

Pulmonary embolism after COVID-19 vaccination

Kristin N Sheehan, David Zhao

ABSTRACT

Introduction: On December 11, 2020 the United States Food and Drug Administration approved the release of the first coronavirus vaccine. The vaccine is an mRNA vaccine and was created by the companies Pfizer and BioNTech. Since its release, millions of Americans have received doses of the vaccine. Reported adverse effects of this new drug have ranged from mild redness to anaphylaxis.

Case Series: Here we present the cases of two patients who developed pulmonary embolisms shortly after receiving Pfizer's COVID-19 vaccine. The first occurred two weeks after vaccination and presented with exertional shortness of breath. The second case occurred one day after vaccination and presented with decreased responsiveness.

Conclusion: Both pulmonary embolisms occurred in patients otherwise not known to be at higher risk for clotting. These cases illustrate a rare but important potential complication of COVID-19 vaccination.

Keywords: Adverse effects, COVID-19, Pulmonary embolism, Vaccination

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INTRODUCTION

A variety of adverse events have been reported since the start of COVID-19 vaccine distribution. Immune reactions characterized by blood clots and thrombocytopenia have been reported in patients who received the Astrazeneca vaccine and the Johnson and Johnson vaccine. However, the same effects have not been extensively reported after the Pfizer COVID-19 vaccine. A literature search of Pubmed articles relating to COVID vaccination, clotting, and adverse events was performed and only one report of thrombosis after Pfizer vaccination was found. The following are two cases of patients who developed large pulmonary embolisms after receiving Pfizer's coronavirus vaccine.

CASE SERIES

Case 1

A 65-year-old female presented to her primary care doctor complaining of worsening dyspnea on exertion over the last several days. The patient had a medical history significant for hypertension and obesity. She described shortness of breath that began suddenly and worsened to the point where she could no longer walk from one room to another in her house; a task she previously had no difficulty performing. At her primary care physician's office she was noted to be short of breath at rest but maintaining oxygen saturations of 96%. She was sent to the emergency room for further imaging. A computed tomography angiography (CTA) was obtained demonstrating a large saddle embolism. This patient had no prior history of deep venous thrombosis or pulmonary embolism, was not taking any estrogen replacement therapies, and was a lifetime nonsmoker. Her travel history was only significant for a 2-hour car ride that occurred after the onset of her symptoms. Her family history was significant for deep

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vein thrombosis in several relatives including a fatal pulmonary embolism in her mother at age 74. Her only home medications were antihypertensives. Two weeks prior to presentation the patient received her second shot of the Pfizer COVID-19 vaccine. After the patient's CTA resulted, she was placed on a heparin drip and admitted to the hospital. She required 2 L of oxygen to maintain her saturations above 92% but was otherwise asymptomatic at rest. A transthoracic echocardiogram was performed and results were consistent with right ventricular strain. Ultimately, the patient received catheter assisted thrombolysis (EKOS) which provided symptomatic improvement and she was discharged home on therapeutic dosage (5 mg twice daily) of oral Apixaban.

Case 2

A 62-year-old female presented to Wake Forest Baptist Hospital by ambulance after pulseless electrical activity arrest. The patient had a medical history significant for hypertension, diabetes, coronary artery disease, and non-secreting paragangliomas. She had recently received her second Pfizer COVID-19 vaccine. She was reported to be in her usual state of health prior to the day of admission when she abruptly developed dyspnea, diaphoresis, and decreased responsiveness. The patient's boyfriend found her in distress in the bathroom and called emergency medical services. Upon their arrival the patient was found without a pulse and cardiopulmonary resuscitation (CPR) was initiated. Return of spontaneous circulation (ROSC) was achieved in the field. During hospital transport, the patient lost pulses two additional times and was revived each time. In the emergency room the patient was immediately intubated and started on vasopressors. The patient went into cardiac arrest a total of 5 times while in the emergency department with subsequent achievement of ROSC after CPR and epinephrine. Computed tomography (CT) images of chest and head were obtained and revealed a large pulmonary embolism with evidence of cor pulmonale (Figure 1). Given the patient's unstable condition, tenecteplase was given and the patient was admitted to the cardiac intensive care unit. Decision was made to initiate venoarterial extracorporeal membrane oxygenation (VA ECMO). Unfortunately, the patient's hospital course was further complicated by massive internal bleeding and hypovolemic shock unresponsive to fluids or blood products. Ultimately, care was withdrawn and the patient died.

DISCUSSION

These two cases highlight an unexpected occurrence of large pulmonary emboli. Both patients had no previous history of blood clots or any known clotting disorders. Neither had prolonged period of immobilization or were taking any medications that would predispose them to



Figure 1: Large pulmonary embolism of the right main pulmonary artery.

clot formation. In both cases, the patients had received Pfizer's COVID-19 vaccine shortly prior to presentation.

It has been well-established that infection with coronavirus triggers inflammatory pathways and leads to a hypercoagulable state [1]. When the virus invades normal human cells it begins by causing local inflammation via cytokine activation, damage to tissues, and recruitment of inflammatory cells. Through the binding of various receptors, the virus triggers the release of pro-inflammatory molecules such as ACE-1 and angiotensin II which act to create systemic inflammation and coagulopathy. There have been many reports on thromboembolic events occurring in patients with COVID-19 infections making these pathways clinically relevant. Because vaccination aims to create a similar immune response as the body would produce to the virus, it is reasonable to assume that vaccination may induce an inflammatory and thrombogenic response similar to that produced by a natural infection. Therefore, there is high suspicion that immunization may also create a hypercoagulable state leading to increased rates of thrombosis. In fact, this has been seen with the Astrazeneca and Johnson and Johnson vaccines.

While deep vein thrombosis and pulmonary embolism are not recognized as established complications of the Pfizer vaccine, they may represent a very small portion of adverse events. A large majority of the current literature focuses on allergic (including anaphylactic) and non-allergic reactions, specifically cutaneous reactions [2–7, 8–12]. There are several case reports on the development of lymphadenopathy, Bell's palsy, and one reported case of Guillain-Barre syndrome after vaccination [13–16]. In regard to thrombosis, only one paper was found describing development of deep vein thrombosis after administration of the Astrazeneca vaccine and one case study of a thrombotic event tied to the Pfizer vaccine [17–19].

CONCLUSION

While we are not able to definitely determine if immunization was a factor in these cases of thrombosis or how strong of an influence it may have had, the relative timing makes it reasonable to question its role. Reports of thrombotic reactions appear to be few at this time, however it is an important differential to keep in mind for patients presenting with acute onset of dyspnea in the days to weeks after vaccination.

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Author Contributions

Kristin N Sheehan – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

David Zhao – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Guarantor of Submission

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Conflict of Interest

Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

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