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Perinatal consequences of COVID-19: A comprehensive Review

REVIEW

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Abstract

Background: The COVID-19 pandemic emphasize the global challenge of inadequate data on SARS-CoV-2's effects on pregnant women and their infants. In response, Kerala, along with other states of India launched a wide study to assess the incidence, characteristics, and outcomes of SARS-CoV-2 infection during pregnancy.

Methods: We conducted an observational descriptive study of SARS-CoV-2 positive cases among pregnant women. In collaboration with the Public Health Office Kottayam, Kerala, we identified 400 pregnant women who tested positive for SARS-CoV-2 and contacted them for participation.

Results: Among the 240 participating SARS-CoV-2-positive pregnant women, 13 required hospitalizations, with an increased need for intensive care and respiratory support. A symptomatic course was dominant, with fatigue (70%), headache (58%), and fever (56%) as the leading symptoms. While maternal and neonatal outcomes were generally favorable, a slight increase in caesarean sections and preterm births suggests an indirect impact on maternity care. Vaccination during pregnancy connected with reduced symptoms and no hospitalizations. High CRP levels were common among infected women, while ultrasound findings remained normal.

Conclusions: This study offers a multi- dimensional view of pregnancy during COVID-19. The findings suggest that most pregnant women with SARS-CoV-2 experience mild to moderate illness, offering reassurance to clinicians about generally favorable maternal and neonatal outcomes while underscoring the need for vigilance in rare severe cases.

Keywords: *COVID-19; pregnancy; SARS-CoV-2; maternal and neonatal health.*

1. Introduction

The corona virus disease 2019 (COVID-19) pandemic, caused by the novel severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), has posed unprecedented challenges to healthcare systems [1,2]. Pregnancy is widely recognized as a risk factor for a more severe course of COVID-19. Research has demonstrated that SARS-CoV-2 infection increases the risk of adverse outcomes such as preterm birth, fetal growth restriction, intrauterine fetal death, and maternal ICU admissions, including cases requiring ventilation.

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Support or resulting in risk factors for severe COVID-19 outcomes in pregnancy, including advanced maternal age (over 35 years), maternal death [3,4]. Several studies identified elevated Body Mass Index (BMI), pre-existing diabetes, chronic hypertension, and pre-eclampsia [5,6]. Even though vertical transmission appears uncommon, the possibility of placental inflammation and its impact on neonatal outcome has been a relevant subject of clinical research. Continuous research and evidence based guidelines help to protect maternal health and improve neonatal outcome in the context of emerging infections. India experienced multiple waves of COVID-19, driven by distinct viral variants, with varying degrees of transmissibility

and disease severity [7]. However, region-specific data on pregnancy outcomes, particularly from Kerala, remain limited. In addition, the impact of COVID-19 vaccination during pregnancy on maternal symptoms, hospitalization rates, and neonatal outcomes requires further evaluation in real-world against this background [8,9]. Pregnancy complications, neonatal outcomes, and the potential protective role of vaccination during pregnancy. The findings contribute region-specific evidence to inform clinical care, public health planning, and future research on emerging infectious diseases in pregnancy.

2. Materials and methods

This retrospective observational cohort study was conducted among pregnant women in kottayam District, Kerala who tested positive for SARS-CoV-2 between 1 March 2023 and 5 May 2025. The study utilizes a population-based dataset and aims to evaluate the impact of COVID-19 on pregnancy outcomes. A multidisciplinary collaboration was established between several departments of the Faculty of Medicine of Mount Zion Medical College, Kerala, and the Public Health Office Kottayam, Kerala. The study was designed with two key objectives.

- *Primary Objective:* To explore the impact of COVID-19 on pregnancy outcomes, with a primary focus on self-reported data to capture patient perspectives, symptoms, and experiences during pregnancy.
- *Secondary Objective:* To provide contextual insights from a subset of clinically collected data, including prenatal care records and labor ward outcomes.

The Public Health Office maintained a registry of individuals who tested positive for SARS-CoV-2 through polymerase chain reaction (PCR) and antigen testing(True Nat), including pregnant women.

Among the confirmed cases in this study, 161 (67.1%) were diagnosed via PCR testing and 79 (32.9%) via antigen tests (Table 1).

Table 1: Demographic characteristics, gestational age at COVID-19 diagnosis, and hospitalization status of study participants (n = 240)

Age	Total n = 240	(%)
≤25	08	3.33
20–34	168	70.00
≥35	64	26.66
Gestational Age at COVID-19 Diagnosis	*	*
≤12 weeks	28	11.66
13–24 weeks	92	38.33
25–31 weeks	65	27.00
32–36 weeks	33	13.75
≥37 weeks	22	09.16
Hospitalizations COVID-19-related hospitalizations	13	5.41

Despite these efforts, limitations in the Public Health Office's surveillance capacity, particularly during the peaks of the Delta and Omicron variants in densely populated areas, resulted in underreported cases.

2.1. Data collection the data collection process focused on two main sources

1. Self-Reported Data: Participants provided subjective information regarding their infection and pregnancy course through a structured patient questionnaire. All 400 women were contacted by telephone, informed about the study, and asked to provide consent.

2. Clinically Collected Data: Objective data were gathered from prenatal care records and labor ward outcomes to provide additional context to the self-reported findings.

3. Results

A total of 400 eligible women who tested positive for SARS-CoV-2 were identified. 240 pregnant women with confirmed COVID-19 Table 1 present the characteristics of the study population. The mean age of the participants was 32 years (range 21–47) at the time of SARS-CoV-2 infection, and the mean gestational age at infection was 23 weeks and 2 days.

Table 2: Comparison of outcomes of vaccination (before vs. during the pregnancy)

Outcome	Before Pregnancy (n = 30)	During Pregnancy (n = 17)	Odds Ratio [95%CI] Before vs. During	p-Value Before vs. During	Chi-Square (Unvaccinated Comparison)	p-Value (Unvaccinated Comparison)
Hospitalizations	1 (3.3%)	0	∞	1.000	2.29	0.319
Dyspnoea	9 (30%)	3(17.6%)	2.00 [0.50–8.07]	0.491	0.28	0.870
Fever > 37◦C	20 (66.6%)	8 (47%)	2.25 [0.69–7.38]	0.227	1.96	0.376
Asymptomatic	0	2(1.8%)	0	0.125	4.50	0.106

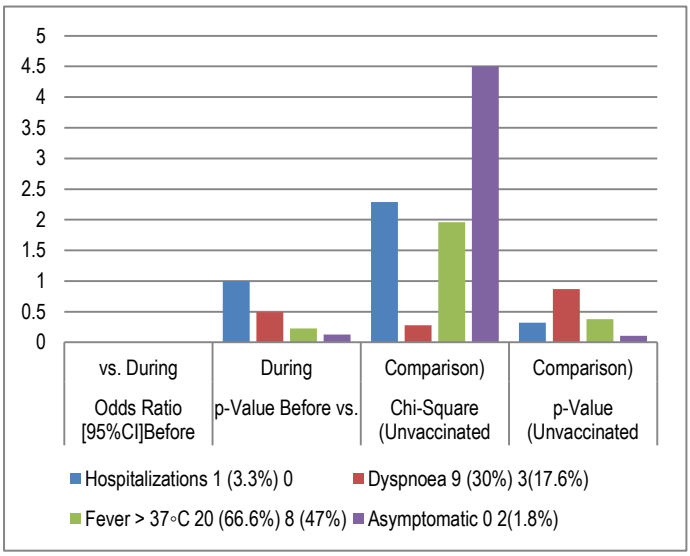

Figure 1: The graph on comparison of outcomes of vaccination (before vs. during the pregnancy)

The symptomatic course was dominant in our cohort, with only 1% of women reporting an asymptomatic course. The most prevalent symptoms were related to the upper respiratory tract, reported by 91 women (42%), less commonly, respondents experienced other symptoms related to the lower respiratory tract (18%) and gastrointestinal symptoms (3%). Among the individual symptoms, fatigue and lethargy were the most frequent, affecting 80% of women, followed by headaches (68%). A total of 52 women (22%) reported experiencing complications during pregnancy before infection.

The most common complications prior to infection were bleeding (19%), risk of preterm labor (17%), and placental issues (5%), including placenta praevia or placental abruption. The most prevalent complications post-infection were hypertensive disorders (25%), risk of preterm labour (25%), and oedema (16%), followed by foetal growth restriction (15%) and placental abnormalities (11%). In terms of the mode of delivery, 67% of the women gave birth vaginally, while 33% underwent caesarean section. Twenty-one women delivered preterm (range 32–37 week of gestation), and twenty-one women had COVID-19 during labour.

Among the 21 women who had COVID-19 during labor, 6 underwent caesarean sections. Vaccination status was analysed among the 47 vaccinated women in the study, comprising 30 vaccinated before pregnancy and 17 during pregnancy. Mild side effects were reported, including febrilities, injection site pain, redness, and fatigure. A comparison of hospitalization rates, febrilities, dyspnoea, and asymptomatic cases among women vaccinated before pregnancy, women vaccinated during pregnancy, and the unvaccinated group is presented in (Table 2). Fisher's exact test and chi-square analysis revealed no statistically significant differences between the groups for any of the evaluated outcomes. Women vaccinated before pregnancy showed higher odds of febrilities (OR: 2.25 [95% CI 0.69–7.38]; p = 0.227) and dyspnea,

(OR: 2.00 [95% CI 0.50–8.07]; p = 0.492) compared to those vaccinated during pregnancy, while women vaccinated during pregnancy were more likely to report being asymptomatic (OR: 0.00, [95% CI 0.00–0.00]; p = 0.126). No hospitalizations were reported in the group vaccinated during pregnancy, but this observed difference was not statistically significant (OR: ∞, p= 1.000) (Table 2). Comparison with the unvaccinated group, trends suggested that vaccination during pregnancy might be associated with fewer symptoms (e.g., febrilities, dyspnoea) and no hospital admissions; however, these differences were also not statistically significant (hospitalizations p = 0.319, dyspnoea p = 0.870, fever p=0.376and asymptomatic p = 0.106). Dyspnoea was also significantly associated with hospitalization, with 53.8% (7/13) of hospitalized women experiencing dyspnoea compared to 20.7% (47/227) of non-hospitalized women (OR = 4.47, p = 0.011). Febrilities were the strongest predictor, as all hospitalized women (13/13) reported fever compared to 54.6% (124/227) of non-hospitalized women (p = 0.0007) (Figure 1).

3.1. Prenatal Care Findings

From laboratory findings, studies commonly describe laboratory changes in pregnant women with COVID-19. Such as low white blood cell counts, low haemoglobin levels, thrombocytopenia, and elevated C-reactive protein (CRP). In our study, no significant deviations in laboratory results were observed.

3.2. Neonatal Outcomes

The cohort included 53 newborns. The mean birth weight of newborns was 3420 g (2200 g–4100 g), with an average length of 50 cm (46 cm–54 cm). The mean cord blood PH at birth was 7.3, indicating a normal range of acid–base balance. Bonding was possible in 90% of cases, with 10% facing bonding challenges due to acute caesarean sections. All newborns were reported healthy, with no issues identified.

4. Discussion

Pregnancy is more severe course of COVID-19. Research has demonstrated that SARS-CoV-2 infection increases the risk of adverse outcomes such as preterm birth, foetal growth restriction, intrauterine foetal death, and maternal ICU admissions, including cases requiring ventilation support or resulting in maternal death. Our COVID-19 project observed that 13 out of 240 (5.42%) pregnant women who tested positive for SARS-CoV-2. Symptom profiles in our study showed differences in frequency compared to another research. A systematic review analyzing symptoms in 135 pregnant women (third trimester) reported fever (67%), cough (35%), and myalgia/arthralgia (25%) as the most common symptoms, with fatigue (15%), dyspnoea (15%), pharyngodynia (12%) and diarrhoea (8%) occurring less often. In our cohort fatigue was the most frequently reported symptom (70%), followed by headache (58%), febrilities (57%), anosmia (55%) and cough (53%), myalgia/arthralgia (48%).

Pharyngodynia (44%), dyspnoea (21%), and diarrhoea (7%). The analysis of vaccination timing and its association with pregnancy outcomes did not yield statistically significant differences between women vaccinated before or during pregnancy or in comparison to unvaccinated women in our cohort. Interestingly, a small proportion of women vaccinated during pregnancy were asymptomatic, compared to none in the pre- pregnancy group and few in the unvaccinated group.

While the small sample size limits the interpretation of these findings, they align with a growing body of evidence supporting the positive impact of maternal vaccination. Recent studies from the INTERCOVID-2022 multinational consortium provide robust evidence for the benefits of COVID-19 vaccination during pregnancy. The first report from this large prospective study demonstrated that unvaccinated pregnant women infected with SARS-

CoV-2 had a greater risk of severe morbidity, ICU admission, and death compared to vaccinated women. Our study also observed a high rate of caesarean deliveries (33%) in women with COVID-19, consistent with global trends reporting an increased risk of caesarean section among symptomatic cases [10]. Neonatal outcomes appeared favorable, with no cases of stillbirth or neonatal death observed [11].

However, the small sample size limits the generalized findings. The COVID-19 pandemic saw the emergence of the following major SARS-CoV-2 variants of concern: Alpha, Delta, and Omicron, each with distinct transmissibility and virulence. For instance, the Delta variant was more transmissible than Alpha and became predominant in many regions. In our study, participants were grouped based on the timeline of dominant variants, but no significant differences in infection rates, disease severity, or pregnancy outcomes were observed [12].

5. Limitations

The main limitation of this study is the sample size, which fail to meet initial expectations due to multiple obstacles encountered during data collection. Discrepancies between actual cases and figures from the National Public Health Office, a declining response rate at each phase and technical issues with our digital platform restricted data availability. Additionally, critically ill or decreased COVID-19 positive women were excluded (absent informed consent)

6. Conclusions

This study demonstrated that symptomatic COVID-19 was prevalent among pregnant women in Kottaym District. Advanced maternal age and infection during the third trimester were associated with an increased risk of hospitalization. Slightly elevated rates of caesarean and preterm births suggest an indirect impact of SARS-CoV-2 on maternity care, warranting further investigation. Overall, maternal and neonatal outcomes were satisfactory. However, broader use of proven treatments, including vaccination during pregnancy, could potentially improve outcomes further. Our study combined mothers' self-reported experiences with supportive clinical data from prenatal and labor care settings, offering valuable insights into pregnancy during the pandemic.

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