

# Case-report of a Neonate with COVID-19 Infection: How he Has been Infected?

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## ABSTRACT

**Background:** It has been indicated that pregnant women and neonates are susceptible to COVID-19 infection. Nevertheless, the unresolved question is about the possibility of COVID-19 infection in neonates born to COVID-19 mothers. The present study aimed to assess the routes through which neonates may be infected with the virus: vertically or nosocomially.

**Case report:** This study reports the case of a neonate with COVID-19 infection who became symptomatic 30 h after birth. His pharyngeal swab specimen was reported as positive by real-time reverse transcription-polymerase chain reaction (RT-PCR). It happened while the newborn's mother was tested for the COVID-19 twice, and she received negative results both times.

**Conclusion:** According to the incubation period of COVID-19 which is at least 1 day, the possibility of nosocomial transmission is less than other cases reported so far. Moreover, the mother had no COVID-19 symptoms during the last month of delivery. Further clinical research is necessary to determine the routes of maternal transmission of COVID-19 to neonates.

**Keywords:** COVID-19, Neonate, Nosocomial infection, Vertical transmission

## Introduction

The World Health Organization (WHO) office in China reported cases of pneumonia with an unidentified cause on 31 December 2019. At the meeting of the Emergency Committee of the WHO on 30 January, the novel COVID-19 2019 epidemic was declared as a Public Health Emergency of International Concern (PHEIC). The first case of COVID-19 in Iran was reported on February 19, 2020, in Qom province, 150 km south of Tehran. Markazi province, 140 km west of Qom, the setting of the current study, was introduced as the second place in which a case of COVID-19 was reported (1, 2).

Pregnant women like other population groups are susceptible to COVID-19. The doubts cast on

the pathogenesis of COVID-19 in children and neonates were resolved after the gradual emergence of new cases among them. Nonetheless, the unresolved question in this regard is about the possibility of COVID-19 infection in neonates born to COVID-19 mothers (1). There is a dearth of evidence on COVID-19 infection during pregnancy; therefore, the amount of damage to pregnant women and neonates, as well as transmission mechanisms from mother to neonate is not well-recognized. The vertical transmission of the SARS COV-2 virus is open to disagreement, casting doubt on its possibility and the extent of inflicted damage to pregnant mothers and their newborns; therefore, further

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research is needed to resolve these uncertainties. The present study reports the case of a neonate with COVID-19 infection who became symptomatic 30 h after birth, and his pharyngeal swab specimen was positive by real-time reverse-transcription polymerase chain reaction (RT-PCR). Now, the question is how he acquired the virus: vertically or nosocomially?

### Case report

At 10:00 AM on March 28, 2020, on the second visit of healthy neonates who were present in the surgical ward of Taleghani hospital in Arak (medical center of gynecology and neonatal in Markazi province of Iran), a 30-hour-old neonate was transferred to the neonatal ward for fever check. His primary vital signs were T:37.6 axillary, PR:135, and RR:42. With the possibility of hyperthermia, his temperature was checked again 1 h later after the removal of his clothes and placement at normal room temperature. The temperature was recorded at 37.8°C; therefore, due to high fever and R/O of sepsis, he was hospitalized in an isolated ward. The neonate was normal in the examination, without any grunting, hyperpnea, nasal flaring, and retraction. His skin was yellow, the result of the bilirubin test was Bili total: 13.3 and direct: 0.46mg/dl; consequently, he was placed under phototherapy. His G6PD was deficient.

Regarding maternal medical history, she was a 37-year-old primigravid woman with the gestational age of 40w+4d. On March 26, 2020, she had a ruptured membrane and visited Taleghani Hospital, and after 17 h of waiting in the delivery room, she was transferred to the operating room due to full arrest, and cesarean delivery was performed under sterile conditions. She delivered a boy weighing 3,400 g, and Apgar scores at 1st and 5th min were 9 and 10, respectively.

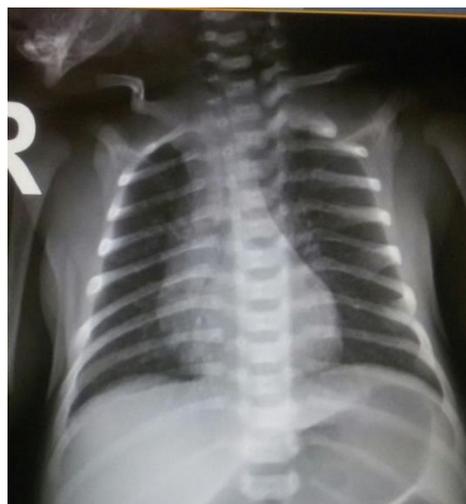
During the initial visit, the neonate was healthy with normal reflexes and vital signs, without any abnormalities. On the second visit on March 28, after his admission to the isolation ward, a chest x-ray and a blood culture test were performed. Antibiotics (clindamycin 54 mg every 8 h and cefotaxime 50 g every 12 h, intravenously) were started for the neonate. Due to the lung involvement with reticular pattern in chest x-ray, a pharyngeal sampling for COVID-19RT-PCR was requested (Figure 1).

In the first hours after hospitalization, his body temperature was 38.2°C. The O<sub>2</sub> saturation by pulse oximeter was above 92%, and his ABG was:

pH =7.36, PCO<sub>2</sub>=30.9 mmHg, HCO<sub>3</sub>=17.3mmol/l, BE= -5.8mmol/l. The neonate was in good mental condition with normal reflexes. He was fed on breast milk without skin contact and observing safety measures. He just vomited once on the first day of admission, and he improved after gastric lavage with 20cc normal saline. The temperature chart was also performed. In the initial tests, the important lab data were as follows: CRP = 1+, LDH = 1054 (NL=<1732), WBC = 10.1\*10<sup>3</sup>/μl (NL = 4-12\*10<sup>3</sup>/μl), and ALC = 3232/μl. Complete lab data is presented in Table 1.

On 30 March 2020, the COVID-19 PCR test result of the neonate was positive. Immediately after the diagnosis of neonatal COVID-19, throat PCR was taken from the mother for SARS-CoV-2, which was negative. The newborn's mother was examined by an infectious diseases specialist. She had a cough a few days before delivery which improved; however, she had no fever, dyspnea, sore throat, headache, myalgia, chills, and gastrointestinal symptoms. Only once, she complained of a mild fever; nonetheless, it was not clinically detected. Moreover, she had no history of these symptoms in the recent weeks and no history of contact with a COVID-19 patient. She was tested again after 24 h by RT-PCR (March 30 and 31), and both were negative. We also took an HRCT (High-Resolution Computed Tomography) from the mother which was good without lung parenchymal abnormality.

The companions who visited the neonate after birth were his aunt and uncles' wife. The aunt was tested negative for COVID-19; however, his uncle's wife did not cooperate to undergo the test. After



**Figure 1.** Chest radiograph of the newborn, obtained on 28 March 2020, demonstrating mild patchy infiltration in lung parenchyma with no abnormalities in the heart and palate

announcing a positive PCR test result for COVID-19, the neonate received antiviral medication and antibiotics since the fourth day after birth (Oseltamivir 10 mg orally every on a daily basis for 5 days, Vancomycin 34 mg every 8 h, and Cefotaxime 170mg intravenously every 12 h). Additional performed tests in subsequent series tests were CRP=3 +, D-dimer = 1339 (NL=<500), CPK=498 U/L, LDH=899, PT=14.4 sec(NL: 12-14), WBC=5.5\*10<sup>3</sup>/μl, and Trop=1.6 ng/L (NL=<19). The neonate's troponin was repeated after 48 h, and after the high result for the second time (Trop =31.3) and the high result of D-dimer = 1339 and for the second time 786, In terms of R/O of subclinical myocarditis, a pediatric cardiologist visit and echocardiography were performed; however, there was no evidence of valvular, wall defects, and EF = 67%.

On April 1, the fifth day of hospitalization, the neonate was tachypnea on the examination (respiratory rate:60). He had a mild retraction without any grunting or nasal flaring. Due to a drop in O<sub>2</sub> saturation (O<sub>2</sub>sat<85%), 5 lit/min oxygen with hood was placed for him, which resulted in the O<sub>2</sub>sat above 92%. Moreover, in recording the vital sign, his temperature

fluctuations were also recorded (With the highest temperature of 38.5). Following the symptoms, the neonate was referred for pediatric infectious disease counseling, which required HR-CT and continuation of previous treatment. A Chest CT scan was performed on 4 April, showing signs of infection in the left lung and the possibility of viral pneumonia.

On 5 April, his blood culture was positive for methicillin-resistant staphylococcus epidermidis that was sensitive to Vancomycin and resistant to Cefotaxime, Cefalotone, Ceftizoxime, Ciprofloxacin, Clotrimazole, Erythromycin, and Penicillin. Therefore, the antibiotic treatment was changed from Cefotaxime to Meropenem (65mg intravenously every 8 h). That day, an ABG was requested which was reported as: pH = 7.42, PCO<sub>2</sub>=27.2 mmHg, HCO<sub>3</sub>=17.3mmol/l, BE= -4.6mmol/l. The blood culture was repeated and was negative on 11 April.

On 14 April and again 24 h later on 15 April, the neonate's RT-PCR test was performed, and both of them negative. The latest CRP test was also negative. All of the neonate's examinations were normal, and he did not need oxygen to maintain o<sub>2</sub>sat>92%. The newborn was discharged on 15

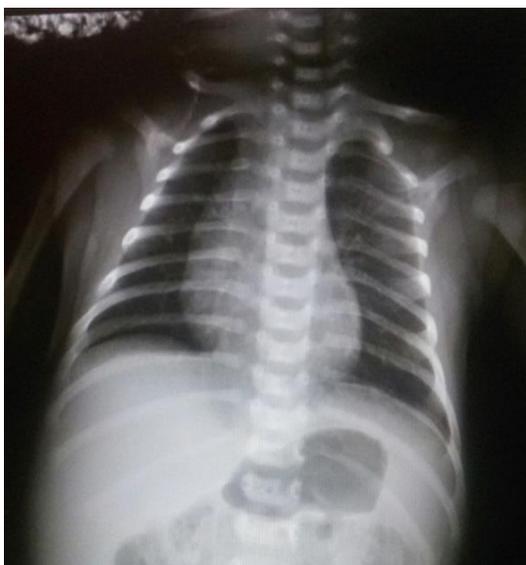
**Table 1.** Laboratory data of the newborn, obtained on 28 March 2020

	3/28/20 3rd day of birth	3/30/20 5th day of birth	3/31/20 6th day of birth	4/2/20 8th day of birth	4/5/20 11th day of birth	4/7/20 13th day of birth	4/11/20 17th day of birth	4/14/20 20th day of birth	4/15/20 21th day of birth
WBC (*10 <sup>3</sup> /μl)	10.1		7.2	5.5	5.6				
Neutrophil	62%		69%	12%	40%				
Lymphocyte	32%		23%	55%	48%				
Hgb (gr/dl)	14.2		11.3	13.6	12.8				
Plt(*10 <sup>3</sup> /μl)	184		255	254	387				
CRP	1+	Weakly +	3+		Negative			Negative	
ESR (mm/h)	3								
Blood Culture	Negative				Positive	Negative			
Bili T (mg/dl)	13.3	5.87	7.39		6		3.3		
Bili D (mg/dl)	0.48	0.35	0.34		0.4		0.4		
BG/Rh	A+								
Retic (%of RBCs)	2								
Coombs D	Negative								
G6PD	deficient								
LDH	1054	899			748				
ALT(U/L)		22							
AST(U/L)		28							
Cr (mg/dl)		0.8			0.45				
Urea (mg/dl)		28			32				
CPK(U/L)		448							
Trop(ng/L)		2.5			41.6	31.3			
BS (mg/dl)		115							
Na (mEq/L)		134							
K (mEq/L)		4.6							
Ca (mg/dl)		9.3							
RT-PCR		Positive						Negative	Negative
D-Dimer			1339		786				
PT (sec)			14.4		14				
PTT(sec)			31		31				
INR			1.1		1.1				



**Figure 2.** Chest computed tomography of the newborn, obtained on 4 April 2020, showing signs of infection in the left lung, indicating the possibility of viral pneumonia

April (19th day of hospitalization) at a good general condition, without fever, O<sub>2</sub>sat = 95% without supplemental oxygen, as well as clear lung in hearing and normal graphics (Figures 2 and 3).



**Figure 3.** Chest radiograph of the newborn obtained on 15 April 2020, showing no abnormalities in the lung and heart

## Discussion

There is a dearth of studies on mother-to-child vertical transmission of viruses, especially COVID-19. In a study on a mother with COVID-19 confirmed infection, the neonate's fever was also confirmed five days after birth. In another study, the infection in a neonate born to an infected mother was silent and diagnosed 36 h after birth by the viral nucleic acid test (3, 4). In both of the mentioned studies, there was considerable controversy over vertical transmission. Vertical mother-to-child transmission has been reported in other respiratory viruses, such as H1N1 and respiratory syncytial virus (5).

In the current study, we reported the first case of neonatal COVID-19 infection that was symptomatic in the first 30 h after birth. The clinical presentations were fever, hyperbilirubinemia, and a decrease in blood oxygen saturation; however, the prognosis was good. The possibility of intrauterine vertical transmission, in this case, remained controversial. The RT-PCR of the mother's pharyngeal swab specimen for COVID-19 was reported as negative and did not support the diagnosis of intrauterine transmission; nonetheless, the possibility of

vertical intrauterine transmission of COVID-19 was not ruled out. Due to the high false-negative rate of viral tests, the patients may experience false-negative RT-PCR results. Numerous studies, including Ai et al. (41%), Fang et al. (29%), Luo et al (29%), and Yang et al.(76%), considered different false-negative percentages obtained by RT-PCR at initial presentation for throat swabs, compared to 43% for nasal swabs (43%) (6-8).

The quality of the kit, the collected sample, and the performance of the test are effective in false-negative results. The RT-PCR that is extensively used in diagnostic virology has resulted in a few false-positive outcomes (9). Therefore, we did two PCR COVID-19 tests for the mother, both of which were negative, and due to the history of maternal coughs a few days before delivery, HR-CT CHEST was performed for the mother, and the result was normal. Furthermore, the neonate's PCR sample was repeated 24 h after the first positive sample, which was reported positive again.

The mother did not have any dyspnea, headache, myalgia, or any other discomfort, such as diarrhea, nausea, or vomiting during the last month before delivery. Her vital signs were stable with a blood oxygen saturation of 97%. Her only complaint was dry coughs a few days before delivery without any fever during admission in the labor room. However, the possibility of mother-to-child transmission of COVID-19 cannot be ruled out since the symptoms of the neonate's illness (fever) had appeared too soon. It is noteworthy that the newborn may have been nosocomially infected; therefore, we immediately collected a pharyngeal swab specimen from the newborn's aunt who was in contact with the neonate. It was reported negative too. The low possibility of maternal transmission of COVID-19 to neonates and nosocomial infection are indicative of the necessity to observe Primary Health Care (PHC) principles to avoid unknown infection (10, 11).

The present study has some limitations. It was mentioned that the mother's PCR was negative twice; therefore, it seems necessary to take samples of amniotic fluid or the neonate's placenta for PCR COVID-19 to more accurately judge the vertical transmission of the virus. Moreover, it was useful to perform the neonate's contact tracing among the nurses and hospital employees and also the neonate's family who had contact with the neonate on the first day of birth. The aforementioned issues can be proposed as the limitations of the present study.

## Conclusion

The present study indicated that a newborn was COVID-19 symptomatic at 30 h after birth. According to the incubation period of COVID-19 which is at least 1 day, the possibility of nosocomial transmission is less than other cases reported so far. Pregnant women and their newborns run a high risk of developing a severe infection during the outbreak of COVID-19. Further clinical research is necessary on the treatment for COVID-19 if we want to understand the potential risks of maternal transmission of the virus to neonates. These types of investigations are effective in improving pregnancy care and saving the lives of pregnant mothers and their neonates in the current and future epidemics.

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## Conflicts of interest

The authors declare no conflict of interest regarding the publication of the present study.

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