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Obstetric and neonatal outcome of COVID-19 positive mothers: A retrospective cohort study in a tertiary care hospital of West Bengal

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ABSTRACT

Background: Coronavirus disease was declared a global pandemic by WHO in March 2020 and since then several reports on obstetric and neonatal outcomes due to COVID-19 infection in pregnancy are showing varying results from different corners of the world. **Aims and Objectives:** The aim of the present study was to describe the clinical course of the disease in pregnancy and evaluation of maternal and neonatal outcomes. The secondary objective was to compare the obstetric and neonatal outcomes of COVID-19-positive mothers and COVID-19-negative mothers admitted in the same time frame. **Materials and Methods:** In this retrospective cohort study we included 155 COVID-positive and 310 COVID-negative pregnant women, from May 2020 to December 2020 admitted at our tertiary care hospital in West Bengal, India. Maternal and neonatal outcomes were compared in both groups. **Results:** Most of the COVID-positive pregnant women were asymptomatic (38%), 45.8% of patients had mild symptoms like fever and cough and only 1.9% of mothers developed severe pneumonia. Pregnancy complications like abortion, stillbirth, intrauterine fetal death, antepartum haemorrhage, pregnancy-induced hypertension, gestational diabetes mellitus were similar in both groups ($P>0.05$) but significantly increased incidence of preterm labor and delivery of the low-birth-weight baby was found in the COVID-positive group ($P<0.05$). Number of neonates with low birth weight (<2.5 kg) was significantly higher in the COVID-positive group than in COVID negative group (28% vs. 16.7%, $P<0.05$). Need for neonatal intensive care unit admission was similar in both groups ($P>0.05$). **Conclusion:** Significantly increased incidence of preterm labor and delivery of the low-birth-weight baby was found in the COVID positive mothers without any evidence of mother-to-child vertical transmission of SARS-CoV-2.

Key words: COVID 19 infection; Retrospective cohort; Pregnant women; Obstetric and neonatal outcome; Preterm labour

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INTRODUCTION

Pandemics like Plague, Smallpox, Cholera, Spanish Flu, and Ebola have ravaged mankind and altered the course of human history. The COVID-19 pandemic is the latest wrath of nature. Rates of severe coronavirus disease 2019 (COVID-19), intensive care unit (ICU) 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 Lancet Global Health (March 31st, 2021), reports that maternal and fetal outcomes have worsened during the COVID-19 pandemic, with an increase in maternal deaths,

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stillbirth, ruptured ectopic pregnancies, and maternal depression. The review included 40 studies and three of which were from India.[3]

An NIRRH-ICMR study in India found the case fatality rate (CFR) among Pregnant and postpartum to be 5.7% during the second wave, which was significantly higher compared to the first wave when CFR was only 0.7%.[4]

There are limited data and research done regarding maternal and perinatal outcomes in COVID-19-affected women globally, both in developed as well as developing countries like India.

Compared to our national MMR (2017–2019) of 103, an MMR of 109 in our state of West Bengal is far from desired, rather increasing (in 2016–2018, it was 98).[5]

Unfortunately, due to myriad reasons, Murshidabad district of West Bengal contributes significantly to the high MMR of our state and Murshidabad Medical College and Hospital being a tertiary care center, caters to most of these high-risk and critically ill mothers.

In the backdrop of a State and district-specific baseline high MMR, Covid 19 infection in pregnancy with no pre-existing guidelines and treatment protocols had thrown an immense challenge to health-care workers in our district of Murshidabad, West Bengal.

Aims and objectives

Aims and Objective of this retrospective, observational, analytical study was to compare the obstetric and neonatal outcomes of COVID-19 positive mothers and COVID-19-negative mothers admitted in the same time frame at Murshidabad Medical College and Hospital.

MATERIALS AND METHODS

This is a retrospective cohort study done in the department of Gynaecology and Obstetrics at tertiary care hospital located at Murshidabad which is the fourth most populous district in the state of West Bengal, India. Murshidabad Medical College has provided tertiary care during the COVID-19 pandemic since the 1st week of April 2020.

Institutional Ethics Committee approval (IEC No: MSD/MCH/PR/1523/2022/K, dated June 24, 2022) was taken for the study. Consent of the patients to review their medical records was not required by the Institutional Scientific Review Board as all patients admitted to our hospital gave consent for treatment and use of their data for research purposes at the time of admission. Any data revealing the identification of the patient was kept confidential.

Inclusion criteria

According to the inclusion criteria of the study, antenatal mothers who had tested positive for the COVID-19 RTPCR test as well as COVID-negative mothers who were admitted and treated from May 2020 to December 2020 were included.

Exclusion criteria

According to exclusion criteria postnatal mothers admitted with some puerperal complications in the same time frame but who delivered outside this hospital, patients who left against medical advice after admission, pregnant mothers with any associated pre-pregnancy comorbidity (Diabetes mellitus, chronic hypertension, Severe anemia, Asthma, Thyroid disorders, Co-infection) and multiple pregnancies were excluded from the study.

Relevant information about the study participants who were in labor or who came with any pregnancy event like abortion or ectopic pregnancy during the study period were recorded from Bed-head-tickets.

As most of our patients were from containment zones or hotspot areas of the district, testing was advised to all pregnant women presenting in labor or likely to deliver in the next 5 days as per ICMR guidelines.[6] They were tested by COVID-RTPCR test even if asymptomatic. Clinical syndromes associated with COVID-19 infection were classified into mild, moderate, and severe pneumonia according to the Clinical Management protocol of COVID-19, Government of India, Ministry of Health and Family Welfare.[7] To reduce the risk of transmission we took several measures including hand hygiene, usage of masks by all patients and health-care personals, collection of swab and delivery after wearing personal protective equipment, maintaining distance between the beds in wards, separate rooms for donning and doffing in labour room and operation theater complex. For covid-positive mothers separate ward was maintained. Rooming in and direct breastfeeding was also encouraged for their babies at the same time.

Initially, a minimum sample size was calculated as 138 for each group using the formula applicable for comparative analytical study considering the total proportion of neonatal complications among COVID-positive mothers as 20.14% adopted from a study by Nayak et al.,[8] but during the data collection period, the total number of COVID-positive mothers fulfilling the inclusion criteria during the stipulated time frame was found to be 155 and the remaining were negative. Hence, finally, all those

155 COVID-positive mothers and 310 COVID-negative mothers were included in the study. For better comparative analysis and to minimize bias as much as possible, 2 unmatched, consecutive covid-negative pregnant women were enrolled immediately after each covid-positive woman was identified irrespective of their period of gestation.

Detailed information about the patients retrieved from bed-head-tickets were recorded in case investigation form (CIF) as designed by NCDC (National Centre for Disease Control).[9] This form included the following details –(a) sociodemographic parameters, (b) clinical features of the disease, (c) associated comorbidities. We collected laboratory and radiological report findings after admission to the hospital. Grade of clinical severity (mild, moderate, severe) and information on therapies received by each patient as per Clinical management protocol, Government of India[7] were also collected. For neonatal data, we collected information about the mode of delivery, gestational age at delivery, birth-weight, Apgar score at 1 and 5 min and the result of nasopharyngeal swab for Covid-RTPCR test taken within 24 h of delivery.

Maternal outcomes (abortion, intrauterine fetal death [IUFD], still-birth, preterm/term birth, low birth weight or small for gestational age, antepartum and postpartum complications, maternal death) were recorded. The clinical course of the disease, maternal admission to ICU, and maternal discharge or death details were analyzed also. Neonatal outcomes (IUFD, pneumonia, RDS, IVH, necrotizing enterocolitis, hypoxic-ischemic-encephalopathy, need of admission to neonatal ICU [NICU], neonatal death) were recorded and analyzed.

We defined gestational age as the total number of weeks calculated from the 1st day of the last normal menstrual period or the expected date of delivery according to the early ultrasound scan report. Abortion was defined as spontaneous or induced termination of pregnancy before achieving fetal viability. Still birth was defined as a baby died after 28 weeks of gestation but before or during birth. Gestational diabetes mellitus (GDM) was defined as carbohydrate intolerance and resultant hyperglycemia of varying severity with onset or first recognition during pregnancy. Pregnancy-induced hypertension (PIH) was defined as systolic blood pressure (BP) of ≥140 mmHg and/or diastolic BP of ≥90 mmHg on two occasions at least 15 min apart on the same arm after 20 weeks of gestation without proteinuria. Preeclampsia was defined as PIH with significant proteinuria and Eclampsia as the new onset of seizures or coma in a pregnant woman with preeclampsia.

Data entered in the Excel sheet was analyzed using SPSS version 20. Continuous variables were expressed in mean and standard deviation whereas categorical variables were expressed in number and percentage. Chi-square test was used to find out the comparative association between categorical variables in COVID-positive and COVID-negative groups. $P<0.05$ was considered significant.

RESULTS

Demographic profile

Table 1 shows demographic profiles of recruited patients in both groups were similar ($P>0.05$). Majority of patients were in the age group of <30 years, were multigravida, and had gestational age ≥37 weeks.

Clinical presentation in COVID-19 affected pregnant women

Table 2 shows that out of 155 patients, 59 (38%) were asymptomatic and 62% had one or more symptoms. Fever in 67 (43.2%) and cough in 54 (34.8%) were the most common symptoms, few 7 (4.5%) presented with diarrhea and 19 (12.2%) had anorexia, headache, myalgia, anosmia, and nasal stuffiness. 71 (45.8%) had mild, 22 (14.1%) moderate, and only 3 (1.9%) patients developed severe pneumonia.

Mode of delivery

Figure 1 shows that the number of patients delivered by lower segment cesarean section (LSCS) in COVID-positive group was higher than in COVID negative group (47.6% vs. 43.8%), but the difference was not statistically significant ($P>0.05$). In both groups LSCS was done for obstetric indications only. Out of 155 patients in the COVID-positive group 4 had abortion and the remaining 151 patients had their baby delivered by either LSCS/instrumental/vaginal delivery. In COVID negative group out of a total of 310 patients, 11 had abortion and 299 patients were delivered by any of the above methods and the difference between the two groups was not statistically significant.

Maternal outcome

Table 3 shows the incidence of maternal complications in both groups. Pregnancy complications such as abortion, stillbirth, IUFD, antepartum haemorrhage (APH), PIH, and GDM were similar in both groups ($P>0.05$) but significantly increased incidence of preterm labor and delivery of low-birth-weight baby was found in the COVID positive group ($P<0.05$). The rate of maternal death in COVID-positive mothers was slightly higher than in COVID negative group but the difference was not statistically significant (1.9% vs. 1.2%, $P>0.05$). Three maternal deaths occurred in COVID positive group, the

Table 1: Demographic profile

Parameters	Covid positive (n1=155) No. (%)	Covid negative (n2=310) No. (%)	P-value
Age group (years)			
<30	138 (89.03)	273 (88.06)	0.75
≥30	17 (10.9)	37 (11.9)	
Gravida			
Primigravida	23 (14.8)	59 (19)	0.26
Multigravida	132 (85.16)	251 (80.96)	
Gestational age (weeks)			
<34	12 (7.7)	17 (5.4)	0.2
34.1–36.6	22 (14.1)	31 (10)	
≥37	121 (78)	262 (8.5)	

Table 2: Clinical presentation of COVID-positive patients (n1=155)

Symptoms	Frequency (%)
Asymptomatic	59 (38)
Fever	67 (43.2)
Cough	54 (34.8)
Shortness of breath	25 (16)
Diarrhoea	7 (4.5)
Others (loss of appetite, headache, anosmia, nasal congestion)	19 (12.2)
Mild	71 (45.8)
Moderate	22 (14.1)
Severe	3 (1.9)

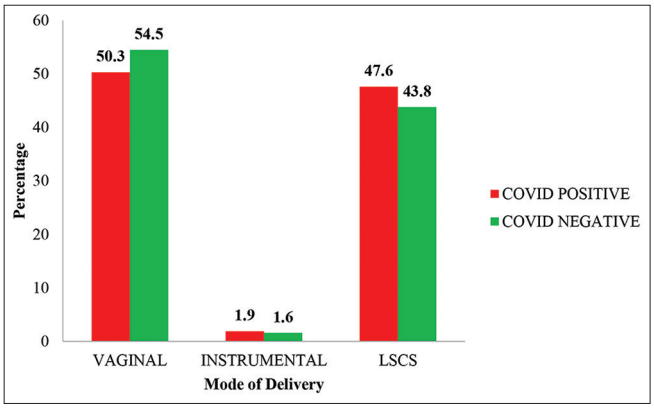

Figure 1: Mode of delivery

first case died of HELLP syndrome, the second case died of eclampsia with CVA, and the third death was due to placental abruption with acute kidney injury. Four maternal deaths occurred in COVID negative group, two patients died due to eclampsia with multiorgan dysfunction, one patient died of severe hypovolemic shock due to APH in a case of central placenta previa and another patient died due to acute pancreatitis in pregnancy.

Neonatal outcome

Table 3 also shows APGAR score was normal (≥7) in majority of neonates in both groups (P>0.05). Number of neonates with low birth weight (<2.5 kg) was significantly higher in the COVID-positive group than in COVID negative group (28% vs. 16.7%, P<0.05). The need for NICU admission was similar in both groups (P>0.05). Babies of COVID-positive and COVID-negative mothers needed NICU support due to low APGAR score, low birth weight, meconium aspiration syndrome, and observation in NICU after birth to avoid neonatal complications of mothers with GDM. Babies of COVID-positive mothers were not tested positive for COVID by swab test after birth.

DISCUSSION

Coronavirus disease (COVID-19) caused by the SARS-CoV-2 virus is highly infectious with a rapid spread across the world causing thousands of morbidities and mortalities since its emergence in Wuhan, Hubei province, China in December 2019.[10] Previous studies have shown that SARS-CoV and MARS-CoV had adversely affected clinical outcomes in pregnant women and new-born babies.[11]

In this retrospective study, we included 155 COVID-positive and 310 COVID-negative pregnant women admitted between the period of May 2020 and December 2020, the period corresponding to the duration of the first wave of COVID-19 disease in India.

Demographic profiles of recruited patients in both groups were similar (P>0.05). Majority of patients were in the age group of <30 years, were multigravida and had gestational age ≥37 weeks. Nayak et al.,[8] had similar results to our study.

Although pregnant women with SARS-CoV-2 infection mostly presented with mild respiratory symptoms, the risk of severe pneumonia is high.[12-14] In this study out of 155 infected pregnant women, 62% were symptomatic. This result was like the study by Gatta et al.,[15] which shows 69% symptomatic. Fever and cough were the most common symptoms in our study, like the findings by several studies worldwide.[16,17] Only 25 (16%) infected mothers in our study complained of shortness of breath due to moderate in 22 (14.1%) and severe pneumonia in 3 (1.9%) requiring oxygen therapy. Our result was similar to the study by Singh et al.,[18] showing only 1 (0.76%) suffered from severe disease and their study period was similar to our study. We critically analyzed

Table 3: Maternal and neonatal outcomes

Maternal outcomes	Covid positive (n1=155) No. (%)	Covid negative (n2=310) No. (%)	P-value
Abortion and ectopic	4 (2.6)	11 (3.5)	0.6
Antepartum haemorrhage	3 (1.9)	5 (1.6)	0.8
Hypertensive disorders of pregnancy	12 (7.7)	22 (7)	0.7
Gestational diabetes mellitus	7 (4.5)	15 (4.8)	0.8
Stillbirth	4 (2.6)	7 (2.2)	0.7
Low birth weight	41 (26.4)	49 (15.8)	0.006
Preterm birth	30 (19.3)	37 (11.9)	0.03
Term birth	121 (78)	262 (54.5)	0.08
Post-partum hemorrhage	5 (3.2)	12 (3.8)	0.7
ICU admission	8 (5.1)	6 (1.9)	0.05
Maternal death	3 (1.9}	4 (1.2)	0.5
Neonatal Outcomes	Covid positive (n1=146) No (%)	Covid negative (n2=292) No (%)	P-value
Apgar score at 1 min			
<7	34 (23.2)	58 (19.8)	0.4
≥7	112 (76.7)	234 (80.1)	0.4
Apgar score at 5 min			
<7	18 (12.3)	41 (14)	0.6
≥7	128 (87.6)	251 (85.9)	0.6
Birth weight <2.5 kg	41 (28)	49 (16.7)	0.005
Birth weight ≥2.5 kg	105 (71.9)	243 (83.2)	0.005
IUFD	5 (3.2)	7 (2.2)	0.5
NICU admission	23 (15.7)	54 (18.4)	0.4
Neonatal death	5 (3.4)	11 (3.7)	0.8

NICU: Neonatal intensive care unit, IUFD: Intrauterine fetal death

the course of the disease in these 25 pregnant women and found that 22 with the moderate disease had vaginal delivery without any puerperal complications and got recovered with oxygen therapy by non-rebreathing mask within 7 days. 3 pregnant women with severe disease were treated in ICU, 2 had undergone emergency LSCS due to fetal distress and one patient delivered vaginally at term without any obstetric complications. These three patients with severe disease were treated in ICU with injection of dexamethasone, low-molecular-weight heparin, and high-flow-nasal-oxygen therapy for 10–14 days and they were discharged in stable condition.

In our study number of patients delivered by LSCS in COVID positive group was higher than in COVID negative group (47.6% vs. 43.8%) but the difference was not statistically significant (P>0.05). In both the groups LSCS was done for obstetric indications only and not just because the mother had COVID-19 disease. Our result was closely similar to the study by Nayak et al.,[8] (50% in COVID positive group vs. 47% in COVID negative group, P>0.05). A cohort study conducted in the UK showed 59% of COVID-positive mothers delivered by cesarean section.[17]

In this study incidence of pregnancy complications like abortion, APH, hypertensive disorders of pregnancy and GDM, IUFD, and stillbirth were similar in both the groups (P>0.05) but significantly increased incidence of preterm labor (19.3%) and delivery of the low-birth-weight baby (26.4%) was found in the COVID positive group (P<0.05). Our result is comparable to the rate of preterm birth (16.3%) in a study by Gajbhiye et al.,[19] Yadav et al.,[20] showed a significant increase in the incidence of preterm birth in COVID positive mothers compared to COVID-negative mothers (28.5% vs. 11.6%, P=0.02). So, we can comment that COVID-19 is a risk factor for preterm birth.

There was no statistically significant difference in the incidence of maternal ICU admission and maternal death between the COVID positive and COVID-negative group in this study like the study done by Nayak et al.,[8] Ahmad et al.,[21] got a significant increased rate of ICU admission in the COVID-19 affected group. Three maternal deaths occurred in COVID positive group but their death was not due to respiratory illness as they were all suffering from mild disease. The first case died of HELLP syndrome, the second case died of eclampsia with CVA, and the third death was due to placental abruption with acute kidney injury. Four maternal deaths occurred in COVID negative group, two patients died due to eclampsia with multiorgan dysfunction, one patient died of severe hypovolemic shock due to APH in a case of central placenta previa and another patient died due to acute pancreatitis in pregnancy. Maternal death audit has shown that pregnancy complications were not diagnosed timely as pregnant women did not turn up for antenatal check-up in fear of contacting covid infection in hospital premises.

Number of neonates with low birth weight (<2.5 kg) was significantly higher in the COVID positive mothers than

in COVID-negative mothers (28% vs. 16.7%, P<0.05). Need for NICU admission was similar in both groups (p>0.05). This result is comparable to the study done by Yadav et al.,[20] This significantly increased number of low-birth-weight babies was due to significant increased incidence of pre-term birth in covid infected pregnant women. APGAR score at 1 and 5 min was similar in both the groups, most of the babies with low APGAR score at 1 min got improved score at 5 min and the need for NICU admission was similar in both the group in our study (15.7% in COVID-positive women vs. 18.4% in COVID-negative women, P>0.05). Nayak et al.,[8] got significantly more need for NICU admission for the babies born to covid negative mothers. The findings of our study propose that neonatal outcome is reassuring keeping with other studies.[17,22-25] Limited data are available regarding vertical transmission of SARS-CoV-2 infection. Many studies have suggested no increased risk of perinatal vertical transmission.[26,27] Their findings are in accordance with our study result as we did not get a single baby born to covid infected mother positive for COVID-19 when tested within 24 h of birth. Nevertheless, vertically acquired infection is still possible as shown by previous studies.[28] Further investigations around the vertical transmission of SARS-CoV-2 infection are needed.

Limitations of the study

Data were collected from hospital records until the time of discharge and follow-up data were not collected and this is an inherent limitation of retrospective study design.

The study was conducted at a single tertiary care hospital and it may not represent the entire state of West Bengal.

CONCLUSION

Further research on Covid 19 infection in pregnancy will help policymakers in making decisions regarding early-stage detection and intervention to reduce potential adverse obstetric and neonatal outcomes. Studies about vertical transmission are needed for further clarity. Long-term follow-up studies on Covid 19 infection on pregnancy, labor, and neonates must be encouraged.

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Authors' Contributions:
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