Post-COVID mRNA vaccine myocarditis in children: report of two cases

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SUMMARY

The SARS-COV-2 pandemic led to the development of several vaccinations to contain the disease. The Pfizer-BioNTech COVID-19 (BNT162b2) vaccine was recommended on May 2021 for use in children above 12 years and older. The vaccine is safe, well tolerated and highly effective. Initial reports showed no serious adverse events; however, cases of myocarditis in young healthy male adolescents have been reported. We report two cases of myocarditis/perimyocarditis who presented with short history of chest pain following administration of the second dose of the MRN COVID-19 vaccine.

BACKGROUND

Although post-COVID-19 vaccination myocarditis is rare, it is a known side effect of the vaccine.[1] Studies from the USA show that the risk of myocarditis after receiving mRNA-based COVID-19 vaccines is increased across all age and sex groups. Epidemiological studies reported an incidence of 20–30 per million patients, and the risk is highest after the second vaccination dose in adolescent males.[2 3] The Centers for Disease Control and Prevention (CDC) recommends that COVID-19 primary series vaccines should be given to everyone aged 6 months and older with COVID-19 boosters for everyone 5 years and older.[4] The vaccine shows excellent efficacy and safety outcomes, but the long-term side effects are still under investigations.[5] We report two adolescent males who developed acute myocarditis, post Pfizer-BioNTech vaccine for COVID-19. The healthcare provider is to suspect myocarditis in healthy children who recently received COVID-19 vaccinations and presented with chest pain with or without cardiac symptoms.

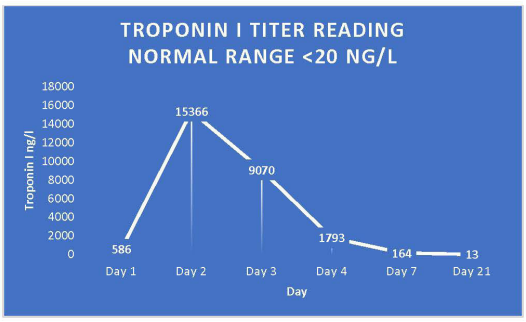

Figure 1 Case 1: troponin I titre reading recorded over 3 weeks.

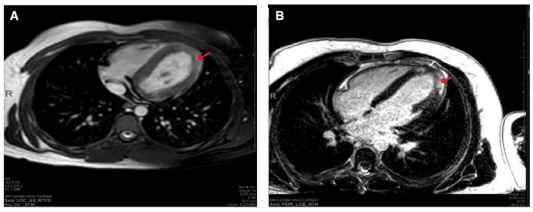

Figure 2 Case 1: Cardiac MRI (A) long axis view showing an abnormal high signal intensity of myocardium highlighted by the arrows. (B) four-chamber views post gadolinium showing late gadolinium enhancement.

CASE PRESENTATION

Case 1

A boy in early adolescence with no significant medical history, apart from Perthe's disease. He presented with a 1-day history of chest pain radiating to the left arm. There were no other symptoms. He received the second Pfizer-BioNTech vaccine dose 4 days before presentation to the paediatric emergency department (PED). On arrival, all his vital signs vitals were stable. His aural temperature was 37°C, heart rate was: 67 beats per minute (bpm), respiratory rate (RR) was 16 bpm, blood pressure was 126/59 mm Hg and oxygen saturation - SpO2 was 100% in air. His weight was 71 kg (90th centile), height was 165 cm (25th centile) and body mass index (BMI) 26.1 kg/m^2. Serum troponin I level, on arrival to PED, was raised at 586 ng/L (normal values <20 ng/L) (see figure 1). ECG showed diffuse ST segment changes and cardiacecho was normal with left ventricular ejection fraction of 67%. The cardiac MRI (cMRI) showed myocardial oedema, wall motion abnormality and transmural delayed enhancement at the apical lateral region of left ventricle supporting the diagnosis of myocarditis (figure 2). His COVID-19 nasal swab antigen test was negative; however, his COVID-19 IgG antibodies were positive with a titre of (binding antibody units -BAU)1930 BAU/mL. He was admitted to paediatric intensive care unit (PICU) for close monitoring of his clinical condition and serum troponin levels (figure 1). He received intravenous immunoglobulin, but this was stopped soon after been started as he developed severe chest pain.

Case 2

A boy in early adolescence with a medical history of allergic rhinitis, presented with 1-day history of non-radiating central chest pain. He had no other symptoms. He had received the second Pfizer-BioNTech vaccine 5 days before attending the PED.

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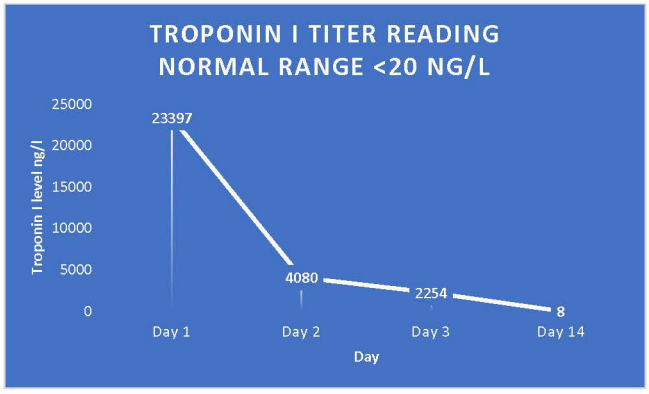

Figure 3 Case 2: Troponin I titre recorded over 2 weeks.

On arrival, all his vital signs were stable: his aural temperature was 37°C heart rate was 78 bpm, respiratory, rate was 22, blood pressure was 115/46 mm Hg and SpO2 in air was 99%. He weighed 125 kg (>97th centile), his height was 183 cm (90th centile) and BMI 37.3 kg/m^2. Serum troponin I on arrival to PED was raised at 23 390 ng/L (see figure 3) and creatine kinase was 1338 IU/L (normal value: 0–178 IU/L)(figure 4). ECG showed diffuse ST segment elevation, cardiac echo was normal and left ventricular ejection fraction was 64%. cMRI showed evidence of perimyocarditis with borderline impairment of right ventricular systolic function figure 5) . His COVID-19 nasal swab antigen test was negative however his COVID-19 IgG antibodies were not tested. He did not require PICU admission. However, he was admitted to the cardiology ward for observation but did not receive any further active treatment such as intravenous immunoglobulin.

OUTCOME AND FOLLOW-UP

Both patients recovered completely without sequalae, and discharged home within 5 days. The chest pain resolved within 48 hours for both patients. Blood result and cardiac enzymes improved before discharge. Follow-up with cardiology in 4 weeks showed complete recovery and good cardiac function for both patients.

DISCUSSION

In December 2020, the Food and Drug Administration (FDA) issued an emergency use authorisation (EUA) for the Pfizer-BioNTech COVID-19 (BNT162b2) vaccine for young adults aged ≥16 years. In May 2021, FDA expanded the EUA for the

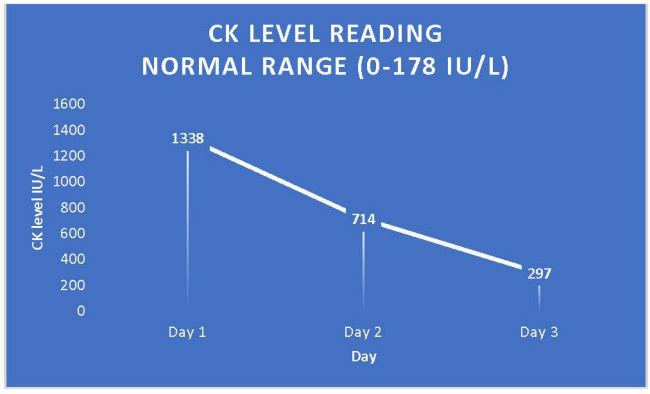

Figure 4 Case 2: CK level. CK, creatine kinase.

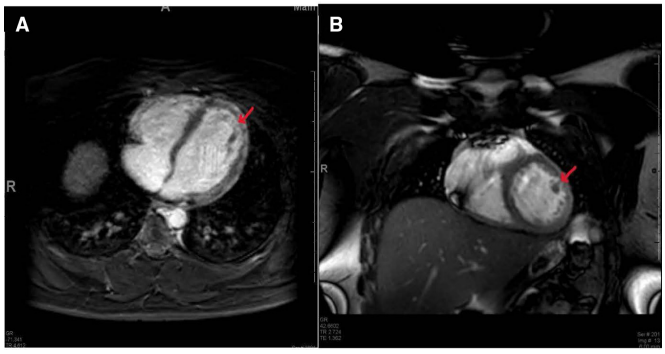

Figure 5 Case 2: Cardiac MR (A) Short-axis view non-contrast showing abnormal high signal intensity involve the perimyocardium (B) - highlighted by the arrows. Long-axis view, late gadolinium enhancement showing perimyocardium enhancement of left ventricle.

Pfizer-BioNTech COVID-19 vaccine to include adolescents aged 12–15 years.[6 7] This was revised recently by the CDC, and the current recommendation is to use the COVID-19 primary series vaccines for everyone ages 6 months and older, and COVID-19 boosters for everyone ages 5 years and older. Most side effects of the vaccine were reported as mild that included fatigue, injection site pain, headaches, chills, fever, and muscle aches and pain. Systemic adverse reactions were more commonly reported after the second dose, with the usual onset of 1–4 days after vaccine receipt.[6] This case report reports cases of a temporal but not proven causal association between the vaccine and myocarditis. Marshall *et al* described seven adolescents who developed myocarditis within 4 days following the second dose of the Pfizer-BioNTech COVID-19 vaccine.[8] Larson *et al* reported further cases of myocarditis post-COVID-19 vaccination in Italy.[9] A recent study from Israel reported that mRNA COVID-19 vaccination was associated with an increased risk for myocarditis (RR 3.24; 95% CI 1.55 to 12.44); with stronger risk for myocarditis from the COVID-19 (RR 18.28, 95% CI 3.95 to 25.12)[9 10] Patients with COVID-19 had nearly 16 times the risk for myocarditis compared with patients who did not have COVID-19.[11]

According to the US CDC, in children and young adults, myocarditis/pericarditis rates are up to 12.6 cases per million doses of second-dose mRNA vaccine. Usual presentation is 2–3 days after the second dose of the vaccine. Patients with myocarditis invariably presented with chest pain, elevated cardiac troponin levels, ST elevations in the ECG, with no evidence of acute COVID-19 or other viral infections.[12] Male predominance in myocarditis/pericarditis cases has been described, however, the

Learning points

- The incidence of myocarditis and pericarditis among young people following mRNA COVID-19 vaccine is low compared with the actual viral infection.
- Most cases are benign, responded well to non-steroid anti-inflammatory drugs and recovered completely without sequala.
- The vaccine is recommended for all eligible populations because the benefit is outweighing the risks.
- Children and young people who presented with chest pain, tachycardia and/or difficulty in breathing following COVID-19 vaccine should be assessed for the possibility of myocarditis.

reason for that was not clear.[12] The CDC Advisory Committee on Immunisation Practices COVID-19 advises that the benefits of vaccinating all recommended age groups with mRNA COVID-19 vaccine clearly outweigh the risks of COVID-19 infection.[7] There have been no deaths reported in Qatar from a vaccine associated myocarditis.

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Contributors This is to state that all authors contributed to this submission. AS: involved in the medical care of the patients, data collection and writing the manuscript. CP: revised the manuscript critically and approved it for publication. AA: participated in the writing of the manuscript. ISA: participated in the data collection and writing the manuscript. All Authors approved the version of the manuscript to be published.

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Case reports provide a valuable learning resource for the scientific community and can indicate areas of interest for future research. They should not be used in isolation to guide treatment choices or public health policy.

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