Myocarditis in Australian children following SARS-CoV-2 infection or COVID-19 vaccination: a retrospective case series

Patrick Walker[1], Timothy C Lai[1], Silja Schrader[2], Nigel Crawford[1], Daryl R Cheng[1]

Myocarditis can complicate both severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections and vaccinations against coronavirus disease 2019 (COVID-19).[1] In adults, myocarditis associated with SARS-CoV-2 infections is seven times as frequent as after vaccination,[1] and mortality is three times as high.[2] In children, both SARS-CoV-2 infection alone and the paediatric inflammatory multisystem syndrome temporally associated with SARS-CoV-2 (PIMS-TS) can cause myocarditis and myocardial dysfunction.[3,4] Among people aged 12–17 years in Victoria, the incidence of myocarditis following COVID-19 vaccination was 8.3 per 100 000 doses;[5] it is generally milder than myocarditis linked with PIMS-TS.[4] However, it is unclear whether the incidence and clinical course of post-COVID-19 vaccination myocarditis in children are similar to those of SARS-CoV-2-related myocarditis.

We examined the clinical features of myocarditis in children and adolescents following SARS-CoV-2 infection or COVID-19 vaccination in a single-centre observational study. We enrolled all children and adolescents (0–18 years) who presented to the Royal Children's Hospital, Melbourne, during 25 January 2021 – 30 September 2022 with Brighton level 1 (definitive) or level 2 (probable) myocarditis. We extracted demographic, coding, and clinical data from the hospital electronic medical record system

Characteristics of 53 people under 18 years of age who presented to the Royal Children's Hospital, Melbourne, with myocarditis after acute infection with SARS-CoV-2, PIMS-TS, or vaccination against COVID-19, 25 January 2021 – 30 September 2022

	SARS-CoV-2 infection-related			
Parameter	Total	Acute SARS-CoV-2 infection	PIMS-TS	Vaccination against COVID-19
Number of patients	24 [45%]	5 [9%]	19 [36%]	29 [55%]
Demographic characteristics				
Age (years), median (IQR)	8.4 (5.2–11.8)	12.3 (0.5–12.4)	8.2 (6.8–10.5)	15.5 (14.2–17.1)
Gender (boys)	12 (50%)	3 (60%)	9 (47%)	24 (83%)
Clinical findings and investigation results				
Brighton Collaboration Definition Category[6]				
Level 1 (definitive)	0	0	0	4 (14%)
Level 2 (probable)	24 (100%)	5 (100%)	19 (100%)	25 (86%)
Peak troponin (ng/L), median (IQR)	110 (45–537)	998 (129–2789)	99 (38–255)	2545 (842–5454)
Electrocardiographic abnormalities	9 (38%)	4 (80%)	5 (26%)	16 (64%)
Echocardiographic abnormalities	6 (25%)	3 (60%)	3 (16%)	2 (8%)
Systolic dysfunction	5 (21%)	3 (60%)	2 (11%)	1 (4%)
Cardiac magnetic resonance imaging abnormalities	2 (100%)	1 (100%)	1 (100%)	4 (80%)
Severity of illness				
Hospital length of stay (days), median (IQR)	5 (3–10)	46 (2–97)	5 (3–8)	2 (1–2)
Paediatric intensive care unit admission	12 (50%)	3 (60%)	9 (47%)	0
Inotropic support	10 (42%)	3 (60%)	7 (37%)	0
Deaths	0	0	0	0

COVID-19 = coronavirus disease 2019; IQR = interquartile range; PIMS-TS = paediatric inflammatory multisystem syndrome temporally associated with SARS-CoV-2; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2. ◆

[1]The Royal Children's Hospital Melbourne, Melbourne, VIC. [2]Surveillance of Adverse Events Following Vaccination in the Community (SAEFVIC), Murdoch Children's Research Institute, Melbourne, VIC. daryl.cheng@rch.org.au • doi: 10.5694/mja2.51922

to a secure REDCap database. The Royal Children's Hospital human research ethics committee approved the study (64003, 38301).

During the 20-month study period, 53 of 77 cases of myocarditis seen at the hospital (69%; no deaths) were associated with COVID-19: five followed SARS-CoV-2 infections, nineteen were linked with PIMS-TS, and 29 followed vaccine administration (Spikevax [Moderna], five; Comirnaty [Pfizer–BioNTech], 22; vaccine unknown, two; 23 of 29 following second doses) (Supporting Information, figure). The median age of children with myocarditis linked with SARS-CoV-2 infections or PIMS-TS (8.4 years; interquartile range [IQR], 5.2–11.8 years) was lower than for people with post-vaccination myocarditis (15.5 years; IQR, 14.2–17.1 years), and a larger proportion were girls (twelve of 24, 50% *v* five of 29, 13%). The median hospital length of stay for patients with acute infection-related myocarditis (ie, excluding those with PIMS-TS) was 46 days (IQR, 2–97 days); three were admitted to the paediatric intensive care unit, required inotropic support, and had echocardiographic evidence of systolic dysfunction. The median hospital length of stay for patients with post-vaccination myocarditis was two days (IQR, 1–2 days); none required intensive care, and echocardiographic abnormalities were found in only two (Box).

We identified five cases of acute SARS-CoV-2 infection-related myocarditis and 29 cases of post-COVID-19 vaccination myocarditis in children treated at the Royal Children's Hospital during 2021–22; the median hospital length of stay suggests that severity of illness was greater for post-infection cases. PIMS-TS, a potential complication of SARS-CoV-2 infection in children, can also include myocarditis as a symptom (nineteen cases). As in other studies,[5] most cases of vaccine-related myocarditis, in contrast to post-infection myocarditis, involved male and adolescent patients, although it should be noted that COVID-19 vaccines were not approved in Australia for children under five years of age until 26 September 2022.

The myocarditis risk in children with SARS-CoV-2 infections differs from that for adults. Awareness of this and other age-specific risks of SARS-CoV-2 infection should inform public health strategies, including the vaccination of children and adolescents. Further studies of the medium and long term outcomes of myocarditis in younger people will assist risk–benefit discussions for both primary and booster COVID-19 vaccination doses.

Acknowledgements: We thank Alissa McMinn (research nurse coordinator at Surveillance of Adverse Events Following Vaccination in the Community [SAEFVIC] and the Murdoch Children's Research Institute) and Bryn Jones (cardiologist at the Royal Children's Hospital) for their invaluable support for and assistance with this investigation.

Competing interests: No relevant disclosures. ■

Received 17 January 2023, accepted 8 March 2023

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Supporting Information

Additional Supporting Information is included with the online version of this article.