

# Pregnancy outcomes and vertical transmission capability of SARS-CoV-2 infection among asymptomatic females: A cross-sectional study in a tertiary care rural hospital

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## ABSTRACT

**Background:** The COVID-19 pandemic is still spreading throughout the world along with its strange and frightening mutations, and the World Health Organization (WHO) has declared it as a global pandemic. **Objective:** The present investigation aims to evaluate the effect of SARS-CoV-2 infection on mother and newborn outcomes and the vertical transmission potential of this virus. **Study Design:** This was a cross-sectional study conducted at a tertiary care dedicated COVID-19 hospital. A total of 40 pregnant females (RT-PCR positive for SARS-CoV-2) and their 41 neonates (including stillbirths and a twin delivery) were included in the present study. **Results:** All the mothers in the study were SARS-CoV-2 positive on the RT-PCR test, but none had any COVID-19 symptoms (pneumonia-like fever, cough, fatigue, sore throat, shortness of breath, and diarrhea). Out of 41 newborns, 38 (92.7%) were healthy, one (2.4%) was a stillbirth, and two newborns (4.9%) could not be revived. All the 41 (100.0%) neonates, including stillborn and preterm were negative for the SARS-CoV-2 RT-PCR test. Twenty-Six neonates (63.4%) were delivered by caesarean section, whereas 15 cases (36.6%) had a normal vaginal delivery. **Conclusion:** The present study showed no suggestion of vertical transmission of SARS-CoV-2 in pregnant females. Therefore, the placenta might function as a barrier to the SARS-CoV-2 virus. Also, there were no complications come upon during the delivery of any neonate in the present study.

**Keywords:** COVID-19, maternal and fetal, perinatal outcome, placental barrier, SARS-CoV-2, vertical transmission

## Introduction

The COVID-19 pandemic is still spreading throughout the world, along with its strange and frightening mutations. According to the World Health Organization, till 28<sup>th</sup> December 2020, COVID-19 has caused 1757947 deaths globally.<sup>[1]</sup> The evidence remains equivocal regarding the placental breach of SARS-CoV-2 and

its sequential complications on the developing fetus. During pregnancy, there are many deviations from the normal physiology in the immune and cardiopulmonary systems. The augmented oxygen demand of the body during the pregnancy due to physiological anemia and fetal demand already cause physiologic dyspnea. Also, the edematous mucosa of the respiratory tract during gestation makes it more susceptible to hypoxia.<sup>[2]</sup> Studies have demonstrated that pneumonia caused by a bacterium causes a severe problem during pregnancy. Also, viral pneumonia causes more morbidity and mortality in pregnant females.<sup>[3]</sup> The researchers in Taiwan (in 2012) demonstrated that the newborns

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of “mothers having pneumonia (non-COVID-19)” had more chances of having low birth weight, low APGAR score, and preterm birth than the newborns of healthy mothers.<sup>[4]</sup> An article published in China hypothesized that birth asphyxia, hypoxemia, and even premature births could result if COVID-19 infects the mother.<sup>[5]</sup> At present, we have an insufficient understanding of the effects of COVID-19 on the maternal-fetal dimensions, and one of the major concerns is whether SARS-CoV-2 can be vertically transmitted from mothers to their fetuses. Although most recent studies indicated no vertical transmission, RT-PCR for COVID-19 was found positive in neonates born to SARS-CoV-2-affected mothers in some studies.<sup>[6-13]</sup> A case report by Parsa Y showed the positive newborn birth by COVID-19 positive mother, but no vertical transmission was proved.<sup>[14]</sup> A study conducted on 44 neonates by Sharma R *et al.*<sup>[15]</sup> showed a negligible possibility of vertical transmission of the SARS-CoV-2 virus. The natural history of COVID-19 infection is not fully understood; many genetic mutations occur in the virus that might be more virulent, so more epidemiological investigations should be done.<sup>[16]</sup> Primary care physicians are involved in maternal and child health services. As the COVID-19 pandemic is still ongoing, primary care physicians must know about the maternal and neonatal outcomes of SARS-CoV-2 infection during pregnancy. The objective of the present investigation is to evaluate the effect of SARS-CoV-2 infection on mother and newborn outcomes and the vertical transmission potential of this virus.

## Methodology

**Study design and settings:** The present cross-sectional study was conducted between April 2020 and December 2020 period. All 40 women admitted for delivery and 41 newborns of index pregnancy of above women (including one stillbirth and a twin delivery) in a dedicated COVID-19 tertiary care hospital of the rural area were included in the present study.

**Inclusion and exclusion criteria:** All RT-PCR positive COVID-19 pregnant females in their late pregnancy were included who came for delivery to the current setting. The females who did not give consent were excluded from the study. **Methods:** RT-PCR test for the SARS-CoV-2 was done on samples of nasopharyngeal swabs from all pregnant females. Immediately after birth, nasopharyngeal swabs were collected from all newborns for evidence of vertical transmission of SARS-CoV-2. All other laboratory and radiological assessments, including chest X-ray, were performed according to the patient's clinical care needs. Laboratory tests included full blood count, kidney and hepatic functions, serum-electrolytes, C-reactive protein, and testing for coagulation. The medications for COVID-19 were given to the patients as per the guidelines. All neonates were immediately separated from their mother and transferred to the pediatric isolation ward. Due to maternal viral infection, breastfeeding was not initiated, and all neonates were fed artificially without any contact with their mother. Data on maternal age and neonatal characteristics, including birth weight, gestational age, mode of delivery, complications, maternal and neonatal RT-PCR status for COVID-19, birth order, and neonatal

status were collected. **Ethical consideration:** The ethical clearance was taken by the ethics committee of the institute. A written consent was obtained from each patient/caregiver. **Statistical methods:** The data were statistically analyzed by using IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY IBM Corp.<sup>[17]</sup> The characteristics of mothers and newborns were presented using descriptive statistics. Continuous variables were calculated using the mean and standard deviations. Categorical variables were summarized using frequency and percentage.

## Results

There were 40 pregnant females included in the present study. The mean ( $\pm$  SD) maternal age was  $26.60 \pm 4.56$  years (minimum age of 20 years and maximum age of 38 years). The mean gravida was 2.15, whereas the mean parity of the pregnant females was 1.18. A total of 41 neonates were included in the present study (one twin pregnancy). The minimum birthweight found in the present study was 0.7 kg, whereas the maximum birth weight of a neonate was 4.0 kilograms (the mean birth weight of neonates in the present study was  $2.62 \pm 0.63$  kg). The mean gestation age was  $37.96 \pm 3.62$  weeks (with a minimum of 27 weeks up to 43 weeks a maximum) [Table 1].

The age group of 20 to 29 years formed the primary (72.5%) proportion of the study group, whereas 27.5% of females were over 30 years. Lower segment caesarean section (LSCS) during the previous pregnancy was done among 22.5% of females. The gravida status of “more than one” was present among 72.5% of females, and 7.5% of females had a more than “three or more” parity status. All the 41 pregnant females included in the current study were asymptomatic COVID-19 positive (on RT-PCR test). No complications were found among 29 (72.5%) females out of 40 who came to the hospital for delivery. All the 40 mothers (100%) faced no maternal complications during or after the delivery [Table 2].

RT-PCR was done for SARS-CoV-2 on all the 41 (100%) neonates was found negative (it included stillborn and preterm births). There was one stillbirth among 41 neonates who were born to these 40 pregnant females. Two newborns (one baby was 0.7 kg at 27 weeks of gestation and the other was 1.0 kg at 28 weeks of gestation) could not be revived, which was most probably caused by prematurity. Rest all the newborns were healthy without any COVID-19 symptoms. The repeated RT-PCR for SARS-CoV-2

**Table 1: Maternal and new-born features**

| Maternal and newborn Features  | Mean $\pm$ SD    |
|--------------------------------|------------------|
| Maternal Features (n=40)       |                  |
| Maternal Age (in years)        | 26.60 $\pm$ 4.56 |
| Gravida                        | 2.15 $\pm$ 0.92  |
| Parity                         | 1.18 $\pm$ 1.06  |
| Newborn Features (n=41)        |                  |
| Birth weight (In Kilograms)    | 2.62 $\pm$ 0.63  |
| Period of gestation (in weeks) | 37.96 $\pm$ 3.62 |

**Table 2: Distribution of mothers according to demographic, antenatal, natal, postnatal characteristics, and COVID-19 status and symptoms (n=40)**

| Variable   | Characteristics         | Number | Percentage |
|--|-------------------------|--------|------------|
| Maternal Age-groups  | 20 to 29 years          | 29     | 72.5       |
|  | 30 and above years      | 11     | 27.5       |
| Gravida status   | One                     | 11     | 27.5       |
|  | More than One           | 29     | 72.5       |
| Parity status  | Zero                    | 12     | 30.0       |
|  | One to Two              | 25     | 62.5       |
|  | Three or More           | 03     | 7.5        |
| LSCS done in previous pregnancy  | Yes                     | 09     | 22.5       |
|  | No                      | 31     | 77.5       |
| Maternal RT-PCR status for COVID-19  | Positive                | 40     | 100.0      |
|  | Negative                | 00     | 0.0        |
| Any COVID-19 symptoms (pneumonia-like fever, cough, fatigue, sore throat, shortness of breath, and diarrhea) | Present                 | 00     | 0.0        |
|  | Absent                  | 40     | 100.0      |
| Presented in the hospital with   | Leaking per vaginum     | 03     | 7.5        |
|  | Placenta Praevia        | 01     | 2.5        |
|  | Pregnancy with IUD      | 01     | 2.5        |
|  | Antepartum Eclampsia    | 01     | 2.5        |
|  | Twin Pregnancy          | 01     | 2.5        |
|  | Transverse Lie          | 02     | 5.0        |
|  | Meconium Stained Liquor | 02     | 5.0        |
|  | No Complication         | 29     | 72.5       |
| Complication during delivery   | Yes                     | 00     | 0.0        |
|  | No                      | 40     | 100.0      |

before the discharge of newborns was also found negative. A total of 15 neonates (36.6%) were delivered via normal vaginal delivery. A total of 26 (63.4%) neonates were delivered by LSCS. These were delivered by LSCS for common obstetric issues (such as fetal distress, previous LSCS, or preeclampsia). Four newborns (9.8%) were postdated (more than completed 42 weeks of gestational age). The birth weight of 78.0% of neonates was  $\geq 2.5$  kg, whereas 2 (4.9%) of neonates had a birth weight of less than 1.5 kg [Table 3, and Figure 1].

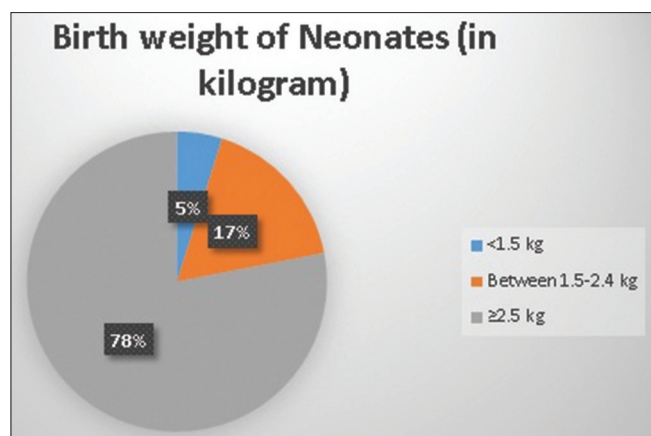
## Discussion

SARS-CoV-2 is a novel virus, and we do not have much knowledge about COVID-19 and its maternal and newborn adverse outcomes to date. Pregnancy is an immunosuppressed condition, and a compromised immune system renders the women more vulnerable to infections.<sup>[18]</sup> In their study, Munn *et al.* (1999)<sup>[19]</sup> showed that females with pneumonia delivered their infants at significantly earlier gestational age than healthy pregnant females. In a study, Chen *et al.*,<sup>[20]</sup> found that during the third trimester, the mother-to-child transmission did not occur among the COVID-19 positive (by RT-PCR) pregnant females. In this study, all the neonatal pharyngeal swabs were found negative for the COVID-19 RT-PCR test. Research conducted by Lie *et al.*,<sup>[21]</sup> showed no evidence of vertical transmission in nine pregnant COVID-19 positive females in the third trimester of pregnancy. Also, the vaginal secretion samples were tested negative for SARS-CoV-2 RNA in this study. Chen *et al.*,<sup>[22]</sup> in their research, showed that there was no vertical transmission

**Table 3: Distribution of new-borns according to Birth weight, Neonatal status, Mode of delivery, Gestational age at the time of delivery, and COVID19 status (n=41)**

| Variable   | Characteristics         | Number | Percentage |
|--|-------------------------|--------|------------|
| COVID-19 RT-PCR status                             | Positive                | 00     | 0.0        |
|  | Negative                | 41     | 100.0      |
| Birth weight (in kilogram)                         | <1.5 kg                 | 02     | 4.9        |
|  | Between 1.5 and 2.4 kg  | 07     | 17.1       |
|  | $\geq 2.5$ kg           | 32     | 78.0       |
| Neonatal status                                    | Healthy                 | 38     | 92.7       |
|  | Stillborn               | 01     | 2.4        |
|  | Not Revived             | 02     | 4.9        |
| Mode of delivery                                   | Normal Vaginal Delivery | 15     | 36.6       |
|  | LSCS                    | 26     | 63.4       |
| Gestational age at the time of delivery (in weeks) | Up to 28.00 weeks       | 01     | 2.4        |
|  | 28.01 to 36.99 weeks    | 08     | 19.5       |
|  | 37.00-42.00 weeks       | 28     | 68.3       |
|  | 42.00 weeks             | 04     | 9.8        |

in the neonates (all were tested negative for SARS-CoV-2 RNA), whose mothers were laboratory-confirmed COVID-19 positive cases in their late pregnancy. Liu W *et al.* did a study on three pregnant women who got SARS-CoV-2 infection. Of these, two of the cases had an uneventful cesarean delivery of healthy neonates. None of the three infants showed infection of SARS-CoV-2 by vertical transmission. Li Y *et al.*, revealed in a case report of a pregnant female (COVID-19 positive in her 35<sup>th</sup> week of pregnancy) delivered a baby by cesarean section, and this neonate was found negative for SARS-CoV-2 infection. Yang



**Figure 1:** Distribution of neonates according to their Birth Weight

*P et al.*, conducted a study on seven pregnant females infected with SARS-CoV-2 in their late pregnancy. All of them were delivered by cesarean section. The six samples were taken from the seven newborn, and all six (100.0%) were found negative for SARS-CoV-2 infection.<sup>[6-8]</sup> These results show agreement with the present study, where most of the deliveries (63.4%) were through LSCS, and no newborn was found COVID-19 positive. Chen S *et al.*<sup>[9]</sup> conducted a study on five SARS-CoV-2 positive pregnant women. The gestational age of the fetus at delivery in these females was between 38 weeks and 40 weeks. Three of them are gravida “1,” and two are gravida “3”; four have a parity “0,” whereas one female had parity of “1.” Cesarean section was done among two females (40%) out of five. Any maternal complication after delivery was not observed. All the newborns were negative for the SARS-CoV-2 RT-PCR test, and no one had any symptoms of COVID-19. The age group, gravida, and parity of the present research were nearly comparable to this study. The proportion of delivery via cesarean section was slightly high (63.4%) in the present study than in this study. Similar to the above, in the present research, there were no maternal complications after delivery, and all the newborns (100.0%) were tested negative for SARS-CoV-2 RT-PCR and none (0.0%) of them had any symptoms of COVID-19.

Lu D *et al.*<sup>[10]</sup> showed no vertical transmission in a 22-year-old pregnant woman infected asymptotically with SARS-CoV-2 in the late pregnancy. In the present study, neonatal pharyngeal swabs were taken, and all 41 (100%) tested negative for the SARS-CoV-2 RT-PCR test. Hence, the results of the present study are consistent with the above-reported researches.

Some studies showed RT-PCR for SARS-CoV-2, positive in newborns of SARS-CoV-2 positive mothers, unlike the above data. Hu X *et al.*, conducted a research on 7 RT-PCR-confirmed COVID-19 positive pregnant females, and found that one infant was positive for SARS-CoV-2 infection out of seven.<sup>[11]</sup> Alzamora MC *et al.*,<sup>[12]</sup> published a case report of a 41-year-old gravida “three” para “two” pregnant female. She had severe symptoms of COVID-19, a C-section delivery was conducted, and the newborn was immediately sent to isolation

without any skin-to-skin contact or any delay in cord clamping. New-born was found positive for the SARS-CoV-2 after 16 h of the delivery, but (Ig)-M and IgG for SARS-CoV-2 were found negative. In a study done on 33 pregnant COVID-19 positive females by Nie R *et al.*,<sup>[13]</sup> the perinatal transmission rate for COVID-19 was 3.6%. The time interval from the clinical manifestation of SARS-CoV-2 to delivery was short. It is unsure whether there could be a risk of vertical transmission when infection occurs earlier in the first or second trimester of pregnancy. After delivery, during the observation period, all mothers remained healthy without any COVID-19 symptoms. Currently, two researches conducted by Dong *et al.*, and Zeng *et al.*, unveiled the potential of vertical transmission of the SARS-CoV-2 virus. Their studies found a virus-specific IgM antibody in neonatal blood tested immediately after birth, whereas the swab from nasopharyngeal mucosa showed negative results for the SARS-CoV-2 RT-PCR test.<sup>[23,24]</sup> Here, the probability of post-delivery neonatal infection with SARS-CoV-2 virus cannot be completely ruled out due to various factors such as the delayed testing and a higher viral load of severely infected mothers.

## Conclusion

The present study showed no suggestion of vertical transmission of the SARS-CoV-2 virus in pregnant females. This suggests that the placenta might function as a barrier to the SARS-CoV-2 virus. Also, there were no complications come upon during the delivery of any neonate in the present study. It is very early to say that SARS-CoV-2 cannot cross the placental barrier. Therefore, research with a large sample size is needed to look for the effects of SARS-CoV-2 on maternal and perinatal outcomes.

## Compliance with ethical standards statements

**Institutional Review Board (IRB) Ethical Approval:** The present study was approved by the Ethics Committee of the University before the start of the study.

## Informed consent

Written informed consent was obtained from each patient/ caregiver.

## Availability of data and material (data transparency)

Data is stored and available.

## Code availability (software application or custom code)

Not applicable (N/A)

## Author contributions

All authors contributed to the concept, design, acquisition, analysis, interpretation of data, drafting of the manuscript, critical revision of the manuscript for important intellectual content, co-ordination, statistical analysis, administrative, technical, material support, and supervision.



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Nil.

## Conflicts of interest

There are no conflicts of interest.

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