

Myocarditis and pericarditis after COVID-19 messenger RNA vaccines

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Abstract

Question With the approval of coronavirus disease 2019 (COVID-19) vaccine for children 5 to 11 years of age and concerns among parents in the past year following reported cases of myocarditis and pericarditis in adolescents, should my office continue to encourage all children and young adults to receive the COVID-19 messenger RNA vaccine?

Answer Since April 2021 reports have documented cases of myocarditis and pericarditis in adolescents and young adults after messenger RNA COVID-19 vaccination, and several hundred such reports were documented in Canada. Clinical presentations were mostly mild, with rare instances of admission to the hospital, and were typically among male adolescents 16 years of age and older within several days after the second dose of the vaccine. After vaccination, children and adolescents with symptoms of chest pain, shortness of breath, or palpitations should be evaluated with a physical examination, an electrocardiogram, and measurement of cardiac troponin levels. If results are abnormal, an echocardiogram or cardiac magnetic resonance imaging should be considered. Myocarditis and pericarditis after vaccination are much less common, and much milder, than cardiac complications of COVID-19 infection, and vaccines should continue to be recommended to all those eligible.

Development of vaccines against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been one of the scientific highlights during the coronavirus 2019 (COVID-19) pandemic, mitigating of the spread of the viral illness and saving lives worldwide. The first COVID-19 vaccine was authorized by Health Canada on December 9, 2020.¹ Health Canada has authorized both Pfizer-BioNTech and Moderna COVID-19 vaccines for adolescents 12 to 17 years of age with the same 2-dose schedule recommended for adults,² and on November 19, 2021, they approved the Pfizer-BioNTech COVID-19 vaccine for children 5 to 11 years of age using one-third of the adult dose.³

As early as April 2021, reports appeared about unexpected cases of myocarditis and pericarditis in adolescents and young adults after messenger RNA (mRNA) COVID-19 vaccination (both Pfizer-BioNTech and Moderna). Clinical presentation was observed especially among male adolescents 16 years of age and older within several days after mRNA COVID-19 vaccination, more often after the second dose.⁴

The incidence of myocarditis after mRNA vaccination is not clearly known, especially as some adolescents' symptoms are so mild that they do not seek medical care. Initial reports from Israel described 5 apparent cases among males with a median age of 23 years that presented after the second dose and 1 after the first dose.⁵ Myocarditis was diagnosed without finding COVID-19 infection. The clinical course was mild in all 6 patients, and the phenomenon was described as an adverse reaction following immunization.⁵ In a case series, 23 healthy male patients from the US military presented with acute onset of marked chest pain within 4 days after receipt of

an mRNA COVID-19 vaccine; 20 of these were following the second dose. They had elevated cardiac troponin levels and recovered with brief supportive care.⁶

As more experience with COVID-19 vaccines accrued, the Centers for Disease Control and Prevention compiled the data in the Vaccine Adverse Event Reporting System, and by the middle of June 2021 it included as many as 687 episodes of myocarditis among persons younger than 30 years after 2 doses of an mRNA vaccine.⁷ Considering that almost 300 million doses of the vaccine had been administered in the United States at that time, the risk of myocarditis from the vaccine was minute.

Based on reports from several countries, in late June 2021 Health Canada updated the product monographs for both Moderna and Pfizer-BioNTech COVID-19 vaccines to include information about risks of myocarditis and pericarditis following vaccination.⁸ As of September 2021, after more than 56 million doses had been administered, the Public Health Agency of Canada and Health Canada reported cases of myocarditis or pericarditis.⁹ These were mostly after Pfizer-BioNTech and Moderna vaccines,⁹ but also include several reports after the AstraZeneca vaccine.⁸

With growing public interest and concerns about potential increases in vaccine hesitancy, in early October 2021 the Council of Chief Medical Officers of Health issued a joint statement about these rare events of myocarditis and pericarditis occurring after immunization with mRNA COVID-19 vaccines, concluding that the risk of developing these conditions is greater following COVID-19 infection.⁹

With high alert regarding adverse events from vaccines, the US Food and Drug Administration asked that

studies on vaccines in those 5 to 11 years of age specifically address these potential complications. In the largest phase 2 and 3 study thus far, in which children received Pfizer-BioNTech vaccine or placebo, no myocarditis, pericarditis, hypersensitivity, or anaphylaxis were reported. However, only 1517 children received the vaccine.¹⁰

Management

In most cases, adolescents and young people with myocarditis had mild symptoms when they presented for medical care. The process is immune mediated, causing inflammation of the heart muscle in response to an infection or some other trigger. Symptoms include chest pain, shortness of breath, or palpitations.


Among patients in a large Israeli health care system (2.5 million vaccinated individuals 16 years and older), most cases of myocarditis were mild or moderate in severity.¹¹

To ensure timely management of children with these symptoms, especially in the first several days after COVID-19 vaccination, diagnostic evaluation should include a full physical examination, an electrocardiogram, and measurement of plasma cardiac troponin levels. If any results of those tests suggest abnormality, echocardiogram or cardiac magnetic resonance imaging should be considered.

If a diagnosis of myocarditis is made, a cardiology consultation is needed, and exercise restriction until the heart recovers is likely the best course of action.

Risks from COVID-19 and from COVID-19 vaccines

Considering the fact that myocardial injury is relatively common in patients with COVID-19,^{12,13} occurring in 7% to 23% of cases, and is associated with a higher rate of morbidity and mortality,¹³ the rate of mild myocarditis reported after a vaccine is extremely low. In the recent population-based study from Israel, the risk ratios for myocarditis were 3.24 (95% CI 1.55 to 12.44) after vaccination and 18.28 (95% CI 3.95 to 25.12) after SARS-CoV-2 infection, with risk differences of 2.7 events per 100 000 persons (95% CI 1.0 to 4.6) and 11.0 events per 100 000 persons (95% CI 5.6 to 15.8), respectively.¹⁴ As vaccines against COVID-19 are available for those 5 years and older, continued use of mRNA COVID-19 vaccines will prevent morbidity and mortality from COVID-19 illness, a benefit that far exceeds the number and severity of cases of myocarditis from the vaccines.¹⁵

The benefit-risk balance between preventing symptomatic disease, hospitalization, or death due to COVID-19 and the cardiac risks of the COVID-19 vaccines is maintained, and vaccination of children is an important step in protecting them and their communities. 

Competing interests
None declared

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Cet article se trouve aussi en français à la page 19.



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