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Does switching type of mRNA COVID-19 vaccine increases the risk of myocarditis and pericarditis? A case report and literature review

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Abstract
Introduction: Myocarditis and Pericarditis are caused by diverse etiologies, such as infection, toxins, drugs, and vaccines. Myocarditis has been reported previously after smallpox vaccination; however, the incidence was rare. Currently, there are two types of COVID-19 vaccines, mRNA vaccines, and viral vector vaccines. Many cases of myocarditis/Pericarditis after the mRNA COVID-19 vaccine have been reported to the VARES (Vaccine Adverse Event Reporting System).
Case Presentation: A 20-year-old male with a history of mild asthma, who previously received two Pfizer covid -19 vaccines, presented to the emergency department with a chief complaint of chest pain two days after receiving a third booster dose of the Moderna vaccine. Troponin and C- Reactive Protein was Elevated, ECG findings revealed acute pericarditis, and MRI showed myocarditis. Echocardiography was normal except for moderate hypokinesis of the septal and inferior left ventricular regional wall segments and trivial pericardial effusion. The patient was admitted for treatment with aspirin, colchicine, metoprolol, and famotidine. His condition was improved, and he was discharged with a follow-up plan.
Discussion: So far, most of the cases of Myocarditis/Pericarditis associated with mRNA COVID-19 vaccine were after the second dose; however, not many cases were reported after the booster dose or switching the type of mRNA vaccine. The risk of myocarditis/pericarditis in our patient, with his history of asthma and two doses of Pfizer vaccine, might be increased after switching his booster vaccine to Moderna; nevertheless, the patient still responds well to the treatment without complications.
Conclusion: Myocarditis/Pericarditis following receipt of mRNA COVID -19 vaccine is a rare side effect; however, the occurrence of a potentially extremely rare adverse event after an immunization should not lessen the value and the effective benefit of the mRNA COVID-19 vaccine. Further studies are needed to determine the risk of complications following switching between the type of mRNA vaccine.

Keywords: Myocarditis, pericarditis, coronavirus, mRNA COVID-19 vaccine

Introduction
The global health impact of the coronavirus disease 2019 (COVID – 19) has been drastically changed with the opportune introduction of vaccines [1]. Two types of vaccines are currently approved by the food and drug administration (FDA); these are mRNA vaccines (Pfizer-BioNTech, and Moderna) and viral vector vaccines (Johnson & Johnson's Janssen) [2]. According to the Centers for Disease Control and Prevention (CDC), the recommended age for Pfizer-BioNTech vaccine administration is ≥ 5 years old, while the recommended age for both Moderna and Johnson & Johnson's Janssen vaccines is ≥ 18 years old [2]. The current mRNA COVID -19 vaccines showed excellent efficacy profiles in several clinical trials in adults [3, 4].
Many Causes of Myocarditis and Pericarditis have been identified, such as infection, toxins, drugs, and vaccines; however, on many occasions, the etiology remains idiopathic [5, 6]. Historically, myocarditis after vaccination was reported following smallpox vaccination [7]. Several articles in the 2000s described the occurrence of myocarditis after smallpox vaccination [8, 9]. However, a study conducted in 2018 to analyze the association between smallpox vaccination and myocarditis/pericarditis found that the incidence of these adverse events is rare [6].

In June 2021, The CDC published a report that included descriptive data regarding cases of Myocarditis and Pericarditis after mRNA COVID -19 vaccines. The data was based on cases reported to the VARES (Vaccine Adverse Event Reporting System). Out of approximately 300 million mRNA vaccines administered in the United States, there were 791 reports after Pfizer-BioNTech administration (150 cases after the first dose, 563 after the second dose, and 75 after unknown dose), and 435 reports after Moderna (117 cases after the first dose, 264 after the second dose, and 54 after unknown dose) [10]. Within the United States Military, there were a total of 23 male patients diagnosed with myocarditis within four days after the administration of an mRNA COVID-19 vaccine [11]. As a result of all of these reported cases, the Food and Drug Administration, in June 2021, added a warning regarding the risk of myocarditis and pericarditis to fact sheets for Moderna and Pfizer-BioNTech Covid-19 vaccines [12].

We present a case of a 20-year-old male with a history of receiving two doses of the Pfizer vaccine who presented with my pericarditis within two days after a booster dose of the Moderna COVID-19 vaccine.

Case Presentation

A 20-year-old male with a history of mild asthma and two doses of the Pfizer vaccine presented to the emergency department with a chief complaint of chest pain. The patient developed fever and myalgia after receiving the third dose of the Moderna COVID-19 vaccine (which are similar to the symptoms developed after the second dose), these symptoms resolved within two days, and by that time, the patient started developing central chest pain, described as heaviness, that was worsened by laying down. The chest discomfort waxed and waned throughout the day and continued to exacerbate by recumbent position. On presentation to the hospital, the troponin was found to be elevated at 6.49 and then increased to 6.72. C-Reactive Protein was 3.6 mg/dl; other lab works were unremarkable. Chewable aspirin 325 mg was given to the patient. Twelve lead ECG shows upsloping ST-segment elevation in the anterolateral leads with PR segment depression, consistent with acute pericarditis. Telemetry has not shown any evidence of arrhythmia. Echocardiography showed normal chambered sizes, left ventricular ejection fraction is 55%, moderate hypokinesis of the septal and inferior left ventricular regional wall segments, normal thickness pericardium with trivial effusion. Magnetic resonance imaging showed findings of myocarditis. Nasopharyngeal swab for the respiratory panel, PCR, was negative for all respiratory organisms, including SARS-CoV-2. After consultation with the cardiology team, the patient started on aspirin 325 mg 2 tablets by mouth (650 mg) three times a day for one week, colchicine 0.6 mg 1 tablet two times a day for three weeks, famotidine 20 mg two tablets daily, metoprolol succinate 50 mg 1 tablet a day for an expected duration of three months. On the third day of admission, the patient's condition improved; his C- reactive Protein decreased to 1.7 mg/dl, troponin level decreased to 2.58, and ECG was normal. The patient was discharged with a plan to follow up with the cardiology clinic and updated CRP, troponin, and echocardiography. The patient was instructed not to exercise for six months and advised not to drink alcohol excessively.

Discussion

The diagnosis of Myocarditis and pericarditis should follow the CDC definition of Myocarditis and Pericarditis [10]. The clinical impact of Myocarditis and Pericarditis varies because of the diverse etiologies of infectious and non-infectious diseases [13, 14, 15]. Also, in many clinical situations, Myocarditis and Pericarditis may be co-presented and identified as Myopericarditis [15]. Several side effects have been reported following COVID-19 vaccines, including localized injection site reactions and systemic adverse events such as fatigue, fever, chills, headache, and myalgias [16]. More serious but rare side effects like anaphylaxis have been reported following Pfizer-BioNTech and Moderna COVID-19 vaccine administration [16]. In addition, Thrombocytopenia and thrombotic events have also been reported following the AstraZeneca vaccine [17]. Several cases of Myocarditis and pericarditis following mRNA COVID-19 vaccination have been reported in the Vaccine Adverse Event Reporting System (VAERS) [10]; however, many of those cases are treated without significant clinical impact [10]. From the publicly available VAERS database and the CDC June 2021 updates report on COVID-19 vaccines, the data showed that the incidence of Myocarditis/Pericarditis is extremely rare, and more in males than the females (male; 66% after the first dose, 79% after the second dose, female; 33% after the first dose, 20 % after the second dose), the median age of Myocarditis/Pericarditis after the first dose was 30 years old, while the median age after the second dose was 24 years old. The median time of the onset of the symptoms of Myocarditis/Pericarditis Post mRNA COVID-19 vaccine is four days (0-61 days) after the first dose and three days (0-98 days) after the second dose [10]. Most of the cases are after the second dose [10, 18]. Out of 323 cases of Myocarditis/Pericarditis after mRNA COVID-19 vaccination reported to VAERS, age < 29 years old, 309 cases were hospitalized, and only 2 cases required admission to the ICU [10]. Finally, more likely susceptible individuals, such as those who developed Myocarditis/Pericarditis after the first dose or with a positive family history of cardiomyopathy, might benefit from the viral vector vaccines as an alternative [18]; however, further research is needed to determine the high-risk individuals and the best approach to diminish the occurrence of Myocarditis/ Pericarditis after mRNA COVID -19 vaccine.

Conclusion

Myocarditis and Pericarditis are rare side effects of the mRNA COVID -19 vaccine; however, most of the cases respond well to medical treatments. Physicians should remain vigilant about the patient's past medical and vaccination history, and should educate about the risk of complications after switching the type of vaccine; however, this complication should be further studied to identify the risk.

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