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## Neonates with Covid-19 infection: Is there any different treatment process?

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### ARTICLE INFO

#### Keywords:

Neonate  
PCR  
COVID-19  
Infection

### ABSTRACT

This study was designed to investigate the neonates with COVID-19 admitted to two hospitals in Neyshabur and Mashhad, Iran. In this study, 17 neonates are introduced with positive nasopharyngeal COVID-19 polymerase chain reaction (PCR) test who admitted to two hospitals in Iran. Perinatal information, contacts with a person with COVID-19 infection, clinical signs at the time of admission, laboratory tests, radiological evaluations, pulmonary and extra pulmonary complications, and short-term outcome have been reported. 8 neonates had positive COVID-19 PCR test of mothers at the time of delivery in the first 24 hours and subjected to invasive or non-invasive mechanical ventilation due to respiratory distress. 9 neonates on 9–18 days of birth were admitted with pulmonary and extra pulmonary symptoms by fever as a main clinical sign. All of cases except one had a history of contact with the infected person. The treatments were mostly supportive, by the way 6 neonates receiving surfactant treatment and 2 of them receiving systemic steroid therapy. Only one neonate died and the others were discharged without any complications. The results showed that the symptoms and severity of the disease in neonates are milder than adults. The possibility of vertical transmission due to the onset of symptoms immediately after birth is still present in some neonates of affected mothers.

### 1. Introduction

Corona virus disease 2019 (COVID-19) is the cause of acute respiratory infection of the corona virus family, which was first identified in Wuhan, China, and spread rapidly to other countries [1]. The infection is mainly transmitted person-to-person by respiratory droplets [2,3]. Although airborne, fecal-oral, maternal-fetal and maternal-neonatal transmission have been reported, the virus has not yet been reported to transmit through breast milk [4–7]. Most patients are adults especially those with risk factors such as underlying diseases(conditions), age, race, etc., including people with a high probability of contracting the virus were identified [8]. However, various studies have reported children and neonates, too [1]. In the case of neonates, there is a risk of developing it from birth following the mother's infection with COVID-19 as well as following close contact with family members [9,10]. Systemic infections, including bacterial pneumonia, increase the risk of preterm delivery, so this kind of delivery following COVID-19 infection in the mother may also be a potential risk of contracting the virus [11]. (see Tables 1–5)

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Over the past year, several questions have been raised in the neonatal age group, including the method of virus transmission, incidence, clinical symptoms, laboratory findings, medication, and respiratory care. The range of clinical symptoms in neonates varies from asymptomatic to severe pulmonary involvement and in some cases, complications such as ileus and necrotizing enterocolitis have been reported [12]. Depending on the patient's clinical symptoms, the treatments performed also varied. There are still many ambiguities regarding the intensive care of premature neonates [13]. Given these ambiguities, especially in the field of pharmacological and respiratory therapies in neonates, it seems that reporting more cases of neonates with COVID-19 will help to further clarify the process of diagnosis and treatment of the disease. Therefore, this study was designed to investigate the group cases of neonates with COVID-19 admitted to Hakim hospital in Neyshabur and Ghaem hospital in Mashhad, Iran (Tables 1-5).

“Cases in Gaem hospital, Mashhad, Iran”

## 2. Case 1

A 39-week gestational age male neonate weighing 3500 g was born by cesarean section with an Apgar score of 8-8. He was admitted to the NICU (neonatal intensive care unit) ward from birth due to respiratory distress (grunting, tachypnea, and cyanosis). His mother had a history of gestational diabetes that was controlled with nutritional and lifestyle modifications. At admission noninvasive ventilation; NCPAP (Nasal continuous positive airway pressure) was started. Due to severe respiratory distress and the grand glass pattern on CXR (Chest X-Ray), the neonate was intubated and the surfactant was administered through endotracheal tube. The history of COVID-19 infection in mother during pregnancy and other family members was negative. Due to clinical manifestations and widespread COVID-19 infections, on the third day of birth, COVID-19 PCR (polymerase chain reaction) test was performed by NP swab (nasopharyngeal swab) method for the neonate. Maternal and neonatal PCR test results were positive. On seventh day, the neonate had a seizure which was treated with phenobarbital and had a good response to the anticonvulsant drug. The antibiotics were started and a sepsis workup was done, which blood culture and CSF culture were negative. Brain MRI (Magnetic resonance imaging) was performed for him, which was normal. After 21 days of hospitalization, the neonate was discharged in good general condition.

## 3. Case 2

A 9-day old female neonate, birth weight 3100 gr and hospitalization weight 3240 gr with vaginal delivery and an Apgar score 9-10 Was admitted to the NICU Ward due to fever (AT: 38.2), poor feeding and lethargy. Sepsis workup was done and antibiotic therapy had started. The COVID-19 infection symptoms began in her mother six days after delivery with fever and cough, and in father began five days after neonatal birth with headache, fever, and loss of smell and taste. COVID-19 PCR test was performed by NP swab method for neonate, mother and father, which was reported to be positive. Due to the elimination of fever and improvement of general condition and negative results of sepsis workup tests, the neonate was discharged in good general condition after 4 days of hospitalization.

## 4. Case 3

A 38-week gestational age male neonate with a birth weight of 3300 g was born by cesarean section with an Apgar score of 9-9. He was admitted to the NICU ward due to Tachypnea and cyanosis at birth. He was treated with NCPAP. Due to severe respiratory distress and need for FIO<sub>2</sub> (The fraction of inspired oxygen) more than 40% and Grand Glass pattern in CXR, surfactant was administered through endotracheal tube by INSURE (intubation-surfactant-extubation) method. The neonate was also treated with antibiotics. COVID-19 PCR test was performed on the 4th day of birth, which was positive. The history of COVID-19 disease in his mother and other family members was negative and his mother was asymptomatic but maternal COVID-19 PCR test was positive, too. The neonate received NCPAP for 8 days. Corticosteroids were nebulized (inhaled). The neonate was then discharged in good general condition after 13 days of hospitalization.

**Table 1**  
Clinical data and PCR test result for 17 neonates with COVID-19.

	GA	Add age	BW	Apgar 1-5 min	Sex	CS/ND	Contact	CRP	lymphopenia	1st PCR	2nd PCR
1	39	0	3500	8-9	♂	Cs	Mother	-	-	+	Not done
2	38	9	3100	9-10	♀	ND	M-F	-	-	+	Not done
3	38	10	3460	9-10	♀	ND	Mother	-	-	+	Not done
4	38	0	3330	9-9	♂	Cs	Mother	-	-	+	-
5	31	0	1550	8-8	♂	ND	M-F	-	-	+	-
6	37	9	3300	9-10	♂	ND	Family member	-	-	+	Not done
7	36	18	2500	8-10	♂	Cs	Father	-	-	+	Not done
8	36	18	2480	8-10	♀	Cs	Father	-	-	+	Not done
9	31	0	1290	4-8	♀	Cs	Mother	-	-	+	-
10	37	0	3100	7-10	♂	ND	Mother	1+	-	+	-
11	30	0	1590	6-8	♀	ND	Mother	-	-	+	+
12	30	0	1540	5-8	♀	ND	Mother	-	-	+	+
13	40	20	3160	9-10	♀	ND	Family member	-	-	+	Not done
14	39	16	2400	8-10	♂	ND	Family member	-	-	+	Not done
15	39	17	3200	9-10	♂	ND	Family member	3+	-	+	Not done
16	39	2	3060	9-10	♂	ND	Mother	3+	-	+	Not done
17	38	2	4050	9-10	♂	ND	-	-	-	+	Not done

**Table 2**  
Sign and Symptoms of 17 neonates with COVID-19.

	Fever	Tachypnea	respiratory distress	Cough	abdominal distention	Vomiting	Poor feeding	Apnea	Seizure	Hypotonic	RDS	NEC
1	-	+	+	-	-	-	-	-	+	-	+	-
2	+	-	-	-	-	-	+	-	-	-	-	-
3	-	+	+	-	-	-	-	-	-	+	-	-
4	+	-	-	-	-	+	-	-	-	-	+	-
5	-	+	+	-	-	-	-	-	+	-	+	-
6	+	-	-	-	-	-	+	-	-	+	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-
8	+	-	-	-	-	-	-	-	-	-	-	-
9	-	+	+	-	-	-	-	+	-	-	+	-
10	-	+	+	-	+	+	-	-	-	-	-	-
11	-	+	+	-	+	-	-	+	+	-	+	+
12	-	+	+	-	+	+	-	+	+	-	+	+
13	-	-	-	-	-	-	-	-	-	+	-	-
14	-	-	-	+	-	-	+	-	-	-	-	-
15	+	-	-	-	-	-	+	-	-	-	-	-
16	-	+	+	-	-	-	-	-	-	-	-	-
17	+	+	+	-	-	-	-	-	-	-	-	-

**Table 3**  
Clinical treatment and the way of feeding for 17 neonates with COVID-19.

	Sys steroid	Inh steroid	Antibiotic	IVIG	GCSF	Surfactant	Feeding	Anti-viral
1	-	-	+	-	-	+	BM + F	-
2	-	-	+	-	-	-	BM + F	-
3	-	-	+	-	-	-	BM + F	-
4	-	+	+	-	-	+	BM + F	-
5	+	+	+	+	-	+	EXP BM	-
6	-	-	+	-	-	-	BM	-
7	-	-	-	-	-	-	BM	-
8	-	-	+	-	-	-	BM	-
9	-	-	+	+	+	+	Formula	-
10	-	-	+	-	-	-	EXP BM	-
11	-	-	+	+	-	+	Not Feed	-
12	-	+	+	+	-	+	Formula	-
13	-	-	+	-	-	-	BM	-
14	-	-	+	-	-	-	BM	-
15	-	-	+	-	-	-	BM	-
16	+	-	+	-	-	-	BM + F	-
17	-	-	+	-	-	-	EXP BM	-

**Table 4**  
The kind of O<sub>2</sub> therapy for 17 neonates with COVID-19.

	Room air	O <sub>2</sub> therapy	Non inv vent	Inv ven
1	-	-	+	+
2	+	-	-	-
3	+	-	-	-
4	-	+	+	-
5	-	+	+	+
6	+	-	-	-
7	+	-	-	-
8	+	-	-	-
9	-	+	+	+
10	-	+	+	-
11	-	+	+	+
12	-	+	+	+
13	+	-	-	-
14	+	-	-	-
15	+	-	-	-
16	-	+	+	-
17	-	+	+	-

**Table 5**  
Paraclinical test result of 17 neonates with COVID-19.

	CXR	Chest CT scan	Brain Sonography	Out come
1	Grand glass - bronchogram	Not done	Normal	Alive
2	Normal	Not done	–	Alive
3	Normal	Not done	–	Alive
4	Grand glass (ARDS)	Not done	–	Alive
5	Grand glass (ARDS)	Not done	IVH grade2	Alive
6	Normal	Not done	–	Alive
7	Normal	Not done	–	Alive
8	Normal	Not done	–	Alive
9	Grand glass - bronchogram	Not done	Normal	Alive
10	Normal	Not done	–	Alive
11	White lung- Pneumothorax	Not done	IVH grade2	Dead
12	Grand glass - Patchy infiltration	Not done	IVH grade1	Alive
13	Grand glass - Patchy infiltration	Not done	–	Alive
14	Normal	Normal	–	Alive
15	Normal	Not done	–	alive
16	Grand glass -bronchogram peribronchial cuffing	Not done	–	Alive
17	Reticular infiltration	Not done	–	Alive

## 5. Case 4

A 10-day old female full term neonate with birth weight 3460 gr and hospitalization weight 3500 gr with vaginal delivery and an Apgar score of 9–10 was admitted to the NICU ward with fever (AT: 39), vomiting, and diarrhea. At the time of admission she was ill and unconscious. Sepsis workup was done and antibiotic therapy was started. Blood and CSF culture was negative. Her mother had a history of hypothyroidism during pregnancy. COVID-19 infection symptoms began in mother two days after delivery with fever and cough. The mother's PCR test result was positive. The neonate's COVID PCR test was sent on the first day of hospitalization and the result was positive. Due to neurologic symptoms Brain MRI was performed, with mild dilation in the lateral ventricles and grad 1 IVH (Intraventricular hemorrhage) in the left lateral ventricle. The hospitalization duration was 14 days and during the follow-up, hydrocephalus developed and ventriculoperitoneal shunt was installed.

## 6. Case 5

A 31-week gestational age preterm male neonate with birth weight of 1550 g was born by normal vaginal delivery with an Apgar score of 8-8. He was admitted to the NICU ward at birth due to respiratory distress and prematurity. The Patient was intubated and surfactant was inserted through endotracheal tube. Due to the mother's infection with COVID19 10 days before delivery and positive COVID-19 PCR test of the mother and father, on the second day of birth, neonate COVID19 PCR test was done and the result was positive. The neonate suffered pulmonary hemorrhage during hospitalization, was resuscitated once for cardiorespiratory arrest, and treated with IVIG (Intravenous immunoglobulin), systemic corticosteroids (hydrocortisone), blood transfusions, and FFP (Fresh frozen plasma). Bilateral Grade II IVH was reported on brain ultrasonography. The neonate was subjected to invasive mechanical ventilation for 20 days. After extubation, he got NIPPV (Noninvasive positive-pressure ventilation). Inhaled corticosteroids and salbutamol spray were started. On the 27th day of hospitalization, COVID PCR was sent again and the result was negative. Finally, he was discharged from the ward after 30 days without the need for oxygen therapy.

## 7. Case 6

The 19-day-old male neonate as a result of normal vaginal delivery with a birth weight of 3300gr and an Apgar score of 8–10 was hospitalized following fever. There was no respiratory distress and respiratory rate was 46 per minute. Oxygen saturation was 91% in room air. He and his Mother both had positive COVID-19 PCR test. Lung scans were normal and blood cultures were negative. The neonate was discharged after 4 days.

“Cases in Hakim hospital, Neyshabur, Iran”

## 8. Case 7

A 36-week gestational age male neonate from twin pregnancy with birth weight 2500 gr was born by cesarean section and admitted due to fever in 18-day old. The neonate's father was hospitalized -5days before the neonate was admitted-with symptoms of headache, cough and dyspnea with a positive COVID-19 PCR test. The neonate had no respiratory symptoms with oxygen saturation 96%. Sepsis workup was done and antibiotic therapy was started. The PCR test of the neonate's throat swab was initially positive. The CRP (C-reactive protein) test was negative. He had no lymphopenia. The lung x-ray and Spinal fluid analysis were normal. Blood, urine and spinal fluid cultures were negative. Antibiotics were discontinued after 5 days and the neonate was discharged.

## 9. Case 8

The 36-week-old female neonate from twin pregnancy was delivered by cesarean section weighing 2480 gr was admitted after first

twins at 18 days of age following situation: the onset of COVID-19 symptoms and the father's hospitalization from 5 days before, and fever. The neonate had no symptoms and was followed up for that during hospitalization. The PCR test of the pharyngeal swab was positive. The neonate remained asymptomatic for 5 days of hospitalization and was finally discharged.

#### 10. Case 9

A 31-week-old female neonate was admitted by cesarean section due to maternal preeclampsia weighing 1290 gr, an Apgar score of 4–8 which was resuscitated at birth under the control of protective conditions and transferred to the NICU under T-Piece Ventilation and hospitalized in an isolated room with respiratory distress. Her mother had symptoms of headache, nausea and chills from 2 days before delivery. Maternal nasopharyngeal COVID PCR test was positive and involvement was reported on CT (computed tomography) scan. Her mother was admitted to the ICU (intensive care unit) after delivery after pleura effusion and cardiomyopathy. In the chest x-ray, the grand glass and air bronchogram pattern was reported. Due to respiratory distress, she received intratracheal insertion of surfactant by INSURE method and then managed with NCPAP. Antibiotic therapy was started. The neonate's COVID-19 test was sent 24 hours after birth and reported positive. Following neutropenia, a 3-day GCSF (Granulocyte colony-stimulating factor) course was performed and received a dose of IVIG. CRP and Blood culture were negative during hospitalization. The second COVID-19 test was performed 6 days after the first test, which was negative. The neonate was discharged at 25-day old without the need for oxygen.

#### 11. Case 10

The 37-week-old male neonate from normal vaginal delivery weighing 3100 gr and an Apgar score of 7–10, with MSAF (Meconium-stained amniotic fluid) was admitted at birth due to respiratory distress, tachypnea, grunting, and decreased oxygen saturation. His mother was evaluated by COVID-19 for fever and headache the day before delivery and her NP swab test was positive. The neonate's CXR was normal. The neonate was managed with NCPAP for 26 hours and weaned from NCPAP after resolving respiratory symptoms. The COVID-19 test was sent 24 hours after birth, which was positive. Trophic feeding began 4 hours after birth and following abdominal distention and vomiting at 20 hours after birth, feeding was stopped. Ileus was seen on abdominal x-ray. After 72 hours, feeding was started again and finally the baby was discharged after 7 days.

#### 12. Case 11

The 30-week-old male neonate from twin pregnancy and normal vaginal delivery following vaginal bleeding, weighing 1590 gr and an Apgar score of 6–8 was admitted at birth. His mother had symptoms of fever and chills from ten days before delivery and her COVID-19 test was positive. Due to severe respiratory distress, high  $O_2$  requirement and RDS pattern on chest x-ray the neonate was intubated and surfactant was inserted to endotracheal tube on first hour of life. 24 hours after birth, a COVID-19 swab test was sent, which was positive. The first CRP was negative but on the third day of life following worsened general condition, it raised. Also gradually respiratory distress was worsened the lung involvement on chest x-ray shown white lung pattern. +3The diagnosis of stage II NEC was made by clinical and radiologic signs and symptoms. Pneumothorax on the left side occurred on the fourth day and a chest tube was inserted. The neonate was treated with antibiotics and received one dose of IVIG. Blood culture was negative and brain ultrasound was normal. Scleroderma occurred on the fourth day and finally he expired by DIC (Disseminated intravascular coagulation) on the sixth day.

#### 13. Case 12

The 30-week-old female neonate from twin birth as a result of normal vaginal delivery with a birth weight of 1540 gr and an Apgar score of 5–8. Her mother with symptoms of fever and chills from ten days before delivery who was followed by a positive COVID-19 test. Delivery occurred after vaginal bleeding. The neonate was admitted at birth due to severe respiratory distress in accordance with health protocols. The neonate was intubated and surfactant was inserted to endotracheal tube on first hour of life. 17 hours later she was extubated and then was treated by NIPPV. The antibiotic treatment was started and the COVID-19 test was sent 24 hours after birth, which was positive. From the third day of birth, respiratory distress intensified and the neonate was intubated again. Patchy infiltration was seen in CXR. The involvement in the graph, which was in the form of a grand glass facade and reticular infiltration, was changed to multiple patchy infiltrations. 30 hours later, the neonate was extubated again to NIPPV. She received a dose of IVIG and inhaled budesonide for a period of 5 days. COVID-19 PCR test was negative 14 days after the first test. Finally, the neonate was discharged after 27 days without the need for oxygen and under complete oral feeding.

#### 14. Case 13

The 20-day-old female neonate as a result of normal vaginal delivery weighing 3800 gr and an Apgar score of 9–10 was hospitalized by poor feeding. The antibiotic treatment was started and the sepsis workup was done. Despite the neonate had no symptoms other than poor feeding, Patchy infiltration and grand glass pattern were reported in the chest x-ray. Oxygen saturation was 96% in room air. Due to lung involvement, a COVID-19 throat test was sent which was positive. The neonate had no suspected contact history. She had a negative CRP test and a normal blood cell count. Blood, urine and CSF cultures were negative. The neonate was discharged after 5 days.

#### 15. Case 14

The 16-day-old male neonate as a result of normal vaginal delivery with a birth weight of 3450 gr and an Apgar score of 8–10 was hospitalized following cough. The respiratory rate was 56 per minute and the neonate had no respiratory distress, grunting or

retraction. Oxygen saturation was 91% in room air. The neonate had a history of contact with a person with COVID-19 at home (except parents) in the days before hospitalization. COVID-19 pharyngeal PCR test was positive. Lung scans were normal and blood cultures were negative. The neonate was discharged after 5 days.

#### 16. Case 15

The 17-day-old male neonate as a result of normal vaginal delivery with a birth weight of 3200 gr and an Apgar score of 8–10 was hospitalized following 2 days of fever and poor-feeding. There was no respiratory distress and no need for oxygen. The neonate had CRP 3+ and ESR (erythrocyte sedimentation rate) 71. Fetal ultrasound reported left kidney hydronephrosis, and 17-day-old ultrasound reported left kidney hydronephrosis with a pelvic AP (anteroposterior) diameter 14 mm. Urine samples were sent and antibiotic therapy started. Due to the contact history of the person with COVID-19, this test was sent which was positive. Blood and urine cultures were negative. The neonate was discharged after 14 days of antibiotic treatment and negative CRP test.

#### 17. Case 16

The male term neonate as a result of normal vaginal delivery with a birth weight of 3060 gr with tachypnea and respiratory distress was hospitalized 26 hours after birth. In room air, oxygen saturation was 88%. Due to respiratory distress and decreased oxygen saturation, treatment with NCPAP started. He had CRP 3+ and lung involvement in reticular infiltration and peribronchial cuffing. COVID-19 PCR test was sent for neonate and his mother. The mother was asymptomatic but both the mother and neonate throat swab test were positive. The neonate received NCPAP treatment with antibiotics and systemic steroids (dexamethasone) under isolated conditions. The neonate was weaning from the NCPAP after 72 hours and had O<sub>2</sub> therapy with oxyhood for 4 days. The second test was sent 7 days after the first one, which was negative. Finally, the neonate was discharged after 10 days.

#### 18. Case 17

The 2 day old male neonate was delivered by cesarean section weighing 4050 gr was hospitalized due to fever, cough, respiratory distress, subcostal retraction with fine rales hearing on the right side of the lung. He had no history of suspicious contact with a person with COVID-19. In room air, oxygen saturation was 89% and under the oxyhood with 5 L/min, oxygen saturation reached 95%. The antibiotic treatment was started and a COVID-19 PCR test was sent which was positive. Lung involvement was seen as a reticular infiltration especially on the right side. CRP test and blood culture were negative. The neonate was separated from oxygen after 48 hours and discharged after 7 days.

#### 19. Discussion

In this study, 17 neonates hospitalized in two hospitals in Iran who were diagnosed with COVID-19 with positive throat PCR test are examined. 7 neonates with a history of maternal COVID-19 infection were admitted to the neonatal intensive care unit immediately after birth and had a positive COVID-19 PCR test in the first 48 hours of birth. The four of them were born preterm under 31 weeks, and 3 of them were over 37 weeks. In the current case report, the increased risk of preterm delivery following COVID-19 infection cannot be judged by the number of neonates.

In some literature like Cavalcante de melo et al. study, no significant relationship was found between maternal COVID-19 infection and preterm delivery, however in Taghavi et al. study, the risk of preterm birth in neonates who were born of affected mothers was reported double [14].

One neonate due to respiratory symptoms was transferred from the nursing care ward to the neonatal intensive care on the second day of birth, and the other 9 neonates were admitted to the hospital mostly between 9 and 18 days old after initial discharge. In 9 neonates, the mother was infected, two twin neonates with symptoms onset at 18 days of age, only the father was infected, and in cases with no infection of any parents, there was a history of neonate contact with the infected person at home. Due to the possibility of transmitting the disease from other family members to the neonate, it is essential to observe hygienic principles (hand and face washing, daily disinfection of baby items with 75% alcohol, disinfection of glass heads and pacifiers with high heat and proper ventilation) to prevent neonate infection [15]. Nine neonates were boys and the others were girls, and gender did not seem to be effective. Only one 31-week-old SGA was born and the other neonates were AGA.

In neonates who admitted at the birth, twin neonates were 30 weeks old with an Apgar score of less than 5 and needed resuscitation at birth, and the rest of them had an Apgar score of more than 8.

Five deliveries were performed by cesarean section, of which only one was performed due to pregnancy complications and the others by selective cesarean section. Among the complications of pregnancy, there was one case of preeclampsia, one gestational diabetes, and one hypothyroidism. Among 9 mothers with COVID-19 nasopharyngeal PCR test, the main symptom was fever, headache and olfactory dysfunction. In addition to fever and headache, one mother had a cough and shortness of breath, who was admitted to the ICU 12 hours after delivery due to respiratory symptoms and subjected to non-invasive mechanical ventilation. In HRCT of this mother reported patchy infiltration, ground glass opacity, and pleural effusion. HRCT was performed for 3 other mothers which reported infiltration and ground glass opacity patchy in all conflicts. In other cases, HRCT was not performed for the mother.

In the assessment of clinical symptoms, the most common symptom in neonates admitted between 9 and 18 days of age was fever (AT>37.8). Cough was reported in 9 of neonates and respiratory symptoms were not predominant and all had oxygen saturation above 91%. Based on Bernardo et al. study, most affected neonates have good clinical conditions [15]. An 18 days old neonate with gestational age of 36-week-old was asymptomatic and admitted only for the hospitalization of his other twin so this may raises the

possibility of asymptomatic infection in neonates. In a 16-day-old neonate, the only complaint at the time of admission was Poor-feeding. Neurological symptoms such as seizures were not seen in neonates and only 2 neonates had hypotension in addition to fever. All neonates had normal heart rate and blood pressure. These neonates had no gastrointestinal or skin symptoms.

In neonates who admitted at the birth, respiratory distress was main symptoms and cyanosis, tachypnea, and retraction were seen. Oxygen saturation was between 78% and 89%. In preterm births, steroids were injected before delivery in all cases. None of these hospitalized neonates had fever at birth. SARA-COV-2 virus by attacking to the AT-II cells reduces the production of surfactant, therefore the respiratory symptoms of Acute respiratory distress syndrome (ARDS) in COVID-19 infection are similar to those of neonatal respiratory distress syndrome (RDS) in neonates [16]. So, due to the severity of clinical symptoms and pulmonary involvement in 6 of these neonates, intra tracheal administer of surfactant was performed.

In neonates under 32 weeks of age, apnea attacks were reported within 24 hours of birth, which was treated with caffeine citrate. Gastrointestinal symptoms, including vomiting and abdominal distention, have been reported in studies of the symptoms of COVID -19 infection [15] abdominal distention and vomiting were seen in 3 of our patients. In the hospitalized neonatal group at the birth time, neurological symptoms were mainly seen as seizures in 4 neonates. NEC occur in one of 32 preterm neonates.

Leukopenia and lymphopenia were not reported in laboratory tests in any neonate. Only one neonate was CRP positive at birth, and three neonates aged 2, 9, and 17days old had positive CRP test. In other neonates, the initial CRP was negative.

In twin neonates with 30 weeks old, CRP was positive at 3rd day of admission following exacerbation of respiratory symptoms, and in one of the twins, thrombocytopenia occurred following sepsis and NEC symptoms. Blood cultures were negative in all neonates.

Lung radiographs of 8 neonates were normal, while radiographs of other patients were mostly reported as Grand glass-Patchy infiltration, which is consistent with existing studies [17]. The pneumothorax Occurred in a neonate during hospitalization and under mechanical ventilation.

Throat PCR was performed in neonates admitted at birth 24 hours after admission, and for those neonates who were hospitalized between 9 and 18 days of age due to clinical signs and history of contact with a person with Covid19, a sample was sent. All cases of the first PCR test were positive. The second PCR test was repeated in 3 neonates 25 days after the first test, and in one neonate 7 days later, all of which were negative. In one of the 30-week-old twins, due to the persistence of respiratory symptoms, the test was performed 3 times with 15-day intervals, the first and second times being positive and finally the third time being negative.

As a matter of fact, neonatal treatment was mainly supportive. All neonates received antibiotics. Two neonates with severe respiratory distress were treated with systemic steroids. 9 neonates did not need respiratory support and were in room air. 5 neonates subjected to invasive mechanical ventilation due to severe respiratory symptoms, but most of the respiratory treatment was non-invasive.

In this study, only one premature neonate died of severe respiratory distress, pneumothorax, and NEC, and the others were discharged, fortunately.

## 20. Conclusion

The results showed that the symptoms and severity of the disease in neonates are milder than adults. The possibility of vertical transmission due to the onset of symptoms immediately after birth is still present in some neonates of affected mothers.

## Patient consent

Consent to publish the Case report was not obtained.

## Funding

The authors gratefully acknowledge the financial support given by the Neyshabur University of Medical Sciences, Neyshabur, Iran (Grant Number: 9901222) (Ethics Code: IR.NUMS.REC.1400.014).

## Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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