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MIS-C with diarrhea complaint and acute kidney injury: A pediatric COVID-19 patient

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ABSTRACT

We present the case of a 3-month-old male infant patient who initially presented with severe dehydration with acute kidney injury secondary to COVID-19. Regarding the individual's previous history, the patient had congenital heart disease and was taking furosemide and captopril. The patient improved after initial hydration therapy. However, on the fourth day of hospitalization, the patient suddenly deteriorated and was found to have MIS-C. The patient's clinical course progressively worsened despite maximum support, and he died from severe MIS-C. We conclude that during the COVID-19 period, MIS-C is a serious health problem that should be considered in the differential diagnosis of patients with acute kidney injury.

1. Introduction

Multisystem inflammatory syndrome (MIS-C) associated with COVID-19 in children is defined as the presence of fever, inflammation, and organ dysfunction after excluding microbial causes [1]. Gastrointestinal symptoms such as diarrhea, nausea/vomiting, abdominal pain and renal dysfunction have been reported in pediatric patients with COVID-19 [2,3].

In this article, we present a 3-month-old patient diagnosed with congenital heart disease who was referred to our hospital with acute kidney injury (AKI) secondary to diarrhea due to COVID-19 and was then diagnosed with MIS-C.

2. Case

A 3-month-old male patient with chronic heart failure secondary to a large ventricular septal defect (VSD) and atrial septal defect (ASD) who was being treated with captopril and furosemide was referred to our department with a diagnosis of AKI due to the absence of urine output and decreased nutrition. The mother said that he had fever and diarrhea for 3 days and that she had continued to give him his home captopril and furosemide medications. On examination, the patient had a body weight of 4.4 kg, his mucosa was dry, his capillary refilling time was long, he was in a confused state, his anterior fontanel was sunken, and he was tachycardic (196/min) and hypotensive (60/32 mmHg) and had reduced turgor tone. The patient's creatinine was 5.76 mg/dL, his BUN was 46 mg/dL, and his uric acid was 18.6 mg/dL. At admission, his CRP was 2.98 mg/L, his procalcitonin was 0.48 μg/L, his WBC was 9960/μL, his troponin-I was 0.04 μg/L, his ProBNP was 2190 ng/L, and his troponin-I was 0.04 μg/L. The patient tested positive for COVID-19 by RT–PCR. The patient had severe dehydration with grade 3 prerenal AKI according to the Kidney Disease: Improving Global Outcomes (KDIGO) criteria. In the emergency room, a urinary catheter was inserted in the patient, but no urine output was observed. The patient was given 20 mL/kg saline twice for 30 min. Then, the patient was taken to the pediatric intensive care unit. The patient's first transthoracic echocardiogram revealed a large perimembranous outlet ventricular septal defect (35 mmHg systolic gradient between two ventricles) and multiple-pass secundum ASD (left-right shunt), pulmonary flow velocity of 2.2 m/s, tricuspid regurgitation velocity 3 m/s suggestive of pulmonary hypertension, ejection fraction (EF) = 79%, and shortening fraction (SF) = 46%. The patient initially had no clinical signs of heart failure. He started urinating in the 6th hour of

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hospitalization. Hydration was achieved in 2 days. The patient's mucous membranes were wet, tear formation and urination occurred as a result of adequate hydration, and the patient's kidney function tests improved. However, on the fourth day of hospitalization, although the patient's condition improved, his clinical course suddenly worsened. He had persistent hypotension. Increases in cardiac troponin-I and ProBNP values were observed. Inotropic support was initiated. A chest X-ray of the patient revealed, in addition to an increase in the cardiothoracic ratio, bilateral symmetrical perihilar interstitial involvement, peribronchial cuffing and mild perihilar airspace opacities (Fig. 1). The patient developed respiratory failure and was intubated. Prothrombin, measured according to the international normalized ratio (INR), and D-dimer levels increased. The laboratory and echocardiographic findings of the patient are shown in Table 1. Upon follow-up, the patient's electrocardiograms showed sinus tachycardia, nonspecific ST segment and T wave changes, long QTc distance (0.46), and a first-degree atrioventricular block. He had a fever at the time of admission and improved following the initial treatment, his clinical presentation suddenly worsened in the follow-up, and he was diagnosed with myocarditis due to MIS-C. In clinical studies, high markers of cardiac injury and cardiac dysfunction associated with myocardial involvement have been reported to be common in children with severe MIS-C [6].

We would like to emphasize that COVID-19 infection in pediatric patients with a diagnosis of congenital heart disease may present with symptoms such as diarrhea, vomiting, and AKI during the COVID-19 pandemic and can easily decompensate in these patients. Additionally, MIS-C may develop later in these patients, as in our patient. Stewart et al. found that 46% of 52 children infected with COVID-19 who were previously healthy had high creatinine values, and 29% of these had acute renal damage [3]. Continuation of medication by the mother with furosemide and captopril despite diarrrhea may have contributed to the development of AKI in the patient. Therefore, children with congenital heart disease should be examined by their doctor when they are sick. Although the acute renal injury in our patient improved following the initial treatment, his clinical presentation suddenly worsened in the follow-up, and he was diagnosed with myocarditis due to MIS-C. In clinical studies, high markers of cardiac injury and cardiac dysfunction associated with myocardial involvement have been reported to be common in children with severe MIS-C [6].

Although guidelines have been developed for the diagnosis of MIS-C, its diagnosis may be difficult, as it presents clinical features similar to myocarditis, meningitis, sepsis, toxic shock syndrome, viral infections and vasculitis. General practitioners, emergency and intensive care providers, pediatricians and cardiologists should be conscious of MIS-C.

Finally, we believe that early diagnosis and treatment management are important to reduce mortality in patients with MIS-C.

### Table 1

| Day | COVID-19 RT-PCR | Echocardiography | CRP (mg/dL) | Procalcitonin (μg/L) | ProBNP (ng/L) | Troponin I (μg/L) | BUN (mg/dL) | Creatinine (mg/dL) | Albumin (g/dL) | Ferritin (μg/L) | Fibrinogen (mg/dL) | D-Dimer (mg/L) | INR
|-----|----------------|-----------------|------------|---------------------|--------------|-----------------|------------|------------------|--------------|---------------|-----------------|---------------|-----
| 1   | +              | Trace           | 2.98       | 0.48                | 2130         | 0.04            | 42         | 5.76             | 4.2          | 158           | 156             | 1.01          | 1.14
| 3   | +              |                 | 2.98       | 0.13                | 14,500       | <0.01           | 13         | 0.3              | 3.1          | 298           | 298             | 1.01          | 1.41
| 4   |                |                 |            | 0.1                 | >35,000      | 0.16            | 3          | 0.18             | 2.8          |               |                 |               | 1.62
| 5   |                |                 |            | 0.1                 | <35,000      | 0.01            | 2          | 0.29             | 3.2          |               |                 |               | 1.52
| 6   |                |                 |            | 0.1                 | <35,000      | 0.17            | 6          | 0.5              | 3.4          |               |                 |               | 1.51
| 7   |                |                 |            | 0.1                 | >35,000      | 0.14            | 26         | 0.7              | 3.4          |               |                 |               | 1.56
| 8   |                |                 |            | 0.1                 | >35,000      | 0.46            | 52         | 1.03             | 3.9          |               |                 |               | 1.81
| 11  |                |                 |            | 0.1                 | >35,000      | 4.27            | 59         | 0.97             | 3.5          |               |                 |               | 1.6
| 14  |                |                 |            | 0.1                 | >35,000      | 1.71            | 82         | 0.83             | 3.5          |               |                 |               | 1.2
| 16  |                |                 |            | 0.1                 | >35,000      | 0.93            | 87         | 1.11             | 3.5          |               |                 |               | 1.3
| 17  |                |                 |            | 0.1                 | >35,000      | 0.99            | 93         | 1.3              | 3.5          |               |                 |               | 1.6
| 18  |                |                 |            | 0.1                 | >35,000      | 0.94            |           | 1.6              | 3.0          |               |                 |               | 2.6

EF: ejection fraction, SF: shortening fraction, MR: mitral regurgitation.

3. Discussion

We present a case of an infant with chronic heart failure who was initially admitted with severe dehydration and AKI secondary to COVID-19 and who, during the same admission, went on to develop and die from severe MIS-C. The patient was initially admitted with a three-day history of COVID-19 symptoms, which resolved, and the patient improved with hydration. However, on the fourth day of hospitalization, the patient suddenly deteriorated and developed signs and symptoms of acute myocarditis and worsening cardiac failure, as shown by the decreased ejection fraction, the increased need for vasoactive drugs, the increased cardiac biomarkers, and electrographic findings of myocardial involvement. While most children infected with COVID-19 survive with asymptomatic or mild symptoms, underlying chronic conditions can cause serious illness. These chronic conditions have mostly been reported as chronic lung diseases, cardiovascular diseases, immunosuppression, and obesity [4]. The risk of developing severe COVID-19 infection exists in pediatric patients with congenital heart disease [5]. Diarrhea and vomiting may cause AKI secondary to dehydration and increased mortality in children with heart failure, as in our patient. Stewart et al. found that 46% of 52 children infected with COVID-19 who were previously healthy had high creatinine values, and 29% of these had acute renal damage [3]. Continuation of medication by the mother with furosemide and captopril despite diarrrhea may have contributed to the development of AKI in the patient. Therefore, children with congenital heart disease should be examined by their doctor when they are sick. Although the acute renal injury in our patient improved following the initial treatment, his clinical presentation suddenly worsened in the follow-up, and he was diagnosed with myocarditis due to MIS-C. In clinical studies, high markers of cardiac injury and cardiac dysfunction associated with myocardial involvement have been reported to be common in children with severe MIS-C [6].

Finally, we believe that early diagnosis and treatment management are important to reduce mortality in patients with MIS-C.

Fig. 1. Chest X-ray reveal, in addition to an increase in the cardiothoracic ratio, bilateral symmetrical perihilar interstitial involvement, peribronchial cuffing and mild perihilar airspace opacities.
Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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