

A study on obstetric management in term pregnancies infected with SARS-CoV-2 and fetomaternal outcomes.

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Abstract

Background

Pregnant women with SARS-CoV-2 infection may be at increased risk of adverse maternal and neonatal outcomes because of physiological and immunological changes during pregnancy. This study aimed to evaluate the obstetric management, maternal outcomes, and neonatal outcomes in term pregnancies complicated by COVID-19 infection.

Materials and Methods

A retrospective observational cohort study was conducted among 200 term pregnant women with laboratory-confirmed COVID-19 admitted to a tertiary care hospital between June 2020 and May 2021. Maternal clinical profile, laboratory parameters, mode of delivery, maternal complications, and neonatal outcomes were analyzed from hospital records.

Results

The mean maternal age was 25.6 ± 3.94 years. Most women were asymptomatic (78%), while cough was the most common presenting symptom among symptomatic women. Common comorbidities included anemia (3%), hypertensive disorders (12%), and hypothyroidism (5.5%). Spontaneous labour occurred in 41.5% of women, while 50% underwent cesarean delivery. Five women (2.5%) required intensive care admission, and two maternal deaths occurred due to acute respiratory distress syndrome. Mean gestational age at delivery was 38.47 ± 0.83 weeks, and mean birth weight was 2810 ± 431 g. Two neonates (1%) tested positive for SARS-CoV-2 and remained clinically stable. One intrauterine death, one stillbirth, and one neonatal death were reported.

Conclusion

Most pregnant women with COVID-19 had mild disease and favorable maternal and neonatal outcomes. Severe maternal morbidity and mortality were more common in women with associated comorbidities.

Recommendation

Early identification of high-risk pregnant women with COVID-19 and close multidisciplinary monitoring may help reduce adverse fetomaternal outcomes.

Keywords: COVID19, Pregnant women, Infant, Respiratory disease, Neonatal, Morbidity, Mortality

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Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been identified as the cause of a febrile respiratory disease officially named COVID-19 that, since its appearance, has spread across the globe. On 30 January 2020, COVID-19 was declared a Public Health Emergency of International Concern by the WHO Director-General. The physiological, immunomodulatory, and mechanical changes that occur during pregnancy can increase both a woman's susceptibility to disease and the severity of certain infections. At baseline, pregnant women are more

vulnerable to respiratory distress from higher circulating blood volume, decreased residual lung capacity, and increased oxygen consumption. As per a study conducted by NIRRH-ICMR in India, the case fatality rate (CFR) among pregnant women and postpartum women was found to be 5.7 per cent during the second wave, which was significantly higher compared to the first wave, when CFR was only 0.7 percent. Rates of severe coronavirus disease 2019 (COVID-19), intensive care unit admission, and maternal mortality increased among pregnant and postpartum women admitted for COVID-19 in the second wave compared with the first wave in India [1]. There is

now growing evidence that pregnant women may be at increased risk of severe illness from COVID-19 compared with non-pregnant women, particularly in the third trimester, and symptomatic maternal COVID-19 is associated with an increased likelihood of iatrogenic preterm birth[2]. The study published in The Lancet Global Health (31st March 2021) found that maternal and fetal outcomes have worsened during the COVID-19 pandemic, with an increase in maternal deaths, stillbirths, ruptured ectopic pregnancies, and maternal depression. The review included 40 studies, three of which were from India[3]. The present study aimed to evaluate the obstetric management, maternal outcomes, and neonatal outcomes among term pregnant women infected with SARS-CoV-2.

Materials and methods

Study design

This retrospective observational cohort study was conducted to evaluate obstetric management and fetomaternal outcomes among term pregnant women infected with SARS-CoV-2.

Study setting

The study was conducted in a medical college-affiliated tertiary care teaching hospital in South India between June 2020 and May 2021. The institution is a referral center providing comprehensive obstetric, neonatal, intensive care, and emergency services, with an annual delivery rate of approximately 17,000 deliveries and a dedicated COVID-19 treatment facility with Level III intensive care support.

Participants

The study included 200 antenatal women with singleton or multiple term pregnancies admitted for delivery during the study period who tested positive for SARS-CoV-2 by reverse transcriptase polymerase chain reaction (RT-PCR).

Inclusion criteria

- Pregnant women with confirmed SARS-CoV-2 infection by RT-PCR or characteristic CT chest findings
- Gestational age ≥ 37 completed weeks
- Women admitted for delivery during the study period

Exclusion criteria

- Women with detectable IgG/IgM antibodies but negative RT-PCR results
- Gestational age < 37 weeks

Eligible participants were identified from hospital admission and delivery registers of the dedicated COVID-19 obstetric unit. Consecutive sampling was used to include all eligible women admitted during the study period.

Variables

The primary outcome variables included maternal morbidity, maternal mortality, mode of delivery, neonatal SARS-CoV-2 infection, neonatal morbidity, stillbirth, intrauterine death, and neonatal mortality.

Exposure variables included confirmed maternal SARS-CoV-2 infection, symptom status, comorbidities, laboratory parameters, and CT chest findings.

Potential confounding variables included maternal age, parity, anemia, hypertensive disorders, diabetes mellitus, obesity, heart disease, hypothyroidism, and other medical comorbidities.

Data collection

Data were extracted retrospectively from patient case records, labour room registers, intensive care records, neonatal records, and laboratory databases using a structured data collection form.

The collected variables included:

- Demographic characteristics
- Obstetric history
- Clinical symptoms
- Comorbidities
- Laboratory investigations including CBC, renal function tests, liver function tests, CRP, serum ferritin, PT/INR
- CT chest findings
- Mode of delivery
- Maternal complications
- Neonatal outcomes, including birth weight, Apgar score, NICU admission, SARS-CoV-2 status, and mortality
- COVID-19 infection was confirmed using RT-PCR testing of nasopharyngeal swab samples.

Bias

To minimize selection bias, all eligible consecutive term pregnant women admitted during the study period were included. Information bias was minimized by using hospital medical records and standardized laboratory-confirmed diagnostic criteria for SARS-CoV-2 infection. Data extraction was performed using predefined variables to maintain consistency.

Statistical analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software version 25. Continuous variables were expressed as mean \pm standard deviation or median with interquartile range where appropriate. Categorical variables were presented as frequencies and percentages.

Associations between categorical variables were analyzed using the chi-square test or Fisher's exact test. Continuous variables were compared using Student's t-test. Correlation analysis was performed to evaluate the association between disease severity and adverse maternal and neonatal outcomes. A p-value < 0.05 was considered statistically significant.

Ethical consideration

Ethical approval for the study was obtained from the Institutional Ethics Committee before commencement of the study.

Informed consent

As this was a retrospective record-based study using anonymized hospital data, the requirement for informed consent was waived by the Institutional Ethics Committee.

Results

Patient characteristics

Among the 200 delivered women, the mean +/- SD age of the cohort was 25.60 +/- 3.94. Most women were asymptomatic 78% and the most common symptom was cough (Figure 1). Common comorbidities were anemia, hypertensive disorders of pregnancy, and heart disease (Figure 2). Five women (2.5%) were admitted to the ICU.

Figure 1: Maternal symptoms in COVID-19

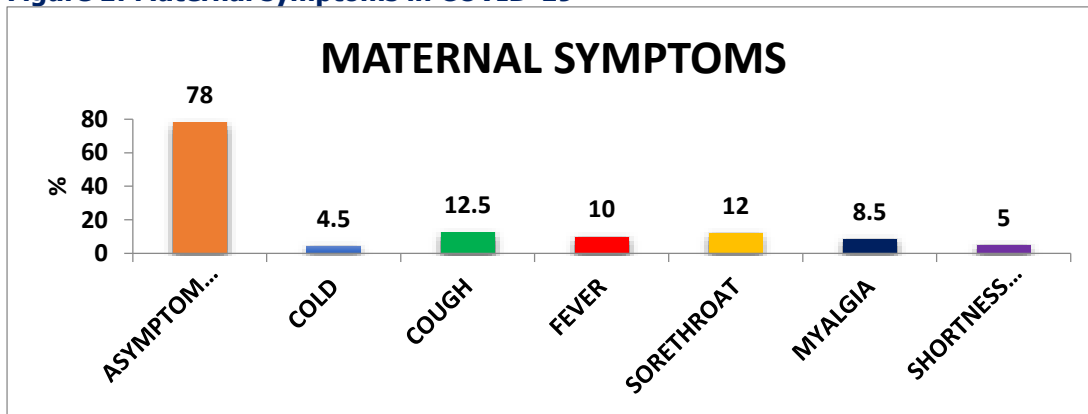
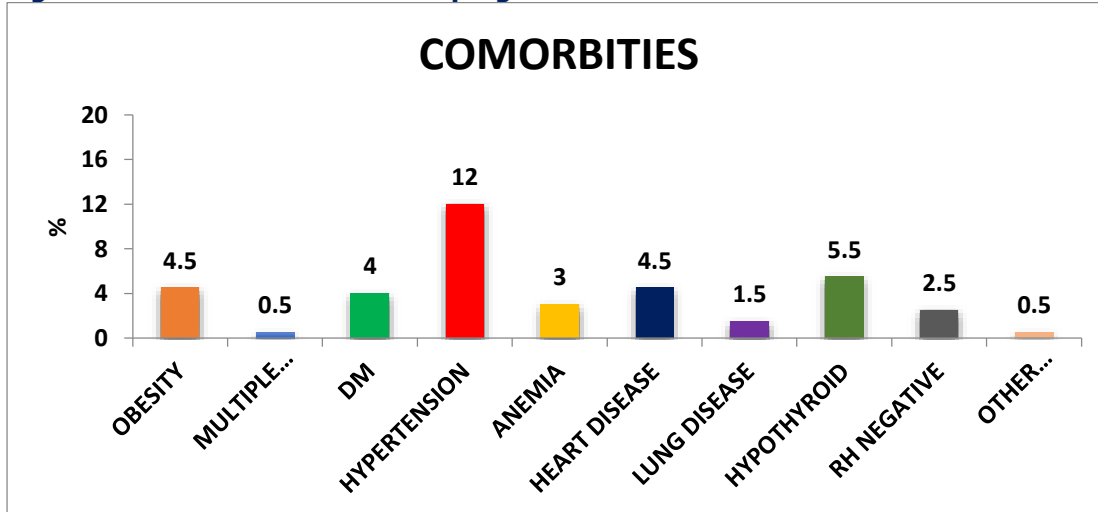


Figure 2: Comorbid conditions in pregnant women with COVID-19



Investigations

The haematological profile in the cohort was within the normal range (Table 1)

Table 1: Hematological characteristics of pregnant women with COVID-19

Variable	Minimum	Maximum	Mean	SD
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WBC	4500	20800	8912.15	2320.48
Neutrophil/Lymphocyte Ratio	0.3	5.1	2.34	0.9
Hemoglobin	7.4	14.8	10.89	0.98
Platelet Count	0.43	5.32	3.15	0.73
Creatinine	0.6	1.4	0.83	0.15
Bilirubin	0.2	1.2	0.55	0.22
SGOT	12	66	22.14	8.86
SGPT	10	40	19.18	5.16
CRP	2	110	23.13	23.22
Serum Ferritin	11	95	21.69	21.67

Note. WBC = white blood cell count; CRP = C-reactive protein; SD = standard deviation.

CT changes in symptomatic patients.

Chest imaging may aid, but not replace, molecular confirmation of COVID-19. When CT scans are performed in pregnancy, concerns regarding the teratogenic effects of ionizing radiation on the fetus are inevitable. It is reassuring that the fetal radiation dose for a routine CT chest is 0.03 mGy, and exposure to radiation doses of <50 mGy is not associated with an increased risk of fetal anomalies or pregnancy loss.

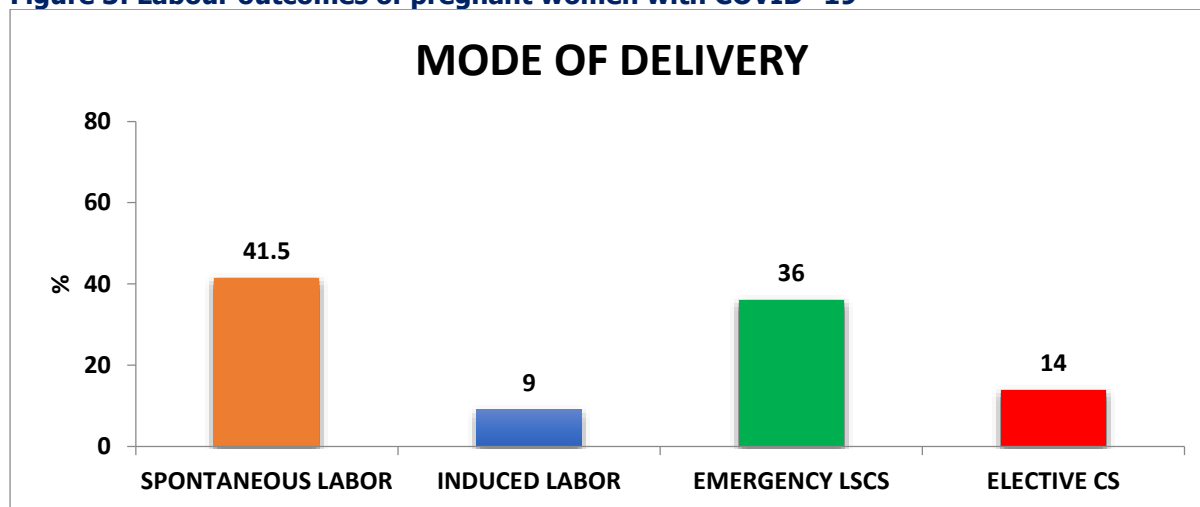
All patients presenting with cough and /or breathlessness or persistent symptoms or abnormal lab findings or oxygen saturation less than 95percent were ascertained for a CT chest.

CT chest findings were abnormal in 18 patients. Chi-square analysis showed no statistically significant association between clinical symptoms and abnormal CT chest findings, $\chi^2(1) = 3.10$, $p = 0.078$.

Pregnancy outcomes

Labour was spontaneous in 83 (41.5%) women and induced with prostaglandins for obstetric indications in 18 (9%). Elective cesarean delivery was performed in 28 (14%), and 72 (36%) underwent emergency cesarean delivery for various maternal-fetal indications, the most common being fetal distress. COVID-19 positive status did not influence the mode of termination.

Figure 3: Labour outcomes of pregnant women with COVID -19



Maternal mortality

Two maternal morbidities (1%) were individually analysed.

Patient 1

The 24-year-old patient was a primigravida with a term pregnancy and presented with severe symptoms of COVID 19, confirmed by qRT-PCR. CT chest showed 55% GGO. She was a known case of non-severe preeclampsia. As she did not maintain saturation in room air, she was on non-invasive ventilation, was on inj remdesivir, dexamethasone, and low molecular weight heparin. However, she deteriorated and was intubated and

connected to a mechanical ventilator. She was taken up for emergency LSCS in view of maternal distress and delivered an alive term girl baby. Patient went into cardiac arrest on POD 1, the cause of death being acute respiratory distress syndrome (ARDS), respiratory failure (complication of COVID-19).

Patient 2

The 27-year-old patient was a primigravida with a term pregnancy, a known case of chronic hypertension, who presented with cough, fever for 5 days, and breathlessness for 2 days. She tested positive by RTPCR and her CT chest showed 50% GGO. She did not maintain saturation

in room air and was on non-invasive ventilation, was on inj remdesivir, dexamethasone, and low molecular weight heparin. However, she deteriorated and was intubated and connected to a mechanical ventilator after 2 days. The

patient went into cardiac arrest for 2 days, the cause of death being acute respiratory distress syndrome (ARDS), respiratory failure (complication of COVID-19).

Table 2: Maternal deaths

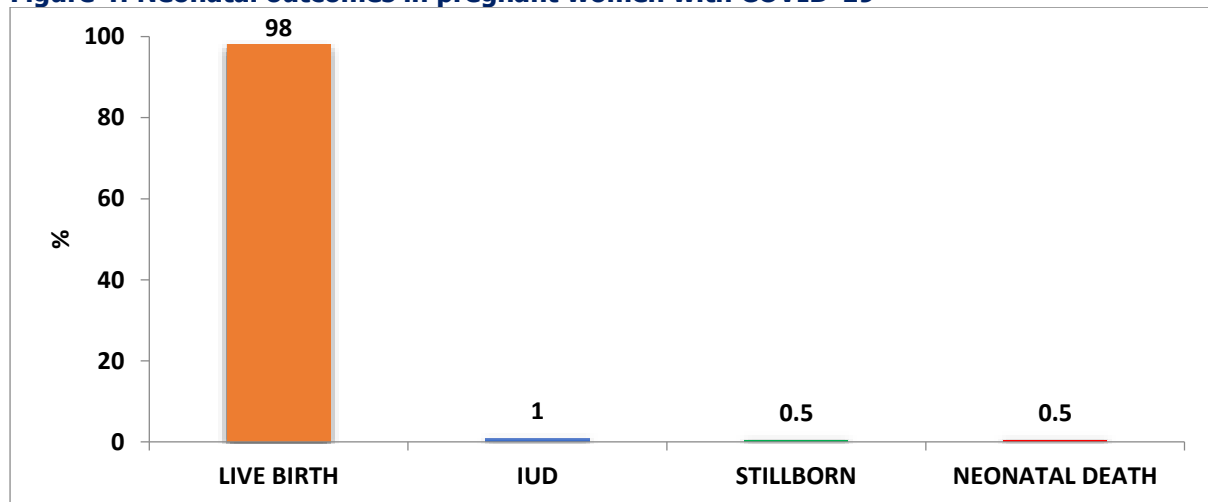
	Patient 1	Patient 2
Age	24	27
Obstetric history	Primigravida	Primigravida
Presentation	Term gestation	Term gestation
Comorbidity	Non-severe preeclampsia	Chronic hypertension
Labour, delivery	Emergency lscs	-
Length of stay	6 days	4 days
Cause of death	ARDS/ respiratory failure	ARDS/ respiratory failure
Neonatal outcome	Baby negative	-
CT chest	55% GGO	50% GGO
Neutrophil lymphocyte ratio	3.8	4.0

Neonatal outcomes

Mean +/- SD gestational age and birthweight were 38.47 +/- 0.83 weeks and 2810 +/- 431 g, respectively. Among all the neonates, two (1%) were confirmed positive for SARS-CoV-2. Both were asymptomatic and

hemodynamically stable during their hospital stay and were discharged. One asymptomatic mother was admitted with intrauterine fetal death and expelled. Another asymptomatic mother who went in for spontaneous labour had a stillborn. One neonatal death occurred, the cause of death being suspected Congenital heart disease.

Figure 4: Neonatal outcomes in pregnant women with COVID-19



Later in the pandemic, studies showed that there was no need to separate mothers from neonates, allowing delayed cord clamping and skin-to-skin contact, along with maintenance of breastfeeding, in a high percentage of

newborns of mothers with COVID-19, and hence all babies were given to their mothers.

Treatment

Table 3: Treatment provided to pregnant women with COVID-19

Treatment modality	No. of patients
Antibiotics	200
Antiviral	11
Corticosteroids	18
Nasal oxygen	5
Non-invasive ventilation	4
Invasive ventilation	2

Discussion

The current study summarises the obstetric-perinatal and neonatal outcomes of infected pregnant women and their newborns during the SARS CoV-2 pandemic. The mean maternal age (25 years) was less than in other studies—36 years by Smith et al[5] and 29.7 years by Breslin et al[6] - possibly because India has a large youth population. In the current study, 41.5% presented in spontaneous labour and 9% were induced; hence, vaginal delivery rates (49.5%) were marginally lower than cesarean delivery rates. A systematic review of 33 studies described the outcomes of 385 pregnant women with COVID-19 with gestational age at birth ranging from 30 to 41 weeks and a preterm birth rate of 15.2%[7]. Although many of the preterm deliveries were iatrogenic (maternal indications and fetal distress), the indications were not clear in others. The majority of cesarean deliveries in the current study were performed for fetal distress (30.5%), which was similar to other studies[8,9,10]. This could suggest an underlying pathology of placental insufficiency/hypoxia leading to fetal distress in COVID-19 infection.

The most common presenting symptom in the current study was low-grade fever, cough, and sore throat (40.5%), similar to other studies[11,12,13]. Ten women (5%) had moderate infection, two (1%) belonged to the severe category, and died. Early reports suggest that the severity category proportions in the pregnant population are similar to those described for non-pregnant adults with COVID-19 infection (approximately 80% mild, 15% severe, and 5% critical disease). Other symptoms, including nasal congestion, rash, sputum production, headache, malaise, and loss of appetite, were reported in less than 5% of cases. It has been suggested that the limited data currently available do not indicate that pregnant individuals are at an increased risk of infection, severe morbidity, or mortality compared with non-pregnant individuals in the general population.

In the current cohort, five women (2.5%) who were admitted to the ICU had comorbidities of chronic hypertension, non-severe preeclampsia, and heart disease. Whether COVID-19 increases the risk of severe morbidity and mortality in high-risk pregnancies is a question to be answered. A review of 108 pregnancies did not report any maternal deaths. However, Breslin et al. reported severe morbidity in mothers with COVID-19 who had a high body mass index and complicated medical history. Hantoushzadeh et al. reported a case series of nine pregnant women diagnosed with severe COVID-19 in their second or third trimester. They reported seven deaths; one patient remained critically ill and ventilator-dependent, and one recovered after prolonged hospitalization. Five of the women who died were over 35, older than the current study population. Most of the women in the study had comorbidities such as obesity, gestational diabetes, and hypothyroidism, and all deaths were due to severe COVID-19. The authors also reported that the outcomes of these women were more severe than the outcomes of high- and low-risk familial/household members. Association with comorbidities appears to worsen pregnancy outcomes in women with COVID-19.

La Scola et al. reported a strong correlation between Ct value and sample infectivity in a cell culture model in 183 samples. They concluded that patients with Ct values ≥ 34 do not excrete infectious viral particles. However, no significant association was found between clinical symptoms and CT chest findings ($P=0.07$), likely because the majority of patients had mild symptoms. Wang et al. reported mean Ct values for different body compartments to be more than 30, except for nasal swabs, which had a mean of 24.3, indicating high viral load in these specimens[4].

In the current study, none of the SARS-CoV-2-positive neonates developed severe manifestations of the disease, and they were subsequently discharged. This suggests a good neonatal outcome in pregnant women with SARS-CoV-2 infection. Zaigham et al. reported one positive neonate among 75 tested for SARS-CoV-2 who was clinically well but had transient lymphocytopenia and deranged liver function[13]. Fan et al. reported two neonates with mild lymphocytopenia and radiologic findings of pneumonia, although both were clinically well and recovered fully. Thus, we cannot exclude the possibility that fetuses and newborns might show a response, often subclinical, to maternal infection; hence, vertical maternal-fetal transmission cannot be ruled out. This view has been seconded by a recently published study that reported three infants born by cesarean delivery who tested positive for SARS-CoV-2 2 days after birth. However, Schwartz et al., in their analysis of 38 infected pregnancies, did not find any evidence for intrauterine transmission. Furthermore, neonates can acquire SARS-CoV-2 in the postpartum period (horizontal transmission), similar to adults.

Generalizability

The findings of the present study may be generalizable to pregnant women with term gestation managed in tertiary care hospitals with dedicated COVID-19 obstetric services, particularly in similar resource-limited settings. However, variations in institutional protocols, viral variants, vaccination status, and healthcare infrastructure may influence maternal and neonatal outcomes across different populations.

Conclusion

A majority of pregnant women with COVID-19 had mild disease and recovered with good perinatal outcomes. Women with comorbidities may have an increased risk of severe morbidity and mortality. Increased rates of cesarean sections were found, with iatrogenic reasons in the early period of the pandemic potentially involved. In cases of symptomatic women with confirmed infection, high maternal ICU admission rates should raise some concerns. Even though neonatal infections were rare, the probability of vertical transmission cannot be eliminated.

Limitations

The study has several limitations. First, this was a retrospective single-center study, which may limit

external validity. Second, the study included only term pregnancies; therefore, outcomes among preterm pregnancies could not be assessed. Third, the majority of patients had mild disease, limiting subgroup analysis of severe COVID-19 infection. Fourth, long-term maternal and neonatal follow-up data were unavailable. Finally, vaccination status and viral variant analysis were not evaluated because the study was conducted during the early phase of the pandemic.

Recommendations

Pregnant women with COVID-19, particularly those with associated comorbidities, should undergo close antenatal monitoring and multidisciplinary management to reduce maternal and neonatal complications. Further multicenter prospective studies with larger sample sizes and long-term neonatal follow-up are recommended to better understand the impact of SARS-CoV-2 infection during pregnancy.

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List of abbreviations

COVID-19	Coronavirus Disease 2019
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
RT-PCR	Reverse Transcriptase Polymerase Chain Reaction
ICU	Intensive Care Unit
NICU	Neonatal Intensive Care Unit
ARDS	Acute Respiratory Distress Syndrome
CBC	Complete Blood Count
RFT	Renal Function Test
LFT	Liver Function Test
CRP	C-Reactive Protein
CT	Computed Tomography
GGO	Ground Glass Opacity
LSCS	Lower Segment Cesarean Section
SD	Standard Deviation
WBC	White Blood Cell

Source of funding

No external funding was received for this study.

Conflict of interest

The authors declare no conflict of interest.

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author contributions

Dr. Sindhukavi P: Conceptualization, study design, patient management, manuscript preparation, and final approval.

Dr. Parvathaneni Divya: Data collection, statistical analysis, manuscript drafting, and literature review.

Dr. Sornalatha C.L.: Clinical supervision, interpretation of findings, and manuscript revision.

Dr. Ramnivas R: Neonatal assessment, neonatal data collection, and manuscript editing.

Dr. Konka Sekar Chaitanya: Data interpretation, critical review, and manuscript

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