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Review Article

A Narrative Review of Myocarditis Following COVID-19 Vaccination

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Abstract

Myocarditis is a rare but serious consequence of COVID-19 vaccination. This study conducted a narrative review of the research on vaccine-induced myocarditis regarding the type, dose of vaccine, time to present from the vaccine, cardiac history, and patient outcomes. All papers of the year 2021 about the study subject were gathered from PubMed using the following MeSH terms: ("Myocarditis" and "COVID-19 vaccine") with no language restriction. Inclusion criteria were case reports and case series. Our search yielded overall 68 studies. After applying inclusion criteria, only 24 studies were included with the total of 46 patients. Forty-one of 46 (89.1%) of

the patients were males. The age range was 14-70 years with a mean age of 28.82±14.65 years. The majority of the myocarditis related COVID-19 vaccine cases (73.9%) were associated with the Pfizer-BioNTech following the second dose of the vaccine. The median time to present from the vaccines was 3 days (range, 1-14 days). 93.5% of cases had no previous cardiac history. 91.3% of myocarditis cases were survived and discharged from the hospital.

Keywords: Myocarditis; COVID-19 Vaccine

1. Introduction

The coronavirus disease-19 (COVID-19) related morbidity and mortality has been declined significantly throughout the world by introducing the variety of COVID-19 vaccines [1]. However, recent scientific reports have raised concerns for myocarditis related to different types of COVID-19 vaccines, both in double-jabbed people [2] and even after the first vaccine shot [3]. Myocarditis subsequent to administration of COVID-19 vaccines, especially the mRNA based one, has been described [4,5]. Similar reports have been defined for Johnson & Johnson's Janssen [6] and AstraZeneca [3] vaccines as well. Although the number of reported myocarditis has been small compared to the large number of people vaccinated, it may become more pronounced as the vaccine is now widely administered. Despite many papers, there are still limited data on vaccine-induced myocarditis. This study conducted a narrative review of the research on vaccine-induced myocarditis regarding the type, dose of vaccine, time to present from the vaccine, cardiac history, and patient outcomes.

We performed a search in the PubMed database. All papers of the year 2021 about the study subject were gathered using the following MeSH terms: ("Myocarditis" and "COVID-19 vaccine") with no language restriction. Inclusion criteria were case reports and case series. The outcomes of interest were vaccine-induced myocarditis regarding the type, dose of vaccine, time to present from the vaccine, cardiac history, and if the patient was died or not.

Our search yielded overall 68 studies. After applying inclusion criteria, only 24 studies were included with the total of 46 patients [2-25]. Forty-one of 46 (89.1%) of the patients were males. The age range was 14-70 years with a mean age of 28.82±14.65 years. The majority of the myocarditis related COVID-19 vaccine cases (73.9%) were associated with the Pfizer-BioNTech 19.6% were associated with the Moderna vaccine, 2.2% were associated with the Johnson & Johnson (Janssen) vaccine, and 4.3% were associated with the AstraZeneca vaccine. Almost all the myocarditis related to the Moderna vaccine (8/9) occurred following the second dose of the vaccine, whereas 27/34 (79.4%) of the myocarditis related to the Pfizer-BioNTech vaccine occurred following the second dose of the vaccine. All the two-myocarditis cases related to the AstraZeneca vaccine occurred following the first dose of the vaccine. The median time to present from the vaccines was 3 days (range, 1-14 days). It was specifically 2.5 days (range, 1-10 days) for Pfizer-BioNTech, 3 days (range, 1-14 days) for Moderna, 2 days (2 days) for Johnson & Johnson, and 2 days (range, 1-3 days) for AstraZeneca vaccine. 93.5% of cases had no previous cardiac history. 91.3% of

myocarditis cases were survived and discharged from the hospital (Table 1).

Table 1: Characteristics and outcomes of patients with myocarditis related to COVID-19 vaccine

Patient	Age, Y	Sex	Vaccine	Dose	Time to present from the vaccine, d	Cardiac history	Died/Discharged
1	27	M	Pfizer-BioNTech	2nd	2	N	died
2	34	F	Pfizer-BioNTech	1st	4	N	discharged
3	70	M	AstraZeneca	1st	3	N	discharged
4	39	M	Pfizer-BioNTech	2nd	1	Y	discharged
5	21	M	Pfizer-BioNTech	2nd	2	N	discharged
6	68	F	AstraZeneca	1st	1	Y	discharged
7	25	M	Pfizer-BioNTech	1st	10	N	discharged
8	20	M	Pfizer-BioNTech	2nd	3	N	discharged
9	22	M	Pfizer-BioNTech	1st	5	N	died
10	30	M	Pfizer-BioNTech	2nd	3	N	discharged
11	40	M	Pfizer-BioNTech	1st	6	N	discharged
12	20	M	Pfizer-BioNTech	2nd	2	N	discharged
13	22	M	Moderna	1st	3	N	discharged
14	15	M	Pfizer-BioNTech	2nd	1	N	discharged
15	29	M	Pfizer-BioNTech	2nd	1	N	discharged
16	24	M	Pfizer-BioNTech	2nd	1	N	discharged
17	22	M	Moderna	2nd	3	N	discharged

18	31	M	Moderna	2nd	3	N	discharged
19	40	M	Pfizer-BioNTech	1st	2	N	discharged
20	56	M	Pfizer-BioNTech	2nd	3	N	discharged
21	26	M	Pfizer-BioNTech	2nd	3	N	discharged
22	35	M	Pfizer-BioNTech	2nd	2	N	discharged
23	21	M	Pfizer-BioNTech	2nd	4	N	discharged
24	22	M	Moderna	2nd	2	N	discharged
25	25	M	Moderna	2nd	1	N	discharged
26	21	F	Moderna	2nd	1	N	discharged
27	16	M	Pfizer-BioNTech	2nd	2	N	discharged
28	19	M	Pfizer-BioNTech	2nd	3	N	discharged
29	17	M	Pfizer-BioNTech	2nd	2	N	discharged
30	18	M	Pfizer-BioNTech	2nd	3	N	discharged
31	17	M	Pfizer-BioNTech	2nd	3	N	discharged
32	16	M	Pfizer-BioNTech	2nd	3	N	discharged
33	14	M	Pfizer-BioNTech	2nd	2	N	discharged
34	16	M	Pfizer-BioNTech	2nd	3	N	discharged
35	17	M	Pfizer-BioNTech	2nd	2	N	discharged
36	52	M	Moderna	2nd	3	Y	discharged
37	70	F	Janssen	1st	2	N	died
38	22	M	Pfizer-BioNTech	1st	2	N	discharged

39	19	M	Pfizer-BioNTech	2nd	1	N	discharged
40	25	M	Moderna	2nd	3	N	discharged
41	37	M	Pfizer-BioNTech	2nd	2	N	discharged
42	20	M	Pfizer-BioNTech	2nd	3	N	discharged
43	19	M	Pfizer-BioNTech	2nd	3	N	discharged
44	45	F	Pfizer-BioNTech	1st	10	N	discharged
45	42	M	Moderna	2nd	14	N	died
46	20	M	Pfizer-BioNTech	2nd	2	N	discharged

M: male; F: female; N: no; Y: yes

The analysis of the available data reveals some key findings. First, for the most part, myocarditis related to COVID-19 vaccines occurs in young males following the second dose of the vaccine. It might support the hypothesis proposed by Levin et al. that a severe response of the immune system (i.e., cytokine storm) is more likely to be elicited after the second dose of the vaccine [26]. Second, most myocarditis related to COVID-19 vaccines occurs with mRNA vaccines (Pfizer-BioNTech and Moderna COVID-19 vaccines). Third, myocarditis related to COVID-19 vaccines has a good therapeutic prognosis for the most. Finally, although myocarditis related to COVID-19 vaccines, specially those based on mRNA technology, are common, myocarditis followed by the other types of vaccines should not be overlooked by the clinician.

Disclosures

The authors declare that they have no competing interests.

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