



Case Series

Myocarditis after BNT162b2 and mRNA-1273 COVID-19 vaccination: A report of 7 cases

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ABSTRACT

Background and objectives: According to some reports, there is a link between the development of myocarditis and the administration of messenger RNA (mRNA) vaccines against coronavirus disease (COVID-19). Here, we report seven cases that developed myocarditis after receiving a second dose of mRNA COVID-19 vaccine.

Methods: This is a multi-center case series study. In this study, we present 7 patients diagnosed with myocarditis following BNT162b2 and mRNA-1273 COVID-19 vaccinations on March 7, 2021, and March 3, 2022.

Results: All seven patients were males and hemodynamically stable. The median age was 24.5 years, ranging from 16 to 36 years old. All patients received the second dose of a messenger RNA (mRNA) vaccine between one and four days before being admitted to the hospital (5 received BNT162b2 [Pfizer-BioNTech] and 2 received mRNA-1273 [Moderna]). The electrocardiograms of all seven patients were abnormal, and their troponin levels were elevated. Moreover, all patients were treated with colchicine and NSAIDs. The average length of stay in the hospital was 2.4 days, and all of the patients' symptoms had resolved by the time they were discharged.

Conclusion: The results of the current study raise the possibility of an association between BNT162b2 [Pfizer-BioNTech] or mRNA-1273 [Moderna] COVID-19 vaccination and myocarditis.

1. Introduction

The World Health Organization (WHO) has approved several different vaccines, including Pfizer/BioNTech/BNT162b2, Moderna COVID-19 (mRNA-1273), Janssen/Ad26.COVS.2.S (Johnson & Johnson), AstraZeneca/AZD1222, Sinovac-CoronaVac, and Sinopharm COVID-19. Pfizer BioNTech (BNT162b2) and Moderna (mRNA-1273) are two examples of mRNA COVID-19 vaccines that have demonstrated high levels of efficacy and effectiveness. After widespread vaccination with mRNA vaccines against coronavirus disease 2019 (COVID-19), myocarditis in young males was found as a potential unusual side effect, leading to widespread concern in the public and eventually leading to vaccine hesitancy or rejection [1]. Young men are the most likely to develop myocarditis in general practice, and at least half of patients will recover without treatment [1]. However, rare complications such as myocarditis and pericarditis events following COVID-19 vaccination have been observed in recent surveillance studies [1–7].

Here, we report seven patients diagnosed with myocarditis after receiving a second dose of BNT162b2 and mRNA-1273 COVID-19 vaccines.

2. Methods

This is a multi-center case series study that will take place between March 7, 2021 and March 3, 2022. In which we gathered seven consecutive young male patients who had received the mRNA COVID-19 vaccine and had developed cardiac involvement. All seven patients were admitted to the hospital following the second dose of the mRNA-based COVID-19 vaccine due to chest pain, fatigue, myalgia, fever, ECG changes, and troponin elevation.

In accordance with the Helsinki Declaration, all patients who participated in the study provided written informed consent during their evaluation, stating that their data may be used for research purposes in the future. Participants under the age of 18 were required to give informed consent, which was given by their parents. Ethical approval has been given by the ethics committee of our faculty. This case series has been reported in line with the PROCESS Guideline [8].

3. Results

A total of seven patients with myocarditis were identified between

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Table 1
Patient Characteristics and Outcomes of 7 patients reported with myocarditis after second dose of mRNA COVID-19 vaccination.

Variables	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Age	28	34	19	16	22	17	36
Gender	Male	Male	Male	Male	Male	Male	Male
Prior COVID-19 infection	No	No	No	No	No	No	No
Vaccine type	BNT162b2	BNT162b2	mRNA-1273	BNT162b2	BNT162b2	BNT162b2	mRNA-1273
Doses received	2	2	2	2	2	2	2
Presenting symptoms	Chest, fatigue pain	Chest pain, fever, and SOB	Chest pain, fatigue	Chest pain, and chills, fatigue	Chest pain, fatigue, fever, headache	Chest pain, fever, and fatigue	Chest pain, SOB, and myalgia
Days to symptom onset	3	2	2	4	1	2	1
Troponin level	Elevated	Elevated	Elevated	Elevated	Elevated	Elevated	Elevated
CRP, mg/dL	Abnormal	Abnormal	Abnormal	Abnormal	Abnormal	Abnormal	Abnormal
Left ventricular ejection fraction (LVEF%)	58%	55%	65%	57%	53%	61%	45%–50%
ECG (ST- change)	Abnormal	Abnormal	Abnormal	Abnormal	Abnormal	Abnormal	Abnormal
Rhythm	Normal sinus rhythm	Normal sinus rhythm	Normal sinus rhythm	Normal sinus rhythm	Normal sinus rhythm	Normal sinus rhythm	Normal sinus rhythm
Chest radiography	Normal	Normal	Normal	Normal	Normal	Normal	Normal
COVID-19 testing (PCR)	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Blood pressure, mm Hg	105/68	125/85	115/80	122/76	112/75	126/68	135/87
Heart rate, bpm	73	65	68	81	79	82	74
Respirations, per min	16	18	17	16	18	16	19
Temperature, °C	36.6	37	36.5	36.7	37.5	37.2	36.8
Length of hospital stay	2	1	3	2	3	2	4
Treatment (s)	Colchicine, NSAIDs	NSAIDs	NSAIDs	NSAIDs	Colchicine, NSAIDs	NSAIDs	Colchicine, NSAIDs
Outcome	Discharged	Discharged	Discharged	Discharged	Discharged	Discharged	Discharged

March 7, 2021 and March 3, 2022. All seven patients were males and hemodynamically stable. The median age was 24.5 years, ranging from 16 to 36 years. It summarizes the demographic and clinical characteristics of the seven cases and is shown in (Table 1). The most common symptoms were chest pain, and fatigue. Everyone in the group had received the second dose of a messenger RNA (mRNA) vaccine between one and four days before being admitted to the hospital (5 received BNT162b2 [Pfizer-BioNTech] and 2 received mRNA-1273 [Moderna]). All seven patients had negative results for COVID-19 and respiratory virus polymerase chain reaction (PCR) tests. The electrocardiograms of all seven patients were abnormal, and their troponin levels were elevated. A chest radiograph revealed that none of them had acute pulmonary disease. According to the findings, left ventricular ejection fraction ranged from 45% to 65% on echocardiograms. All seven patients were treated with colchicine and NSAIDs. The average length of stay in the hospital was 2.4 days, and all the patients' symptoms had resolved by the time they were discharged.

4. Discussion and conclusion

This study evaluated seven young male patients diagnosed with myocarditis following the second dose of mRNA COVID-19 vaccines (5 received BNT162b2 [Pfizer-BioNTech] and 2 received mRNA-1273 [Moderna]) between March 7, 2021 and March 3, 2022. All seven patients presented with chest pain. The troponin levels were elevated in all patients. In accordance with the current literature, post-vaccination myocarditis appears to be more common in younger men under the age of 30 years, and it appears to occur more frequently after the second dose of the COVID-19 mRNA vaccines, which occurs typically within 3–5 days after vaccination [3,9–11]. The precise mechanism of myocarditis after COVID-19 vaccines remains unknown to date. In addition, the vaccine's active component, the nucleoside-modified mRNA that codes for the spike glycoprotein of SARS-CoV-2, may be linked to myocarditis [7,12].

Furthermore, the reasons for the higher incidence of myocarditis in younger males following COVID-19 vaccination, which has been demonstrated in clinical and experimental studies in the past, remain a mystery [13]. Additionally, women may be less likely to undergo cardiovascular investigations, including imaging modalities, due to sex hormone differences in the immune response [12,14].

All published papers on myocarditis after COVID-19 vaccination have similar findings. The most common presenting symptom is chest pain, followed by fever, malaise, and other myocarditis symptoms [3,4,9,10,15–17]. Interestingly, all of our patients complained of chest pain at the time of presentation. The majority of patients reported on, developing symptoms within one week of receiving a second dose of the mRNA COVID-19 vaccine. However, a case of myocarditis has been reported following the first vaccination [16].

Future research should answer this question: (Should patients who developed myocarditis after mRNA COVID-19 vaccination receive a booster COVID-19 vaccination in the future?). The current study has some limitations, including the fact that it only received reports of myocarditis cases that resulted in hospitalization, and that the diagnosis was not validated by myocardial biopsy.

In conclusion, myocarditis is more prevalent in males. The results of the current study raise the possibility of an association between BNT162b2 [Pfizer-BioNTech] or mRNA-1273 [Moderna] COVID-19 vaccination and myocarditis. Additionally, we hope that our case series will raise awareness among physicians and nurses about this uncommon side effect following mRNA COVID-19 vaccinations.

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Ethical approval

Ethical approval has been given by the ethics committee of our faculty.

Consent

Written informed consent was obtained from the patients for publication of this case series and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Sirwan K. Ahmed: Conception and design, execution, analysis and interpretation of data, involved in drafting the article, revised it critically for important intellectual content, read and approved the final version of the manuscript.

Registration of research studies

Name of the registry: OSF Registries.

Unique Identifying number or registration ID: osf.io/pbkzd.

Hyperlink to your specific registration (must be publicly accessible and will be checked): <https://archive.org/details/osf-registrations-shcwq-v1>.

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Data availability statement

All relevant data are within the manuscript.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Declaration of competing interest

There is no conflict to be declared.

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Not applicable.

Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.amsu.2022.103657>.

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