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Myocarditis after COVID-19 Vaccination

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Abstract

Aim: The ongoing COVID-19 pandemic is an acute medical, social, political and economic problem. Acute myocarditis is a rare complication of the widely used mRNA-based vaccines. **Case Presentation:** 20-year old male with no preexisting disease or cardiovascular risk factor presented in October 2021 with chest pain after receiving the second dose of the Moderna COVID-19 vaccine 2 days previously. He discharged from ward care only a few days after his initial presentation. **Conclusion:** Despite the meta-analysis results suggesting a higher risk of myocarditis with COVID-19 vaccination, vaccination should still be recommended because benefits of the vaccine likely outweigh its harms.

Keywords

COVID-19, mRNA-Based Vaccine, Myocarditis, Spike Protein

1. Introduction

The ongoing COVID-19 pandemic is an acute medical, social, political and economic problem [1] [2]. Tremendous effort has gone into developing vaccine to prevent SARS-COV-2 infection. To date, several mRNA-based vaccine and vaccines with adenovirus as vectors have been approved. Since these mRNA-based vaccines have not been used so broadly before, little is known about adverse events. The most common systemic adverse effects of mRNA-based vaccine are fatigue, headache, chill, muscle pain and fever. The initial registration studies described no cases of myocardial injury [3] [4]. However, increasing evidence of myocarditis in the context of vaccination has been reported in the subsequent literature [5]. However, only the smallpox vaccine has previously been causally associated with myocarditis based reports among US military personnel, with cases typically occurring 7 to 12 days after vaccination [6]. Myocarditis is an in-

flammatory disease of the myocardium that can be caused by various infectious agents, systemic disease, drugs, and toxins. We present case of acute myocarditis caused by mRNA vaccines and discuss them in the context of the current literature.

2. Case Presentation

20-year-old male with no preexisting disease or cardiovascular risk factor presented in October 2021 with chest pain after receiving the second dose of the Moderna COVID-19 vaccine 2 days previously. The initial physical examination showed Bp 124/72 pulse 68/min SpO_2 (room air) 97% and 35.9˚C. The initial laboratory tests showed increased levels of high-sensitivity troponin T 0.258 ng/ml (normal < 0.014 ng/ml), CRP 7.04 mg/dl (normal <0.30 mg/dl). An ECG showed a sinus rhythm with III, aVf Q wave (Figure 1). This patient was hospitalized with suspected myocarditis with high troponin and chest pain.

In the middle of the night next day, he complained of sever left anterior chest pain, and an ECG showed ST elevation in lead II, III. Toroponin also rose to 0.609 ng/ml. Pentazine was administered and the pain subsided. Echocardiography showed no apparent wall motion dysfunction and an ejection fraction of 73%, but slightly effusion was noted in inferior wall. The next day, the EKG returned to normal, and the patient was discharged from the hospital.

3. Discussion

In this review of reports to Vaccine adverse event reporting system (VAERS) between December 2020 and August 2021, myocarditis was identified as a rare but serious adverse event that can occur after mRNA-based COVID-19 vaccination, particularly in adolescent males and young men. The absolute risk of myocarditis or pericarditis, calculated as the incidence rate within 1 - 7 days of

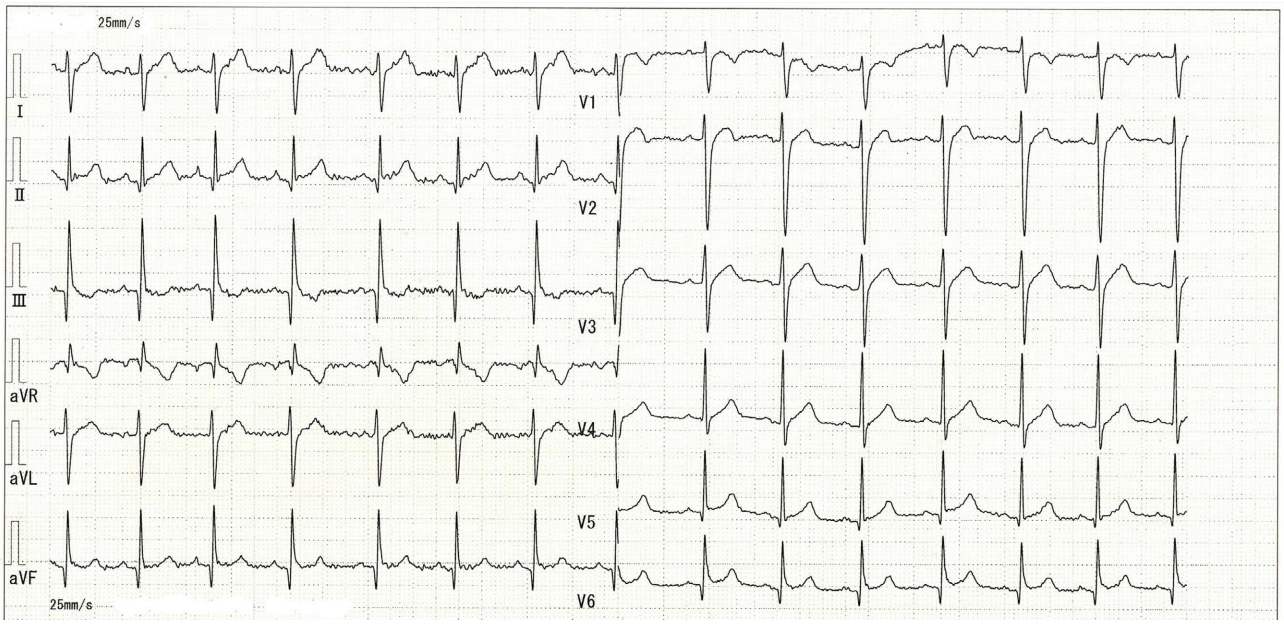

Figure 1. An electrocardiogram showed Q waves in III and aVf.

vaccination, for men aged 18 - 25 years after a second vaccination dose was 2.17 (95% CI 1.55 - 3.04) cases per 100,000 person-days for the Moderna vaccine, mRNA-1273, and 1.71 (1.31 - 2.23) cases per 100,000 person-days for the Pfizer-BioNRech vaccine, BNT162b2 [7]. Furthermore, the study supports the previous finding that the association is principally short term. The data indicate that this adverse event occurs within 1 - 7 days of vaccination, because a longer duration of follow-up attenuated the association. Although not significantly different, the study found a tendency towards a higher risk of myocarditis after vaccination with mRNA-1273 in a head-to-head comparison with BNT162b2 (with an adjusted incidence rate of 1.43 {95% CI 0.88 - 2.34} among men aged 18 - 25 years). Similar findings of a more pronounced risk of myocarditis after mRNA-1273 in comparison with BNT162b2 have been observed in other large observational studies [8].

The onset of myocarditis symptom after exposure to a potential immunological trigger was shorter for COVID-19 vaccine associated cases of myocarditis than is typical for myocarditis cases diagnosed after a viral illness [9] [10]. Cases of myocarditis reported after COVID-19 vaccination were typically diagnosed within days of vaccination, whereas cases of typical viral myocarditis can often have indolent courses with symptoms sometimes present for weeks to months after a trigger if the cause is ever identified [11]. The major complaining symptoms appeared to resolve faster in cases of myocarditis after COVID-19 vaccination than in typical viral cases of myocarditis. But there are still two major unanswered research questions: firstly, are there any long-term consequences of vaccine-associated myocarditis.

Although the long-term outcomes of vaccine-associated myocarditis and pericarditis are unclear, most of myocarditis after COVID-19 mRNA vaccination have been predominantly mild. Long-term outcome data are not yet available for COVID-19 vaccine-associated myocarditis cases.

Secondary, what is the biological mechanism linking COVID-19 mRNA vaccination to these rare cases of acute myocarditis and pericarditis? The reason why mRNA vaccines trigger myocarditis is unclear. L M Yonker *et al.* [12] recruited 61 adolescents and young adults: 15 that developed myocarditis after being given the Pfizer BNT162b2 or Moderna mRNA-1273 COVID-19 mRNA vaccines, and 45 healthy, vaccinated and age-matched volunteers. They screened blood samples from the participants to profile their immune system, including testing for autoantibodies and antibodies against human viruses, analyzing T cells and measuring blood levels of cytokines and SARS-COV-2 antigens such as the spike protein. They discovered that the myocarditis patients had indistinguishable antibody responses and T cell responses to those of the controls, such as antibody production, autoantibodies and T cell profiles. However, they found that the myocarditis patients had elevated levels of the spike protein in their blood, which had seemingly evaded the immune response. In contrast, the healthy controls showed no detectable levels of spike protein in their blood. Additionally, the myocarditis patients had higher blood levels of cytokines—an indicator of

innate inflammation and troponin, a sign of injury to the heart. They also noted it remains unclear whether the circulating spike protein was the cause of the myocarditis observed in these patients. Rare cases of myocarditis can occur after receiving vaccines for other conditions such as smallpox, so the spike protein could have been a biomarker of underlying immune dysregulation leading to the symptoms. In most cases, post-vaccination myocarditis is mild and self-resolving.

4. Conclusion

The vaccination for COVID-19 carries much fewer risks than infection by the virus, including for adolescents and young adults. But new insights about its etiology help us to improve patient's symptom or prevent this complication for occurring. Vaccination should still be recommended because benefits of the vaccine likely outweigh its harms.

Patient Consent

Written informed consent was obtained from the patient for publication of the submitted article and accompanying images.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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