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Myopericarditis with Significant Left Ventricular Dysfunction Following COVID-19 Vaccination: A Case Report

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Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
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Patient: Male, 46-year-old
Final Diagnosis: Myopericarditis
Symptoms: Chest discomfort
Medication: —
Clinical Procedure: —
Specialty: Cardiology

Objective: Unknown etiology

Background: Since Emergency Use Authorization of COVID-19 vaccines in December 2020, more is becoming known about their adverse effects. Growing numbers of myopericarditis cases after COVID-19 vaccination are being reported, mostly in younger adults. While most of these patients have recovered rapidly and without complications, it is still unclear whether patients who are older and have greater cardiac dysfunction secondary to myopericarditis will also experience the same recovery.

Case Report: We report the case of a middle-aged man with myopericarditis and significant left ventricular dysfunction after the second dose of the Pfizer/BioNTech BNT162b2 COVID-19 vaccine. He presented several days after vaccination, and with non-steroidal anti-inflammatory treatment, he quickly recovered ventricular function, and symptoms resolved within 1 week after vaccination.

Conclusions: Vaccines are a key tool in combating the COVID-19 pandemic, yet many people are hesitant to seek vaccination, perhaps for fear of adverse events. Our report of a middle-aged patient with significant left ventricular dysfunction, who still experienced rapid recovery, should reassure the public about the safety of vaccines. Such rare adverse effects should not deter people from receiving COVID-19 vaccination.

Keywords: COVID-19 Vaccine • Pericarditis • Ventricular Dysfunction, Left

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Background

The Pfizer/BioNTech and Moderna COVID-19 vaccines were the first to receive Emergency Use Authorization from the U.S. Food and Drug Administration (FDA). At the time of approval, there was limited information about adverse effects, but now more is becoming known about unexpected adverse reactions. Recent reports of pericarditis and myopericarditis occurring after COVID-19 vaccination are predominantly in younger individuals; most have normal left ventricular ejection fraction (LVEF), and most experience rapid, uncomplicated recovery [1-4]. We identified a middle-age male patient who presented with myopericarditis with a decreased LVEF of 42%. We describe in detail his management, discuss the association of myopericarditis with COVID-19 vaccination, and discuss the benefits of vaccination, despite the risk of adverse events such as myopericarditis.

Case Report

A 46-year-old man presented to the Emergency Department with 3 days of fevers and chest pain that began 1 day after receiving the second dose of the Pfizer/BioNTech BNT162b2 COVID-19 vaccine. The chest pain was positional (severity 8/10 when supine), with resolution sitting upright, pleuritic, and non-exertional. The patient noted slight improvement with naproxen. His associated symptoms of fever and headache had resolved the day prior to presentation. The patient is a former smoker but otherwise has no significant past medical history. He had not contracted COVID-19, nor had symptoms of such, prior to vaccination.

In the Emergency Department, the patient was tachycardic up to 120 bpm, normotensive, afebrile, with normal oxygen saturation on room air. There was no jugular venous distension or lower-extremity edema on physical exam. No murmurs or rubs were noted on cardiac exam. A 12-lead electrocardiogram (ECG) showed diffuse concave-upward ST elevation and PR depression (**Figure 1A**). Laboratory tests were notable for elevated troponin-I to 3.771 ng/ml (normal range <0.30 ng/ml), elevated CRP to 199.3mg/L (normal range <10 mg/L), elevated ESR to 44 mm/h (normal range <15 mm/h), a normal D-dimer (334 ng/mL; normal range <500 ng/mL), and elevated white blood cell count to 13.5 (normal range 4.5 to 11.0×10^9/L). A lipid profile test was not obtained, and no recent results were available. Polymerase chain reaction (PCR) testing for influenza A, influenza B, respiratory syncytial virus, and SARS-CoV-2 were negative. Chest radiography revealed no abnormalities. A transthoracic echocardiogram (TTE) showed a mild-moderately reduced left ventricular ejection fraction (LVEF) of 40-45% with global hypokinesis and no pericardial effusion (**Figure 2**).

The patient's constellation of symptoms, ECG changes, and laboratory and imaging findings were all consistent with myopericarditis. Given the timing of the presentation, no history of recent illness, and negative viral panel, we concluded that the Pfizer/BioNTech COVID-19 vaccine was the most likely etiology. The clinical presentation, significantly elevated inflammatory markers, relatively young age, and lack of coronary disease risk factors except for remote smoking history made acute coronary syndrome much less likely.

The patient received aspirin 650 mg and ketorolac i.v. with good effect. His Emergency Department course remained uneventful and he was discharged on colchicine 0.6 mg daily and ibuprofen 600 mg 3 times daily for treatment of myopericarditis. He was also prescribed metoprolol succinate 25 mg daily for left ventricular dysfunction. A cardiac magnetic resonance imaging (MRI) and outpatient clinic follow-up were scheduled for within 1 week of discharge.

At the time of his outpatient cardiac MRI, now 7 days after vaccination, the patient reported near resolution of chest pain. The MRI showed recovery of his LVEF to 54% with no definitive evidence of myocardial edema on the T2-weighted images (**Figure 3**). It is worth noting that comparing the initial LVEF from a TTE to follow-up LVEF from an MRI may not give as accurate a comparison as using the same modality at initial presentation and follow-up. The patient was then seen in the outpatient clinic 2 days later. At that time, he reported minimal chest discomfort, only with multiple very deep breaths, and felt his symptoms were essentially resolved. Repeat ECG showed improvement of ST changes compared to presentation (**Figure 1B**). Lab tests performed 12 days after initial presentation (15 days after vaccination) showed ESR decreased to 17 mm/hr and CRP to 36.7 mg/L. Ibuprofen was tapered over 2 weeks, with colchicine continued for 3 months and plans for repeat TTE at 3 months. Metoprolol was continued for 1 month. We reported this case to the Centers for Disease Control and Prevention (CDC) Vaccine Adverse Event Reporting System (VAERS).

Discussion

We identified a patient who developed myopericarditis with moderately reduced LVEF days after the second dose of the Pfizer/BioNTech BNT162b2 COVID-19 vaccine. Compared to most other reports of myopericarditis after COVID-19 vaccination, our patient is relatively older and had greater left ventricular dysfunction. Despite this, he experienced a similarly rapid and uncomplicated recovery with NSAID treatment.

Myopericarditis is inflammation of the pericardium and myocardium; it can have either an infectious or non-infectious etiology [5]. In developed countries, viruses, particularly enteroviruses,

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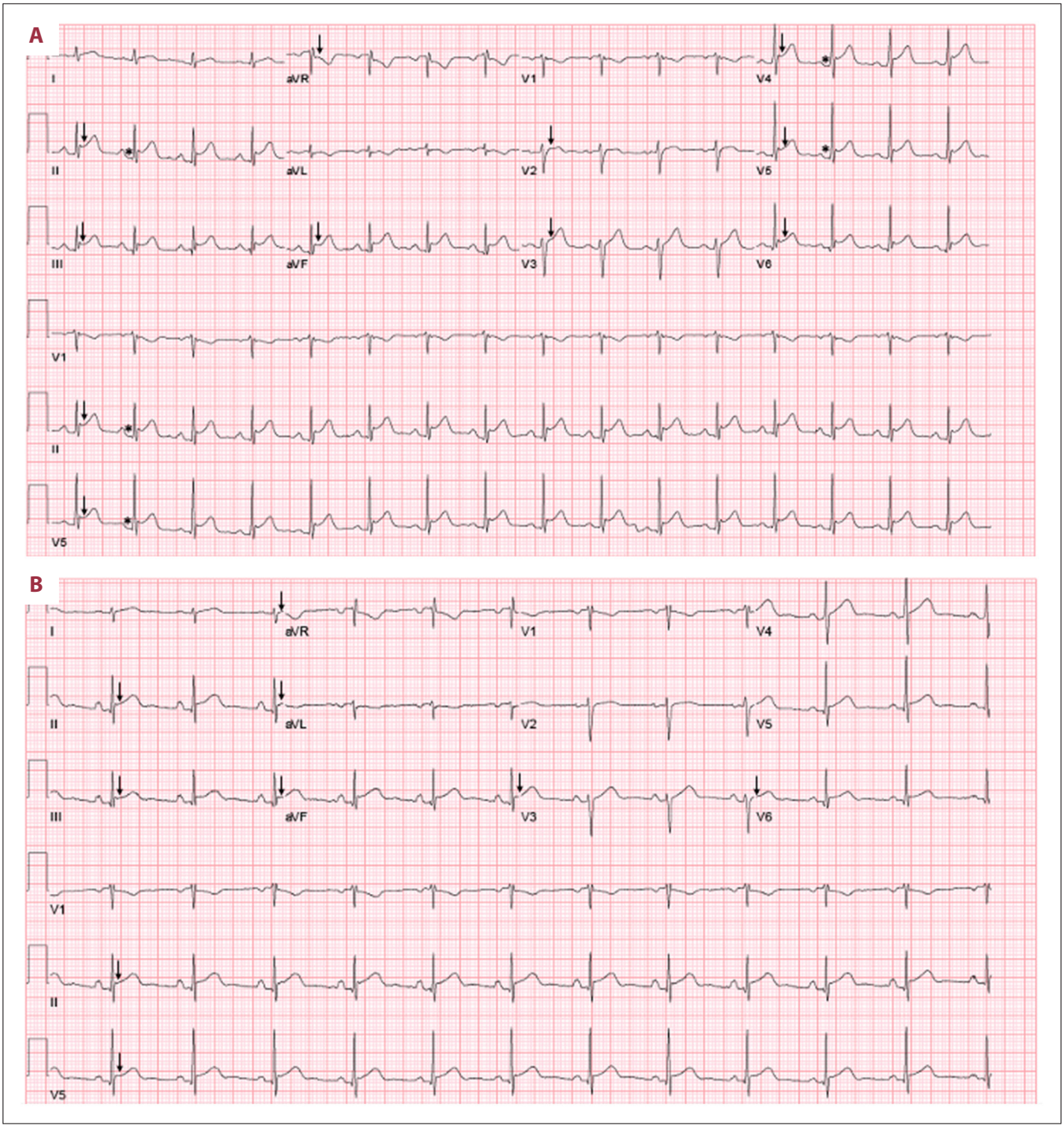

Figure 1. Electrocardiogram (ECG) at presentation (3 days after vaccination) and at 1 week follow-up (9 days after vaccination). Electrocardiogram at presentation (3 days after vaccination) showing diffuse concave-upward ST elevation (black arrow) and PR depression (asterisk) (**A**). Echocardiogram at 1 week follow-up (9 days after vaccination) showing improvement of ST changes as compared to presentation ECG (black arrows) (**B**). Written permission received from patient to use images.

are the most common infectious cause, and there have also been reports of myopericarditis in the setting of COVID-19 [6]. Of the non-infectious etiologies, autoimmune causes are most common. Myopericarditis has also been reported after vaccinations, most commonly smallpox vaccinations [7]. The Pfizer/BioNTech COVID-19 vaccine utilizes messenger RNA (mRNA) vaccine technology, which induces in vivo translation of the receptor-binding domain of the SARS-CoV-2 spike protein. Translation of these antigen proteins induces immune production of IgG antibodies against the spike protein [8]. Although the etiology of vaccine-associated myopericarditis is unknown, a possible mechanism is molecular mimicry, in which, after presentation of the viral antigen, the immune system is also activated against pericardial and myocardial proteins in predisposed individuals [9].

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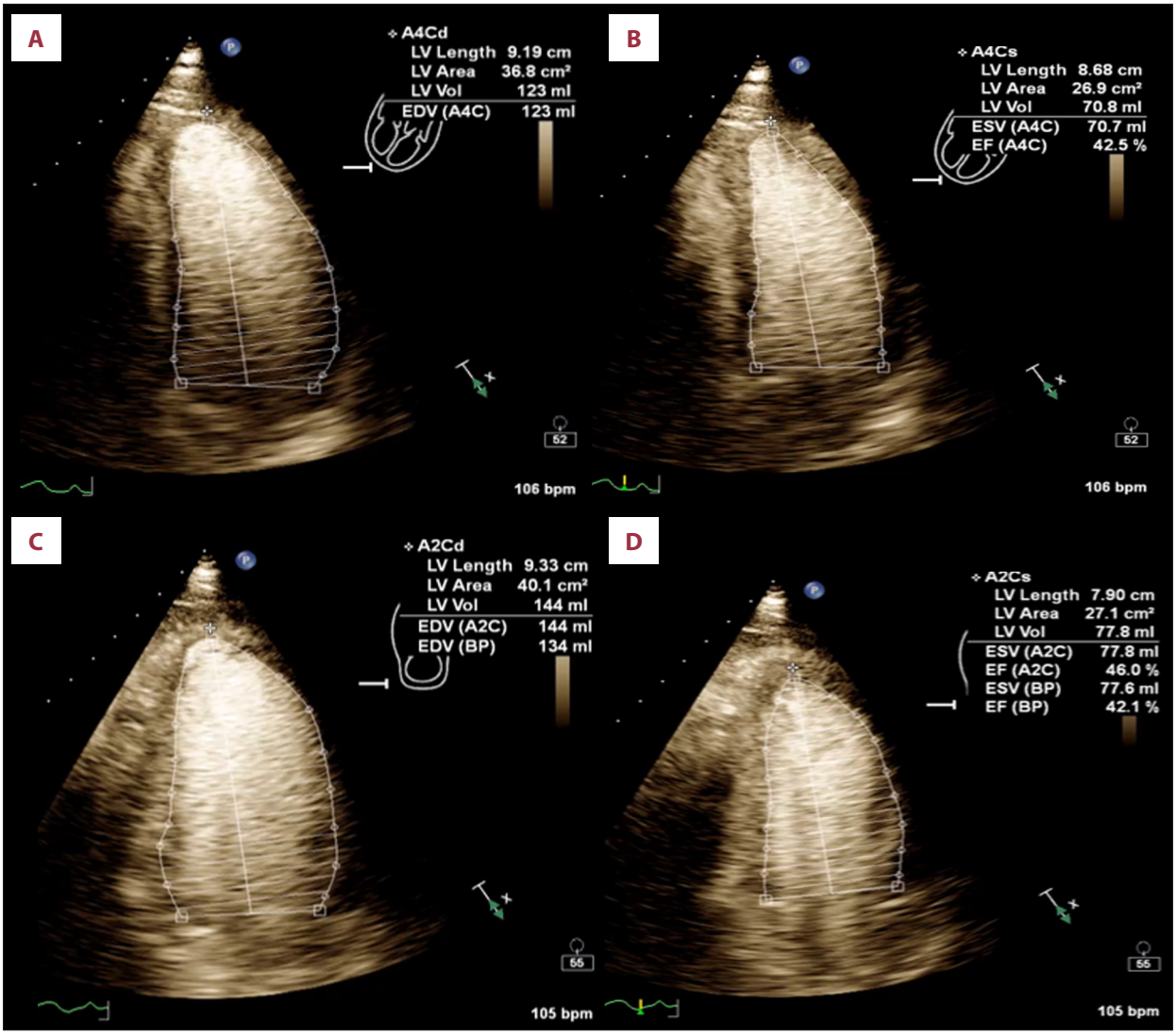

Figure 2. Transthoracic Echocardiogram (TTE) at presentation (3 days after vaccination). Apical four-chamber views at end-diastole (**A**), end-systole (**B**), and apical two-chamber views at end-diastole (**C**) and end-systole (**D**). Calculated LVEF is 42% using the Biplane Simpson's method. Written permission received from patient to use images.

We managed this mild case of myopericarditis without hospital admission. Aside from involvement of the myocardium, the patient did not have any risk factors associated with poor prognosis, such as high fever, pericardial effusion, cardiac tamponade, or failure to respond to non-steroidal anti-inflammatory drugs (NSAIDS) [5]. Thus, we treated him with NSAIDs and monitored improvement of symptoms, inflammatory markers, and ECG with outpatient follow-up. Beta-blocker therapy was given for the patient's mild-to-moderately depressed LVEF, which also resolved within 1 week of follow-up.

Our patient's case of myopericarditis after COVID-19 vaccination shares similarities with other reported cases. The majority have been in males and most have occurred several days after the second vaccination [1]. As with our patient, other cases have not involved large pericardial effusions or cardiac tamponade, and they have responded well to NSAID therapy with resolution of symptoms within 2 weeks [2,3]. Our patient was older and had greater LVEF depression than most other reported cases, although he still had a similar recovery trajectory. The mechanisms behind demographic differences in the incidence and severity of myopericarditis are not well understood, and it is unclear why our patient had greater left ventricular dysfunction, at an older age, than other cases reported [10]. As data on myopericarditis after vaccination continue to emerge, further possible associations with greater left ventricular dysfunction that could be investigated include age, brand of vaccine, and demographic, genetic, and lifestyle predispositions.

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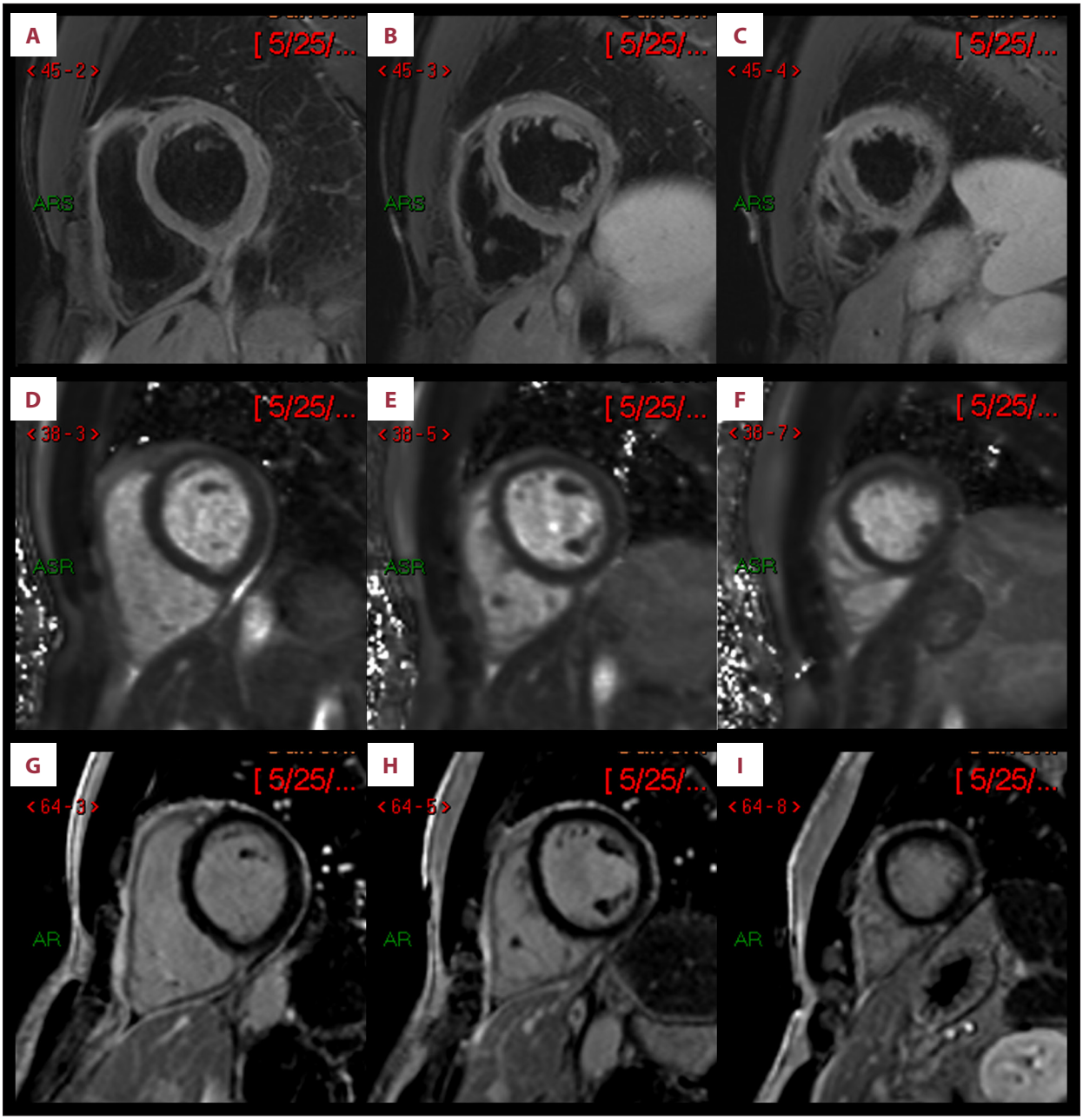

Figure 3. Cardiovascular magnetic resonance imaging (7 days after vaccination, 4 days after initiation of anti-inflammatory treatment). Pre-contrast T2-weighted imaging (**A-C**) and T2 mapping (**D-F**) show no definite high signal intensity in the left ventricular myocardium to suggest myocardial edema/inflammation. Post-contrast imaging shows no left ventricular late gadolinium enhancement (**G-I**). Written permission received from patient to use images.

Cases of myopericarditis after COVID-19 vaccination remain rare, with only 1168 reported in the United States at the time of writing [11]. Myopericarditis in the setting of all vaccines is also very rare, with only 0.1% of all vaccine adverse events between 1990 and 2018 being due to myopericarditis [7]. COVID-19 vaccine-related myopericarditis has a much milder clinical course than myopericarditis associated with COVID-19 infection. In 14 cases of myopericarditis in COVID-19, the survival rate was 81% [6]. Twenty percent of patients had cardiac tamponade physiology, 60% had reduced LVEF, and 42% had pericardial effusion. Of the 11 patients with documented hemodynamic status, 45% experienced cardiogenic shock. Thus, reports of rare, mild myopericarditis associated with COVID-19 vaccination should not dissuade people from receiving the vaccine. Concerns about adverse effects are not the only reasons for low vaccine uptake. Inequalities in access to vaccines and patient concerns about

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efficacy should also be considered to address the multi-factorial reasons for suboptimal vaccination rates [12,13].

Conclusions

As more becomes known about COVID-19 vaccinations, increasing reports of adverse events, such as myopericarditis, may dissuade patients from seeking vaccination. However, our patient, who was older and had more left ventricular function than many other patients with myopericarditis after COVID-19 vaccination, still experienced rapid recovery. Despite the growing number of case reports of vaccine-related adverse events, the vaccine's benefits continue to outweigh the risks, and healthcare professionals should be aware of the potential adverse effects in patients with recent vaccination.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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