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Original Research Article

CLINICAL CHARACTERISTICS AND OUTCOMES IN NEONATES BORN TO COVID-19 POSITIVE MOTHERS: A RETROSPECTIVE COHORT STUDY

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ABSTRACT

Background: The COVID-19 pandemic has raised concerns about the potential risks faced by neonates born to COVID-19 positive mothers. While the risk of vertical transmission of SARS-CoV-2 is considered low, the clinical characteristics and outcomes of these neonates remain under-researched. This study aims to provide a comprehensive analysis of these neonates to guide clinical practices.

Material and Methods: This retrospective cohort study was conducted at a tertiary care center in Northern Maharashtra, India, from March 2020 to December 2021. Data were collected from 69 neonates born to COVID-19 positive mothers, focusing on maternal demographics, neonatal clinical characteristics, and outcomes. Neonates were assessed for SARS-CoV-2 infection, respiratory complications, and other clinical parameters.

Results: Of the 69 neonates, 10.1% tested positive for SARS-CoV-2. Preterm births accounted for 42.0% of cases, with 60.9% of neonates having a birth weight of less than 2.5 kg. Elevated C-reactive protein (CRP) levels were observed in 56.52% of neonates, and respiratory distress was present in 42.0%. Oxygen saturation levels varied, with 26.1% of neonates experiencing severe hypoxemia.

Conclusion: The study highlights the significant proportion of preterm births and respiratory complications in neonates born to COVID-19 positive mothers. While the risk of vertical transmission is low, vigilant monitoring and tailored clinical management are essential. The findings underscore the need for continued research to develop robust guidelines for neonatal care in the context of maternal COVID-19 infection.

Keywords: COVID-19, neonates, maternal infection, vertical transmission, neonatal outcomes, respiratory distress, preterm birth.

INTRODUCTION

The COVID-19 pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has had a profound impact on global health, affecting populations across all demographics. Among the various groups studied, neonates born to COVID-19 positive mothers are of particular concern due to their unique vulnerabilities. Neonates, with their underdeveloped immune systems, are at potential risk for both direct and indirect impacts of maternal COVID-19 infection.[1] Understanding the clinical characteristics and outcomes of these neonates is crucial for several reasons. First, the potential for vertical transmission of SARS-CoV-2, though considered to be low, needs thorough investigation to ensure accurate risk assessments and the development of effective preventative strategies.[2] Additionally, the indirect effects of maternal infection, preterm birth and the need for specialized neonatal care, must be

understood to optimize clinical management and resource allocation in neonatal intensive care units (NICUs).[3]

Despite extensive research on COVID-19 in adults and older children, data on neonates born to infected mothers remain limited and sometimes inconclusive. Early studies indicate varying clinical presentations among these neonates, from asymptomatic cases to severe respiratory distress, highlighting the need for detailed and comprehensive research.[4] Moreover, the impact of maternal COVID-19 severity on neonatal outcomes is not fully elucidated, necessitating further study to inform guidelines and protocols.[5]

This study aims to fill these gaps by examining the clinical characteristics and outcomes of neonates born to COVID-19 positive mothers. By conducting a retrospective cohort study, we seek to provide a detailed analysis of the health status of these neonates, identify potential risk factors, and contribute to the body of knowledge necessary for improving neonatal care during the ongoing pandemic. This research is critical for guiding clinical practices and ensuring the well-being of both mothers and their newborns in the context of COVID-19.

MATERIAL AND METHODS

This retrospective cohort study was conducted at a tertiary care center in Northern Maharashtra, India, from March 2020 to December 2021. The study aimed to evaluate the clinical characteristics and outcomes of neonates born to COVID-19 positive mothers.

The study included all neonates born to mothers who tested positive for SARS-CoV-2 at the time of delivery. Mothers were diagnosed with COVID-19 based on positive results from reverse transcription-polymerase chain reaction (RT-PCR) tests. Neonates were eligible for inclusion if they were delivered at the study site and their mothers had confirmed COVID-19 infection. Data were collected retrospectively from medical records. Information gathered included maternal demographics, clinical presentation of COVID-19, comorbidities, mode of delivery, and neonatal outcomes. Neonatal data comprised gestational age at birth, birth weight, Apgar scores at 1 and 5 minutes, clinical symptoms, results of SARS-CoV-2 testing, and details of any complications or interventions required. Maternal COVID-19 severity was classified based on clinical symptoms and the need for respiratory support. Neonatal assessments included physical examinations and laboratory tests. RT-PCR testing for SARS-CoV-2 was performed on all neonates within 24 hours of birth and repeated if clinically indicated. Additional laboratory tests, such as complete blood counts and markers of inflammation, were conducted as needed. The primary outcome was the incidence of SARS-CoV-2 infection in neonates, determined by RT-PCR. Secondary outcomes included neonatal morbidity and mortality, need for respiratory support, and length of hospital stay. Clinical features such as respiratory distress, sepsis, and other complications were also recorded.

Data were entered into a secure database and analyzed using statistical software (Stata, version 10.1). Descriptive statistics, including means, medians, and percentages, were used to summarize the data. Comparative analyses between groups (e.g., infected vs. non-infected neonates) were performed using chi-square tests for categorical variables and t-tests for continuous variables. A p-value of less than 0.05 was considered statistically significant. The study was approved by the Institutional Ethics Committee of the tertiary care center. Confidentiality and anonymity of the participants were maintained throughout the study.

RESULTS

A total of 69 neonates born to COVID-19 positive mothers were included in the study. The gender distribution was nearly equal, with 34 males (49.3%) and 35 females (50.7%). [Table 1] Of the 69 neonates, 62 (89.9%) tested negative for COVID-19, while 7 (10.1%) tested positive. [fig -1]

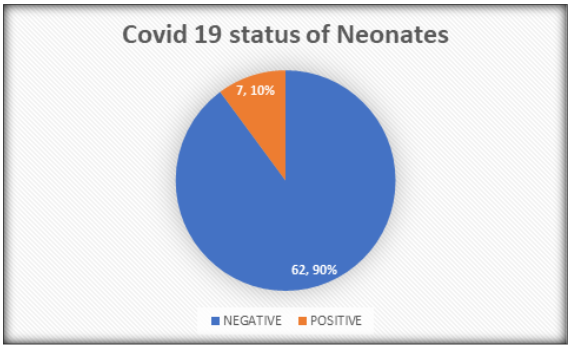

Figure 1: Neonatal COVID-19 Status

Most mothers were young adults aged 20-24 years (55.1%), followed by adult mothers aged 25-34 years (34.8%). Only 3 mothers (4.3%) were adolescents aged less than or equal to 19 years, and no mothers were in the late reproductive age group (35-49 years). The age of 4 mothers (5.8%) was not available. Regarding the mode of delivery, 44 mothers (63.8%) underwent lower segment caesarean section (LSCS), and 25 (36.2%) had normal vaginal deliveries. Most mothers were primigravida (G1) (59.4%), followed by G2 (23.2%), G3 (13.0%), and G4 (4.3%). The term of pregnancy was predominantly full term (56.5%), with 1.4% being post-term and 42.0% preterm. Birth weight data showed that 60.9% of the neonates weighed less than 2.5 kg, while 39.1% weighed 2.5 kg or more. Most neonates cried immediately after birth (71.0%). [Table 2]

Hemoglobin levels were within the normal range (14 to19g/dl) for 56.52% of the neonates. Total leukocyte count (TLC) was normal (9000 to 30000) for 68.12% of the neonates, with 30.43% having a count below 9000 and 1.45% above 30000. The neutrophil to lymphocyte (N/L) ratio was less than 0.5 in 34.78% of neonates, between 0.5 to 2.0 in 36.23%, and greater than 2.0 in 28.99%. Platelet counts were normal (150,000 to 450,000) for 69.57% of the neonates, with 17.39% having thrombocytopenia (<150,000) and 13.04% having thrombocytosis (>450,000). C-reactive protein (CRP) levels were elevated (≥10) in 56.52% of the neonates. [Table 3]

Lethargy was observed in 52.2%. Tachycardia (heart rate more than 140 beats per minute) was noted in 4.3% of the neonates. Tachypnoea (respiratory rate more than 60 breaths per minute) was observed in 47.8% of neonates, and respiratory distress was present in 42.0%. [Table 4]

Oxygen saturation levels varied among the neonates: 39.13% had normal levels (95%-100%), 18.8% had mild hypoxemia (91%-94%), 15.9% had moderate hypoxemia (86%-90%), and 26.1% had severe hypoxemia (≤85%). Oxygen saturation data was not recorded for 7.2% of the neonates. [Table 4]

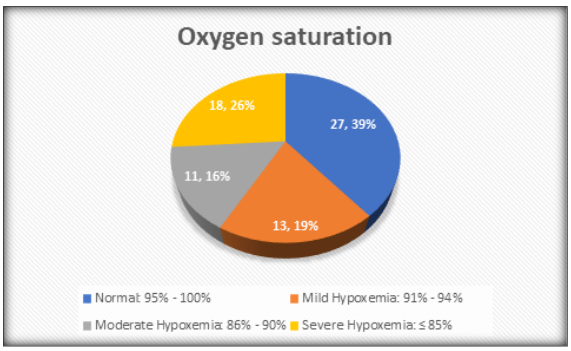

Figure 2: Oxygen Saturation Levels in Neonates Born to COVID-19 Positive Mothers

Table 1: Gender Distribution of Neonates

Gender	Frequency	Percentage
Male	34	49.3%
Female	35	50.7%
TOTAL	69	100.0%

Table 2: Maternal and Obstetric History of COVID-19 Positive Mothers

	Variable	Frequency	Percentage
Age of Mother	Less than or equal to 19 years	3	4.3%
	Young Adult Mothers: 20-24 years	38	55.1%
	Adult Mothers: 25-34 years	24	34.8%
	Late Reproductive Age Mothers: 35-49 years	0	0.0%
	No data available	4	5.8%
Mode of delivery	LSCS	44	63.8%
	Normal	25	36.2%
Gravida	G1	41	59.4%
	G2	16	23.2%
	G3	9	13.0%
	G4	3	4.3%
Term	Full Term	39	56.5%
	Post Term	1	1.4%
	Preterm	29	42.0%
Birth weight	Less Than 2.5	42	60.9%
	More than or equal to 2.5	27	39.1%
Cried immediately after birth	Yes	49	71.0%
	No	20	29.0%
	TOTAL	69	100.00%

Table 3: Haematological Parameters of Neonates Born to COVID-19 Positive Mothers

	Variable	Frequency	Percentage
HB (Haemoglobin)	14 TO 24 g/dl	39	56.52%
	<14	30	43.48%
TLC (Total Leukocyte count)	<9000	21	30.43%
	9000 TO 30000	47	68.12%
	>30000	1	1.45%
	TOTAL	69	100.00%
Neutrophil/ Lymphocyte ratio (N/L ratio)	<0.5	24	34.78%
	0.5 TP 2.0	25	36.23%
	>2	20	28.99%
Platelet count	Normal: 150,000 to 450,000	48	69.57%
	Low (Thrombocytopenia): <150,000	12	17.39%
	High (Thrombocytosis): >450,000	9	13.04%
CRP	Normal: <10	30	43.48%
	Elevated: ≥10	39	56.52%
	TOTAL	69	100.00%

Table 4: Clinical Signs and Symptoms in Neonates Born to COVID-19 Positive Mothers

	Variable	Frequency	Percentage
Lethargy	Present	36	52.2%
	Absent	33	47.8%
Tachycardia	More than 140	3	4.3%
	Less than 140	66	95.7%
Tachypnoea	More than 60	33	47.8%
	Less than 60	36	52.2%
Respiratory Distress	Present	29	42.0%
	Absent	40	58.0%
	Total	69	100.0%

DISCUSSION

Our study found an almost equal gender distribution among neonates born to COVID-19 positive mothers, with 49.3% male and 50.7% female. This is consistent with the findings of other studies conducted in India. For example, Sarvi et al,[4] (2023) reported a nearly equal gender distribution in their study of neonates born to COVID-19 positive mothers in North Karnataka.[4]

Most mothers in our study were young adults aged 20-24 years (55.1%), and a significant proportion underwent cesarean sections (63.8%). These findings are like those reported by Anand et al,[6] (2020) in a tertiary care center in India, where caesarean sections were also prevalent among COVID-19 positive mothers, accounting for 63.9% of deliveries.[6]

In our study, 42.0% of the neonates were preterm, which is higher than the 17.24% preterm birth rate reported by Sarvi et al [4]. (2023). However, other studies, such as the one by Hariharan et al,[7] (2022), reported a preterm birth rate of 14.5%, indicating variability in preterm birth rates depending on the population and healthcare settings [7]

In our study, normal haemoglobin levels were observed in 56.52% of neonates, while the total leukocyte count (TLC) was within the normal range for 68.12%. Elevated CRP levels were found in 56.52% of neonates. Similar findings were reported by Biswas et al,[8] (2023) in West Bengal, where elevated inflammatory markers were common among neonates born to COVID-19 positive mothers.[8] Lethargy was present in 52.2% of neonates, and respiratory distress was observed in 42.0%. Increased respiratory activity was noted in 10.1% of cases. These findings are in line with the study by Malik et al,[9] (2021), where respiratory distress and lethargy were commonly reported among neonates born to COVID-19 positive mothers.[9]

Our study showed that 31.9% of neonates had normal oxygen saturation levels, while 26.1% experienced severe hypoxemia. This is comparable to the findings from Kundragramiet al. [10] (2023), who reported varied oxygen saturation levels among neonates born to COVID-19 positive mothers in Eastern India.[10]

CONCLUSION

This study provides important insights into the clinical characteristics and outcomes of neonates born to COVID-19 positive mothers in Northern Maharashtra. The findings indicate a nearly equal gender distribution among the neonates and a significant proportion of preterm births, which aligns with other studies conducted in various regions of India. Most mothers were young adults, and a high rate of cesarean sections was observed, reflecting the clinical decision-making influenced by maternal COVID-19 infection.

Hematological parameters in the neonates revealed that while most had normal hemoglobin and leukocyte counts, elevated CRP levels were common, indicating an inflammatory response. Clinically, lethargy and respiratory distress were prevalent among the neonates, although the incidence of severe complications was relatively low. Oxygen saturation levels varied, with a notable proportion of neonates experiencing severe hypoxemia.

The study's findings underscore the importance of vigilant monitoring and tailored clinical management for neonates born to COVID-19 positive mothers. Despite the low risk of vertical transmission, the potential for neonatal complications necessitates continued research and the development of robust clinical guidelines to ensure optimal outcomes for this vulnerable population.

Limitations

This study has several limitations. First, the retrospective design may introduce selection bias and limit the ability to establish causality. Second, the sample size, while adequate for initial observations, may not be representative of broader populations. Third, the study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other settings with different healthcare infrastructures and resources. Future studies with larger, more diverse populations and prospective designs are needed to confirm these findings and further elucidate the long-term outcomes of neonates born to COVID-19 positive mothers.

Conflict of interest: The authors declare no conflict of interest.

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