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Evaluation of the Characteristics of Neonates Hospitalized with COVID-19 from July 2020 to August 2021

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Abstract

Introduction: The recent pandemic is caused by the new coronavirus (COVID-19). The disease primarily affects adults but can also affect children of all ages, including infants. It is not known what the prevalence of this disease is in children, but it is evident that the severity of symptoms in children and infants is less than in adults.

Case Presentation: Fifteen neonates with COVID-19 were reported in this paper who were hospitalized in neonatal intensive care units. Five of the neonates were preterm, and all of them tested positive for PCR. The most common symptom was respiratory distress. During their hospitalization, five neonates died.

Conclusions: The results of this study indicate that clinical manifestations, laboratory findings, and radiological findings are less severe in infants than in other ages. Consequently, it can be predicted that the prognosis for infants will generally be favorable.

Keywords: Neonates, COVID-19, Clinical Manifestations, Consequence

1. Introduction

The first acute respiratory illness caused by COVID-19 was reported in China in 2019 due to coronavirus beta infection. The disease spread rapidly around the world and became a pandemic. It is important to note that, even though COVID-19 primarily affects adults, about 19% of people with the disease are children (1). Although the exact prevalence of COVID-19 in infants is unknown, the severe form of the disease is more common among children under one year of age. In general, children are less severely affected by the disease than adults (2, 3). Many body systems are affected by this disease, including the cardiovascular, respiratory, gastrointestinal, nervous, dermatological, hematological, immunological, renal, and hepatic systems. The risk of vertical transmission of COVID-19 is reported to be less than 1%, and recent studies have identified postpartum transmission by respiratory droplets from parents or relatives to the infant as one of the most important modes of disease transmission in infants (4).

Adults with COVID-19 commonly experience fever, restlessness, cough, respiratory distress, diarrhea, and vomiting. In neonates with non-specific signs of this infection, there may be temperature instability, acute respiratory syndrome, cardiovascular dysfunction, or gastrointestinal upset (5).

It is not known what causes milder disease in children and infants. However, some hypotheses, including different responses to SARS-CoV2, suggest that this is due to direct virus-to-virus interactions caused by the simultaneous presence of other viruses in children's airways and thoracic mucosa and different levels of ACE-2 receptor expression (6).

In this study, 15 symptomatic infants with COVID-19 and positive PCR were admitted to the neonatal intensive care unit of Firoozabadi Hospital due to the new manifestations of COVID-19 in infants. A comparison is made between clinical signs, radiological and laboratory findings, and the characteristics of the fifth COVID-19 peak.

2. Cases Presentation

This study evaluated 15 infants who were admitted to the neonatal intensive care unit of Firoozabadi Hospital at the Iran University of Medical Sciences in Tehran. The mother and/or infant were symptomatic of COVID-19 at

Table 1. Demographic, Clinical, Radiological, and Patient Outcome Findings

Patients Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Gender	F	M	F	M	M	M	F	M	M	F	F	M	F	M	M
Birth weight (gr)	3300	3500	3600	3500	1135	1100	2900	1450	2350	2050	1960	1000	2450	3170	3600
Gestational age (w)	38+4d	41	37	39	28+3d	28+3d	40	31+6d	36+2d	38+5d	34+1d	28	35+2d	39+6d	39
Hospital age (d)	17	17	1	1	1	1	1	1	1	1	1	1	37	1	15
5 min APGAR score < 8	-	-	+	-	+	+	-	-	-	-	-	+	-	-	-
Duration of hospitalization (d)	8	10	13	7	3	6	9	20	11	16	9	4	13	4	7
Suspicious mother to COVID-19	-	+	+	N	+	+	N	+	-	-	+	+	-	-	+
PCR oF mother	-	N	+	N	+	+	N	+	-	-	-	-	N	N	N
COVID-19 history of other family members	+	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Temperature instability	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Fever	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Respiratory distress	-	+	+	+	+	+	+	+	+	+	+	+	+	-	-
Gastrointestinal symptoms	PF	PF	-	-	-	-	-	-	-	-	-	-	PF	-	-
Convulsions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Respiratory support	-	-	MV	NCPAP	MV	MV	HFNCNCPAP	MVHFNC	MVNCPAP	MVNCPAP	MV,NCPAP	NCPAP	MVNCPAP	-	-
Get a surfactant	-	-	-	+	+	+	-	-	+	-	+	-	+	-	-
Pneumothorax	-	-	-	-	-	-	-	-	+	+	-	+	-	-	-
Heart echo findings	PFO	PFO	ASD,PDA	PFO	PDA,TR; ASD	PDA,PFO	PDA,TR; ASD	PFO; VSD	ASD,VSD; PDA	ASD,VSD; PDA,PAH	TR,PFO	PFO; PDA	MR	PFO	PFO
Abnormal lung X-ray findings	-	-	-	-	RDS	RDS	RDS	-	RDS	-	RDS	RDS	RDS	RDS	-
Duration of receiving antibiotics (d)	8	12	14	6	3	6	8	6	12	10	6	21	13	4	4
WBC	7200	8300	12800	23300	10500	6400	20800	12600	12800	13500	18500	11200	4300	17900	6400
PMN (%)	50	35	82	74	20	32	76	58	80	35	57	70	35	49	40
LYM (%)	40	52	12	17	74	59	13.8	42	13.7	48	32	26	53	45	55
PLT /mm^3	371000	338000	180000	412000	205000	223000	354000	260000	292000	307000	283000	145000	380000	178000	341000
The first CRP (d)	1	15	1.3	1	1	.3	3	1	32	1	1	1	2	1	1
COVID PCR	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Consequences	L	L	L	L	D	D	L	L	D	D	L	L	D	L	L

Abbreviations: N, unspecified/ not conducted; L, live; D, dead; MV, mechanical ventilation; PF, poor feeding; PAH , pulmonary hypertention.

admission. As shown in Table 1, demographic information, disease symptoms, radiological findings, and laboratory results are provided for the patients. Seven of these infants (46%) were born full-term, three (20%) were born near-term, and five (33%) were born preterm. Eight minutes after birth, four babies (3, 5, 6, 12) had Apgar scores less than five, and eleven infants (73%) were admitted to the hospital within 24 hours. Infants 1, 2, 14, and 15 were hospitalized 7 and 21 days after birth. The COVID-19 PCR test was performed at the time of admission.

Of the seven neonates who required resuscitation at birth, five infants died during hospitalization, one of whom was a 28-week-old preterm twin. An infant (No. 10) suffered from acute renal failure during hospitalization due to syndromic conditions (corpus callosum agenesis, dextrocardia, and horseshoe kidney). Four infants were reported to have suffered a pulmonary hemorrhage. During hospitalization, all patients had an increased CRP.

A quarter of infants were hospitalized between July and August 2021 (the beginning of the fifth peak). There was almost one hospitalization per month during the year, which increased to two cases per month during the fifth COVID-19 peak. Other reports of child conflict escalating during the fifth peak of COVID-19 support this finding. The mortality rate among these four infants was one (Nos. 11, 13 - 15). A mean length of hospitalization of 8.5 days was observed, which was not significantly different from that observed in other neonates (9.5 days). A predominant sign of hospital admission in these infants was respiratory distress and, in one case, apnea. Within the first 24 hours of their birth, 50% were symptomatic and hospitalized.

3. Discussion

This study aimed to examine 15 infants who were born to mothers with COVID-19 (definite or suspected) and were admitted to the neonatal intensive care unit of Firoozabadi Hospital, Tehran, Iran, from June 2020 to September 2021.

As a result of this study, hospitalization rates were higher for infants less than 37 weeks of gestation, and one-third of them delivered naturally. As a result, respiratory distress was the most common symptom (80%), of which 91% required severe respiratory support, consistent with some other studies (2). Meanwhile, some studies have reported fever as the most common symptom of COVID-19 in infants and children (4); however, in this study, fever was only reported in two infants. Neonates in our study did not exhibit neurological or gastrointestinal symptoms, which have been reported in some studies that were observed more in adults (7). We observed poor feeding in three infants in this study; however, none displayed neurological symptoms such as seizures. Since the PCR test has a low likelihood of producing false results, the lower severity of symptoms in our infants confirms other reports of milder symptoms of COVID-19 in infants. One family member also reported a history of COVID-19; however, only five mothers had positive PCR tests. Accordingly, this finding may confirm the transmission of COVID-19 from asymptomatic individuals to infants or postpartum transmission of the disease, a hypothesis that has also been proposed by De Bernardo et al. (7). Nevertheless, 11 infants (73%) developed symptoms within the first 24 hours of birth and were hospitalized, of which 5 (45%) had a positive PCR. All infants in our study did not undergo lung CT scans, and the most common abnormal lung radiographic findings were characteristics such as RDS aspects (53%); also, we observed pneumothorax in 20% of patients. All infants in our study did not undergo lung CT scans, and the most common abnormal lung radiographic findings were characteristics such as RDS aspects (53%); also, we observed pneumothorax in 20% of patients (8, 9).

COVID-19 (10-12) has been reported to cause myocarditis, pericarditis, and arrhythmias in children; however, none of these heart diseases were observed in any of the neonates in this study. In contrast, at least one congenital heart disease, such as PFO, ASD, VSD, and PDA, was reported in the total sample of neonates studied. In addition, one infant (Infant No. 10) had pulmonary hypertension.

Compared to previous waves of COVID-19 in Iran, the rate of infant infection with COVID-19 has almost doubled (15:6) in the Fifth wave. In order to explain this increase in the rate of infection, we believe that a lack of proper observance of protocols and new variants of the virus caused by a mutation (delta or lambda) are responsible.

Overall, the neonates had a poor outcome in terms of mortality rate (5 deaths). Table 2 provides information regarding the dead babies. However, the small sample size of our study makes it impossible to judge the overall outcome of COVID-19's effects on neonates. The limitations of our study are the lack of CT scans and PCR tests for the mothers or other family members. In this study, maternal age, parity, delivery type, the onset of labor, presentation, birth weight, and sex were all confounding factors.

Table 2. Dead Neonates Data

	Patient Findings
Total	5
F/M	2/3
Preterm (< 37 W)	4
LBW < 1500	2
APGAR Score < 8	2
+ COVID-19 PCR (mother)	2
+ COVID 19 PCR	5
Abnormal CXR	3
Pneumothorax	2
Mean of admissions days	9.8

Abbreviations: F, female; M, male; LBW, low birth weight; CXR, chest x-ray.

3.1. Conclusions

As reported in this study, clinical symptoms, laboratory findings, and imaging findings of infants with COVID-19 were mild. There is a need to keep in mind the increased risk of pulmonary hemorrhage in infants receiving surfactant treatment. New mutations of COVID-19 have increased the prevalence of the disease in children and infants.

Footnotes

Authors' Contribution: Study concept and design: Z. V. and A. M.; Analysis and interpretation of data: A. J. and H. M.; Drafting of the manuscript: N. T.; Critical revision of the manuscript for important intellectual content: N. T., M. K., and H. M.; Statistical analysis: Z. V..

Conflict of Interests: The authors have no conflict of interest with the subject matter of this manuscript.

Data Reproducibility: The dataset presented in the study is available on request from the corresponding author during submission or after publication.

Ethical Approval: The investigation committee approved this study at the Iran University of Medical Sciences, Tehran, Iran, and informed consent was obtained from all parents.

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Informed Consent: We obtained the parent's consent to publish information without their child's name.

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