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LETTER TO THE EDITOR

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The potential rationale of COVID-19 vaccine-induced myopericarditis

Dear Editor,

Following the severe acute respiratory syndrome coronavirus 2 (SARS-COV-2) pandemic and the subsequent development of various vaccinations, there have been a few studies establishing the significant correlation of myopericarditis after Pfizer-BioNTech COVID-19 vaccination amongst adolescents. We would like to suggest a potential rationale for COVID-19 vaccine-induced myopericarditis. Myopericarditis refers to a rare condition where the myocardium is involved subsequent to primary pericarditis. The myopericarditis cases reported are relatively mild compared to that of COVID-19-infected cases.[1,2] The symptoms are generally less severe with a better prognosis. The conditions of these patients improved with treatment, such as nonsteroidal anti-inflammatory drugs and/or steroids.[1,2]

A retrospective case series consisting of 13 patients (Table 1), who have severe chest pain and developed signs of myopericarditis after receiving Pfizer-BioNTech COVID-19 vaccination, was conducted by Schauer et al.[2] All patients were younger than 18 years old and had received their second dose. Myocardial inflammation and edema were developed as detected by cardiac magnetic resonance imaging (CMRI) following the second dose of immunization. The knowledge of vaccine-induced myopericarditis is limited, which raised the researcher's concern. Although all patients have recovered from myopericarditis, the CMRI findings indicate that patients could develop long-term consequences such as myocardial fibrosis.[2,3] Based on the results, hyperimmune response to the vaccine could be a probable reason for myopericarditis development in young people, as it is known that children could have a more robust immune response toward SARS-CoV-2 infection than adults.[2,3] This could explain why the pediatrics population is more likely to develop inflammations after the vaccination, especially after the second dose.

TABLE 1 Demographics and clinical findings in patients who developed myopericarditis after Pfizer mRNA COVID-19 vaccination.[2]

	Findings
Number of patients	13 Patients
age range	12–17 years old
Gender	• 12 Males • 1 Female
Ethnicity	• 10 Caucasians • 2 Asians • 1 American Indian/Alaska Native
Cardiac biomarkers (troponin)	Troponin elevations were detected in all patients
Electrocardiogram (ECG) findings	• 7 Patients presented with ST-elevation • 2 Patients presented with T-wave changes • 4 Patients with normal ECG findings
Cardiovascular magnetic resonance imaging (CMR)	Myopericarditis were confirmed with CMR in all patients
Time from vaccination to symptoms presentation	2–4 days
Other symptoms	• All patients presented with edema • 5 Patients presented with fever • 4 Presented with myalgias • 3 Patients presented with headaches • 5 Patients with shortness of breath • 1 Patient with vomiting • 1 Patient with chills • 2 Patients with no symptoms

Abbreviation: mRNA, messenger RNA.

However, a recent study attempted to explain the potential reason for developing cardiological complications, such as acute myopericarditis after COVID-19 messenger RNA (mRNA) vaccination. The study compared the cardiological condition of the mouse injected with the COVID-19 mRNA vaccine intravenously (IV) and intramuscularly (IM).[4] The result revealed that IV administration of the vaccine could induce apoptosis of cardiomyocytes, while merely mild myocardial congestion and edema was observed in the mouse receiving the vaccine IM.[4] The study concluded that inadvertent intravenous injection could induce myopericarditis and suggested that the development of myopericarditis after the vaccination could be due to injection techniques, such as aspirating before the injection.[4,5]

The slightly higher incidence of vaccine-induced myopericarditis may be explained by the anatomical differences between children, adolescents, and adults. The deltoid muscle is the most common injection site for IM administration. Nevertheless, children and adolescents have notably less deltoid muscle mass, the vaccine might easily reach adjacent blood vessels and could eventually induce myopericarditis. Injecting the vaccine in alternative larger size muscles, such as vastus lateralis at the thigh, might reduce the risk.

In conclusion, based on the proposition established by the previous clinical study,[2] reviewing the dosage of the vaccine might benefit pediatric recipients. Additionally, the more recent animal study revealed an alternative rationale of COVID-19 mRNA vaccine-induced myopericarditis.[4] We propose that the risk of developing myopericarditis after receiving the vaccine might be reduced by picking a substitute injection site. However, the deduced reasoning has not been proven, and robust monitored clinical or animal studies should be performed. We would like to encourage future investigations on the compensated dosage in children and adolescents, injection techniques, and injection sites of the COVID-19 mRNA vaccine in correlation with the vaccine-induced myopericarditis incidents. These studies would play a great impact on potentially improving the safety of COVID-19 vaccine administration, especially in the pediatrics population

AUTHOR CONTRIBUTIONS

The authors confirm contribution to the paper as follows: *Study conception and design*: Tsz Yuen Au. *Draft manuscript preparation*: Tsz Yuen Au and Chanika Assavarittirong. All authors approved the final version of the manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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