A Case Series of the 2019 Novel Coronavirus (SARS-CoV-2) in 3 Febrile Infants in New York

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We describe 3 febrile infants <2 months of age admitted to a large tertiary care children's hospital in New York and subsequently found to be infected with severe acute respiratory syndrome coronavirus 2. All 3 patients presented with fever, feeding difficulty, lymphopenia, and thrombocytosis on laboratory evaluation. Two of the 3 patients were found to have neutropenia, and 2 had known exposures to sick contacts. In this case series, we describe 3 of the youngest patients to be reported with severe acute respiratory syndrome coronavirus 2 in the United States.

The 2019 novel coronavirus (severe acute respiratory syndrome coronavirus 2 [SARS-CoV-2]) has spread rapidly across the globe since it was identified in January 2020. Pediatric cases have been described in China,[1–4] but the clinical characteristics of pediatric patients affected in the United States are only being described. Milder cases are reported for this population in the few published studies, although the reason for this is unknown.[5,6] Literature that describes the epidemiology, clinical features, and prognosis of SARS-CoV-2 in neonates and infants is scarce. It is suggested in 1 study that infants, although rarely affected, are vulnerable to severe manifestations.[1] As the number of pediatric cases in the United States continues to climb, there is opportunity to further describe neonatal and infantile presentations of SARS-CoV-2. Here, we describe 3 hospitalized infants <2 months of age who presented to a large tertiary care pediatric hospital and were found to be infected with SARS-CoV-2.

PATIENT 1

A 43-day-old term previously healthy boy presented to the pediatric emergency department (PED) on March 17, 2020, with the chief complaint of fever and lethargy for 1 day. Two days before, the infant developed nasal congestion. There was no report of cough, difficulty breathing, or gastrointestinal symptoms. The mother of the child reported difficulty feeding that was attributed to the infant's lethargy. A rectal temperature taken at home was noted to be 39.2°C. Emergency medical services were called, and the infant was brought to the PED.

Of note, the infant's parents and uncle had recently attended a wedding with an individual suspected to be infected with SARS-CoV-2. At the time of the infant's presentation, SARS-CoV-2 testing of multiple family members was pending. On presentation to the PED, the patient was febrile to 38.2°C and had a normal oxygen saturation. The patient was noted to be lethargic and markedly irritable and had nasal congestion. The rest of his examination was unremarkable.

Blood, urine, and cerebrospinal fluid (CSF) cultures were obtained with

abstract

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Drs Feld, Belfer, and Kabra conceptualized and designed the study, collected data, drafted the initial manuscript, obtained consents, and reviewed and revised the manuscript; Drs Rai and Moriarty collected data and reviewed and revised the manuscript; Dr Goenka collected data, revised the manuscript, and critically reviewed the manuscript for important intellectual content; Dr Barone supervised data collection, revised the manuscript, and critically reviewed the manuscript for important intellectual content; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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routine hematologic, urine, and CSF studies; the results are listed in Table 1. The patient was noted to have lymphopenia, neutropenia, and thrombocytosis. Additionally, the patient had a negative respiratory viral panel (RVP) result and a negative CSF polymerase chain reaction (PCR) panel result. SARS-CoV-2 testing was obtained because of the family's suspected exposure. The patient was admitted, and antibiotics were initiated. Blood, urine, and CSF culture results were ultimately negative, and the SARS-CoV-2 PCR test result was positive. On day 2 of admission, the patient developed mild respiratory distress with tachypnea and subcostal retractions. He did not require any additional respiratory support. The patient was discharged without complications on day 3 of admission.

PATIENT 2

A 28-day-old boy, born at 36 weeks' gestation, presented to the PED on March 20, 2020, with the chief complaint of fever, sleepiness, and poor feeding for 1 day. The patient had no associated cough, nasal congestion, rhinorrhea, or gastrointestinal symptoms. A rectal temperature was taken at home and noted to be 38.8°C. There were no known sick contacts or any known SARS-CoV-2 exposure.

On presentation to the PED, the patient was febrile to 38.5°C and had a normal oxygen saturation. The patient was noted to be lethargic but arousable, with mottled skin and prolonged capillary refill. The respiratory examination was unremarkable. Blood, urine, and CSF cultures were obtained along with routine hematologic, urine, and CSF studies; the results are listed in Table 1. The initial laboratory studies were notable for lymphopenia and thrombocytosis. The patient had a negative RVP result. The patient was admitted, and antibiotics were initiated. The clinical decision to test for SARS-CoV-2 was made because of persistent irritability and lymphopenia. Blood, urine, and CSF culture results were negative. The SARS-CoV-2 PCR test result was positive on day 1 of admission. The patient was discharged without complications on day 2 of admission.

PATIENT 3

A 43-day-old term girl with a solitary left-sided kidney presented to the PED on March 20, 2020, with fever. Concerned that the infant felt warm at home, the parents took a rectal temperature, which was noted to be 38°C. The patient had been feeding well at home without evidence of respiratory distress. The father of the patient, who was a physician, had tested positive for the SARS-CoV-2 virus on the day of the patient's presentation.

On presentation to the PED, the patient was afebrile and had a normal oxygen saturation. The patient was noted to be well-appearing with an unremarkable physical examination. An evaluation of routine hematologic and urine studies was undertaken.

TABLE 1 Demographic and Clinical Characteristics of Three Infants With SARS-CoV-2

Patient Characteristics	Patient 1	Patient 2	Patient 3
Age at admission, d	43	28	43
Sex	Male	Male	Female
Exposure			
Contact with individual with confirmed SARS-CoV-2 infection or individual with fever and/or respiratory symptoms	Yes	No	Yes
Signs and symptoms			
Fever	Yes	Yes	Yes
Cough	No	No	No
Feeding difficulty	Yes	Yes	Yes
Lethargy	Yes	Yes	No
Irritability	Yes	Yes	No
Supplemental oxygen support	No	No	No
Laboratory studies			
Leukocytes, thousands per μL[a]	3.85 (6.0–17.5)	7.49 (5–19.5)	5.28 (6.0–17.5)
Neutrophils, thousands per μL[a]	0.79 (1.5–8.5)	4.44 (1.0–9.0)	0.90 (1.5–8.5)
Lymphocytes, thousands per μL[a]	1.82 (4.0–10.5)	1.62 (2.5–16.5)	2.65 (4.0–10.5)
Platelet count, thousands per μL[a]	523 (150–400)	455 (120–370)	529 (150–400)
CSF leukocytes, cells per μL	10	1	N/A
Hospital course			
Respiratory distress	Yes	No	No
Need for supplemental intravenous fluids	Yes	Yes	No
Airborne isolation precautions	Yes	Yes	Yes
Length of stay, h	92	45	N/A[b]

N/A, not applicable.

[a] Age-appropriate reference ranges listed after each value.

[b] Patient was not admitted on initial presentation.

The hematologic laboratory findings were notable for lymphopenia, neutropenia, and thrombocytosis; the results are listed in Table 1. The patient had a negative RVP result, and no CSF studies were obtained. The infant was tested for SARS-CoV-2 because of the known infected family contact. The patient was discharged from the PED without concern for a serious bacterial infection.

The following day, the patient's SARS-CoV-2 PCR test result was noted to be positive. The patient was called back to the PED because of a blood culture positive for *Streptococcus salivarius*. On return to the PED, physical examination was again unremarkable. A repeat blood culture was obtained, and the patient was admitted. She was discharged after a negative repeat blood culture result. The initial positive blood culture result was deemed to be a contaminant.

DISCUSSION

In this case series, we describe 3 of the youngest pediatric patients reported to date with SARS-CoV-2 infection. Data on the characteristics and clinical features of children with the 2019 novel coronavirus (SARS-CoV-2), based on the experience in China, are beginning to be published, but little has been published from the United States. Additionally, little is known thus far about the effect of SARS-CoV-2 on infants.

The Chinese Center for Disease Control and Prevention reported that only 1% (416 cases) of 72 314 confirmed or suspected cases were in children <10 years of age.[2] There were no deaths reported. Dong et al[1] presented a review of 2143 pediatric patients in China with confirmed or suspected cases of SARS-CoV-2, with 17.7% of them in children <1 year of age. Additional data on children with infection at Wuhan Children's Hospital mirror this, with 31 of 171 children (18.1%) <1 year of age infected.[7]

Less is known about the clinical course of infants infected with SARS-CoV-2. Wei et al[3] reported only 9 hospitalized infants diagnosed with SARS-CoV-2 between December 8, 2019, and February 6, 2020, in China. The patients ranged in age from 1 to 11 months, and all 9 infants had at least 1 family member who was infected. The authors did not fully describe the patients' hospital courses, but 4 had fever on presentation and 2 had mild upper respiratory tract infection symptoms. None of the 9 infants had severe complications or required critical care management.[3] Cai et al[8] described a series of 10 children infected with the virus (2 of these patients were <12 months of age), with little information published about the severity of illness.

There have been reports of significant morbidity and mortality in infants with SARS-CoV-2. In the review from Wuhan Children's Hospital, the authors describe the death of a 10-month-old child with intussusception who developed multiorgan failure and died 4 weeks after admission.[7] Cui et al[9] described a 55-day-old otherwise healthy girl presenting with rhinorrhea and cough, with known SARS-CoV-2 exposure, who was admitted, tested positive, and subsequently developed liver and cardiac injury.[9] Published reports based on the experience of SARS-CoV-2 infection in infants in China suggest that the number of infants infected is small and that the disease process in hospitalized patients is generally milder. Authors have speculated this may be from a lower risk of exposure or incomplete identification due to mild or asymptomatic disease.[3]

From this case series of 3 patients admitted to a children's hospital in New York over a period of 1 week in March, it is suggested that the number of hospitalized infants with SARS-CoV-2 infection may ultimately be higher in the United States than in China. Although this series is small, it is also suggested that in febrile infants without an otherwise identifiable source of illness on blood, urine, CSF, and RVP studies, SARS-CoV-2 should be considered as an etiology of the illness. All 3 patients described here presented with fever and feeding difficulty and had an absence of cough. None of the 3 had respiratory distress; therefore, no chest imaging was pursued. The 3 patients had lymphopenia and thrombocytosis on initial presentation, and 2 had neutropenia. All infants were tested via nasopharyngeal swab PCR testing. Although 2 of the infants did have suspected or known SARS-CoV-2 exposure, hospital policy at the time of publication is to test all febrile patients without an obvious other source.

All 3 patients had unremarkable hospital courses. Two of the 3 patients required intravenous fluid support because of poor feeding. One patient had persistent tachycardia, which was attributed to irritability and dehydration. One of the 3 was discharged within 48 hours of admission, which is standard practice for our hospitalized febrile infants, and 1 patient remained an additional day because of his respiratory status. The third patient was admitted after being called back and was discharged <36 hours later.

The clinical spectrum of SARS-CoV-2 infection is evolving. To date, much of the literature is focused on the respiratory sequelae of the illness. Our limited experience with hospitalized febrile infants with SARS-CoV-2 infection reveals that although respiratory manifestations may be present, they are less prominent; irritability, lethargy, and poor feeding are more frequently encountered. Lymphopenia, thrombocytosis, and possibly neutropenia, in the absence of another fever source, may prompt investigation for SARS-CoV-2 infection. Further studies are needed to determine the

impact of this rapidly emerging infection on the pediatric population.

ABBREVIATIONS

CSF: cerebrospinal fluid
PCR: polymerase chain reaction
PED: pediatric emergency department
RVP: respiratory viral panel
SARS-CoV-2: severe acute respiratory syndrome coronavirus 2

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