Perimyocarditis after COVID-19 mRNA Vaccine: The Role of Cardiac Magnetic Resonance Imaging

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Abstract

A 22-year-old male presented with chest pain 3 days after his second dose of the COVID-19 vaccine. Cardiac magnetic resonance imaging demonstrated myocardial and pericardial enhancement. Given imaging and clinical findings, he was diagnosed with perimyocarditis. He was treated with a multitude of medications including NSAIDs, colchicine, and steroids. Fortunately, he was able to achieve symptom improvement. Due to COVID-19 vaccination novelty, further research is needed to identify side effects.

Perimyocarditis after COVID-19 mRNA Vaccine: The Role of Cardiac Magnetic Resonance Imaging

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ABSTRACT:

A 22-year-old male presented with chest pain 3 days after his second dose of the COVID-19 vaccine. Cardiac magnetic resonance imaging demonstrated myocardial and pericardial enhancement. Given imaging and clinical findings, he was diagnosed with perimyocarditis. He was treated with a multitude of medications including NSAIDs, colchicine, and steroids. Fortunately, he was able to achieve symptom improvement. Due to COVID-19 vaccination novelty, further research is needed to identify side effects.

KEY WORDS: pericarditis, multimodality imaging, COVID-19, mRNA vaccine, cardiac magnetic resonance imaging

Presentation

A 22-year-old male with past medical history of Coxsackie myocarditis in 2019 presented to the emergency department with acute chest pressure and diaphoresis. He described his chest pain as squeezing with radiation to the back. The patient denied dyspnea, edema, and lightheadedness. Physical examination and vital signs were within normal limits. Cardiovascular exam showed regular rate, normal rhythm, S1, S2 sounds, and no pericardial rub. He was taking no medications and had received his second dose of the Pfizer (BNT162b2) mRNA Coronavirus-19 disease (COVID-19) vaccine 3 days prior to symptoms onset. Laboratory examination showed high sensitivity C-reactive protein (hs-CRP) (3.15 mg/L), troponin (126 ng/mL) and brain natriuretic peptide (105 pg/mL) levels were all elevated. Severe acute respiratory syndrome-Coronavirus-2 (SARS-CoV-2) IgG test was positive indicative of prior infection with COVID-19. Electrocardiogram (ECG) showed diffuse ST-segment elevation suggestive of pericarditis. CXR was negative. Bedside echocardiography (Echo) demonstrated mildly reduced ejection fraction (EF) (45%). Cardiac magnetic resonance imaging (CMR) identified a small pericardial effusion, and profound basal inferolateral and lateral myocardial involvement **(Figure 1A).**Given his clinical and imaging findings, he was diagnosed with perimyocarditis secondary to COVID-19 vaccination. He was prescribed Aspirin 650 mg TID, colchicine 0.6 mg BID, and 1 month prednisone taper (30 mg). At 6 week follow-up, the patient noted his pain was significantly improved. The patient had completed his steroid taper and discontinued aspirin therapy due to gastrointestinal distress. Laboratory markers and ECG were normal. Echo showed EF recovery**(Video 1).** Repeat CMR demonstrated interval improvement in pericardial effusion and delayed enhancement **(Figure 1B)** . His colchicine was tapered to 0.6 mg daily and he was told to follow up in 4 months.

Discussion

COVID-19 vaccination efforts have been increasing resulting in many receiving mRNA vaccines. The COVID-19 mRNA vaccine encodes for the spike glycoprotein of the virus. The vaccine's liquid suspension particles allow for direct delivery of mRNA into host cells. Once intracellular, the mRNA upregulates ribosomal activity to create the spike glycoprotein.[1] The spike glycoprotein is then presented on the surface of the cell, this subsequently triggers the immune system to produce antibodies specific to the spike protein.[1,2] COVID-19 vaccine side effects are typically mild and may involve local injection site pain, myalgia, and fatigue. Serious adverse effects are rare, but recent reports have suggested that mRNA COVID-19 vaccines may cause myocarditis, pericarditis, and myopericarditis. As of June 11th 2021, the Centers for Disease Control (CDC) have identified 323 cases of myocarditis, pericarditis, and myopericarditis in the United States.[3] CDC findings suggest that afflicted patients are more likely to be male, younger with a median age of 19 years, and experience symptoms within two days after vaccination.[3] The most common presenting symptoms include chest pain (85%-95%), fever (65%) dyspnea (19%-49%), and syncope (6%).[4] The CDC also determined that patients were more likely to be hospitalized, but clinical course was mild as most patients recover fully .[3,5] While no consensus mechanism has been elucidated, vaccine component hypersensitivity, inflammatory reaction, and inappropriate immune system activation have been mentioned as potential causes.[4] Perimyocarditis diagnosis requires fulfillment of 2 out of 4 major criteria: pleuritic chest pain, auscultation of pericardial rub, ECG changes, and effusion on imaging.[6] Additionally, patients must also have elevated biomarkers suggestive of myocardial injury (troponin) and reduced left ventricular function.[4] Our patient presented with pleuritic chest pain, characteristic ECG changes, effusion on imaging, minor LV dysfunction, and biomarker elevation.

Imaging with Echo and CMR are useful for diagnosis and informing clinical course. Echo can identify the presence of effusion as well as be used for risk stratification in patients with cardiac tamponade.[7] Findings of pericarditis on CMR include T1-weighted enhancement of the thickened pericardium, T2-weighted increased pericardial intensity, and presence of pericardial edema on delayed hyperenhancement (DHE).[8] Notably, CMR findings of DHE in patients who develop non-vaccine myocarditis is associated with increased risk of cardiac complications.[9]Therefore, assessing the long term risk of complications in patients who have DHE on CMR after vaccination is paramount.[9] While much is still unknown about management of perimyocarditis in patients after COVID-19 vaccination, patients are treated using current guidelines for pericarditis management (non-steroidal anti-inflammatory drugs, colchicine, and/or steroids). Luckily, our patient was able to achieve clinical improvement on this regimen alone. Biologics (rilonacept) are indicated in patients who develop dependence on NSAIDs, colchicine, and steroids.[10]To our knowledge, this is one of the first reports of perimyocarditis after COVID-19 vaccination. Fortunately, these patients seem to experience mild disease courses. However, further observational studies are required to understand the side effects associated with COVID-19 vaccination.

Conclusion:

Perimyocarditis after COVID-19 mRNA vaccination is a rare occurrence. Patients present rapidly after vaccination, but overall have mild clinical courses. Diagnosis requires high clinical suspicion and proper clinical assessment. Multi-modality imaging especially CMR imaging is also helpful for diagnosis and management.

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Figures:

Figure 1. Timeline of Disease Course

A. Initial CMR with basal inferolateral and lateral myocardial involvement *(arrows)* and associated pericardial effusion

(star)

B. Follow up CMR with interval improvement in pericardial effusion and delayed enhancement *(arrows)*

BNP: Brain Natriuretic Peptide

CMR: Cardiac Magnetic Resonance Imaging DHE: Delayed Enhancement Hs-CRP: High Sensitivity C - reactive protein

LV: Left Ventricle

RV: Right Ventricle

RV: Right Ventricle Outflow Tract

Figure 2. Follow-Up Echocardiographic Findings

Four chamber apical view demonstrating normal biventricular function after symptom resolution.

LA: Left Atrium LV: Left Ventricle RA: Right Atrium RV: Right Ventricle