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RESEARCH ARTICLE

Vertical Virus Transmission from SARS-CoV-2-positive Mothers to Neonates: A Tertiary Care Hospital Experience

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ABSTRACT

Objectives: The coronavirus disease 2019 (COVID-19) outbreak is evolving rapidly worldwide. However, little is known about the association between pregnant women with COVID-19 and its transmission to neonates. This investigation aimed to see if COVID-19 infection could be transmitted vertically into the uterus.

Methods: We conducted a prospective observational study. 48 COVID-19 infected mothers were enrolled during their third trimester. A qRT-PCR assay of the nasal and oropharyngeal swab samples was performed to confirm positive for COVID-19 infection as per WHO protocol. In addition, characteristics of pregnant women with confirmed SARS -CoV-2 infection and newborns were documented.

Results: Forty-eight expectant mothers, 10 (20.8%) were found symptomatic, and 38 (79.2%) were asymptomatic, with COVID-19 infection were delivered (33 cesarean section & 15 vaginal deliveries). One female child (4.1%) out of 48 newborns was initially diagnosed with COVID-19 infection based on a nucleic acid qRT-PCR. The female child showed no or negligible signs and recovered completely, whereas 47 neonates (95.9%) confirmed negative. None of the mothers or neonates died from COVID-19 related pulmonary problems.

Conclusion: There is insufficient evidence on vertical virologic transmission of COVID-19 infection during the third trimester of pregnancy. Additionally, research and surveillance involving adequate testing of samples of placental tissue, breast milk, vaginal swab, amniotic fluid, and cord blood will be needed to establish the possibility of vertical transmission of infection. *J Microbiol Infect Dis 2022; 12(1):1-5.*

Keywords: *Coronavirus, COVID-19, Neonate, Pregnant mothers, SARS-CoV-2, Vertical transmission*

INTRODUCTION

Respiratory droplets spread SARS-CoV-2 infection; alternative spreading mechanisms have been proposed but not proven. When and how SARS-CoV-2 can be passed from the mother to the fetus is unknown [1]. Because of physiologic changes in immunological and cardiovascular systems, pregnant women are more likely to contract a viral respiratory infection and develop severe pneumonia [2]. It is widely acknowledged that the vertical transfer of several microorganisms from an infected woman to her fetus can have disastrous implications. Because rare examples of mother-to-new-born vertical transmission have been observed, obstetricians and neonatologists are concerned that the newborn could be in danger of inborn COVID-19 [3]. During this pandemic, COVID-19 infected mothers were recruited for the present study were towards the end of their pregnancies in the late third trimesters. Forty-eight liveborn infants were delivered from pregnant women having

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COVID-19 infection at our tertiary COVID care hospital. Out of 48 deliveries, one newborn happens to be positive for COVID-19 infection when tested through qRT-PCR of an oropharyngeal swab. None of the mothers and newborns were died or showed the severity of the disease. There was a lack of sample assortment for detecting viruses in this present study, as many patients and newborns only go through oropharyngeal or nasopharyngeal swab testing. This is not enough to prove or disprove the occurrence of mother to newborn transfer.

METHODS

During this pandemic, COVID-19 infected mothers were recruited for the study from July 20 to September 1, 2020. In the late third trimesters, all the infected women enrolled for the delivery were towards the end of their pregnancies. A qRT-PCR assay of the nasal and oropharyngeal swab samples confirmed COVID-19 infection. Maternal nasopharyngeal and throat swab samples were collected in viral transport media (VTM, HiViralTM, Transport kit) and tested for COVID-19 with FDA EUA approved and recommended kit (SD Biosensor, Korea), which is designed according to interim WHO regulation for qRT-PCR laboratory testing for novel coronavirus (2019-nCoV) in individuals. All the samples were collected at the Department of Obstetrics and Gynecology & COVID care ward of Pt JNM Medical college. They were processed simultaneously at the State Key Virology Lab, Department of Microbiology, Pt. JNM Medical College, Raipur, Chhattisgarh, India. Neonatal nasopharyngeal and throat swab samples were collected between 0 to 24 hr after delivery in the laboratory room or operating room. All 48 women wore masks, and medical personnel wore full personal protective gear at delivery.

Characteristics of pregnant women with confirmed SARS-CoV-2 infection and newborns were recorded at delivery time. The underlying health conditions or associated comorbidities (hypertension, Cardiac diseases, Diabetes, chronic lung diseases, past/present tuberculosis, and renal diseases) were questioned. The incidence of SARS-CoV-2 viral RNA in these clinical samples was used to assess vertical transmission [4]. The sample assortment, processing, and laboratory testing were performed according to the WHO guidance [5]. Total RNA was extracted from samples using a predefined kit to conduct the qRT-PCR assay (SD Biosensor RNA extraction kit, Korea). All samples were processed and tested by qRT-PCR (SD Biosensor, Korea) kit, which CDC suggested for SARS-CoV-2, and test results were confirmed by pre-designed primers for E gene and RdRP gene [6].

RESULTS

The forty-eight pregnant mothers confirmed positive for the COVID-19 infection and were admitted to our COVID ward of tertiary care hospital. Most of the mothers have been exposed to COVID-19 in the past. All cases were reported from the hotspot or containment zone of Raipur, Chhattisgarh. All forty-eight mothers were infected between 33 to 41 weeks of gestational age. The mothers were 19 to 35 years old and admitted mild to moderate symptoms. Out of 48 mothers, 10 (20.8%) were found symptomatic, and 38 (79.2%) mothers were asymptomatic. None of them had a travel story in the last month and no underlying health conditions or associated comorbidities. On admission, the frequent symptoms of COVID-19 infected mothers were recorded as cough (14.6%), fever (10.41%), and diarrhea (6.25%) (Figure 1).

One mother was found HIV positive during pregnancy but did not develop any severity for the Covid-19 disease. At the moment of delivery, all 48 women wore masks, and medical personnel wore full protective gear, including double masks. Thirty-three women underwent cesarean section and 15 vaginal deliveries. Twenty-eight male and 20 female children were born beyond 36 weeks' gestational age and had birth-weight in a range of 2 to 3.5 kgs. All infants had a 1-min Apgar score of 6–9 and a 5-min Apgar score of 8–10. A premature delivery happened with a 33-week gestational age, and the neonate's birth weight was recorded at 1.4 kgs, with Apgar score 5 and 7 at 1 and 5 min, respectively. The baby shifted to Neonatal Intensive Care Unit (NICU) and was supported with a face mask and bag; however baby tested negative for SARS-CoV-2 when qRT-PCR was performed for an oropharyngeal swab and discharged from NICU after full recovery on the 10^{th} day of birth. Immediately after birth, all newborns were separated from their mothers, and nasopharyngeal and

oropharyngeal swabs were collected between 0 to 24 h of life for qRT-PCR. Out of 48 deliveries, 47 infants confirmed negative for COVID-19 infection. At the same time, one mother, at gestational age 40 weeks, delivered a female child vaginally, which was tested as positive for COVID-19 infection based on nucleic acid test from the oropharyngeal swab after 24 h of birth, baby weight was recorded 2.8 kgs with Apgar score 7-8 at 1 and 5 min, respectively. Family members were not introduced to the newborn, and breastfeeding was not initiated. The baby was immediately shifted to the NICU with no new COVID-19 cases. However, the neonate developed mild fever with no other severity. Neonate discharged from NICU after 14th day of life. The outcomes of pregnant women are shown in Table 1.

DISCUSSION

Despite the multiple studies on vertical transmission of COVID-19 during pregnancy, further investigations are needed to form unbiassed decisions about the severity and transmission of the virus from an infected mother to her newborn. Out of 48 COVID-19 infected mothers, only 20.8% were found symptomatic in our findings. In a study from New York Presbyterian Allen Hospital and Columbia University Irving Medical Centre, 211 pregnant women were tested through qRT-PCR of nasopharyngeal swabs, of which 210 were asymptomatic (99.5%). Twenty-nine (13.7%) of those women were found confirmed positive for SARS-CoV-2 [7].

COVID-19 is thought to have an increasingly severe and rapid spread in individuals with underlying health issues or comorbidities, frequently resulting in a fatality. However, no mother had displayed significant comorbidities in our series [8]. Parental COVID-19 infection has been testified to comprise respiratory and fetal distress in utero, premature delivery, and PROM in a few cases [9-10] in the same way, in our case as well out on 48 cases, one premature delivery happened with a-33 week gestational age, which further confirms likelihoods of PROM due to COVID-19 infection. In our survey, in a series of 48 neonates, we found one female child positive with mild symptoms and no other severity. Correspondingly, it has been discovered that in a single series of 33 neonates delivered with the symptoms of COVID-19 positive mothers, three neonates (9%) tested as positive for SARS-CoV-2 in an RT-PCR of nasopharyngeal swabs with mild symptoms of fever, some breathing shortness with no further severity [12-13]. Our records make it challenging to declare the possible vertical transmission of COVID-19 from mother to child as the incidence of one positive case can also be due to the external exposure of the newborn after delivery. Similarly, medical professionals said that it could be a case where the infection was contracted in the uterine, but it is also believed that possibly the newborn got infected due to having close contact with the mother soon after birth [14].

Table 1. Outcomes of pregnant women and newborns.

Features	N (%)
Gestational age (weeks)	33-41
Caesarean section	33 (68.8)
Vaginal deliveries	15 (21.2)
Male child	28 (58.3)
Newborn needed critical care	0 (0.0)
Maternal death	0 (0.0)
Live-born infants of women with SARS-CoV-2	48 (100.0)
Negative SARS-CoV-2 test RT-PCR <12 h of age	47 (97.9)
Positive SARS-CoV-2 test RT-PCR < 12 h of age	1 (2.1)
1- min Apgar score	6–9
5- min Apgar score	8-10
Birth-weight	2-3.5 kgs
Neonatal death	0 (0.0)
NICU admission	1 (2.1)

According to our findings, perinatal transmission of COVID-19 is uncommon, provided proper cleanliness procedures are followed. In previous studies, it's already been seen that intrauterine transmission of infection to fetuses by respiratory viruses is rare; hence intrauterine transmission of SARS-CoV-2 is expected to be minimal. However, according to the data, there is evidence that SARS-CoV-2 has been isolated from amniotic fluid and placental tissue. Alexandre et al. (2020) have been documented isolation of SARS-CoV-2 from the nasal swabs of the two newborns within 48 h of life, which suggested possible congenital infection.

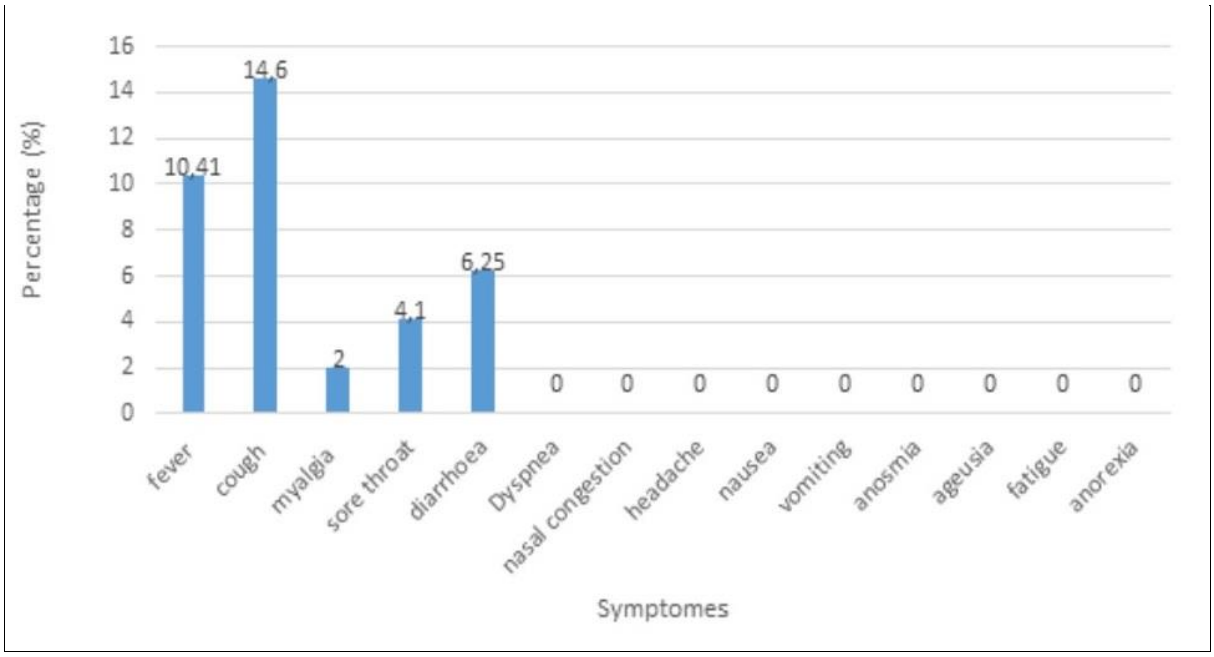

Figure 1. Maternal symptoms at diagnosis of Covid-19.

Based on what has been examined so far, there is no other indication of vertical transmission due to a scarcity of suitable biological samples such as amniotic fluid, placental tissues, vaginal swabs, breast milk, for testing nucleic acid for SARS-CoV-2 as well as a lack of information on the care provided during and after delivery it is tough to conclude a consistent outcome. Whether or not the infection is associated with comorbidities, a medical illness in pregnant women infected with COVID-19 cannot be ignored. The incidence of congenital infections in neonates from SARS-CoV-2-infected mothers is unclear.

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