



# A Case Report of Late-Onset Neonatal Meningitis Caused by SARS-CoV-2

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## Abstract

**Introduction:** Central nervous system involvement by SARS-CoV-19 appears to be very rare in neonates. We report a case of viral meningitis in a neonate admitted to Kerman Afzalipour Hospital in Southeastern Iran.

**Case Presentation:** The patient was a 15-day-old neonate who presented with lethargy, fever, and poor feeding the day before admission. After the initial evaluation and experimental treatment, viral meningitis was diagnosed with SARS-CoV-19 by polymerase chain reaction (PCR) analysis of cerebrospinal fluid. Empirical treatment was done with antibiotics and supportive care. After viral meningitis was confirmed, the antibiotics were discontinued. In a follow-up two weeks later, the neonate had a good condition with no particular problem.

**Conclusions:** This report is a case of SARS-CoV-2 meningitis in a neonate. Therefore, if there is epidemiological evidence, the central nervous system involvement due to this virus should also be considered in neonates.

**Keywords:** Neonate, Meningitis, SARS-CoV-2

## 1. Introduction

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that was unknown to humans before December 2019, seems to affect all age groups, including infants (1). In the beginning, the emphasis was more on the symptoms of the respiratory system, but later it was realized that the virus could also affect other organs, including the brain. Besides, SARS-CoV-2 could invade the brain and cause inflammation and neurological disease (2-4). Viral meningitis is an inflammation of the brain membrane that is usually caused by enteroviruses. Other less common viral agents include herpes zoster, mumps, and influenza virus (5). Here, we report a 15-day-old neonate with late-onset meningitis by SARS-CoV-2 after obtaining informed consent of the parents for publication.

## 2. Case Presentation

A 15-day-old neonate was admitted to the Neonatal Intensive Care Unit (NICU) due to fever, lethargy, jaundice, and poor feeding for 48 h. The parents did not mention any history of the neonate's cough or rhinorrhea. His parents were asymptomatic, but the patient's brother and sister had cough, fever, and malaise. On physical examination,

the neonate was lethargic without any other neurologic signs. The heart rate and respiratory rate were 167/min and 58/min, respectively. Oxygen saturation was 95% without receiving oxygen, and the core temperature was 38.5°C.

The patient was born at 39 weeks of gestation and had a normal Apgar score of one and five minutes. He was born by normal vaginal delivery to a 35-year-old multi-gravida woman with an unremarkable antenatal period. The neonate was normal at well-baby visits. The mother took full prenatal care during pregnancy.

Sepsis screening and all related lab tests were done. An arterial blood gas revealed a metabolic acidosis (HCO<sub>3</sub> 16 mmol/dL (reference range 22 - 26)). Total serum bilirubin was 15.2 μg/dL. He did not need phototherapy. Cerebrospinal fluid (CSF) analysis revealed an elevated white cell count of 520 × 10<sup>6</sup> cells/L. The brain sonography was normal. Chest X-ray had no pathological features. Due to the pandemic of COVID-19 and the history of upper respiratory tract infection in his siblings, the patient underwent nasopharynx polymerase chain reaction (PCR) test for COVID-19.

Despite the cerebrospinal fluid profile according to age, the empirical treatment of bacterial meningitis was started after obtaining blood, urine, and CSF bacterial cultures. His general condition improved after the empirical treatment and supportive care.

The result of the patient's initial CSF culture for bacteria was negative. The PCR test results of the nasopharyngeal sample were positive for SARS-CoV-2. Some part of the CSF sample was available in the laboratory, and we decided to check SARS-CoV-2 on it. Antibiotics discontinued after blood, CSF, and urine cultures became negative and the general condition improved. The result of CSF PCR was also positive for SARS-CoV-2. After discontinuing the antibiotic, the patient was monitored for three days and then discharged in good general condition. In a follow-up two weeks later, the neonate had a good condition with no particular problem.

### 3. Discussion

As the COVID-19 pandemic continues, certain trends are emerging. In the early months of the pandemic, while the number of cases and deaths in adults continued to rise, the disease did not appear to affect infants and children as much as adults (6). Later on, the multisystem inflammatory syndrome was described in children, which could affect all organs, including the brain (7). Meningitis has been implicated in previous reports, although in those cases, it was not in infancy (8, 9).

In general, meningitis is more common in infants under one year of age, followed by in children between five and 10 years (5). This study is a case report of the involvement of the brain and surrounding membranes with COVID-19 in a neonate whose primarily signs and symptoms were consistent with bacterial meningitis. This leads to the theory that the coronavirus also can attack the brain membrane in neonates. This hypothesis may be conceptually appealing, but the data supporting the idea that SARS-CoV-2 can infect the peripheral and central nervous systems are limited (10).

In a study of 214 adults with COVID-19, 36.4% of them had neurological involvement, besides symptoms such as loss of consciousness and encephalopathy (8). Therefore, at least so far, COVID-19 does not appear to cause neurological involvement in infants, and the risk of brain involvement is estimated less in this age group. These observations do not exclude the potential neonatal brain involvement in COVID-19 and long-term medical, neurodevelopmental, and psychosocial consequences of the disease. As time goes on, a wider range of neurological manifestations in infants is likely to emerge.

#### 3.1. Conclusions

This report is a case of SARS-CoV-2 meningitis in a neonate. The virus makes a wide range of clinical symptoms. New symptoms sometimes interfere with diagnosis

and may affect treatment. Therefore, if there is epidemiological evidence, the central nervous system involvement due to this virus should also be considered in neonates. The lesson to be learned from this case report is that the new coronavirus may be the cause of neonatal meningitis. We did not check blood PCR for SARS-CoV-2, and this is one of the limitations of this report.

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### Footnotes

**Authors' Contribution:** Study concept and design: Zahra Jamali. Acquisition of data: Fatemeh Dehghani. Study supervision: Ali Hosseininiasab.

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