LETTER TO THE EDITOR

Systemic Inflammation With Cardiac Involvement in Pediatric Patients With Evidence of COVID-19 in a Community Hospital in the Bronx, New York

To the Editor—On April 27, 2020, the Paediatric Intensive Care Society of the United Kingdom reported cases of critically ill children presenting with features of Kawasaki disease or toxic shock syndrome, associated with coronavirus disease 2019 (COVID-19). Subsequent case definitions for the multisystem inflammatory syndrome in children associated with COVID-19 have been released [1, 2]. New York City (NYC) has had the largest burden of COVID-19 cases in the United States, with the Bronx borough experiencing the highest rate of infections (2766 per 100 000) [3]. Our initial clinical experience of mostly mild COVID-19 illness in children changed with the presentation of children with systemic inflammation and cardiac involvement, all of whom tested negative at presentation for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by polymerase chain reaction (PCR), with subsequent positive antibody testing. We present 4 patients who presented over a 2-week period (April 26–May 11, 2020).

All patients had fever, and 3 patients (patients 1, 2, and 4) presented with gastrointestinal symptoms and tachycardia (Table 1). None had respiratory symptoms or features of Kawasaki disease. Only one had a known contact with a confirmed COVID-19 case. Laboratory investigations showed signs of systemic inflammation with increased levels of C-reactive protein and ferritin, but normal procalcitonin levels. Peripheral white blood cell counts revealed lymphopenia in all patients. All had elevated troponin and pro–brain natriuretic peptide levels. Two patients (patients 2 and 3) had features of clinical myocarditis (markedly elevated troponin and decreased ejection fraction on echocardiography). All patients were transferred to pediatric cardiac centers. Patient 1 developed refractory vasoplegic shock on his second day of admission, necessitating transfer for mechanical circulatory support. Patient 2 was also transferred for mechanical circulatory support in the setting of severely depressed myocardial function. After the learned experience of rapid clinical deterioration, subsequent patients presenting to our emergency department with high suspicion of COVID-19 have had prompt cardiac investigations with electrocardiography and cardiac biomarkers.

These cases highlight the challenge for physicians assessing pediatric patients presenting with symptoms of fever and gastrointestinal illness. In addition to the standard differential diagnoses of bacterial sepsis, gastroenteritis, and acute abdomen, multisystem inflammatory syndrome with myocardial involvement must also be considered, even with negative SARS-CoV-2 PCR results. We report a wide range of cardiac involvement in children with documented COVID-19, including valvulitis, myocarditis, and shock. We propose that in addition to simultaneous SARS-CoV-2 PCR and antibody testing, inflammatory markers, cardiac enzymes, and electrocardiography should be considered in lymphopenic pediatric patients presenting with fever, significant tachycardia, and gastrointestinal symptoms in areas with widespread community transmission of COVID-19. Prompt referral to an advanced pediatric cardiac center should be considered if myocardial involvement is suspected, as clinical deterioration can be rapid.

Notes

Potential conflicts of interest. All authors: No reported conflicts of interest. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

Tanya Rogo,[1] Kanika Mathur,[1,2] and Murli Purswani[1]

[1]Division of Pediatric Infectious Diseases, Department of Pediatrics, BronxCare Health System, Bronx, New York, USA; and [2]Division of Pediatric Cardiology, Department of Pediatrics, Children's Heart Center/Mt Sinai School of Medicine, New York, New York, USA

References

1. Centers for Disease Control and Prevention. Multisystem inflammatory syndrome in children (MIS-C) associated with coronavirus disease 2019. Available at: https://emergency.cdc.gov/han/2020/han00432.asp. Accessed May 18, 2020.
2. New York City Department of Health and Mental Hygiene. 2020 health advisory #16: updated reporting requirements for multisystem inflammatory syndrome in children associated with COVID-19 (formerly pediatric multisystem inflammatory syndrome). Available at: https://www1.nyc.gov/assets/doh/downloads/pdf/han/advisory/2020/covid-19-providers-mis-c.pdf. Accessed May 18, 2020.
3. New York City Department of Health and Mental Hygiene. COVID-19: data. Available at: https://www1.nyc.gov/site/doh/covid/covid-19-data.page. Accessed May 20, 2020.

Correspondence: Tanya Rogo, MD, BronxCare Health System, 1685 Morris Ave, Suite 1G, Bronx, NY 10457 (trogo@bronxcare.org).

Journal of the Pediatric Infectious Diseases Society 2020;XX(XX):1–1

DOI: 10.1093/jpids/piaa087

Table 1. Clinical Presentation, Laboratory and Cardiac Investigations, and Outcomes of Pediatric Patients With Systemic Inflammation, Cardiac Involvement, and Evidence of COVID-19 Presenting at a Bronx Community Hospital, April 26-May 11, 2020

Characteristic	Patient 1	Patient 2	Patient 3	Patient 4
Date of presentation	April 26, 2020	April 29, 2020	May 9, 2020	May 11, 2020
Age	5 years	20 years	17 years	3 years
Sex	Male	Male	Male	Female
Presenting symptoms	Abdominal pain and fever × 3 days	Fever × 2 days, neck pain, vomiting, diarrhea	Chest pain (fever several days prior which resolved before presentation)	Fever × 6 days, diarrhea
Known COVID-19 contact	Yes	No	No	No
SARS-CoV-2 rtPCR[a]	Negative	Negative	Negative (positive at OSH)	Negative
SARS-CoV-2 IgG[b]	Positive	Positive	Positive	Positive
CRP, mg/L (<5)	117→280	257	53	390
Procalcitonin, ng/mL (0.02–100)	4	2.25	0.18	Not done
WBC count, 1000/μL	6.2	7.1	9.2	17.2
Neutrophils, %	84	88	75	82
Lymphocytes, %	11	5	10	7
Hemoglobin, g/dL	12.5	11.3	15.8	9.9
Platelets, 1000/μL	186 → 89	82	289	426
Troponin T, ng/L (<12)	27	123 → 293	1084→1771	21
pro-BNP, pg/mL (0–125)	24 604	1780	97→324	14 127
AST, U/L (9–51)	WNL	WNL	104	WNL
ALT, U/L (5–40)	WNL	WNL	27	WNL
D-dimer, ng/mL (0–230)	793→9187	521	<50	817
Fibrinogen, mg/dL (185–450)	328	836	753	Not done
Ferritin, ng/mL (13–150)	395→840	411	153	355
PT, sec (10.7–12.9)	16.8	22.1	12.1	16
INR (0.9–1.09)	1.4	1.84	1.02	1.34
Electrocardiogram	Sinus tachycardia, low voltages, nonspecific T-wave abnormality	Sinus tachycardia, rightward axis	Normal sinus rhythm → developed inferior ST segment elevation	Sinus tachycardia, nonspecific T-wave abnormality, borderline QTc prolongation
Echocardiography[c]	Moderate MR. Mildly depressed LV function (LV EF 48.1%). Small pericardial effusion. Moderate bilateral pleural effusions.	Mild TR. Mildly depressed RV function. Severely depressed LV function (LV EF 32%).	OSH: Mildly depressed LV function (LV EF 44%). No coronary artery abnormalities.	Mild TR, mild MR, mildly depressed LV function (LV EF 46.9%). No coronary artery abnormalities.
Outcome	Developed vasoplegic shock. Transferred. OSH: ECMO, died due to catastrophic ICH and herniation.	Transferred. OSH: vasopressors, IABP, intubated. convalescent plasma. EF 50% at discharge. Discharged on apixaban.	Transferred. OSH: IVIG. No pressors or intubation. Normal function at discharge. Discharged on lovenox.	Transferred. OSH: IVIG, tocilizumab × 2. Normal function at discharge. Discharged on lovenox.

Normal range in parentheses.

Abbreviations: ALT, alanine aminotransferase; AST, aspartate aminotransferase; BNP, brain natriuretic peptide; COVID-19, coronavirus disease 2019; CRP, C-reactive protein; ECMO, extracorporeal membrane oxygenation; EF, ejection fraction; IABP, intraaortic balloon pump; ICH, intracranial hemorrhage; IgG, immunoglobulin G; INR, international normalized ratio; IVIG, intravenous immunoglobulin; LV, left ventricle; MR, mitral regurgitation; OSH, outside hospital; PT, prothrombin time; rtPCR, real-time polymerase chain reaction; RV, right ventricle; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; TR, tricuspid regurgitation; WBC, white blood cell; WNL, within normal limits.

[a]Cobas SARS-CoV-2 Test (Roche).

[b]Alinity i SARS-CoV-2 IgG (Abbott).

[c]Coronary artery assessments for patient 1 and 2 were not performed as they were clinically unstable at the time of initial cardiology assessment.