Case report

Management of a critically ill patient with COVID-19-related fulminant myocarditis: A case report

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ARTICLE INFO

Keywords:
Myocarditis
Critical illness
COVID-19
Intravenous immunoglobulin (IVIG)
Ascorbic acid
Melatonin

ABSTRACT

A 78-year-old man with COVID-19 infection was admitted. Initial echocardiography indicated left ventricular ejection fraction (LVEF) of 15%, high pulmonary arterial pressure, severe left ventricular dysfunction, mild diastolic dysfunction, mild regurgitation mitral valve, and normal septal thickness. Considering the probable diagnosis of COVID-19-related myocarditis, the patient was early managed with the antivirals, immunomodulatory agents, a high dose of ascorbic acid, melatonin, and immunoglobulin therapy. His clinical condition was improved and his last echocardiography revealed LVEF of 40% and improvement in systolic and diastolic dysfunction. The clinicians should be aware of the potentially lethal cardiac complication of COVID-19, especially in geriatrics.

1. Introduction

Coronavirus disease 2019 (COVID-19) is a severe acute respiratory syndrome declared as a global pandemic by the World Health Organization (WHO) since March 2020 [1]. Although respiratory manifestations including fever, cough, and dyspnea are the dominant presentations of COVID-19 [2], extra-pulmonary presentations (cardiac, gastrointestinal, hepatic, renal, etc.) and organ failure may happen [3]. Myocarditis is a type of inflammatory syndrome preceded by non-infectious and infectious causes, especially viral disease. Myocarditis is classified as acute, chronic, and fulminant which may lead to acute heart failure, cardiogenic shock, chronic dilated cardiomyopathy, and malignant arrhythmias [4,5]. Elevated serum troponin, cardiac arrhythmia, diffuse ST elevation on an electrocardiogram (ECG), and regional or global left ventricular hypokinesis on ECG can be the best clues in the diagnosis of myocarditis. Viral infections such as enteroviruses and adenoviruses have been known as a common cause of myocarditis, but evidence for SARS-CoV-2 has been limited to case reports and case series [5]. Clinical diagnosis of myocarditis during the COVID-19 pandemic may be hampered due to similar presentations of both conditions. Herein, we present a case of a critically ill geriatric patient with confirmed SARS-CoV-2 induced fulminant myocarditis.
2. Case presentation

A 78-year-old male was presented to the emergency department of a tertiary academic center in Iran, in March 2020. His chief complaint was dyspnea exacerbating during the last ten days. The main symptoms were shortness of breath, cough, anosmia, and myalgia. The only disease in his past medical history was hypertension and Valsartan tablet 80 mg has been prescribed for him.

Assessment of vital signs at admission revealed tachycardia (HR = 110 bpm), normal core temperature (T = 37.2 °C), hypertension (BP = 170/85 mmHg), and tachypnea (RR = 40). Oxygen saturation (O₂Sat) was 72% on room air, and the level of consciousness was estimated by Glasgow Coma Scale (GCS) to be 12 out of 15.

A nasopharyngeal swab test was performed to detect SARS-CoV-2 RNA and was reported positive. The patient’s laboratory findings were all normal except for the tests that follow (reference ranges are brought in parentheses): Plasma lactate = 65 (up to 18) mg/dL, Albumin = 2.5 (3.5–5.2) g/L, C-Reactive Protein (CRP) = 163 (<6) mg/L, high sensitivity troponin = 103 (0–0.3) ng/ml, creatine kinase myocardial band (CK-MB) = 66 (0–24) IU/L.

In order to assess the diagnosis of COVID-19, chest computed tomography (CT) was performed and revealed diffuse bilateral ground-glass opacities (GGO) suggesting severe COVID-19 and viral pneumonia that scattered across two lungs with mild pleural effusion and cardiomegaly (Fig. 1).

A standard 12-lead ECG has been recorded which showed atrial fibrillation (AF) rhythm (Fig. 2).

According to echocardiography on admission date, reduced left ventricular ejection fraction (LVEF = 15%), high pulmonary arterial pressure (PAP = 50 mmHg), mildly enlarged LV and moderate to severe LV dysfunction, mild diastolic dysfunction (grade 1), mild mitral valve regurgitation, and normal septal thickness has been reported (Fig. 3).

The patient was intubated at admission and transferred to the Intensive Care Unit (ICU) on day-1. The ultrasound cardiac output monitoring (USCOM) revealed low systemic vascular resistance (SVR), low cardiac output (CO), and low delivery of oxygen (DO₂). Hence a combination of cardiogenic and septic shock was proposed for the patient. According to the national guideline of COVID-19 management at the time of patient’s admission, the initial treatment with oral Hydroxychloroquine 400 mg twice daily for the first day and then 200 mg twice daily for 7 days was considered. Intravenous Dexamethasone 16 mg daily for 5 days, and Intravenous Immunoglobulin (IVIG) 10 g for four days were prescribed, the last one as immunotherapy. Although high level of troponin was reported, the diagnosis of myocardial infarction was not confirmed by cardiology consult. Moreover, intravenous Ascorbic acid (Vitamin C) 1 g four times daily, and oral Melatonin 18 mg daily were prescribed for their antioxidant and anti-inflammatory properties [6,7]. The patient received broad-spectrum antibiotics with individual doses as a part of the septic shock management [8]. On day 25, echocardiographic measurement was performed and LVEF was reported as 25%, accompanying PAP of 38 mmHg and moderate LV dysfunction and right ventricular (RV) dilation. Follow up assessment on day 35 was performed and echocardiographic results were as follows: LVEF = 35%, PAP = 55, and mild RV dilation. At this time, respiratory distress was improved. The results on day 42 showed LVEF = 45%, PAP = 45, and mild RV dilation. In the whole course of admission, the patient received vasopressor and amiodarone for management of refractory shock and atrial fibrillation several time during his admission. Also, Midodrine was prescribed for septic shock and shortening the need for vasopressor [9]. The hemodynamic parameters were successfully stable at last and he could wean mechanical ventilation. The patient was discharged from ICU with normal vital signs and venous oxygen saturation. Unfortunately, after 2 days of being in the ward, the patient underwent respiratory arrest and cardiopulmonary resuscitation (CPR) was performed for 40 minutes that was not successful and he was expired. The reason for the respiratory arrest was not fully understood but it was

Fig. 1. Chest CT imaging shows ground-glass opacities (GGO) pattern with mild pleural effusion and cardiomegaly.
probably acute foreign-body aspiration.

3. Discussion

We described a case of probable fulminant myocarditis secondary to COVID-19 presenting with cardiogenic and septic shock. The patient was successfully cured using anti-inflammatory agents, immunotherapy, and supportive care.

Due to the limited number of studies that are mostly case reports and case series, there is little information about certain risk factors of COVID-19-related myocarditis. Our patient has a number of similarities with Sawalha et al.’s findings of the evaluation of 14 cases of myocarditis/myopericarditis secondary to COVID-19 that most of them had no specific past medical history except for hypertension.
The majority of these patients were presented with hemodynamic instability and about 70% were in cardiogenic shock and 30% in mixed cardiogenic and septic shock. Moreover, echocardiographic results showed LV dysfunction in most of the cases [10].

Proper treatment for COVID-19 induced myocarditis is not fully understood. Although routine treatment modalities like the use of vasopressor and inotropes for cardiogenic shock can be taken into consideration, it seems more supportive rather than therapeutic. The use of IVIG in myocarditis was first described in pediatric setting in 1990s [11]. Then some successful cases of IVIG treated myocarditis in adults were published [12,13]. To the best of our knowledge, there is only one case report that utilized IVIG for the treatment of COVID-19 induced myocarditis, although there are some cases of use of IVIG in other types of myocarditis, as it was mentioned [14]. IVIG may improve viral clearance and help the removal of cytokines that have caused myocardial damage [15]. In this report, we administrated the standard dose of IVIG as 40 g divided into four doses for 4 days.

Glucocorticoid was also administrated for the management of cytokine storm and viral myocyte damage [16]. Another unique treatment considered for this case was a high dose of intravenous ascorbic acid and melatonin. Because of the efficacy of vitamin C in the reduction of cytokine storm in acute respiratory distress syndrome (ARDS), it was proposed for COVID-19 [7]. The main mechanism of Vitamin C is the strengthening of host immune response and the protection of cells against oxidative stress. Also, the use of melatonin in different conditions in critically ill patients [17], before the COVID-19 era, proposed the role of this supplement in critically ill COVID-19 patients [6].

The severity of COVID-19 is not necessarily related to the occurrence of myocarditis. It means that some cases with mild involvement of lung parenchyma may be presented with acute myocarditis, while others may have severe involvement of lungs in imaging [18]. This highlights the importance of awareness about the occurrence of cardiomyopathy and cardiovascular involvement, even in mild cases, and probable further requirement of follow-up in suspected cases. In our case, the patient had severe involvement of both lungs, according to the results of the CT scan.

Definite diagnosis of myocarditis is via endomyocardial biopsy (EMB) and cardiac magnetic resonance imaging (MRI). However, both methods have some limitations in the COVID-19 era, i.e. infection control and poor access due to pandemic conditions [19]. EBM or cardiac MRI could not be performed for our patient due to his critical illness and poor access to these modalities. Although the diagnosis of myocarditis is considered probable, many findings like imaging, echocardiography, and laboratory results are highly suggestive for fulminant myocarditis [20].

4. Conclusion

The clinicians should be aware of the potentially lethal cardiac complication of COVID-19, especially in geriatrics. Using anti-inflammatory and immunotherapy as well as supportive care and minute-by-minute hemodynamic monitoring may be beneficial in critically ill patients with fulminant myocarditis in a severe infection context.

Declaration of competing interest

The authors declare no conflict of interest.

Acknowledgments

We would like to thank the nurses and other staff of Sina Hospital.

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