Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia
South East European Journal of Cardiology. 2022 Nov 30; 3(1): 11-14.
https://doi.org/10.3889/seejca.2022.6032
eISSN: 1857-9361
Category: *Case Report*
Section: *General Cardiology*

OPEN ACCESS

Acute Myocarditis after Pfizer-BioNTech COVID-19 m-RNA Vaccination

Elena Grueva-Nastevska[1]*, Valentina Andova[1], Planinka Zafirovska[2], Ema Kandic[1], Ana Chelikikj [1], Elif Vrajnko[1], Simona Jovchevska[1], Oliver Busljetikj[1], Zhan Zimbakov[1], Igor M. Spiroski[1], Silvana Jovanova[1]

[1]University Clinic of Cardiology, Skopje, Republic of North Macedonia; [2]Zan Mitrev Clinic, Skopje, Republic of North Macedonia

Edited by: Emilija Andonoska
Citation: Grueva-Nastevska E, Andova V, Zafirovska P, Kandic E, Chelikikj A, Vrajnko E, Jovcevska S, Busljetikj O, Zimbakov Z, Spiroski IM, Jovanova S. Acute Myocarditis after Pfizer-BioNTech COVID-19 m-RNA Vaccination. SEE J Cardiol. 2022 Nov 30; 3(1):11-14. https://doi.org/10.3889/seejca.2022.6032
Keywords: Prosthetic mechanical valve endocarditis; Heart failure symptoms; Pfizer-BioNTech COVID-19 m-RNA vaccination
***Correspondence:** Elena Grueva-Nastevska, University Clinic of Cardiology, Skopje, Republic of North Macedonia. E-mail: gruevaelena@gmail.com
Received: 14-Nov-2022
Revised: 20-Nov-2022
Accepted: 25-Nov-2022

Funding: This research did not receive any financial support
Competing Interests: The authors have declared that no competing interests exist

Abstract

BACKGROUND: Prosthetic mechanical valve endocarditis (PVE) can be manifested as early PVE (acquired perioperatively) and late PVE (resulting from infections unrelated to the valve operation). Causes of both are similar but are late PVE are more prone to less virulent microbes. PVE resulting with paravalvular abscess is confirmed through echocardiography (transthoracic or transesophageal), it results with a high mortality rate especially if it is not early recognized.

CASE PRESENTATION: We are presenting a patient with heart failure symptoms caused by PVE after Pfizer-BioNTech coronavirus disease-2019 (COVID-19) m-RNA vaccination.

CONCLUSION: The exact mechanism of myocarditis in young men who received the second dose of mRNA COVID-19 vaccine is not yet known. However, this is a rare complication and most people generally recover quickly requiring only supportive treatment. In contrast, the risk of developing myocarditis from the viral infection is much higher.

Introduction

Coronavirus disease-2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), has impacted the global population, leading to a worldwide pandemic affecting millions of lives in one way or another [1]. This novel coronavirus predominantly affects the respiratory system, causing acute respiratory distress syndrome in severely affected patients, which can result in death from respiratory failure. Cardiovascular complications, such as myocarditis, heart failure, acute coronary syndromes, pulmonary embolism, stress cardiomyopathy, and arrhythmias, have been described in these patients. COVID-19 vaccines were developed in record time to control and reduce the spread of the pandemic and, therefore, prevent such complications. Among currently available COVID-19 vaccines, mRNA-based vaccines have shown high efficacy against SARS-CoV-2 infection and severe disease in clinical trials and real-world setups. However, according to the World Health Organization vaccine safety committee report, a small proportion of individuals, especially young adults, mostly males, may develop viral myocarditis, more often after receiving the second dose of mRNA COVID-19 vaccines. The estimated incidence per million was 40.6 cases among males and 4.2 cases per million among females aged 12–29 years [2]. Most cases of myocarditis were mild or moderate in severity. Symptoms can include chest pain, shortness of breath, or palpitations. In rare cases, myocarditis can lead to cardiac arrhythmias [3], [4].

Case Report

A 24-year-old male with no medical history was admitted to our emergency department with a chief complaint of chest pain. The day before admission, he developed acute midsternal chest pain radiating to the jaw that lasted for ~30 min and was associated with nausea and vomiting. He had no history of recent viral illness symptoms and no known COVID-19 exposures. He received his second Pfizer-BioNTech COVID-19 vaccine dose 3 weeks ago. ECG revealed

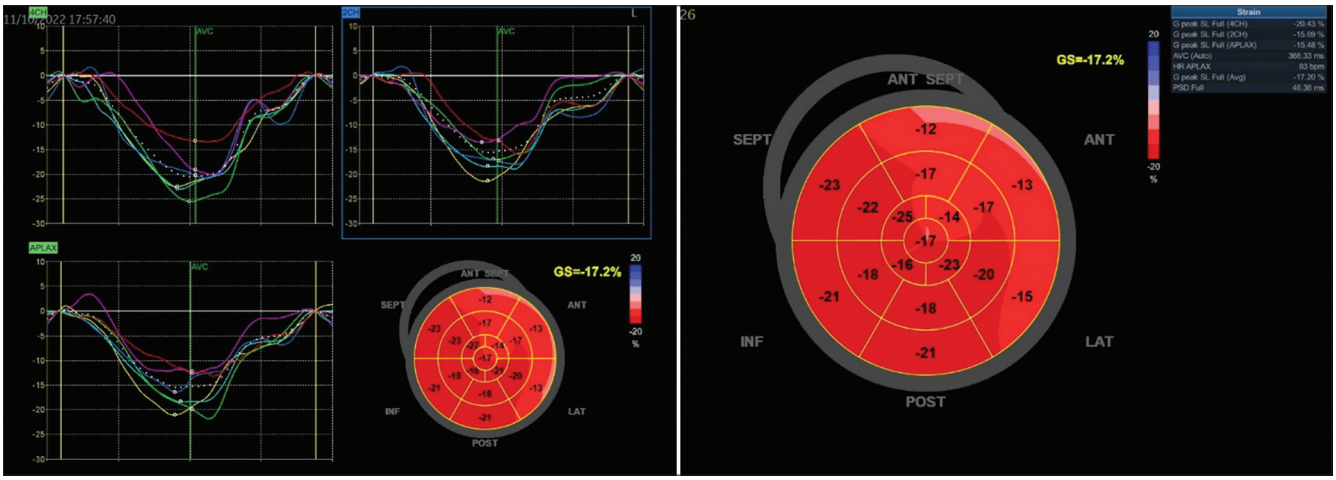

Figure 1: Assessment of the left ventricular wall deformation with global longitudinal strain

ST-segment elevation in anterior and lateral leads. Notable laboratory studies included elevated cardiac biomarkers: high-sensitive troponin I >50000 ng/L, normal range: <34,2 ng/L, creatine kinase (CK) 2251 U/L, normal range: <173 U/L, CK-myocardial band (CK-MB) 227 U/L, normal range: <25 U/L, Non-terminal-pro b-type Natriuretic Peptide (NT-proBNP) 235 pg/mL, normal range: <125 pg/mL, lactate dehydrogenase 726 U/L, normal range <248 U/L, myoglobin 369 ng/mL, normal range <75 ng/mL, elevated transaminases: aspartate aminotransferase 286 U/L, normal range: <34 U/L, and alanine aminotransferase 51 U/L, normal range: <45 U/L. The transthoracic echocardiography revealed mildly reduced left ventricular (LV) systolic function with ejection fraction (EF) 52%, normal range: >55%, borderline LV global longitudinal strain 17%, and mildly hypokinetic LV anterior and lateral wall.

A coronary angiography was performed and revealed normal coronary arteries without significant stenosis (Figure 1). Results of a nasopharyngeal SARS-CoV-2 PCR were negative; antibody testing revealed positive neutralizing SARS-CoV-receptor-binding domain IgG antibodies (>100,0 AU/mL, normal range: <1,00 AU/mL). All other viral diagnostic studies were negative. To provide definitive diagnosis, cardiac magnetic resonance imaging (MRI) was indicated (Figure 2). It revealed delayed gadolinium enhancement at the LV anterior, lateral, and mid-to-apical segment of inferior wall. There was evidence of myocardial edema on T2 mapping and mild pericardial enhancement. The presence of elevated cardiac markers and inflammation on cardiac MRI prompted the diagnosis of acute myocarditis.

In addition, evaluation included a 24-h ambulatory blood pressure and heart rate monitoring that revealed normal values of blood pressures over 24 h and normal sinus rhythm with occasional premature ventricular contractions (PVCs), one triplet

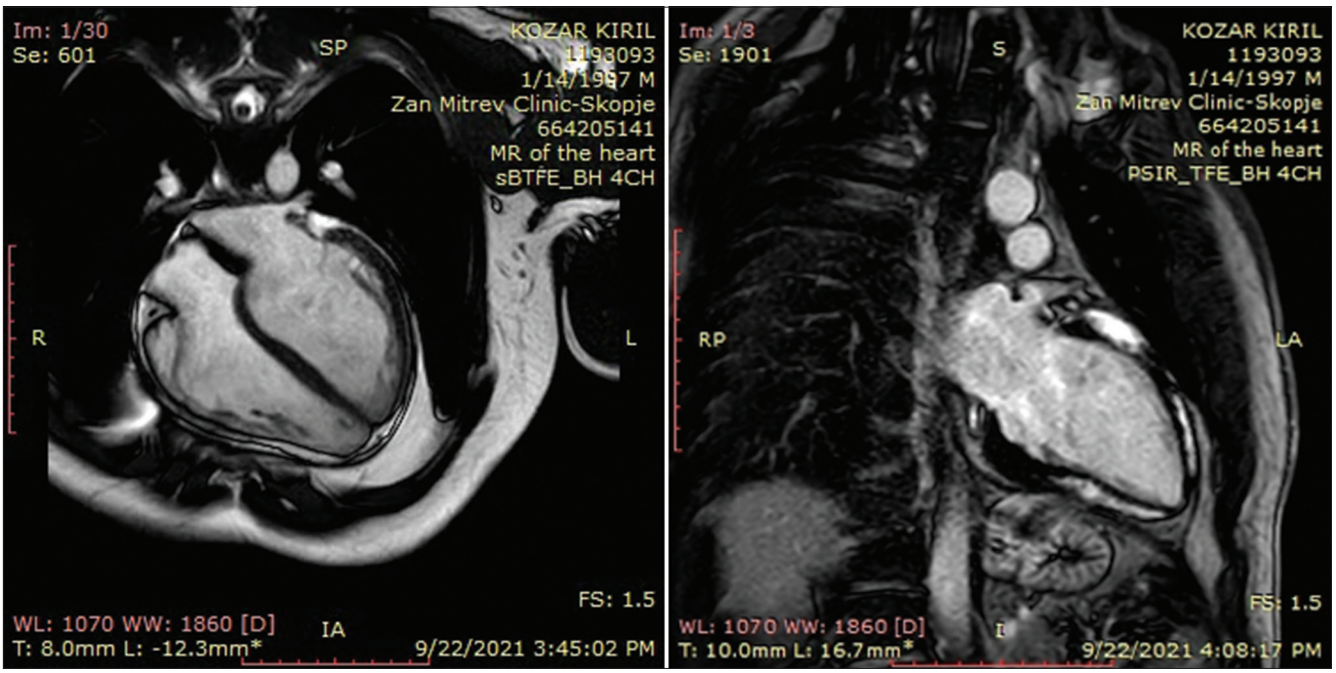

Figure 2: Cardiac magnetic resonance showing myocardial edema and mild pericardial enhancement

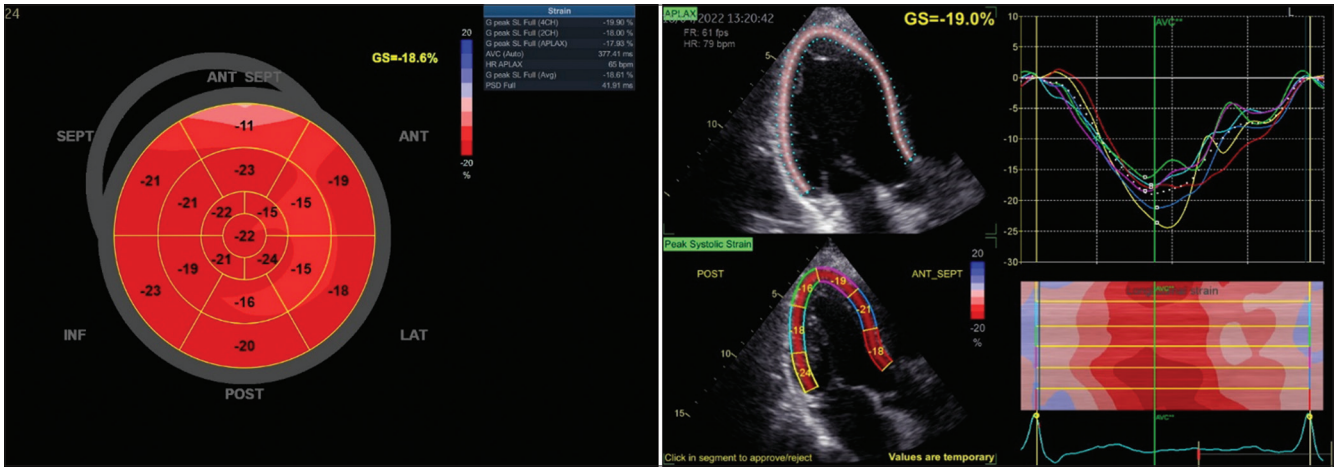

Figure 3: Speckle tracking echocardiographic showing global longitudinal strain in recovery

of PVCs and nodal rhythm with a rate of 50 beats/min during sleep but was otherwise normal (Figure 3). He remained well appearing, hemodynamically stable and cardiac markers level had normalized throughout the 14-day hospitalization. He was treated with 6 mg dexamethasone intravenously, followed by dexamethasone 4 mg orally once daily over 2 weeks, B-blocker, and angiotensin-converting enzyme (ACE) inhibitor. He also received colchicine 0.5 mg orally twice daily and aspirin 400 mg orally once daily and was discharged with a 3-month prescription for colchicine 0.5 mg orally once daily, 2-week prescription for aspirin 400 mg orally once daily and then aspirin 100 mg once daily, lower dosage of beta-blocker nebivolol 2.5 mg orally once daily, and ACE inhibitor perindopril 2 mg once daily, as well as gastroprotective drug famotidine 40 mg once daily. At 1-month, 6-month and 1-year follow-up, the patient remained asymptomatic, with normal ECG and normal echocardiography findings.

Discussion

Vaccine-induced myocarditis is an extremely rare side effect that has been reported in the literature with a variety of vaccines such as tetanus, smallpox, and influenza vaccines [5], [6], [7], [8]. This, however, has not been reported in the clinical trials of the Pfizer-BioNTech COVID-19 mRNA vaccines. It has been postulated that the underlying mechanisms for vaccine-associated myocarditis include a molecular mimicry between viral spike protein and non-specific inflammatory response. The occurrence after the second vaccine dose raises the possibility of a hypersensitivity response.

Our patient had typical symptoms, ECG pattern, biomarkers, and imaging findings of myocarditis. He was diagnosed with vaccine-associated myocarditis due to the strong temporal relationship of systemic inflammatory symptoms and cardiac injury following administration. Ischemic mechanisms were excluded by coronary angiogram. The ECG changes were diffuse and transthoracic echocardiogram showed a decreased LV EF. Treatment with beta-blocker and angiotensin converting enzyme inhibitor was initiated. Cardiovascular magnetic resonance is the gold standard and the primary tool for non-invasive assessment of myocardial inflammation in patients with suspected myocarditis showing late gadolinium enhancement associated with myocardial edema involving most of the myocardium and mild pericardial enhancement [9], [10]. These results satisfied two of the three Lake Louise tissue criteria for myocarditis diagnosis. Endomyocardial biopsy was not performed as the patient experienced mild symptoms, had no hemodynamic or electrical instability, and responded promptly to initial management, therefore would have incurred unnecessary procedural risk. Steroids and high-dose NSAID use were considered as a treatment. Colchicine was utilized as the patient's predominant symptom was chest pain and there was evidence of pericardial enhancement on MRI.

In the medical literature, there have been three papers detailing myocarditis following administration of Pfizer-BioNTech COVID-19 vaccine [11], [12], [13]. In a review of reports to VAERS, a US spontaneous reporting (passive surveillance) system that functions as an early warning system for potential vaccine adverse events, 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. However, this increased risk must be weighed against the benefits of COVID-19 vaccination [14].

In April 2021, the center for disease control and prevention (CDC) issued recommendations for clinicians regarding reported cases of myocarditis and pericarditis after the Pfizer-BioNTech mRNA COVID-19 vaccines stating that most cases responded well to medical therapy and rest, and that most occurred in young male adolescents and young adults, more commonly after the second dose. The CDC is currently investigating these reports, but continues to recommend

the vaccine for everyone aged 12 years or older [15]. As the rapid vaccine rollout continues, further data may help shed new light on whether myocarditis could be an adverse effect of Pfizer-BioNTech mRNA-COVID-19 immunization. Pfizer-BioNTech mRNA-COVID-19 vaccines have so far shown to be relatively safe and effective. The benefits of administering the vaccine will still overwhelmingly outweigh the risk of developing myocarditis, if such an association was to be established; however, clinicians should be aware of this potential relationship.

Conclusion

The exact mechanism of myocarditis in young men who received the second dose of mRNA COVID-19 vaccine is not yet known. However, this is a rare complication and most people generally recover quickly requiring only supportive treatment. In contrast, the risk of developing myocarditis from the viral infection is much higher. According to the data from the Vaccine-Adverse Events-Reporting System, the CDC has estimated that the incidence of myocarditis is 1.2 cases per 100,000 among vaccine recipients between the ages of 18 and 29 years. Among available imaging techniques, echocardiography and cardiac magnetic resonance, along with the cardiac biomarkers, are established and highly valuable diagnostic tools in patients with clinically suspected myocarditis.

References

1. Kunal S, Gupta K, Sharma SM, Pathak V, Mittal S, Tarke C. Cardiovascular system and COVID-19: Perspectives from a developing country. Monaldi Arch Chest Dis. 2020;90:231-241. https://doi.org/10.4081/monaldi.2020.1305
   PMid:32380802
2. COVID-19 Subcommittee of the WHO Global Advisory Committee on Vaccine Safety (GACVS): Updated Guidance Regarding Myocarditis and Pericarditis Reported with COVID-19 mRNA Vaccines 9 July 2021 Statement [Last accessed on 2023 May 11].
3. Available from: https://www.cdc.gov/vaccines/covid-19/clinical-considerations/myocarditis.html [Last accessed on 2023 May 11].
4. Dilber E, Karagoz T, Aytemir K, Ozer S, Alehan D, Oto A, *et al*. Acute myocarditis associated with tetanus vaccination. Mayo Clin Proc. 2003;78(11):1431-3. https://doi.org/10.4065/78.11.1431-a
   PMid:14601707
5. Saurina G, Shirazi S, Lane JM, Daniel B, DiEugenia L. Myocarditis after smallpox vaccination: A case report. Clin Infect Dis. 2003;37(1):145-6. https://doi.org/10.1086/377178
   PMid:12830420
6. Pfizer-BioNTech. COVID-19 Vaccine (BNT162, PF-07302048) FDA VRBPAC FDA; 2020. Available from: https://www.fda.gov/media/144246/download [Last accessed on 2020 Dec 10].
7. Helle EP, Koskenvuo K, Heikkila J, Pikkarainen J, Weckstrom P. Myocardial complications of immunisations. Ann Clin Res. 1978;10:280-7.
   PMid:736507
8. Cheng MP, Kozoris MG, Ahmadi AA, Kelsall J, Paquette K, Onrot JM. Post-vaccination myositis and myocarditis in a previously healthy male. Allergy Asthma Clin Immunol. 2016;12:6. https://doi.org/10.1186/s13223-016-0114-4
   PMid:26877725
9. Ferreira VM, Schulz-Menger J, Holmvang G, Kramer CM, Carbone I, Sechtem U, *et al*. Cardiovascular magnetic resonance in nonischemic myocardial inflammation: Expert recommendations. J Am Coll Cardiol. 2018;72(24):3158-76. https://doi.org/10.1016/j.jacc.2018.09.072
   PMid:30545455
10. Adler Y, Charron P, Imazio M, Badano L, Barón-Esquivias G, Bogaert J, *et al*. 2015 ESC guidelines for the diagnosis and management of pericardial diseases: The task force for the diagnosis and management of pericardial diseases of the European society of cardiology (ESC) endorsed by: The European association for cardio-thoracic surgery (EACTS). Eur Heart J. 2015;36(42):2921-64. https://doi.org/10.1093/eurheartj/ehv318
    PMid:26320112
11. Garcia JB, Ortega PP, Fernandez JA, Leon AC, Burgos LR, Dorta EC. Acute myocarditis after administration of the BNT162b2 vaccine against COVID-19. Rev Esp Cardiol (Engl Ed). 2021;74(9):812-4. https://doi.org/10.1016/j.rec.2021.04.005
    PMid:33994339
12. Marshall M, Ferguson ID, Lewis P, Jaggi P, Gagliardo C, Collins JS, *et al*. Symptomatic acute myocarditis in 7 adolescents following Pfizer-BioNTech COVID-19 vaccination. Pediatrics. 2021;148(3):e2021052478. https://doi.org/10.1542/peds.2021-052478
    PMid:34088762
13. Ammirati E, Cavalotti C, Milazzo A, Pedrotti P, Soriano F, Schroeder JW, *et al*. Temporal relation between second dose BNT162b2 mRNA Covid-19 vaccine and cardiac involvement in a patient with previous SARS-COV-2 infection. Int J Cardiol Heart Vasc. 2021;34:100774. https://doi.org/10.1016/j.ijcha.2021.100774
    PMid:33821210
14. Gargano JW, Wallace M, Hadler SC, Langley G, Su JR, Oster ME, *et al*. Use of mRNA COVID-19 vaccine after reports of myocarditis among vaccine recipients: Update from the advisory committee on immunization practices-United States, June 2021. MMWR Morb Mortal Wkly Rep. 2021;70(27):977-82. https://doi.org/10.15585/mmwr.mm7027e2
    PMid:34237049
15. Centers for Disease Control and Prevention Clinical considerations: Myocarditis and Pericarditis after Receipt of mRNA COVID-19 Vaccines among Adolescents and Young Adults; 2021. Available from: https://www.cdc.gov/vaccines/covid-19/clinical-considerations/myocarditis.html [Last accessed on 2023 May 11].