Case Report

The mRNA-Based Coronavirus Disease-2019 Vaccine-induced Severe Cardiomyopathy: A Rare Incident

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ABSTRACT

We are presenting a case of severe dilated cardiomyopathy (DCM) post-mRNA-based coronavirus disease-2019 (COVID-19) vaccine (Pfizer-BioNTech) in a young healthy man. After the second dose of the vaccine, his health rapidly declined, and he developed severe DCM with reduced ejection fraction. Investigations for other causes of DCM were unremarkable. Severe DCM following COVID-19 vaccine injection is a rare but serious condition. It also highlights the importance of close follow-up of pericarditis and perimyocarditis cases post-COVID-19 vaccine and we recommend clinicians have a low threshold for using echocardiography for early diagnosis and management.

Key words: Coronavirus disease-2019 vaccination, dilated cardiomyopathy, myocarditis

INTRODUCTION

Pericarditis and myocarditis have been reported following the mRNA-Based Coronavirus Disease-2019 Vaccine administration. These conditions are usually mild to moderate and respond to the treatment well. We present a very rare case of severely dilated cardiomyopathy related to the mRNA-Based Coronavirus Disease-2019 Vaccine.

CASE PRESENTATION

A 35-year-old previously healthy male presented with severe dilated cardiomyopathy (DCM) following the second dose of mRNA-based coronavirus disease 2019 (COVID-19) vaccine (Pfizer) injection.

Of note, the patient had not experienced any adverse effects after receiving the first dose of the same vaccine 2 months prior. Two days following receiving the second dose of the vaccine, he presented to the local emergency department with sharp pleuritic positional central chest pain with normal serum troponin level suggestive of pericarditis. The electrocardiogram showed sinus rhythm with no significant ST-T changes. He was commenced on ibuprofen and colchicine and was discharged home. Five weeks later, he gradually developed exertional dyspnea, orthopnea, mild sharp chest discomfort of different nature, and bilateral lower limbs edema. There was no history of recent flu-like symptoms. In addition, there was no family history of any significant cardiac condition. The patient did not drink alcohol.

The clinical assessment revealed features of decompensated heart failure on admission. The serum troponin level was still within the normal range (17 ng/L, reference interval <26 ng/L). The full blood count and renal function and thyroid function tests were unremarkable. Pulmonary embolus was excluded. The electrocardiogram still shows sinus rhythm with no evidence of significant ischemic changes or tachyarrhythmia/bradyarrhythmia.

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A transthoracic echocardiogram demonstrated a severely dilated left ventricle with severe global left ventricular systolic dysfunction. Left ventricular ejection fraction (LVEF) was 25%–30%.

He was commenced on an intravenous diuretic and other standard antifailure therapies including ramipril, bisoprolol, and spironolactone.

Cardiomyopathy screens for infiltrative, autoimmune, and viral causes were unremarkable.

Coronary angiography did not demonstrate any evidence of significant coronary artery disease.

Cardiac magnetic resonance imaging (MRI) showed severe impairment in biventricular function with mild left ventricular dilatation. LVEF was 20%. The left ventricular end-systolic and end-diastolic volumes were 127.1 ml/m^2 (normal range 69–121) and 102.1 ml/m^2 (normal range 26–56), respectively. The right ventricular ejection fraction was 14% (normal range 44%–62%). There was no evidence of the late gadolinium enhancement and no features of ischemic fibrosis or infiltrate or arrhythmogenic right ventricular cardiomyopathy [Figures 1 and 2]. Therefore, the overall impression was that he had severe DCM most likely secondary to mRNA COVID-19 vaccine (Pfizer-BioNTech) – a related myocardial insult.

DISCUSSION

COVID-19, caused by severe acute respiratory syndrome-coronavirus-2, has resulted in a global pandemic with over 392 million cases and upward of 5.7 million deaths as of early February 2022.[1] Multiple vaccines have been developed since the discovery of the virus using a variety of different technologies, including viral vector vaccines, messenger RNA-based vaccines, and inactivated live virus vaccines.[2]

Being recently developed, the side effects of COVID-19 vaccines are not entirely known. Studies have shown evidence of an association between the administration of the Pfizer-BioNTech COVID-19 vaccine "Comirnaty," the Moderna COVID-19 vaccine "Spikevax," and the subsequent development of myocarditis.[3]

Cases of pericarditis and myocarditis related to COVID-19 vaccination are already known and discussed.[3,4]

We present a rare case of the DCM post-mRNA COVID-19 vaccine (Pfizer). To the best of our knowledge, this is the first case of severe biventricular heart failure as an adverse effect of the Pfizer-BioNTech COVID-19 vaccine administration and there were no similar cases reported in the literature.

DCM is a cardiac muscle disorder characterized by left ventricular or biventricular dilation and impaired contraction in the absence of hypertension, valvular heart disease, or coronary artery disease.[4] The etiologies of DCM include genetic mutations, infections (viral/bacterial/fungal), autoimmune diseases, toxin exposure, metabolic dysfunction, and neuromuscular disease. To establish the diagnosis, one needs to rely on history, physical examination as well as utilizing transthoracic echocardiography, cardiac catheterization to rule out the presence of coronary artery disease, and cardiac MRI looking for inflammatory and infiltrative causes.[5]

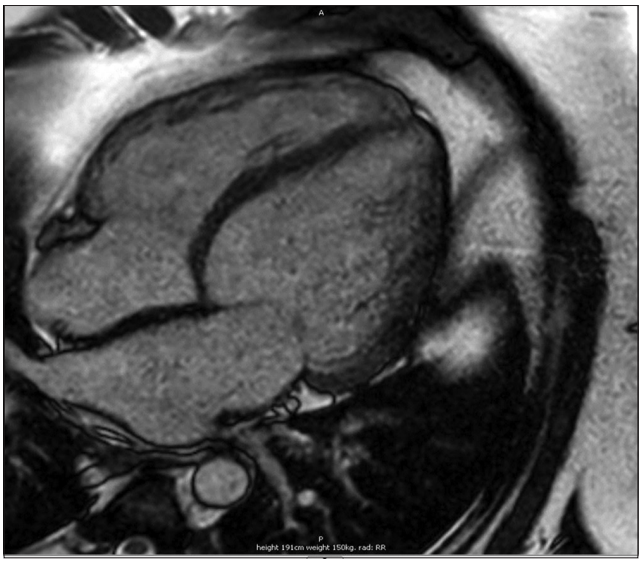

Figure 1: Horizontal long-axis steady-state free-precession MR image shows biatrial mild dilatation characteristic of diastolic heart failure, with LV wall mural thinning, MR: Magnetic resonance, LV: Left ventricular

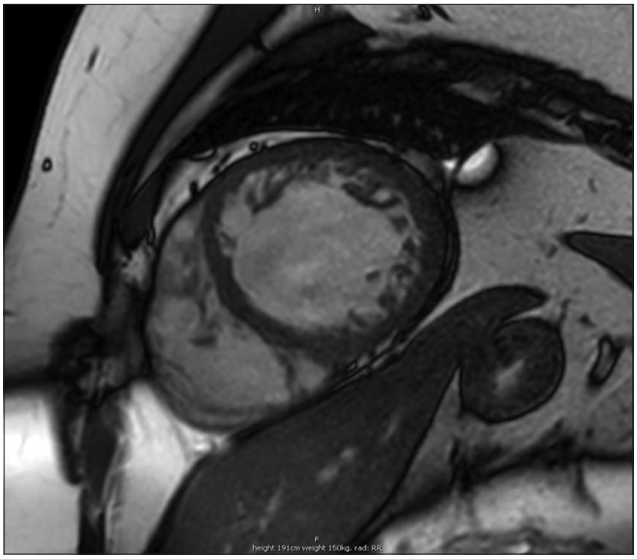

Figure 2: The short-axis steady-state free-precession MR image shows inhomogeneous mural thinning of the left ventricle with no evidence of discernible scarring suggestive of the long-standing nature of the disease, MR: Magnetic resonance

The standard antifailure management includes introducing angiotensin-converting enzyme inhibitors, beta-blockers, mineralocorticoid receptor antagonists, loop diuretic agents, and in refractory cases implantable cardioverter-defibrillators or heart transplantation.[5]

Our case was initially diagnosed with pericarditis as an adverse effect of the COVID-19 vaccine during the first presentation to the emergency department. Because his serum troponin level was within normal range, he was not referred for echocardiography. Unfortunately, he then presented 5 weeks later with severe left ventricular systolic dysfunction.

CONCLUSION

This unique case highlights the fact that all patients who develop COVID-19 vaccine-related pericarditis or myocarditis need close follow-up and it is reasonable to advise that all of them need to have echocardiography following initial presentation regardless of their serum troponin levels.

This strategy could assist in identifying cases of DCM at an earlier stage and avoid delayed diagnosis.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initial s will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed

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Conflicts of interest

There are no conflicts of interest.

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