressed breast milk feeding can be considered safe in neonates born to COVID-19 positive mothers. If general condition permits, even sick mothers with COVID-19 can safely continue to express breast milk after ensuring proper safety measures. The financial burden of alternative feeds can be avoided by opting for expressed breast milk feeding, particularly in the context of developing countries.

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Conflicts of interest

The author(s) declare that they have no conflict of interest regarding the publication of the current study.

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