

ORIGINAL ARTICLE

ASSOCIATION BETWEEN MATERNAL COVID-19 SEVERITY AND NEONATAL OUTCOME IN A TERTIARY HOSPITAL

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ABSTRACT

Background: During the COVID-19 outbreak, studies indicated that neonates born to COVID-19-positive mothers are susceptible to adverse outcomes. However, limited research explored the link between maternal COVID-19 severity and perinatal outcomes.

Objectives: To determine the characteristics and outcomes of newborns born to COVID-19 positive mothers and its association with maternal COVID-19 severity.

Methodology: This was a cross-sectional study conducted in a tertiary hospital which involved a retrospective chart review of mother-newborn dyads who delivered between June 1, 2020, and December 31, 2022.

Results: One hundred forty COVID-19 infected mothers and their respective newborns (143) were included in the study. Majority of mothers were 18 - 30 yrs. old, multigravida, multiparous, delivered by normal spontaneous delivery (NSD) and were asymptomatic. Only 3.6 % have severe COVID-19. Neonatal outcome was generally good in both non-infected and COVID-19 infected newborns. Most were term, with normal birthweights, appropriate for gestational age (AGA), with good APGAR scores. Hyperbilirubinemia is a common morbidity (15%). There is a higher prevalence of preterm births, low birthweight, low APGAR score in the 5th minute of life, respiratory distress syndrome (RDS), neonatal sepsis, neonatal intensive care unit (NICU) admission and mortality among neonates born to mothers with severe COVID-19, but there is no statistically significant association between maternal COVID - 19 severity and neonatal outcome except for APGAR score on the 5th minute of life.

Conclusion: Most COVID-19-infected pregnant women were asymptomatic and neonatal outcomes were generally favorable. Maternal COVID-19 severity did not substantially contribute to adverse neonatal outcomes.

KEYWORDS: *Neonates, COVID-19, Outcome, Covid-19 confirmed mothers*

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The author declares that the data presented are original material and has not been previously published, accepted or considered for publication elsewhere; that the manuscript has been approved by the author, and that the author has met the requirements for authorship.

INTRODUCTION

SARS-CoV-2 infection, or COVID-19, has caused a global pandemic, significantly affecting public health. Pregnant women are particularly vulnerable during infectious disease outbreaks, putting their newborns at risk of infection and adverse health outcomes.

Current literature suggests that SARS-CoV-2 infections in neonates are rare, with generally favorable outcomes and no deaths linked directly to the virus.^{1,2} However, data on neonatal outcomes, especially in the local setting remain limited. While much is known about COVID-19 in pregnant women, only a few studies explored the link between maternal infection severity and neonatal outcomes.^{3,4}

This study aims to address this gap by determining the clinical and demographic characteristics and outcomes of neonates born to COVID-19-positive mothers. By focusing on this specific population, this research will provide valuable data from developing countries to develop clinical guidelines in managing mother-child dyads with COVID-19 and providing recommendations on screening, rooming-in, and breastfeeding protocols.

MATERIALS AND METHODS

Study Design

This is a cross-sectional study which involved a retrospective review of records of mother-infant dyads to determine the clinical characteristics and outcomes of all neonates born to COVID-19 confirmed mothers at Baguio General Hospital and Medical Center (BGHMC), a tertiary hospital in North Luzon, Philippines.

Study Population

The study population included pregnant women at or more than 24 weeks age of gestation, with PCR confirmed COVID-19 infection who were admitted and who delivered at BGHMC from June 1, 2020, to December 31, 2022, along with their respective newborns. Excluded were maternal-infant dyad readmissions, those who went home against

medical advice or transferred to another institution where neonatal outcomes cannot be determined, and those with incomplete medical charts.

Sample Size and Sampling Design

The sample size was computed through estimation by proportion. With a prevalence of 10%, based on data published by the World Health Organization last November 2020 (where 75 cohort studies on rates of COVID-19 among pregnant women were pooled), 7- 12% of pregnant women were confirmed to have COVID-19³. With a confidence level of 95%, and margin of error of 5%, the computed sample size was 140. Simple Random Sampling, with the use of a random number generator (e.g., Microsoft Excel), was used to determine subjects to be enrolled in this study.

Scope and Delimitation of the Study

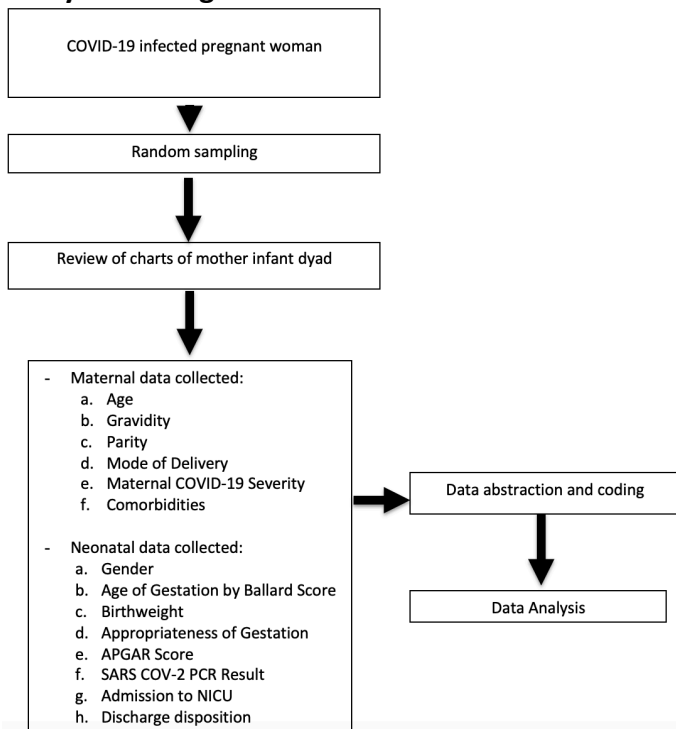
The study was limited to COVID-19-infected mothers who were admitted and delivered at BGHMC from June 1, 2020, to December 31, 2022. The study focused on characteristics and outcomes of neonates born to SARS-CoV2 infected mothers and the following data were collected: (a) maternal age, gravidity and parity, mode of delivery, COVID-19 severity, and comorbidities (b) neonatal sex, gestational age by Ballard scoring, birthweight, appropriateness of gestation, APGAR score on the 5th minute of life, SARS COV-2 PCR result, neonatal morbidities, admission to Neonatal Intensive Care Unit (NICU), and discharge disposition.

Data Processing and Statistical Analysis

After protocol approval from the technical review board and research ethics committee, institutional consent was obtained from the Medical Center Chief through the Health Information Management Office and Data Privacy Officer. Data gathering was done by the primary researcher at the Medical Records Office starting with a list of all cases of pregnant women who tested positive for SARS-COV- 2 and who delivered between June 1, 2020, to December 31, 2022. Eligible charts were coded with

numbers and names and did not appear in any of the data collection tools. With this list, 140 samples were derived by selecting random numbers using Microsoft Excel. The medical record corresponding to the set code was reviewed to determine the characteristics of pregnant women. Subsequently, charts of their respective newborns were also reviewed to determine the clinico-demographic characteristics and outcomes. The data collected was kept confidential in a secure place and only the researcher had full access to the data. There was no study intervention nor direct patient contact in this study.

Study Flow Diagram



RESULTS

A total of one hundred and forty COVID-19 infected pregnant women who were admitted and delivered at our hospital from June, 2020 to December, 2022, were included in this study. Majority of mothers were between 18- 30 years old (50%), multigravid and multiparous (> 60%), and delivered via normal spontaneous delivery (60%). Sixty percent (60%) had asymptomatic COVID-19 infection

while 3.6 % had severe COVID-19. As for maternal comorbidity, the most frequently observed were pre-eclampsia (6%) and gestational diabetes (6%).

Table 1: Clinical Characteristics of Mothers with Covid - 19 Infection

Characteristics	Frequency (N=140)	Percentage (%)
Age		
< 18 yrs. Old	7	5%
18- 30 yrs. Old	70	50%
> 30 yrs. Old	63	45%
Gravidity		
Multigravid	88	63 %
Primigravid	52	37 %
Parity		
Multiparous	90	64 %
Primiparous	50	36 %
Mode of Delivery		
Normal Spontaneous Delivery	84	60 %
Low Segment Cesarean Section	54	39 %
Assisted Vaginal Delivery	2	1%
COVID-19 Severity		
Asymptomatic	86	61%
Mild Symptoms	29	21%
Moderate Symptoms	20	14%
Severe/Critical	5	3.6 %
Comorbidities		
Pre-eclampsia	9	6%
Gestational Diabetes	9	6%
Gestational Hypertension	7	5%
Asthma	4	2.8%
Chronic Hypertension	3	2%
Pre- gestational Diabetes	2	1.5%
Others	20	14%

For the newborns, most were singleton deliveries with 1 case of twin and 1 triplet gestation. Most had negative RT-PCR for SARS-COV-2 (89%) while 11% were COVID-19 positive, with 14 being asymptomatic, 1 having moderate COVID-19 and 1 having severe COVID-19.

Majority of newborns were female (51.7%), full term (90.2%), appropriate for gestational age (91.6%) with most having normal birthweights (83.2%). For the APGAR score on the 5th minute of life, 98.6% were found to have a good outcome (APGAR ≥ 7), with only 2 having poor outcome both of whom did not have COVID-19 infection. The most common neonatal morbidity seen is hyperbilirubinemia (15%), followed by neonatal sepsis (6.9%), and neonatal pneumonia

(4.9%). Other neonatal morbidities (5%) seen include transient tachypnea, apnea of prematurity, neonatal seizure, congenital adrenal hyperplasia, and gastroschisis. Among COVID 19 infected neonates, the common neonatal morbidities were neonatal sepsis and neonatal pneumonia. Only 10.5 % of neonates were admitted at the NICU including 1 case of moderate and 1 severe COVID-19. There were 5 mortalities (3.5 %) and one was a case of severe COVID-19 infection. The other four mortalities tested negative for SARS- COV 2. There is no significant difference in the outcome between COVID-19 positive and COVID- 19 negative newborns in terms of sex (*p- value: 0.57*), age of gestation (*p- value: 0.74*), birthweight (*p-value: 0.82*), appropriateness of gestation (*p- value: 0.27*), APGAR score at 5th minute of life (*p- value: 0.63*), neonatal morbidity (*p- value: 0.47*), admission to NICU (*p- value: 0.67*) and disposition (*p-value: 0.46*).

Table 2: Clinical characteristics and outcomes of neonates born to mothers with Covid- 19 infection

Neonatal Characteristics	Newborns without SARS-COV-2 (n=127,) 89%	Newborns with SARS-COV-2 (n=16,) 11%				TOTAL (n=143)	z- value	p- value
		Asymptomatic (n=14)	Moderate (n=1)	Severe (n=1)	Total			
Sex								
Male	61	7	0	1	8	69 (48.3%)	-0.56	0.57
Female	66	7	1	0	8	74 (51.7%)		
Age of Gestation								
> 42 weeks	0	0	0	0	0	0	-0.32	0.74
37- 42 weeks	114	13	1	1	15	129 (90.2%)		
32-36 weeks	12	1	0	0	1	13 (9%)		
28-31 weeks	1	0	0	0	0	1 (0.7%)		
<28 weeks	0	0	0	0	0	0		
Birthweight								
> 2500 g	105	13	1	0	14	119 (83.2%)	-0.23	0.82
LBW (1500-2499g)	21	1	0	1	2	23 (16.1%)		
VLBW (1000-1499g)	0	0	0	0	0	0		
ELBW (500- 999 g)	1	0	0	0	0	1 (0.7%)		
Appropriateness of Gestation								
AGA	116	14	0	1	15	131 (91.6%)	-1.09	0.27
SGA	10	0	1	0	1	11 (7.7%)		
LGA	1	0	0	0	0	1 (0.7%)		
APGAR Score								
≥ 7 at 5 mins	125	14	1	1	16	141 (98.6%)	-0.48	0.63
< 7 at 5 mins	2	0	0	0	0	2 (1.4%)		
Neonatal Morbidity								
Hyperbilirubinemia	20	1	0	0	1	21 (15%)	-0.72	0.47
Neonatal Sepsis	8	1	1	0	2	10 (6.9%)		
Neonatal pneumonia	5	0	1	1	2	7 (4.9%)		
Respiratory Distress Syndrome	2	0	0	0	0	2 (1.4%)		
Asphyxia	1	0	0	0	0	1 (0.7%)		
Others	7	0	0	0	0	7 (5%)		
Admission to NICU								
No	114	14	0	0	14	128 (89.5%)	-0.43	0.67
Yes	13	0	1	1	2	15 (10.5%)		
Disposition								
Alive	123	14	1	0	15	138 (96.5%)	-0.74	0.46
Mortality	4	0	0	1	1	5 (3.5%)		

LBW- low birthweight, VLBW- Very low birthweight, ELBW- Extremely low birthweight, AGA- Appropriate for gestational age, LGA- Large gestational age, SGA- Small for gestational age

The association of maternal COVID-19 severity and neonatal outcome is seen in Table 3 which show that late preterm deliveries are relatively low across all maternal groups, with 8% in the asymptomatic group, 10% in both the mild and moderate COVID-19 groups, and 20% in the severe COVID-19 group. Statistical analysis revealed no association between maternal COVID- 19 severity and gestational age (*p- value:0.99*). As to birthweight, there is a noted higher prevalence of LBW in newborns delivered to mothers with severe COVID- 19 (40%), however, there is no association between maternal COVID-19 severity and birthweight (*p- value: 0.85*). Only 7.7 % were born SGA, mostly to an asymptomatic mother and no association was found between maternal COVID-19 severity and appropriateness of gestation (*p- value: 0.53*). In terms of APGAR score on the 5th minute of life, prevalence of neonates having a poor outcome (APGAR of <7) is highest in those with severe maternal COVID-19 with a significant association between maternal COVID - 19 infection and neonatal APGAR score on the 5th minute of life (*p-value: 0.02*). Only 16 neonates have a positive SARS COV-2 RT-PCR and most were born from asymptomatic COVID-19 infected mothers. Among these COVID 19 infected neonates, only 1 had severe infection and he too was born from an asymptomatic COVID-19 infected mother. Statistical analysis showed no significant association between maternal COVID-19 severity and the presence of neonatal COVID - 19 infection (*p- value of 0.98*).

There is a noted high prevalence of respiratory distress syndrome (20%) among neonates of mothers with severe COVID-19, compatible with the high prevalence of preterm birth in this group, however, there is no association between maternal COVID-19 severity and neonatal morbidity (*p-value: 0.65*). Subsequently, it was observed that there is a high prevalence of mortality in those born to mothers with severe COVID-19 at 20% compared to mothers with mild and moderate COVID 19 infection. However, analysis showed no association between maternal COVID-19 severity and neonatal outcome

based on NICU admission (*p*-value- 0.36) and disposition (*p*-value: 0.19).

Table 3: Association between Maternal COVID-19 Severity and neonatal outcome

Neonatal Outcome (n:143)	Maternal COVID-19 Severity					<i>p</i> -value
	Asymptomatic (n: 89)	Mild (n: 29)	Moderate (n:20)	Severe/Critical (n:5)	Total (n:143)	
Gestational Age by Ballard Score						
Term (37-42 weeks)	81 (91%)	26 (90%)	18 (90%)	4 (80%)	129 (90%)	0.99
Late Preterm (32-36 weeks)	7 (8%)	3(10%)	2 (10%)	1 (20%)	13 (9%)	
Very Preterm (28- 31 weeks)	1 (1%)	0	0	0	1 (0.6 %)	
Early Preterm (<28 weeks)	0	0	0	0	0	
Birthweight						
≥ 2500 g	73 (82%)	27 (93%)	16 (80%)	3 (60%)	119 (83.2%)	0.85
LBW (<2000g)	15 (17%)	2 (7%)	4 (20%)	2 (40%)	23 (16.1%)	
VLBW (<1500g)	0	0	0	0	0	
ELBW (<1000g)	1 (1%)	0	0	0	1(0.7%)	
Appropriateness of Gestation						
AGA	78 (88%)	28 (97%)	20 (100%)	5 (100%)	131 (91.6%)	0.53
SGA	10 (11%)	1 (3%)	0	0	11 (7.7%)	
LGA	1 (1%)	0	0	0	1 (0.69%)	
APGAR Score						
< 7 at 5 th min	0	1 (3%)	0	1 (25%)	2 (1.4%)	0.02
≥7 at 5 th min	89(100%)	28 (97%)	20 (100%)	4 (80%)	141 (98.6%)	
Neonatal COVID 19 Infection						
Negative RT- PCR	77 (87%)	28 (97%)	17 (85%)	5 (100%)	127 (88.8%)	0.98
Positive RT PCR	12 (13%)	1 (3%)	3 (15%)	0	16 (11%)	
Asymptomatic	10 (11%)	1	3	0	14 (9.8%)	
Mild	0	0	0	0	0	
Moderate	1 (1%)	0	0	0	1 (0.69%)	
Severe/ Critical	1 (1%)	0	0	0	1 (0.69%)	
Neonatal Morbidity						
Respiratory Distress Syndrome	1 (1%)	0	0	1 (20%)	2 (1.4%)	0.65
Neonatal Sepsis	6 (7%)	2 (7%)	0	2 (40%)	10 (6.9%)	
Hyperbilirubinemia	11 (12%)	6 (20%)	3 (15%)	1 (20%)	21 (14.7%)	
N. pneumonia	6 (7%)	1 (3%)	0	0	7 (4.9%)	
Asphyxia	1 (1%)	1 (3%)	0	0	2 (1.4%)	
Others	5 (6%)	2 (7%)	0	1 (20%)	8 (5.6%)	
NICU admission						
Yes	10 (11%)	4 (14%)	0	1 (20%)	15 (10.5%)	0.36
No	79 (89%)	25 (86%)	20 (100%)	4 (80%)	128 (89.5%)	
Disposition						
Discharge/Recovered	86 (97%)	28 (97%)	20 (100%)	4 (80%)	138 (96.5%)	0.19

DISCUSSION

Maternal Outcome

Most COVID-19-infected pregnant women in this study were between 18 and 30 years, consistent with earlier findings^{3,5,6} that pregnant women with COVID-19 are more likely to be in their early 30s or younger. This may be related to the socio-behavioral characteristics of this population group as they are likely to interact, travel, and struggle to practice social distancing and adhere to other safety measures.⁵ This study also showed that majority of COVID-19 infected mothers delivered via normal spontaneous delivery, in contrast to some systematic reviews and meta- analyses done abroad^{7, 8, 9, 10}, wherein majority of COVID- 19 infected women delivered via cesarean section particularly for

moderate/ severe COVID-19 infection. This is done to minimize cross-infection by reducing maternal physical exertion, and thereby protecting the spread of the virus among the healthcare team. In this study, indications for Cesarean section were a previous uterine scar, uncontrolled pre- eclampsia, and non-reassuring fetal status.

Majority of COVID- 19 infected pregnant women in our study were asymptomatic and only 3.6% had severe symptoms. This result was similar to an earlier study in France where 63.4% of COVID- 19 infected pregnant women were asymptomatic.¹¹ As to maternal comorbidity, this study showed that majority were pre-eclamptic (6%) and with gestational diabetes (6%). A systematic review and meta-analysis done in the United States in 2021 found a higher risk of preeclampsia among pregnant women with SARS-CoV-2 infection compared to those without infection.¹²

Neonatal Outcome

Our study showed that only 11 % of neonates have a positive RT PCR for SARS-COV 2. This figure is higher than results from studies done during the early part of the pandemic^{13, 14} and the CDC surveillance report of 2021-2022, wherein only <5% of neonates born to COVID-19 infected mothers have a positive RT PCR within the first 48 hours of life. Literature from India however, also reported as high as 14.47% prevalence of COVID-19 in neonates.¹⁵ This can be due to variations in healthcare infrastructure and access, socio-demographic factors such as higher population density, living conditions, access to prenatal care, and differences in public health policies between countries, which could influence the reported rates of infection. Subsequently, results in this study showed that among COVID-19 infected neonates, most were asymptomatic. This finding is similar to results from a systematic review and meta-analysis done by Hcini et al. in 2022 which included a total of 1,307 neonates born to COVID-19 positive mothers. The prevalence of neonatal COVID-19 infection was 2.9% (95% CI 1.8-4.6) with most neonates having

asymptomatic COVID-19 infection.¹⁶ There is still a limited understanding of the mechanism for perinatal COVID-19 infection and the low prevalence of neonatal COVID-19 infection may be attributed to multiple factors such as neonates having an adaptive but immature immune system that causes fewer inflammatory reactions, antibodies transferred from the mother during pregnancy providing temporary immunity, and different expression of ACE2 receptors, which the virus uses to enter cells.

Most of the newborns in this study were term deliveries (90.2 %), including those who are positive for COVID-19. The low rate of preterm deliveries in our study is similar to the study of Alzamora et al. done in 2020 which found that only 30% of newborns born to COVID-19 positive mothers were delivered preterm and had a higher risk of respiratory distress syndrome and admission to the neonatal intensive care unit.^{17,18} In this study, 4 of 13 cases of late preterm deliveries, were admitted to the NICU due to concurrent respiratory distress, sepsis, and other neonatal morbidities. However, this study revealed no significant difference in neonatal outcomes based on gestational age between COVID-19 positive and COVID-19 negative neonates.

Our study showed that only 16.1 % of newborns have low birthweights. This is consistent with a retrospective cohort study done in Indonesia¹⁹ and a cross-sectional study done in Thailand,²⁰ where both studies reported a low prevalence of LBW among neonates born to COVID-19 infected women at 17.54% and 14 % respectively. In both studies, there was also no significant difference in neonatal outcomes between COVID-19 positive and negative newborns. This shows that maternal COVID-19 infection may directly affect fetal growth and development but neonates born to COVID-19 positive mothers are not an increased risk of being born with low birthweights.

Case reports on infants born to mothers with COVID-19 reveal that they are at higher risk of being born small for gestational age compared to infants born to mothers without COVID-19.^{21, 22} However in this study, only 7.7% were small for gestational age.

Similarly, a report from the US found no difference in SGA rates between neonates born to mothers with COVID-19 compared to those without COVID-19.²³ Another local study which included 88 neonates born to COVID-19 positive mothers and 88 neonates born to COVID-19 negative mothers, found a slightly higher prevalence of SGA among neonates born to COVID-19 positive mothers (8.0%) compared to neonates born to COVID-19 negative mothers (5.7%), though not statistically significant.²⁴

Almost all neonates, in this study had a good outcome (APGAR \geq 7) with no significant difference in outcomes between COVID-19 negative and COVID-19 positive newborns in terms of APGAR score at the 5th minute of life. Another local study found that most neonates born to COVID-19 infected mothers had a good APGAR score, with no significant difference in APGAR scores between neonates born to COVID-19 infected and non-infected mothers.²⁵ Good APGAR scores in neonates born to COVID-19-infected women can be attributed to several factors. Standard obstetric practices, including timely delivery and effective neonatal resuscitation ensured immediate care for newborns.

Hyperbilirubinemia is a common morbidity among neonates in this study. This was also observed in a third-level center in Northern Italy where they recorded an increased rate of neonatal hyperbilirubinemia (13%) during the first phase of the COVID-19 pandemic.²⁶ It was theorized that SARS-CoV2 infection during pregnancy resulted in placental vascular malperfusion, eliciting polycythemia in the fetus as a compensatory response, and resulting in hyperbilirubinemia. However, as of this time, there is no established data to support this. Similar findings were found in a study done in Saudi Arabia, where neonates born to COVID-19 positive mothers had a high incidence of hyperbilirubinemia (40%).²⁷ The authors hypothesize that the inflammatory response brought on by COVID-19 infection in mothers may have caused the hyperbilirubinemia in neonates. Additionally, most neonates with COVID-19 infection in this study had concomitant sepsis and pneumonia leading to ICU

admission. This may be due to their underdeveloped immune system, making them susceptible to viral and bacterial infections. Additionally, COVID-19 infection is known to cause respiratory illnesses and pneumonia, which can further increase the risk for sepsis in neonates.

Association between Maternal COVID-19 Severity and Neonatal Outcome

Our study showed a high prevalence of preterm births, low birthweight, low APGAR score on the 5th minute of life, presence of respiratory distress syndrome & neonatal sepsis, and NICU admission and mortality on neonates born to mothers with severe COVID-19. These findings support the evidence that pregnant women with severe COVID-19 have an increased risk of delivering preterms, with low birth weights, and having NICU admissions, compared with neonates of asymptomatic patients.^{3,4} The higher prevalence of neonatal morbidity and mortality in neonates born to mothers with severe COVID-19 is thought to be due to various factors. First, direct infection of neonates has been reported by several studies as demonstrated by the presence of SARS-CoV-2 in breast milk samples.¹¹ Also, indirectly, maternal severe COVID-19 is linked to hypoxia (affecting the fetal respiratory and cardiovascular systems) and higher levels of inflammatory markers that could lead to placental inflammation and dysfunction^{28,29} and in severe cases, fetal growth restriction.^{1,3,28,29}

Data in this study relied on the charts and records' completeness and thoroughness of the attending physician's documentation. This study was also conducted within a limited time frame. There are also confounding variables such as maternal comorbidity, mode of delivery, maternal COVID-19 vaccination status and completeness of essential intrapartum and neonatal care practices. These factors are known to affect neonatal outcome, especially in mothers with COVID-19 infection.

It is recommended in the future to have follow up studies on neonates born to COVID-19 infected mothers, especially during the first year of life.

Established practices such as non-separation from the mother and breastfeeding remains at the core for good neonatal outcomes as well as observance of standard precautions (daily proper hand hygiene and use of personal protective equipment). These must always be observed by COVID 19 infected mothers taking care of their newborns.

CONCLUSION

Most COVID-19-infected mothers were asymptomatic and common maternal morbidities included pre-eclampsia and gestational diabetes. Neonatal outcomes were generally good, with majority testing negative for SARS-CoV-2, full-term, with normal weight, and having good APGAR scores. Hyperbilirubinemia was the most common neonatal morbidity among infected newborns, while sepsis and pneumonia were common among those born to mothers with severe COVID-19. There is a higher prevalence of adverse outcomes such as preterm birth, low birth weight, and neonatal mortality in neonates of severely infected mothers, but the severity of maternal COVID-19 infection does not significantly influence these outcomes. However, it is associated with a higher risk of low APGAR scores at the 5th minute of life, indicating a potential need for closer monitoring and interventions to improve neonatal health and reduce risks associated with maternal COVID-19 severity, such as enhanced prenatal care, timely delivery planning, frequent monitoring of both maternal and fetal health and immediate postnatal support.

CONFLICT OF INTEREST

None declared.

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