

ORIGINAL RESEARCH

CORONA EXPERIENCE

Seroprevalence of COVID-19 antibodies in babies born to COVID positive or suspected mothers and their outcome

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ABSTRACT

Background & Objective: COVID-19 infection has been the most researched topic since its emergence in 2019. Little is known about the vertical transmission of this disease and its effects on the babies of the infected mothers in our country. We evaluated the antibody titers of babies born to COVID-19 positive or suspected COVID mothers and observed the immediate and short-term outcome of such babies. We share our experience of 43 babies born to known or suspected COVID positive mothers in a tertiary care hospital in Karachi, Pakistan.

Methodology: It was a cross-sectional study conducted in the departments of gynecology/obstetrics and the pediatrics of Memon Medical Institute Hospital, Karachi. Cases delivered during December 2020 till May 2021 were included in this study. Mothers known or suspected COVID positive were included and their newborn babies were screened for antibody titer. Babies were followed up for any sign of the disease for six months.

Results: Out of a total of 547 deliveries conducted in our hospital during the study period, PCR test was performed amongst 43 suspected mothers and 41 (95.34%) came out to be positive on PCR, while two mothers had antibodies in their blood, so were included in the study. The antibody titer was positive in 17 (39.53%) of babies of all PCR positive mothers, and 41.46% of the babies of all confirmed COVID positive mothers.

Conclusion: The results of our study conclude that the babies of a fair proportion of all the COVID affected women exhibited a good antibody response, and no disease manifestation was noticed in them for six months after birth.

Key words: COVID-19; Vertical transmission; Antibody titers

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1. INTRODUCTION

COVID-19 pandemic has disrupted the lives of almost everyone on the earth, poor and rich alike. By June 2020, over 8 million cases and over 400,000 deaths had been reported. Neonatal COVID-19 appears to have a horizontal transmission, based on the reports that are currently accessible and they seem to perform much better as compared to the older population.¹ This could be due to the antibody protection transferred from the mother.

The unique Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) first became a life-threatening disease in China in December 2019 and then its spread became significant enough to be declared a pandemic by the World Health Organization (WHO).² Since pregnancy is a decreased state of immunity, it poses greater risk for mothers as well as babies if they acquire infections such as the COVID-19. It has been observed that during the first two peaks of the pandemic, in symptomatic mothers with severe disease, the fetal outcome was also affected.³

Pregnant women with COVID-19 are at highest risk for hospitalization, preterm birth and admission to the ICU compared to the non-pregnant women of the same reproductive age.^{4,5}

Newborn protection from infection mainly depends upon neonatal innate immune responses and maternally derived, transplacental acquired antibodies. The maternal antibodies produced in response to corona virus infection during pregnancy, which cross the placenta is an important factor to understand neonatal protection from COVID-19. Studies have shown that the breast milk and the placental membrane have evidence of the virus (PCR positive) and it has also been observed that the mothers who contracted COVID-19 can transmit antibodies against the virus through breast milk.^{6,7,8} IgM is the antibody isotype produced initially in newborns as first immune response to infection and as first immunoglobulin class to be synthesized by a fetus or infant. IgM antibodies are too large to pass through the placenta, so it is reasonable to presume that their detection in a newborn reflects fetal production after in utero infection.⁹

This research was carried out during the peak COVID season at Karachi. Our objective was to evaluate the antibody titers of babies born to positive or suspected COVID-19 mothers and see the immediate and short-term outcome for six months in such babies.

2. METHODOLOGY

A cross-sectional study was conducted in postnatal ward of the Obstetric Department and Neonatal Intensive Care

Unit of Pediatric Department at Memon Medical Institute Hospital (MMIH), Karachi, from December 2020 till May 2021. Sample size was calculated to be 43, using the standard formula for calculating the sample size on the basis of the disease prevalence. Prevalence was taken at 50% because no relevant data was available in case of local population. The margin of error was 5% with 95% confidence interval.

Non-probability consecutive sampling technique was utilized. Inclusion criteria consisted of all suspected pregnant females, irrespective of gestational age and having nasal or throat swab confirming COVID-19 on RT-PCR (Reverse-Transcriptase Polymerase Chain Reaction) or antibodies in their blood. The exclusion criteria were COVID-19 PCR negative mothers and the mothers who refused to give consent for PCR. We also excluded mothers with other known comorbidities. A specific questionnaire was designed and used for the collection of data, with a section for maternal information and a section for neonatal information. Ethical approval was taken from the Institutional Review Board of MMIH before conducting the study.

Data was stored and analyzed using IBM-SPSS version 23.0, numbers with percentages were reported on baseline maternal characteristics, including age, socio-economic class, gravida, parity, mode of delivery, complete blood count (CBC), symptoms of COVID, COVID antibodies test and outcomes. Descriptive parameters were also reported for neonatal outcomes, including gestational age, gender, APGAR scores, COVID PCR and antibody tests. These babies were followed up for 6 months. The frequency of visits was 1st week of life, monthly for 3 months corresponding with the vaccination dates and then finally at 6 months of age. During these visits, their height, weight and head circumference were plotted on the WHO growth centile charts, milestones were checked, and any current illness or problems were addressed. These parameters were associated with results of the mother's COVID PCR using Pearson Chi Square test. P-values less than 0.05 were considered statistically significant.

3. RESULTS

Out of 547 deliveries conducted during the study period, PCR was performed amongst 43 (7.86%) mothers; 41 out of them tested positive. Two more mothers were tested negative on PCR, but had detectable antibodies in their blood. However, only 17 (41.46%) neonates born to the positive mothers showed positive antibody response.

Table 1 reports the baseline maternal characteristics of studied samples in the present study. Amongst the total

Table 1: Baseline characteristics of the studied mothers (n = 43)

Parameters		PCR +ve mothers	PCR -ve / Antibody +ve mothers	Total
Mother age (y)	< 20	6 (14.6)	2 (100)	8 (18.6)
	20-30	27 (65.9)	0	27 (62.8)
	> 30	8 (19.5)	00.0	8 (18.6)
Socio-economic status	Upper middle class	11 (26.8)	1 (50)	12(27.9)
	Lower middle class	22 (53.7)	1 (50)	23 (53.5)
	Lower class	8 (19.5)	0	8 (18.6)
Gravida	< 2	12 (29.3)	1 (50)	13 (30.2)
	3-5	20 (48.8)	1 (50)	21 (48.8)
	> 5	9 (22.0)	0	9 (20.9)
Para	< 2	21 (51.2)	1 (50)	22 (51.2)
	> 3	19 (46.3)	1 (50)	20 (46.5)
	3	1 (2.4)	0	1 (2.3)
Mode of delivery	SVD	12 (29.3)	1 (50)	13 (30.2)
	VVD	2 (4.9)	0	2 (4.7)
	Elective LSCS	13 (31.7)	0	13 (30.2)
	Emergency LSCS	14 (34.1)	1 (50)	15 (34.9)
CBC	Normal	39 (95.1)	2 (100)	41 (95.3)
	Low TLC	1 (2.4)	0	1(2.3)
	Anemic	1 (2.4)	0	1 (2.3)
Symptoms	present	8 (19.5)	0	8 (18.6)
	absent	33 (80.5)	2 (100)	35 (81.4)
COVID antibodies mother	Reactive	23 (56.1)	2 (100)	25 (58.1)
	Nonreactive	6 (14.6)	0	6 (14.0)
	Not done	12 (29.3)	0	12 (27.9)
Outcome	Well baby	30 (73.2)	1 (50)	31 (72.1)
	Admitted to NICU	7 (17.1)	1 (50)	8 (18.6)
	Expired/ IUD	2 (4.9)	0	2 (4.7)
	Meconium stained	1 (2.4)	0	1 (2.3)
	Mas sepsis	1 (2.4)	0	1 (2.3)

Data presented as n (%)

43 samples, 62.8% were found within the age group of 20–30 y, 53.5% belonging to lower middle class. 48.8% were multigravida and 51.2% were primigravida. 30.2% had elective LSCS, 95.3% had normal CBC, 18.6% had the symptoms of COVID, and 58.1% were found reactive in COVID antibodies test. In neonatal outcome, 72.1% delivered babies were healthy, while 2 (4.9%) were died or had IUD.

In mothers with positive PCR 65.9% samples were found within the age group of 20–30 y, 53.7% belonging to lower middle class. 48.8% were multigravida and 51.2% were primigravida. 31.7% were delivered by elective LSCS. CBC was normal in 95.1%. 19.5% were with symptoms of COVID, and 56.1% were found reactive for COVID antibodies test. Regarding neonatal outcome, 73.2% mothers delivered healthy babies; 4.9% expired/IUD (Table 1).

Table 2: Neonatal outcomes with mother COVID PCR Results n=43

Parameters		PCR +ve mothers	PCR -ve / Antibody +ve mothers	Total
Gestational Age (Week)	Term	37 (90.2)	1 (50)	38 (88.4)
	Preterm	4 (9.8)	1 (50)	5 (11.6)
Gender of Baby	Male	22 (53.7)	1 (50)	23 (53.5)
	Female	19 (46.3)	1 (50)	20 (46.5)
Weight of Baby (kg)	< 2.5	14 (34.1)	0	14 (32.6)
	> 2.5	27 (65.9)	2 (100)	29 (67.4)
APGAR Scores	Good	38 (92.7)	2 (100)	40 (93.0)
	Poor	3 (7.3)	0	3 (7.0)
COVID antibodies Baby	Reactive	16 (39.0)	1 (50)	17 (39.5)
	Nonreactive	25 (61.0)	1 (50)	26 (60.5)

Data presented as n (%)

Whereas in samples with negative PCR all mothers comprised age group less than 20 y old, 50% belonging to lower middle class, 1 (50%) was multigravida and 1 (50%) was primipara, none with elective LSCS, all exhibited normal CBC, none were with symptoms of COVID, and all reacted positive for COVID antibodies test. In neonatal outcomes 1 (50%) delivered normal healthy babies (Table 1).

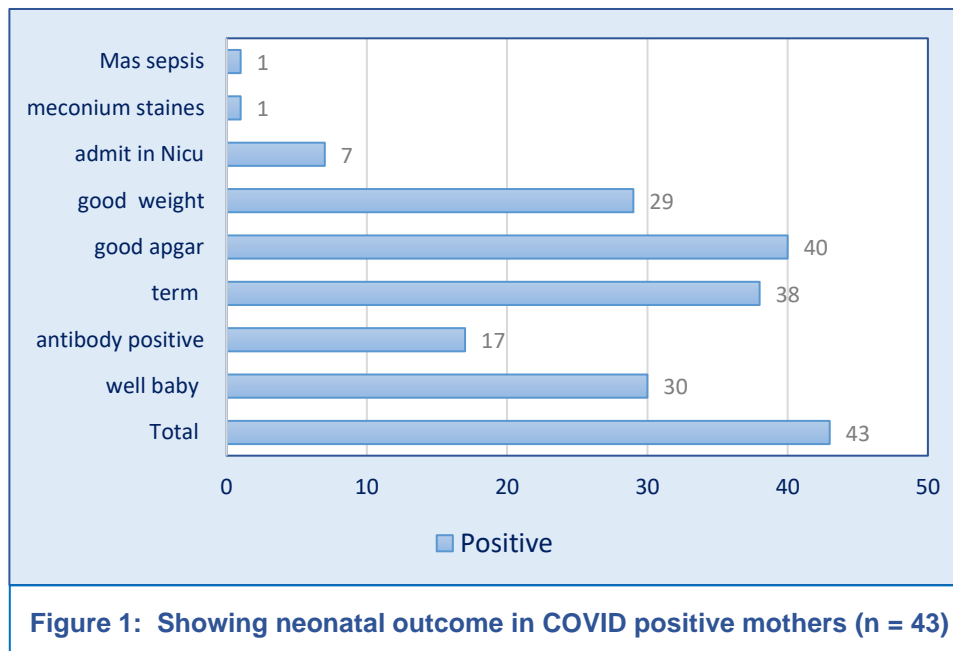
Pearson Chi Square test gives a significant association of maternal age with COVID PCR results, $P = 0.01$, all other parameters were statistically insignificant.

Table 2 reports the neonatal outcomes. Out of 43 babies, born to COVID positive mothers, 88.4% were with term gestational age, 53.5% were male, 67.4% were born with normal weight (2.5–4 kg), 93% had good APGAR scores, none was COVID PCR positive, while 39.5% were reactive for COVID antibodies test. Pearson Chi Square test did not give any significant association of neonatal outcomes with maternal COVID PCR test results, ($P > 0.05$).

4. DISCUSSION

According to the currently available data, maternal and neonatal outcomes had a significant impact during COVID-19 pandemic. Maternal mortality, stillbirths, preterm births, and consequently neonatal complications have all been shown to increase especially in lower middle-income countries.¹⁰

Our study shows that 17 ((39.5%) of the neonates born to COVID-19 positive mothers had antibody response. While a review done from US hospital shows 6.6% neonates with positive PCR for COVID-19. In the same study 112



(25%) babies were born preterm whereas in our study only 5 (11.6%) were born preterm.¹¹ However, in a study done in Netherlands concluded that preterm births were significantly less common in the months that followed the initial introduction of COVID-19 mitigation measures.¹²

Till date most of the studies do not give a strong evidence of vertical transmission in COVID-19 positive mothers.^{13,14,15} However, seropositivity in neonatal blood suggests some evidence.^{16,17} According to most data, risk of transmission is possibly under 1% following maternal SARS-CoV-2 infection during pregnancy.^{18,19} Our study shows that most of the babies delivered to COVID affected mothers received antibodies without being afflicted by the disease.

Most of the babies were given routine care as they had good APGAR scores, whereas in 7% of the babies with poor APGAR were admitted to NICU and were treated based upon their condition. According to a meta-analysis the percentage of pregnancies with 5-min Apgar scores under 7 remained unchanged.¹⁰

Similar to the general population, the majority of COVID-19-positive pregnant women (86%) only have minor to moderate symptoms. Additionally, asymptomatic infection has been found in up to 33% of expectant women in institutions thanks to universal COVID-19 screening at presentation to the labor and delivery unit.¹¹ Similarly, in our study only 18.6 % mothers had symptoms while majority were asymptomatic. During this outbreak, the pregnant ladies in our study had a much better outcome as compared to Western studies. A total of 1,637 pregnant women, reported with a COVID-19 infection and 15 deaths were reported with COVID infection in this period in USA.²⁰

Ratio of infection with SARS-CoV-2 in pregnant women is different geographically and it reflect the prevalence of the virus in the overall population. For example, data from a single center in New York City show that 20% of the 161 pregnant women tested positive for SARS-CoV-2 with an asymptomatic carrier rate of 13%.²¹ In contrast, a similar study performed in Connecticut found that 3.9% of pregnant women were positive for SARS-CoV-2 with an asymptomatic carrier rate of 2.9% on time of admission to labor and delivery (in addition to 1.5% of known infections on time of admission).²²

We followed all babies till the age of 6 months. In our set up, all these babies remained well and followed normal growth curves and milestones. For most babies, we allowed mothers to continue to feed their babies, but they were asked to wear masks and sterilize their hands and wash their breasts every time they fed their babies. Few babies had to be separated from their mothers as they had been isolated in a separate area for COVID

patients with no pediatric staff facility. Ronchi et al, evaluated safety of babies with mothers and risk of postnatal transmission and concluded that risk of mother-to-infant transmission of SARS-CoV-2 was unlikely and very low if the infected mothers were not having severe disease and followed contact precautions and infection control policy during breastfeeding their infants.²³

Our study focused the need to provide resources to areas of clinical care that require effective decision making, and it also provides encouragement for future research and gives good insight about the very low vertical transmission from mother to fetus and in the newborn.

5. LIMITATIONS

The major limitation was that not all infants born to COVID-19-positive mothers were tested for PCR early in the pandemic and in their newborn period, we only detected antibodies titers. In our hospital, we only had the kit to detect total antibodies and hence could not assess the exact amount of IgM levels in the neonates.

6. CONCLUSION

Our study concludes that the babies of almost all the affected women exhibited a very good antibody response and no disease manifestation was noticed earlier and after 6months. Our data also confirms that there is very little chance of vertical transmission of SARS-CoV-2 in infants, even after follow-up, and it suggests that there is probably less chance of post-natal transmission, late-onset infection, or long-term complications.

7. Data availability

All numerical data related to this study is available with the authors and can be requested from the corresponding author.

8. Conflict of Interest

No conflict of interest was declared by the authors. No external or industry funding was involved in the study.

9. Acknowledgement

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10. Author Contribution

NA, SQB, FH: Concept & design of study; Acquisition of Data:

NA, SQB, FH, UHS: Drafting of Paper and revising

SQB, NA, UHS: Data analysis & interpretation; Final approval of version

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