A Case Report of Neonatal Acute Respiratory Failure Due to SARS-CoV-2

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Key Words

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Introduction

The etiological agent of 2019 coronavirus disease (COVID-19), severe acute respiratory syndrome coronavirus–2 (SARS-CoV-2), emerged December 2019 in Wuhan, Hubei Province, China [1]. SARS-CoV-2 has spread globally and the World Health Organization has declared a global pandemic. More than two million cases have been identified worldwide with >600,000 cases in the United States alone. Numerous case reports and features of SARS-CoV-2 infection in adults have been reported. Common symptoms include fever, myalgia, dry cough, with progression to pneumonia most often seen in patients with underlying conditions and the elderly [1]. In contrast, there is a paucity of data on clinical presentation and course in pediatric SARS-CoV-2 infections, particularly among infants and neonates. The Chinese Center for Disease Control and Prevention reported that children accounted for <1% of 72,314 COVID-19 cases and pediatric disease was most often mild [1]. Additionally, the U.S. Centers for Disease Control and Prevention (CDC) reported 1.7% of 150,000 COVID-19 cases in the U.S. through April 2nd, 2020 occurred in patients <18 years old, with few requiring hospitalization [2]. Here we report a case of COVID-19 in a 10-day old infant with no underlying health conditions who presented with acute respiratory failure and discuss clinical presentation, treatment course, clinical outcomes, and testing of alternative sample types for presence of SARS-CoV-2.

Case Presentation

On April 1st, 2020 a 10-day old male infant born at 39 weeks gestation via normal spontaneous vaginal delivery presented to the Emergency Department (ED) of a California hospital with increased nasal secretion and labored breathing approximately one week after exposure to his grandmother and older sibling who experienced upper respiratory symptoms the week prior. No other family members reported being symptomatic. A capillary blood gas (CBG) revealed a pH of 7.36 and partial pressure of

carbon dioxide (PCO2) and oxygen (PO2) of 39 and 53 mmHg, respectively; serum lactic acid was 4.1 mmol/L. The patient was treated with oxygen by nasal cannula (NC); oxygen saturation (SpO2) on 2 L/min was 90% and increased work of breathing (WOB) was noted, therefore he was escalated to 5 L/min high flow (HF) NC. Taken together these findings were consistent with hypoxic respiratory failure. Blood cultures were collected, and the patient was placed empirically on intravenous (IV) ampicillin and gentamicin. He was immediately transferred to the Pediatric Intensive Care Unit (PICU) at Children's Hospital of Los Angeles (CHLA) for higher level care. Chest radiograph from the outside hospital demonstrated bilateral ground glass opacities with no focal consolidations suggestive of viral etiology (Figure 1). On admission to the PICU, increased nasal flaring and secretions, increased WOB, subcostal retractions, and lethargy were noted. He was afebrile with no cough. The patient was continued on HFNC, SpO2 was monitored hourly and kept above 90%. His respiratory rate (RR) varied between 20-40 breaths/minute. As he demonstrated a clinical improvement with SpO2 maintained at 99% on 5 L/min HFNC, he was weaned to 0.5 L/min NC oxygen within 24 hours.

Overall, blood tests were unremarkable with slightly low mean corpuscular volume and mean corpuscular hemoglobin (Supplemental Table 1). A nasopharyngeal (NP) swab was collected and SARS-CoV-2 RNA was detected by reverse transcriptase real-time polymerase chain reaction (RT-PCR) using the CDC Emergency Use Authorization SARS-CoV-2 RT-PCR protocol and reported within 12 hours. Cycle threshold (Ct) values of 21.9 and 21.7 for neuraminidase gene targets 1 and 2 (N1, N2) detected by the assay, respectively. A FilmArray® Respiratory viral panel (FA-RVP) (BioFire Diagnostics, Salt Lake City, UT) performed on the same specimen was negative, ruling out other viral etiologies or viral co-infections (Supplemental Table 1). Additional SARS-CoV-2 RT-PCR testing was performed on blood and a nares swab, SARS-CoV-2 was detected from nares only. No antivirals were initiated. No other family members were tested for SARS-CoV-2 at this time.

The patient remained stable on 0.5 L/min NC oxygen and weaned to 0.25 L/min later the same day. Normal appetite and fluid intake were noted, along with no apparent respiratory distress. On day three of admission, the patient was successfully weaned off NC oxygen to room air. Blood culture from the outside hospital grew *Staphylococcus epidermidis* which was deemed a contaminant. The patient was stable and afebrile on day four of admission and was discharged.

The patient returned to CHLA five days later presenting to the ED with increased nasal congestion, subcostal retractions, and decreased feeding. He was afebrile with no other symptoms, SpO2 was 100%, CBG PCO2 and PO2 were slightly abnormal measuring 46 and 43 mmHg, respectively. The mother, who was previously asymptomatic, was noted to have nasal congestion at this time. NP swabs from both the patient and the mother tested positive for SARS-CoV-2. No other family members were tested. The patient's NP swab exhibited Ct values of 31.1 and 34.8 for N1 and N2 respectively, qualitatively indicating a lower viral load than the first NP specimen tested five days prior. The patient, at this time, also tested positive for human metapneumovirus by FA-RVP. On the same day, SARS-CoV-2 was detected in stool but nares swab was negative. The patient was monitored overnight, no investigational therapies were initiated, and his respiratory symptoms resolved; he was stable on room air and discharged the next morning.

Discussion

Here we present a confirmed COVID-19 case in a 10-day old full-term male infant with no known underlying medical conditions who was hospitalized with acute respiratory failure for approximately three days. The patient was managed with HFNC oxygen and did not require invasive mechanical ventilation. Previous pediatric COVID-19 case reports indicate that patients who required mechanical

ventilation had preexisting conditions [3]. To date, few cases of COVID-19 in newborns have been published. A case report on a confirmed SARS-CoV-2 positive pregnant woman and her newborn showed the child tested SARS-CoV-2 positive 36 hours after birth, the child was afebrile and stable [4]. No treatment was needed despite presence of a high-density nodular shadow in the right lung [4]. Similarly, a 15 day-old infant admitted for fever, lethargy, cutaneous mottling, respiratory distress, and cough was diagnosed with COVID-19; chest x-ray was normal and supportive care was administered [5].

Several pediatric case series have been reported with the majority from China. A retrospective analysis of clinical data and chest CT images for nine children diagnosed with COVID-19 showed five were asymptomatic, four had fever, two had cough, and one had rhinorrhea; CT scans revealed ground glass opacities with consolidation (n=6), nodular lesions (n=6), or patchy lesions (n=7) [6]. Another report of 10 children indicated no patients sought medical care directly but were tested for SARS-CoV-2 due to exposure history and hospitalized only after testing positive [7]. Upon evaluation, most patients were febrile but cough, sore throat, nasal congestion, rhinorrhea, and diarrhea were less common, additionally two were asymptomatic [7]. Taken together, infants and young children tend to range from asymptomatic to mild/moderate clinical symptoms, but as described in our case, can present with acute respiratory failure requiring non-invasive oxygen therapy. Additionally, the epidemiological history of COVID-19 positive children is often linked to family cluster and exposure to sick contacts [3,6]. This was also the case for our patient who lives with seven relatives and presented following exposure to ill family members at home.

Detection of SARS-CoV-2 from alternate sources including stool/rectal swabs, alternative respiratory samples other than NP swabs, urine, and blood have been documented in a small subset of studies.

Here we report two separate NP swabs from the same patient collected approximately eight days apart, both of which tested positive for SARS-CoV-2 via RT-PCR. Despite an initial positive nares swab, subsequent sampling upon readmission was negative indicating lower clinical sensitivity compared to NP swab. However, SARS-CoV-2 was detected from fresh stool collected approximately eight days after initial presentation. Interestingly, fecal viral shedding was reported in children up to 27 days after admission, while paired NP specimens from the same patients tested negative [7]. Intermittent and prolonged SARS-CoV-2 shedding were reported in a child with two consecutive negative tests for both NP and rectal swabs, but was positive by rectal swab six days later [7]. Current data suggests respiratory samples and stool/rectal swabs are appropriate specimen types for SARS-CoV-2 testing in pediatric patients, with stool/rectal swabs having higher potential utility for monitoring viral shedding. Overall, this case represents a unique presentation of respiratory failure due to SARS-CoV-2 in a neonatal patient and expands the clinical spectrum of pediatric COVID-19.

Conclusions

More extensive studies are needed to better understand the pediatric disease spectrum and clinical outcomes of COVID-19, particularly in newborns and young children <1-year-old. It is important for pediatricians to know COVID-19 could potentially present as respiratory failure in young children given that current clinical data indicates that children most often do not require oxygen therapy, intensive care support, and/or invasive mechanical ventilation. Pleural effusion, enlarged lymph nodes, or progression to pneumonia that occurs in critically ill adults was not seen in our patient, nor is it common in children based on other reports. Lastly, while respiratory and potentially stool specimens have high yield of SARS-CoV-2 detection in children, the prevalence of viremia appears to be low.

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Figure Legend

Figure 1. Chest radiograph showing bilateral ground glass opacities with no focal consolidations, image was obtained and provided by the outside hospital on same day patient was admitted to Children's Hospital of Los Angeles.