

Case Report:

Myocarditis, a Life-Threatening Presentation of COVID-19 in a 4-Month-Old Infant



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Please cite this article as Zargar Sh, Ghandi Y, Mousavi-Hasanzadeh M. Myocarditis, a Life-Threatening Presentation of COVID-19 in a 4-Month-old Infant. Journal of Vessels and Circulation. 2021; 2(1):43-48. <http://dx.doi.org/10.32598/JVC.2.1.70.1>

 <http://dx.doi.org/10.32598/JVC.2.1.70.1>



Article info:

Received: 23 Mar 2020

Accepted: 25 May 2020

Publish: 01 Jan 2021

Keywords:

Coronavirus infections, COVID-19, Infantile cardiomyopathy, Ventricular dysfunction, Myocarditis, SARS-CoV-2

ABSTRACT

Background and Aim: Significant cardiac sequelae may be one of the main causes of death in COVID-19 patients; however, very few reports are available that address these complications and their treatment strategies in children.

Case Presentation: A 4-month-old male infant was admitted to the pediatric intensive care unit with sudden tachycardia, tachypnea, and low oxygen saturation after surgery. Laboratory tests and echocardiography revealed elevated troponin I levels and myocardial dyskinesia with decreased Left Ventricular Ejection Fraction (LVEF= 50%) and pulmonary hypertension (30 mm Hg) consistent with the cardiac injury. Despite his normal chest x-ray, the chest CT scan disclosed ground-glass opacities in the periphery of the left lower lobe indicative of viral infection. The patient fulfilled the diagnostic criteria of the “Chinese expert consensus statement for clinical myocarditis”. The viral test for COVID-19 obtained on the first day of admission was found positive a few days later. The patient successfully recovered clinically after receiving anti-failure therapy and IVIG. Trop I level reduced to 0.10 g/L, and the LVEF eventually recovered to 68%.

Conclusion: COVID-19 patients may develop severe cardiac complications such as myocarditis and heart failure. Myocarditis in this patient was treated without antiviral drugs and only with supportive therapies.

1. Introduction

In December 2019, a novel coronavirus (COVID-19) emerged in Wuhan, China, and rapidly became a serious public health issue worldwide. The virus primarily results in viral pneumonia and presents with fever, cough, myalgia, and or fatigue; however, recent studies demonstrated that

multiple different organs might also be involved, including the nervous system [1], heart [2], and liver [3].

COVID-19 mainly affects older age groups and men with underlying chronic diseases [4, 5]. Most pediatric patients are asymptomatic carriers. Low rates of infection and mild symptoms are reported in children [6], but these groups, particularly infants, are susceptible to

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contracting the virus [7]. Low infection rates and low mortality rates in children may be attributable to their fewer ACE-II receptors than adults, similar to the SARS-CoV-2 infection [7, 8].

Patients suffering from COVID-19 may develop severe illness and life-threatening complications, including significant cardiovascular sequelae such as myocarditis that may result in death [7]. In recent research, cardiac involvement in patients with COVID-19 has been characterized by the elevation of troponin, Creatine Phosphokinase-MB (CPK-MB), and pro-Brain type Natriuretic Peptide (pro-BNP), as well as diminished left ventricular function, coronary artery dilation, sinus tachycardia, atrial arrhythmias, non-sustained ventricular tachycardia, atrio-ventricular block, premature atrial and ventricular contractions, and incomplete right bundle branch block [9].

Because of the high incidence of fulminant myocarditis and profound cardiogenic shock in COVID-19 patients [2], the devastating complications of the condition call for more research to help identify clinical symptoms, diagnostic measures, treatment strategies, and outcomes. Also, considering the enormous capability of coronaviruses for miscellaneous pathogenesis and the outstanding mortality rate of COVID-19, it is necessary to pay more attention to the direct cardiac consequences of this disease [10]. In this regard, we report a COVID-19 infant that developed clinical myocarditis after surgery.

2. Case Presentation

A 4-month-old male (Weight 7800 g) was admitted to the Pediatric Intensive Care Unit (PICU) with tachycardia, tachypnea, decreased oxygen saturation, and fever after ureteropelvic junction obstruction surgery. He had no prior history of heart disease or contact with positive COVID-19 subjects.

On the first day of hospital admission, the infant suffered from tachycardia, tachypnea, and fever without cough or sputum. Vital signs were measured and revealed a blood pressure of 70/45 mm Hg, respiratory rate of 70 breaths/min, pulse rate of 180-200 beats/min, and body temperature of 38.8°C. His O₂ saturation increased with mask ventilation from 77% to 92%. Lower limb examination revealed pallor and a delayed capillary refill of 4 seconds, indicating peripheral vasoconstriction. Hepatomegaly and edema were not observed. Cardiac examination revealed a gallop rhythm and a high-pitch murmur which was best heard at the apex without pericardial rub or muffled heart sounds. Lung auscultation revealed fine crackles at the bases of both right and left lungs.

His Arterial Blood Gas (ABG) analysis showed a pH of 7.33, a PCO₂ of 23 mm Hg, PO₂ of 75 mm Hg, and SaO₂ of 77%. Blood tests revealed a WBC count of 18400/ μ L with 15% lymphocytes, hemoglobin of 10.2 g/dL, creatinine of 1.0 mg/dL, and blood sugar of 80 mg/dL. Erythrocyte Sedimentation Rate (ESR) and C-reactive protein levels were normal. Myocardial enzymes showed elevated Troponin-I (Trop I), D-dimer, and Lactic Dehydrogenase (LDH) levels of 222.6 ng/mL, 12649 IU/L, and 4246 IU/L, respectively.

Nasal and pharyngeal swabs for COVID-19 RT-PCR obtained on admission due to suspected viral infection came back positive a few days later. The child's parents' tests were negative for COVID-19. Additional laboratory and imaging studies were not performed since the parents were asymptomatic.

Bedside chest radiography did not reveal the typical ground-glass lung infiltrates usually indicative of viral pneumonia. Moreover, cardiomegaly and pulmonary venous congestion were not seen (Figure 1). Chest CT-scan obtained 12 hours later to investigate the clinical findings further disclosed ground-glass opacities in the periphery of the left lower lobe (Figure 2).

The 12-lead electrocardiogram revealed sinus tachycardia, low voltage QRS complex, and no ST-segment elevation (Figure 3). No ventricular or atrial arrhythmias occurred during hospitalization. Also, echocardiography showed myocardial dyskinesia along with a low Left Ventricular Ejection Fraction (LVEF) (50%), pulmonary

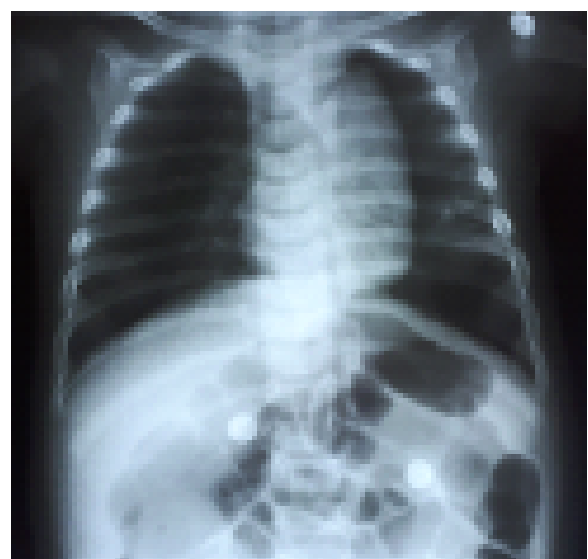


Figure 1. Bedside chest X-ray on day 1

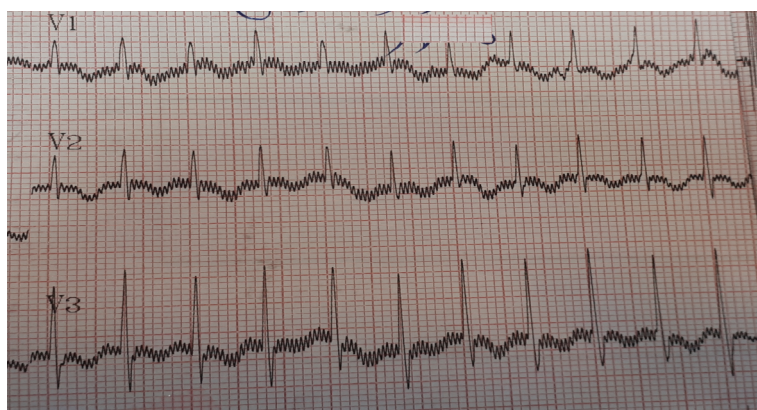


Figure 2. Electrocardiogram revealing sinus tachycardia and no ST-segment elevation during hospitalization

hypertension (30 mm Hg), dilated Inferior Vena Cava (IVC) with diminished inspiratory collapse despite a normal-sized left ventricle, and no evidence of pericardial effusion.

Consequently, sudden hypoxemia, tachycardia, tachypnea, fever, leukocytosis, neutrophil, lymphopenia, reduced LVEF, acidosis, elevated troponin I, LDH, and D-Dimer levels along with positive testing for COVID-19 raised suspicion for viral-associated myocarditis and the diagnosis of acute myocarditis in the absence of multiple organ dysfunction syndromes was considered.

The patient was admitted to the pediatric intensive care unit and hospitalized there for nine days. Supportive medical treatment was initiated with oxygen, inotropic drugs such as milrinone and dobutamine, and immunoglobulin (IVIG) without antiviral therapy.

Table 1 summarizes hematologic and biochemical test results on days 0, 3, and 7 of hospitalization. It can be seen that troponin-I and LDH levels returned to normal values within seven days.

Nineteen days later, his follow-up physical examination was unremarkable; the patient was hemodynamically stable, and the blood oxygen status was favorable. Ventricular function and cardiac chamber sizes were normal. LVEF had recovered to 68%, and left ventricle wall motion was normal.

3. Discussion

This study highlights myocarditis as the presenting symptom of COVID-19 in a 4-month-old male infant. Symptoms of viral infection usually precede myocardi-

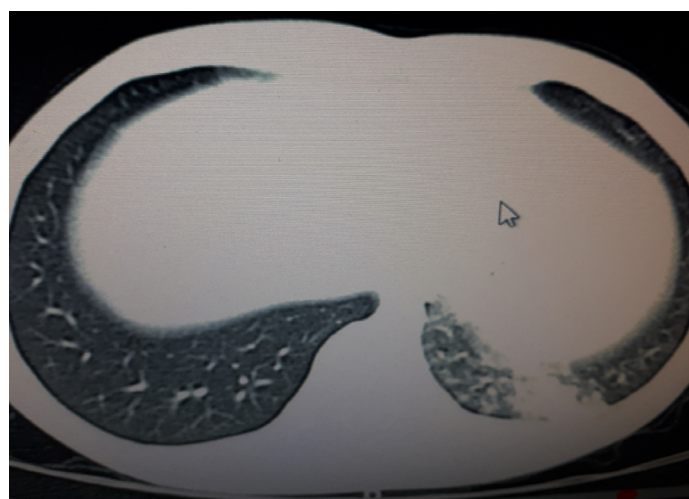


Figure 3. (a, b) Chest CT-scan (axial lung window at the level of lung bases); ground glass opacities in the periphery of the left lower lobe

Table 1. Hematological and biochemical laboratory findings on days 0, 3 and 7

Hematological and Biochemical Tests	Day 0	Day 3	Day 7
WBC ($\times 10^9$ cells/L)	18400	13200	14000
Hemoglobin (g/dL)	10.2	7.9	11.7
Lymphocyte count ($\times 10^9$ cells/L)	2700/15%	1320/10%	5600/40%
Neutrophil count ($\times 10^9$ cells/L)	14720/80%	8580/65%	8260/59%
Erythrocyte sedimentation rate	20	-	w11
C-reactive protein	+	++	Negative
Troponin	222	34	15
Lactic dehydrogenase	4246	2781	1300
Creatine phosphokinase-MB			
D-Dimer ($\mu\text{g/mL}$)	12649	7249	800
Alanine aminotransferase	-	23	-
Aspartate transaminase	-	45	-
CR	1.1	0.9	0.7
RT-PCR	Positive	-	-
O ₂ Saturation	77%	89%	92%
pH	7.33	7.40	7.43
PCO ₂	23	36	38
PO ₂	75	82	95
HCO ₃	15	18	19
BE	-7.5	-4	-4

WBC: White Blood Count; CR: Creatinine; RT-PCR: Reverse Transcription Polymerase Chain Reaction; Pco₂: Pressure of Carbon Dioxide; PO₂: Pressure of oxygen; HCO₃: Serum Bicarbonate; BE: Base Excess

tis; however, our patient lacked flu-like symptoms and presented with a sudden outbreak of respiratory distress along with echocardiographic and laboratory findings indicative of obvious myocardial injury after ureteropelvic junction obstruction surgery. Nasal and pharyngeal swabs were obtained for COVID-19 due to the presence of fever, tachypnea, and hypoxia that came back positive for the virus a few days later.

A recent review of the literature on COVID-19 in the pediatric population suggests a growing incidence of this disease in children with a slightly higher predilection for males and those with underlying diseases. The disease affects children over a wide age range and may vary in

severity, with a majority categorized as asymptomatic, mild, and moderate. Only a minority present with a severe or critical disease which is inversely proportional to the age, affecting infants less than one year to a great extent. The study also highlighted that for those children deemed sick enough to require admission, further evaluation for myocardial disease, coagulopathy, and organ damage must be considered [11].

Myocarditis is characterized by myocardial inflammation and necrosis that ultimately impairs ventricular function. Previous studies have documented that this novel coronavirus may directly injure cardiac myocytes by using Angiotensin-Converting Enzyme-2 (ACE-II)

receptors to enter host cells or by inducing a systemic inflammatory response with high levels of pro-inflammatory cytokines and chemokines as was formerly seen with SARS and MERS [2]. A recent study of 19 autopsies of COVID-19 patients [12] showed mononuclear inflammatory infiltration in the heart tissue without any viral inclusion body, supporting systematic inflammatory response as the primary mechanism of Fulminant Myocarditis (FM) in COVID-19 patients.

According to the “Chinese expert consensus statement on the diagnosis and treatment of fulminant myocarditis”, the sudden onset and rapid progression of this patient’s disease, poor condition, and evidence of myocardial injury, fast recovery, and favorable long-term outcome are highly suggestive of clinical myocarditis rather than fulminant myocarditis. This patient was isolated and admitted to the pediatric intensive care unit for nine days and rapidly recovered after close clinical monitoring and supportive treatment with milrinone, dobutamine, and Intravenous Immunoglobulin (IVIG) without antiviral agents. In contrast, FM is a devastating, life-threatening disease with remarkably higher mortality rates characterized by severe cardiovascular compromise presenting with heart failure, rapid-onset hypotension, cardiac arrhythmias, and cardiogenic shock that usually requires mechanical life support, immunological modulation by using sufficient doses of glucocorticoid, immunoglobulin and antiviral therapy [13]. Several studies have reported great susceptibility to COVID-19 and its severe complications in patients with cardiac risk factors and underlying cardiovascular diseases [8, 14, 15].

It is determined that SARS-CoV-2 can also present in children as severe heart failure, even without previous heart disease. Also, a concerning association between COVID-19 and the multisystem inflammatory syndrome has been recently discovered.

Rodriguez-Gonzalez et al. reported a 6-month-old infant with a history of short bowel syndrome presenting fever, cyanosis, and cardiogenic shock secondary to severe pulmonary hypertension and right ventricular failure without pulmonary thromboembolism. They reported that severe cardiovascular impairment in children with COVID-19 could be attributable to the primary pulmonary infection, and not only to a multisystem inflammatory syndrome but also in children without heart disease [8]. Cui et al. reported a 55-day-old female infant infected with coronavirus presented with pneumonia, liver injury, and heart damage. The laboratory cardiac examinations showed elevated myocardial zymogram, cardiac complication, and myocarditis. They showed

that children with COVID-19 can also present with multiple organ damage and rapid disease changes [16].

Del Barba et al. presented a 38-day old infant and confirmed case of COVID-19 with mild cardiovascular inflammation. They suggest that SARS-CoV-2 cardiac involvement should always be taken into account, even in children. Even if it was mild, it might be of concern, especially in patients with underlying conditions. Also, they offered that follow-up is necessary to detail the long-term outcomes of cardiac involvement in affected patients [17]. Mehrabi et al. showed that in children infected with SARS CoV-2, the symptoms were milder. The lungs chest CT imaging indicated minor lung involvement in pediatrics; however, the patterns of imaging changes were almost similar [18]. this pattern happened in our patients.

Mansurian et al., in This review study, showed that clinical presentations were milder, the prognosis was better, and the mortality rate was lower in children with COVID-19 compared with adult patients; however, children are potential carriers, like adults, and can transmit the infection among the population. Therefore, early identification and intervention in pediatric patients with COVID-19 are essential to control the pandemic. Moreover, gastrointestinal symptoms were more common symptoms among children [19].

In conclusion, at the moment, there are much data on cardiac complications about the role of cardiovascular involvement with or without multisystem inflammatory syndrome in children in COVID-19 in children. Therefore, children with acute COVID-19 should undergo a cardiac workup and close cardiovascular monitoring to identify and treat timely life-threatening cardiac complications.

4. Conclusion

COVID-19 patients may develop severe cardiac complications such as clinical myocarditis. The heart may be one of the important target organs besides the lung. It can show not only abnormal myocardial enzymes but also structural and functional damage. The outbreak of myocarditis may be more common in the male gender. The prognosis of such patients may be better if no malignant arrhythmia is present. Supportive treatment with anti-failure agents and immunoglobulin demonstrated favorable outcomes in our case; however, limited research on the topic and the potential for fulminant myocarditis and its poor outcomes call for more research, particularly in children.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethical Committee of Arak University of Medical Sciences.

Funding

This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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