

**Short Report**

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**Autoimmune response and myocarditis associated with COVID-19 vaccination**Tuo Han<sup>1</sup>; Haoyu Wu<sup>2</sup>; Yan Zhang<sup>1</sup>, Cong-xia Wang<sup>1\*</sup><sup>1</sup>Department of Cardiology, The Second Affiliated Hospital of Xi'an Jiaotong University, Xi'an, China.<sup>2</sup>Department of Cardiology, People's Hospital of Shaanxi Province, Xi'an, China.**\*Corresponding Author: Cong-xia Wang**

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Recently, there have been numerous reports of suspected myocarditis cases following vaccination against Corona Virus Disease 2019 (COVID-19), although the exact mechanism behind it is still unclear [1,2]. Shaw KE and colleagues reported four cases of acute myocarditis that were temporally related to the receiving of COVID-19 vaccine based on their Cardiac Magnetic Resonance (CMR) imaging findings [3]. Among them, two patients with previous COVID-19 infection developed symptoms after the first dose, while the other two patients with no previous COVID-19 infection developed symptoms after the second dose. Therefore, the authors argued that there might be a potential immune-boosting mechanism flowing prior immune exposure or priming.

Inspired by this, we performed a systemic literature search and retrieved all case reports and series on COVID-19 vaccines-

related myocarditis as of October 31, 2021 in the PubMed database. Finally, a total of 71 myocarditis cases were enrolled, and their demographics, vaccine types and injection doses, clinical symptoms, cardiac biomarkers and imaging findings, interventions and outcomes extracted. According to their history of COVID-19 infection, patients were divided into prior COVID (n=12) and non-prior COVID (n=59). The clinical characteristics of the patients are presented in Table 1. Almost all patients (65/71) were male and associated with two mRNA vaccines, Pfizer-BioNTech and Moderna mRNA-1273. The most common symptoms of myocarditis after COVID-19 vaccination are chest pain, fever, shortness of breath, and fatigue. Symptoms usually began within 5 days after the second dose, accompanied by abnormal increase in troponin and C-reactive protein. CMR examination frequently showed local edema and late gadolinium enhancement, consistent with features of myocarditis. Nonsteroidal anti-inflammatory drugs and colchicine are commonly used to

relieve the condition. Few patients received glucocorticoids, and patients usually recovered quickly within 1 to 3 weeks, consistent with previous reports [4,5].

In these 12 cases with prior COVID infection, there were no differences in age, gender, vaccine types and time to onset compared to the cases with on prior infection. However, 7 patients (58.3%) with prior COVID developed myocarditis symptoms after the first dose, while the majority (89.8%) of patients in the non-prior COVID group developed symptoms after the second dose. Also, fever or chills were more common in the cases with prior COVID. This evidence strongly supports the enhancement of the autoimmune response during the onset of vaccine-related myocarditis.

Recently, a nationwide study in Israel showed a 3.24-fold increased risk of myocarditis within 42 days after vaccination with the BNT162b2 vaccine [95% Confidence Interval (CI): 1.55-12.44] with an incidence of 1-5 vaccine-associated myocarditis per 100,000 vaccinated persons [6]. And a larger case series study in England confirmed the above results, showing an increased risk of myocarditis associated with ChAdOx1, BNT162b2 and mRNA-1273 vaccines over the 1-28 days post-vaccination, particularly in mRNA-1273 recipients [7]. It was estimated that

an additional six (95% CI: 2-8) and ten (95% CI: 7-11) myocarditis events per 1 million vaccinees in the 28 days following the first and second doses of mRNA-1273, respectively [7]. Further analysis showed the increased risk of myocarditis associated with the two mRNA vaccines only existed in people under the age of 40. Therefore, young adults could be more susceptible to the myocarditis associated with COVID-19 vaccine.

### Conclusion

In summary, myocarditis is a serious adverse reaction associated with COVID-19 vaccine, which is mostly observed after the second dose of mRNA vaccine. Incidence is relatively low and clinical signs are mild. Patients can recover quickly after anti-inflammatory and symptomatic treatment. However, the risk of serious adverse events such as myocarditis was significantly increased in patients with previous COVID-19 infection after vaccination. It occurred more frequently after the first vaccine dose and showed some differences in clinical symptoms and outcomes from those with no prior COVID-19 infection. These results suggested that COVID-19 vaccination associated-myocarditis might be mechanically linked to immune system priming and genetic susceptibility in individuals after COVID-19 infection.

**Table 1:** Clinical characteristics of patients with COVID-19 vaccine related myocarditis.

Items	Total (n=71)	Non-prior COVID (n=59)	Prior COVID (n=12)	P Value
Age (Median [Min, Max])	23 [15,70]	23 [15,70]	25 [16,56]	0.470
Sex (n (%))				1.000
Male	65 (91.5)	54 (91.5)	11 (91.7)	
Female	6 (8.5)	5 (8.5)	1 (8.3)	
Type of Vaccine (n (%))				0.216
Pfizer-BioNTech	51 (71.8)	43 (72.9)	8 (66.7)	
Moderna mRNA-1273	16 (22.5)	14 (23.7)	2 (16.7)	
Janssen Ad26.COVS.2	3 (4.2)	2 (3.4)	1 (8.3)	
Other (inactivated)	1 (1.4)	0 (0.0)	1 (8.3)	
Dose (n (%))				0.001*
First	13 (18.3)	6 (10.2)	7 (58.3)	
Second	58 (81.7)	53 (89.8)	5 (41.7)	
Days to symptom onset	3 [1, 25]	3 [1, 16]	3 [1, 25]	
Symptoms (n (%))				
Fever/chills	32 (45.1)	30 (50.8)	2 (16.7)	0.030*
Chest pain	67 (94.4)	57 (96.6)	10 (83.3)	0.069
Shortness of breath	12 (16.9)	11 (18.6)	1 (8.3)	0.676
Nausea/vomiting	3 (4.2)	3 (5.1)	0 (0.0)	1.000
Fatigue	7 (9.9)	6 (10.2)	1 (8.3)	1.000
Myalgia	19 (26.8)	18 (30.5)	1 (8.3)	0.161
Headache	9 (12.7)	9 (15.3)	0 (0.0)	0.340
Electrocardiogram (n (%))				
Sinus tachycardia	9 (12.7)	8 (13.6)	1 (8.3)	1.000
Diffuse ST elevation	31 (43.7)	28 (47.5)	3 (25.0)	0.153
Local ST elevation	16 (22.5)	14 (23.7)	2 (16.7)	0.722
Tnl/T abnormal (n (%))	68/69* (98.6)	56/57 (98.2)	12/12 (100.0)	1.000
CRP abnormal (n (%))	41/47 (87.2)	37/41 (90.2)	4/6 (66.7)	0.162
Echocardiogram (n (%))				
LVEF < 50%	13/67 (19.4)	11/56 (19.6)	2/11 (18.2)	1.000

Hypokinesia	16/67 (23.9)	12/56 (21.4)	4/11 (36.4)	0.438
Pericardial effusion	11/67 (16.4)	8/56 (14.3)	3/11 (27.3)	0.371
CMR Results (n (%))				
Edema	38/60 (63.3)	31/50 (62.0)	7/10 (70.0)	0.632
LGE	59/60 (98.3)	49/50 (98.0)	10/10 (100.0)	1.000
Treatment (n (%))				
None Specific	13/60 (21.7)	9/50 (18.0)	4/10 (40.0)	0.201
NSAIDs	30/60 (50.0)	27/50 (54.0)	3/10 (30.0)	0.166
Colchicine	20/60 (33.3)	17/50 (34.0)	3/10 (30.0)	1.000
Beta blocker	12/60 (20.0)	9/50 (18.0)	3/10 (30.0)	0.403
Steroids	7/60 (11.7)	5/50 (10.0)	2/10 (20.0)	0.330
Outcome (n (%))				1.000
Discharged	69 (97.2)	57 (96.7)	12 (100.0)	
Death	2 (2.8)	2 (3.4)	0 (0.0)	
Length of Stay	4 [1,15]	4 [1,8]	5 [2,15]	0.640

CRP: C-Reactive Protein; LGE: Late Gadolinium Enhanced; & number of abnormal results/total number of available results; \*P<0.05 with statistical significance.

### Declarations

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**Conflict of interests:** The authors declare that there is no conflict of interests. And this article does not contain any studies with human or animal subjects.

### References

1. Kim HW, Jenista ER, Wendell DC, Azevedo CF, Campbell MJ, et al. Patients with Acute Myocarditis Following mRNA COVID-19 Vaccination. *JAMA Cardiol.* 2021; 6: 1196-1201.
2. Larson KF, Ammirati E, Adler ED, Cooper LT, Jr., Hong KN, et al. Myocarditis After BNT162b2 and mRNA-1273 Vaccination. *Circulation.* 2021; 144: 506-508.
3. Shaw KE, Cavalcante JL, Han BK, Gössl M. Possible Association Between COVID-19 Vaccine and Myocarditis: Clinical and CMR Findings. *JACC Cardiovasc Imaging.* 2021; 14: 1856-186.
4. Diaz GA, Parsons GT, Gering SK, Meier AR, Hutchinson IV, et al. Myocarditis and Pericarditis After Vaccination for COVID-19. *JAMA.* 2021; 326: 1210-1212.
5. Montgomery J, Ryan M, Engler R, Hoffman D, Mc Clenathan B, et al. Myocarditis Following Immunization With mRNA COVID-19 Vaccines in Members of the US Military. *JAMA Cardiol.* 2021; 6: 1202-1206.
6. Barda N, Dagan N, Ben-Shlomo Y, Kepten E, Waxman J, et al. Safety of the BNT162b2 mRNA Covid-19 Vaccine in a Nationwide Setting. *N Engl J Med.* 2021; 385: 1078-1090.
7. Patone M, Mei XW, Handunnetthi L, Dixon S, Zaccardi F, et al. Risks of myocarditis, pericarditis, and cardiac arrhythmias associated with COVID-19 vaccination or SARS-CoV-2 infection. *Nat Med.* 2021. Online ahead of print.