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Case Report

Pediatric COVID-19 related myocarditis in multisystem inflammatory syndrome: a case report

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A number of coronavirus disease-19 (COVID-19)-related myocarditis cases have recently been reported. Myocarditis is an inflammatory disease of the heart characterized by inflammatory infiltrates and myocardial injury without an ischemic cause.[1] While multiple etiologies exist, the major cause appears to be related to viral illnesses. Clinical presentations vary from asymptomatic to sudden unexpected death.[2] Acute heart failure due to COVID-19-related acute myocarditis has been associated with multisystem inflammatory syndrome, mimicking Kawasaki disease.[3] Here, we report a case of a 1-month old girl with reactive anti-COVID-19 IgG, presenting with arrhythmia following the shortness of breath during hospitalization. Respiratory distress and myocarditis progressed to multiple organ failure and the patient died on her third day in the PICU. **[Paediatr Indones. 2021;61:283-6 ; DOI: 10.14238/pi61.5.2021.283-6**].

Keywords: *COVID-19; myocarditis; multisystem inflammatory syndrome; IgG*

The Case

A 1-month old girl with shortness of breath was brought to the Pediatric Emergency Department from a referral hospital, Medan, North Sumatera. The patient had been hospitalized since birth with atelectasis and meconium aspiration syndrome. Her parents had no history of travel or contact with COVID-19 patients. The first serology rapid test and PCR swab test were negative in Adam Malik hospital. The patient clinically improved until the third week of hospitalization at which time the shortness of breath worsened, with oxygen desaturation. The patient was intubated and admitted to the PICU.

In the PICU, the patient presented with fever, tachycardia and desaturation, heart rate of 180 beats per minute, and 85% oxygen saturation while mechanically ventilated with 90% FiO_2. On the third day of her PICU stay, the patient had arrhythmia. Her electrocardiography (ECG) showed a right bundle branch block (RBBB) with echocardiography result of severe tricuspid regurgitation (TR), moderate pulmonary regurgitation (PR), pulmonary hypertension, and left ventricular hypertrophy suggestive of myocarditis. Her laboratory tests showed Hb 13.4 g/dL, Ht 41%, white blood cells 15690/μL, platelet 87000/μL, neutrophil 69.2%, lymphocyte 12.1%, albumin 3.6 g/dL, sodium 138 mEq/L, potassium 5.8 mEq/L, chloride 97 mEq/L, calcium 9.6 mg/dL, lactate 1.6 mmol/L, procalcitonin 1.76 ng/mL, PT 46.1 (12.9), INR 4.16, APTT 105.2 (30.6), 38.5 (12), D dimer 7500 ng/mL, troponin T 1705 ng/mL, and CKMB 899 μg/L. Blood gas analysis results were pH 7.26, pCO_2 43 mmHg, pO2 160 mmHg, HCO_3 19.3 U/L, TCO_2 20.6 U/L, BE -7.2 U/L, oxygen saturation 99%. The second rapid test in PICU

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was anti-COVID-19 IgG reactive and anti-COVID-19 IgM non-reactive.

Chest X-ray showed that left heart covered by the consolidation area, the aorta was not able to analyze. Mediastinum did not enlarge, the trachea laid on the middle of mediastinum and the hilar were difficult to interpret. Infiltrates were seen in perihilar and right paracardiac, developing the in-homogenous consolidation in the superior middle lobe of right lung (**Figure 1**); while chest CT scan revealed that trachea and esophagus were laid on the middle of mediastinal, the right and left of main bronchus appeared open and the hilar were not thick. No enlargement of perihilar and peri-mediastinal lymph nodes. The enlargement of the heart size and good pericardium appearance, no pericardial effusion. Homogenous consolidation with air-bronchogram in the upper lobe of the left lung. Fibro-infiltrates in the right lung and infiltrates in the left lung (**Figure 2**).

Before diagnosed with COVID-19, patient was treated with antibiotics, beta-agonist, and corticosteroid. Respiratory distress and myocarditis progressed, lead to multiple organ failure. Multisystem organ failure in MISC should be minimum 2 system organ involvement (cardiac, renal, respiratory, hematologic, gastrointestinal, dermatologic, and neurological). Patient died on the third day in PICU.

Discussion

Children with COVID-19 often experienced a mild-to-moderate course of illness. Multisystem inflammatory syndrome in children (MIS-C) associated with COVID-19 is characterized with hyperinflammation, fever, abdominal symptoms, conjunctivitis, rash, and multiple organ dysfunction, and diagnosed after ruling out other possible causes of infection.[4] In the context of COVID-19, myocardial injury, defined by an increased troponin level, is often due to non-ischaemic myocardial processes, including severe respiratory infection with hypoxia, sepsis, systemic inflammation, pulmonary thrombosis, embolism, cardiac adrenergic hyperstimulation during cytokine storm syndrome, and

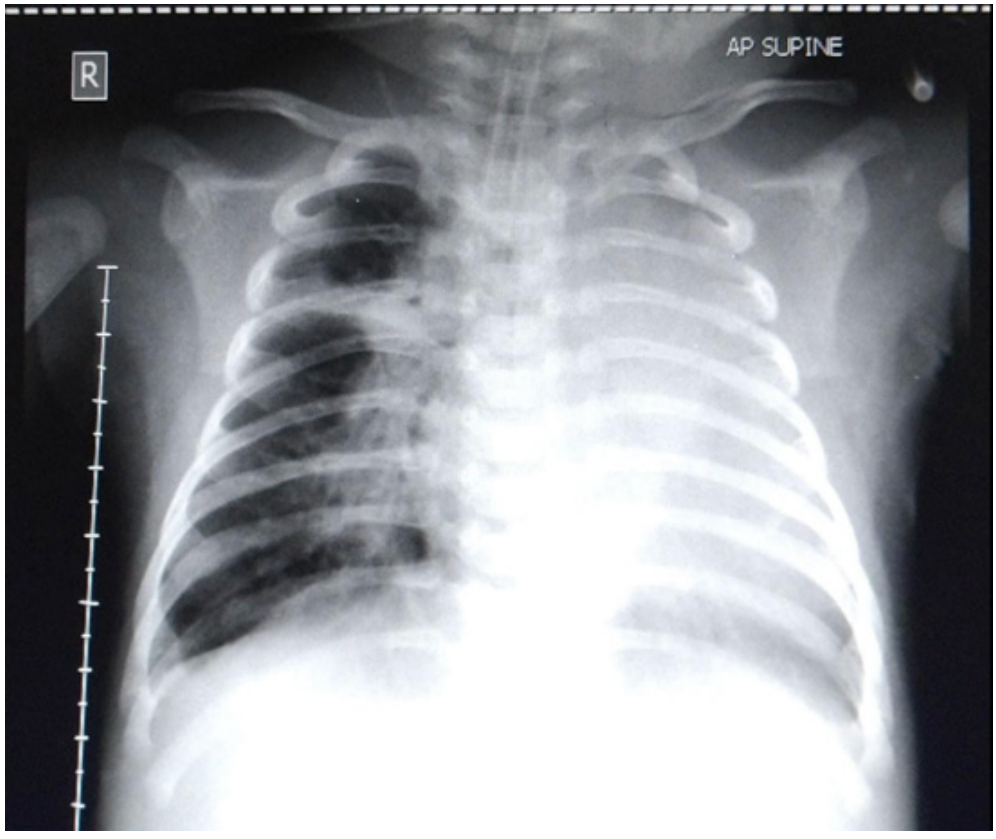

Figure 1. Chest x-ray with pneumonia and left lung atelectasis

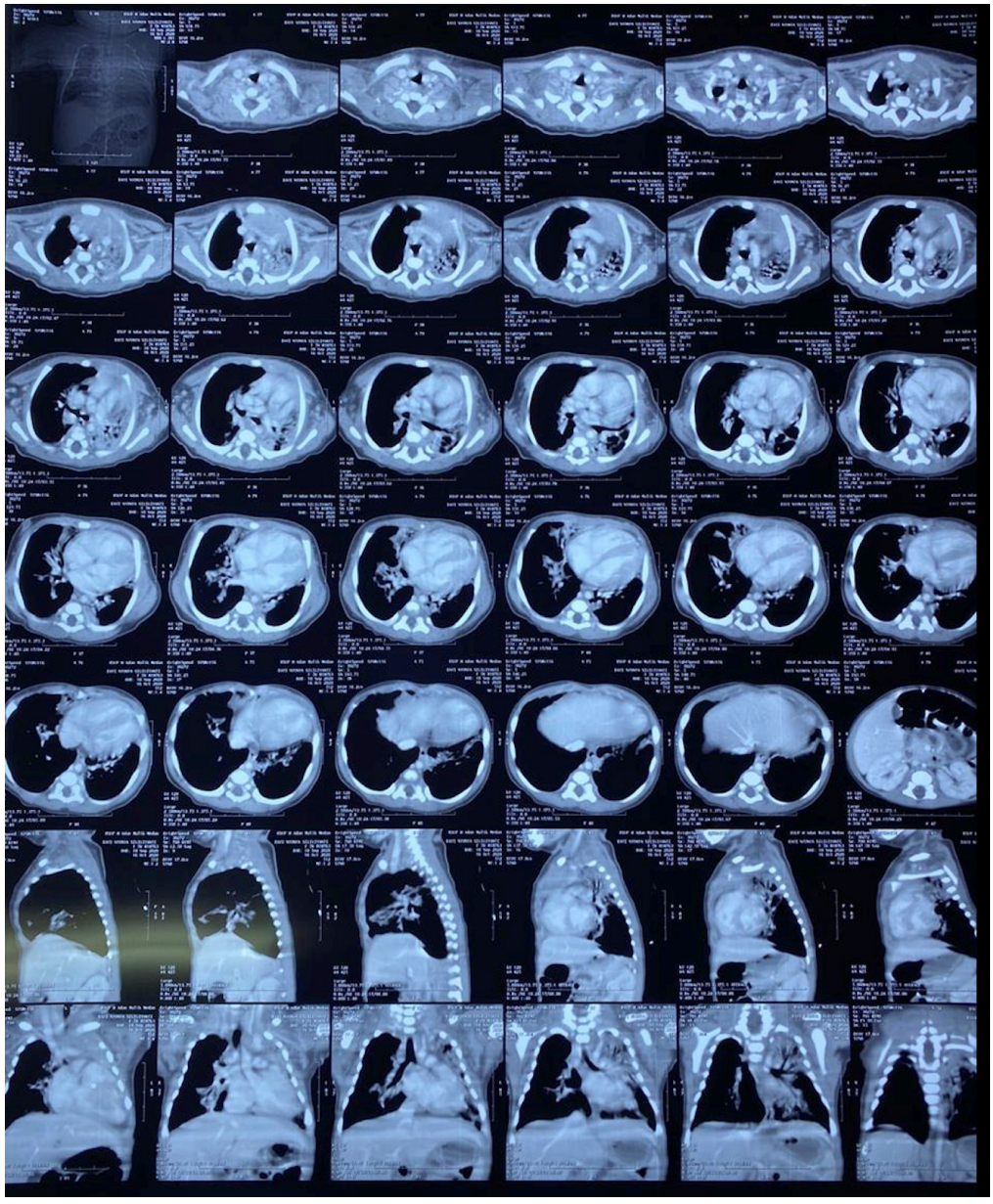

Figure 2. Chest CT scan with pneumonia and left upper lobe atelectasis

possibly myocarditis.[5]

The pathophysiology of COVID-19-related myocarditis is thought to be a combination of direct viral injury and cardiac damage due to the host immune response. A COVID-19 myocarditis diagnosis should be related to previous coronavirus infection.[1] An inflammatory process begins when the body's immune cells penetrate the heart tissue. These immune cells activate and produce chemicals that damage cardiac muscle cells, leading to thickening and swelling of the heart muscle. If this process is extensive and a large portion of the heart is involved, impairment of the heart's ability to pump blood can lead to multiple organ failure.[2] Early diagnosis of this SARS-CoV-2-associated multisystem disease (MIS-C) complicated by heart failure is important in identifying children who require treatment, in order to prevent left ventricular dysfunction and acute heart failure.[6]

Investigators have recently described cases with confirmed or highly suspected COVID-19 who

presented with clinical features of Kawasaki disease.[7] Cardiovascular syndromes observed with pediatric myocarditis include sudden death, arrhythmias, chest pain, myocardial infarction, and acute heart failure. Arrhythmia is recognized as one of the possible clinical manifestations of COVID-19 patients. An observational study of the clinical characteristics of adult COVID-19 patients in Hubei, China, reported a 7.3% incidence of heart palpitations among 137 patients.[8] A study reported that arrhythmia was the cause of intensive care unit transfer in 44.4% of COVID-19 adult patients.[9]

In pediatric patients with COVID-19 and severe disease, a thorough cardiac evaluation should be conducted, including EKG, echocardiography, and cardiac biomarker levels (troponin, CK, and CK MB).[10] Our patient presented with arrhythmia and fever, but without history of abdominal symptoms, conjunctivitis, or rash. The laboratory tests showed an increase of cardiac enzyme markers with anti-IgG Covid-19-reactive serology, Hence, we strongly suspected myocarditis related to COVID-19 infection. We also performed a chest X-ray and chest CT scan that showed left lung atelectasis, but the patient history of meconium aspiration syndrome might have been the cause of atelectasis in this patient. Echocardiogram did not reveal any coronary abnormalities, but there were severe TR, moderate PR, pulmonary hypertension, and left ventricle hypertrophy.

In conclusion, pediatric and cardiology health professionals should aware of possible myocarditis in children, probably related to SARS-CoV-2 infection (MIS-C), for early diagnosis and timely management.

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