Radiology Case Reports 19 (2024) 4087–4090

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

Acute extensive pulmonary embolism after mRNA SARS-CoV-2 immunization ☆,☆☆

Safi Ur Rehman Daim, MD[a,*], *Aya Alsermani, MBBS*[b], *Renad Khalid Althomali, MBBS*[b], *Muhammad Fawad Ashraf, MD*[a], *Maamoun AlSermani, MBBS*[b]

[a] *Mayo hospital, Anarkali, Lahore 54000, Punjab, Pakistan*
[b] *Department of Medicine, Dar Al Uloom University, Riyadh, Saudi Arabia*

ARTICLE INFO

Article history:
Received 24 May 2024
Revised 3 June 2024
Accepted 8 June 2024
Available online 13 July 2024

Keywords:
COVID 19
mRNA Vaccine
Pfizer- BNT162b2
Pulmonary embolism
Vaccination
Thromboembolism

ABSTRACT

COVID-19 vaccines, a cornerstone of the fight against the disease have generally proven to be safe with most commonly reported side effects being mild and self-limiting. Uncommon severe adverse effects like thromboembolism have been reported during postmarketing surveillance. Viral-based vector vaccines have been most commonly implicated in these reports. Our report however portrays a case of a 26-year-old female who developed extensive pulmonary embolism following administration of the Pfizer- BNT162b2 mRNA COVID-19 vaccine. The patient did not have any risk factors for thromboembolism. She was admitted, put on enoxaparin, and given Altaplase thrombolytic therapy. Her condition improved and she was discharged on Apixaban. The Thrombophilia screen performed on the 6-month follow-up was negative and following the resolution of thrombosis, Apixaban was stopped. Our case highlights the importance of continued surveillance of uncommon adverse effects and the need for prompt diagnosis and management of such side effects.

Introduction

The COVID-19 pandemic, caused by Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) severely impacted public health and the economy worldwide [1]. In the absence of definitive management, vaccination campaigns became the cornerstone of the fight against the pandemic. These vaccines were extremely effective and helped restore the normalcy of life.

Clinical trials for the vaccines reported mild and self-limited side effects. These included injection site pain, most common, followed by headache, flu-like symptoms, and fatigue [2]. Rare adverse effects were observed during post-marketing surveillance, with vaccine-induced thrombotic events and inflammatory syndromes most serious of

☆ Acknowledgments: All authors contributed towards data analysis, drafting and revising the paper, gave final approval of the version to be published and agree to be accountable for all aspects of the work.
☆☆ Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.
* Corresponding author.
E-mail address: safiurrehmandaim1@gmail.com (S.U.R. Daim).
https://doi.org/10.1016/j.radcr.2024.06.022

those [3]. These uncommon adverse events were most commonly reported with viral-based vector vaccines AstraZeneca ChAdOx1 nCov-19 and Janssen Ad26.COV2-S and led to the suspension of these vaccination campaigns [4]. mRNA vaccines Pfizer BNT162b2 and Moderna mRNA-1273 were considered safe in this regard. Our report portrays a case of 26 year 26-year-old female with no known risk factor of thromboembolism presenting with massive pulmonary embolism 4 days after the second dose of dose of Pfizer BNT162b2 mRNA vaccine.

Very few cases of pulmonary embolism have been reported associated with the Pfizer- BNT162b2 mRNA COVID-19 vaccine [5]. In general, the benefits of vaccines outweigh the risks. It is important however that continued post-marketing surveillance is ensured and review done to make sure these uncommon adverse effects are accounted for. This also allows the physician to be vigilant and ensures that they are aware of the uncommon adverse events associated with vaccines.

Case presentation

A 26-year-old Saudi female with no history of any medical issue presented with a 4-day history of shortness of breath, minimal excretion, and palpitation associated with pre-syncope and non-radiating chest pain. She had no history of trauma, surgery, cellulitis, lifting heavy weights, hormonal injections, or contraceptives.

The patient received the COVID-19, mRNA-type (Pfizer) vaccine second dose 4 days before her presentation. She received the first dose in May 2021 and the second dose in September 2021. Four days after the second dose, she presented to the Emergency Department. The patient had regular visits with her primary care physician at the same hospital. She did not have any medical condition and was in perfect state of health before her recent presentation.

Upon presentation in the ER, she looked unwell and in distress. She was unable to lie down. Her O2 sat at 88 on RA; HR was 160, and BP was 90/49. She was afebrile. At admission, her WBC was 13.6 $\times$ 10^9/L, Hb was 16 mg/dL. Her platelets were 231$\times$10^9/L. Her PT was 15.3 sec, PTT was 33 sec. Her D Dimer was $>$20 μg/mL (Reference value, $<$0.50 μg/mL normal and $>$5 μg/mL critical high with cut off value to exclude DVT and PE being 0.50 μg/mL FEU). On suspicion of pulmonary embolism, a chest CT scan was done and showed extensive pulmonary embolism. Radiology department reported the following findings; “Extensive bilateral PE seen involving bilateral main pulmonary divisions extending to bilateral lobar and segmental branches, mainly middle and lower segments. Clear both lung fields apart from tiny 2 nonspecific pleural-based nodules seen at the left lung measuring about 1.5 mm. No pleural effusion was noted.” The result of CTA is shown in Figs. 1A-C.

She was admitted as a case of massive PE to the ICU as her blood pressure went down and O2 requirements increased. She was put on Enoxaparin and given thrombolytic therapy (Altaplase full dose). Her condition then started to improve dramatically, and the next day she was on 2L O_2 only.

She was discharged in stable condition after a few days of admission on apixaban 5 mg bid. Platelets after 5 days were 450, and the baseline after 1 year was almost 350. The patient was followed up in a Hematology clinic in OPD after 6 months. She was fine and had no dyspnea. She was vitally stable, and had no chest pain or SOB. She was still on Apixaban. A Thrombophilia screen was done at this visit. Lupus anticoagulant was Negative, ACLA, and B2 GI were negative. Anti-thrombin was normal, Protein C and protein S values were also normal. Factor-V laden was 180.7 (normal). The patient was reassured and apixaban was stopped.

Discussion

COVID-19, declared a pandemic in March 2023 massively disrupted the global economy and impacted public health [6]. The scale of the impact leads to widespread efforts to find a solution or way to curtail the effects. Both therapeutic and preventive avenues were explored. Definitive treatment of COVID-19 proved elusive [7]. However, progress was made in the prevention of the disease.

Vaccination became the foundation of the fight against COVID-19. Multiple vaccines were simultaneously worked upon and developed. The first to be approved was of Pfizer BNT162b2 mRNA vaccine. This was followed by the approval of other mRNA and viral-based vector vaccines [8]. All of these vaccines were approved following clinical trials that demonstrated their efficacy and proved their safety [9]. Minor side effects were reported during these trials. This was expected and on par with other effects witnessed by other vaccine administrations. These included injection site pain, most common, followed by headache, flu-like symptoms, and fatigue [10]. Following mass production and administration of these vaccines, surveillance revealed some rare serious adverse effects not initially encountered in clinical trials. Among these adverse effects, thromboembolism was the most serious one [11].

Most of the reported thromboembolism cases following COVID-19 vaccine administration have been with viral-based vector vaccines. Mechanisms to explain this have been hypothesized. For Viral based vector vaccines, negatively charged polyadenylated hexone proteins mimicking heparin to induce a conformational change in PF-4 and the formation of antibodies against it is the preeminent theory [12]. Impurities in the vaccine, intrinsic acquired or inherited factors like pre-priming of B cells, or differences in T cells enhance this effect and lead to the development of thromboembolism in the affected individuals while unaffected vaccinated individuals don’t develop these side effects in the absence of these factors.

Of the thromboembolism cases associated with COVID-19 vaccination, very few have been reported following mRNA vaccine administration [13]. mRNA vaccines do not have the polyadenylated hexone hypothesized to be the triggering factor in viral-based vector-based vaccines. Cases however have continued to be reported in literature of thrombosis and occasional Pulmonary embosom associated with mRNA vaccines [14,15]. Pathophysiology for this is as yet undetermined. Our report portrays an extensive pulmonary embolism case in a 26-year-old female following BNT162b2 mRNA COVID-19 vaccine administration. She did not have any predisposing factors

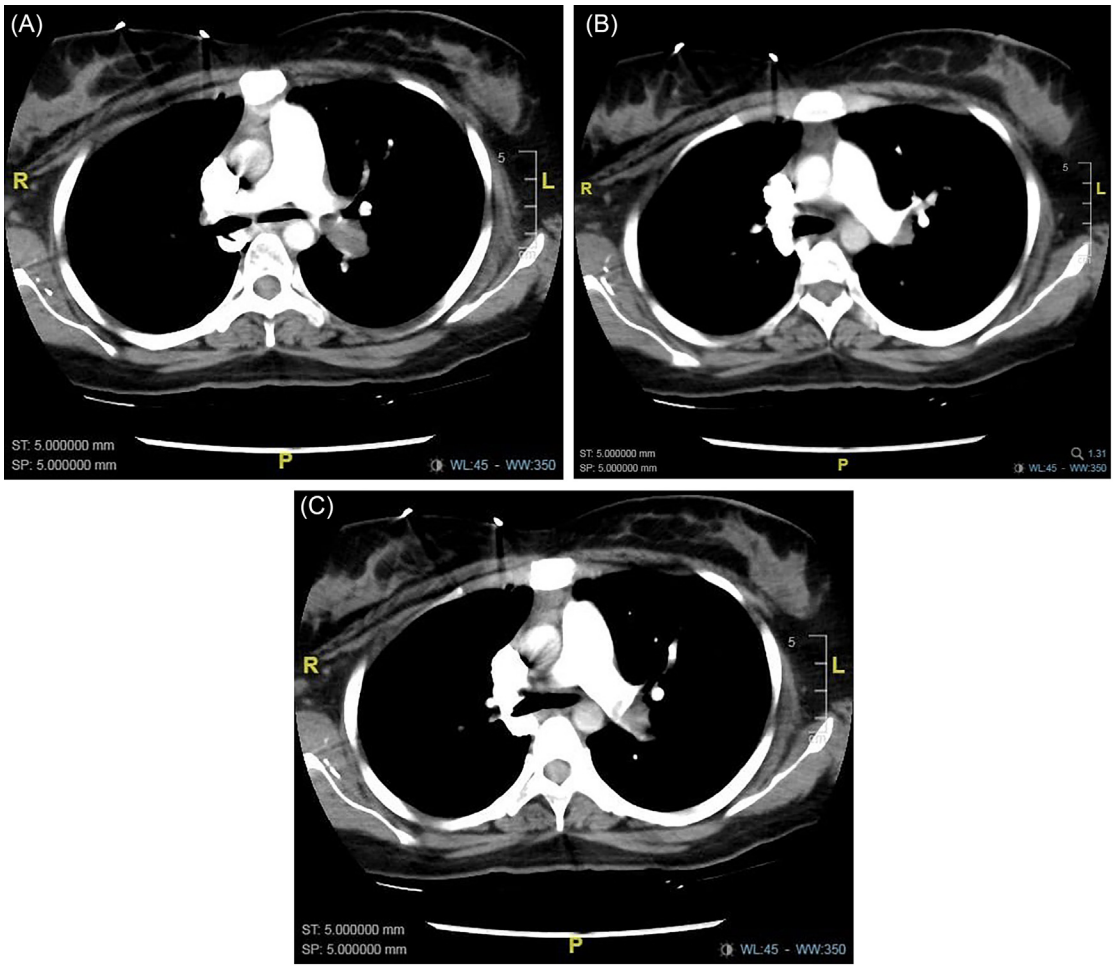

Fig. 1 – (A-C) CTA showing massive pulmonary embolism.

for thromboembolism and eventual thrombophilia screen was negative in her. Our literature review shows that only a handful of cases of Pulmonary embolism have been associated and reported with mRNA vaccines [16].

COVID-19 vaccines have proved pivotal in the fight against the pandemic. Careful monitoring and reviews have ensured that serious adverse effects are reported and accounted for. It is vital that continued surveillance is sustained in the future and physicians are aware of the rare serious effects associated with vaccines to ensure early diagnosis and treatment of such conditions.

Conclusion

In this report, we present rare adverse effect associated with mRNA vaccine. Our case reports a 26 year old female with no known thromboembolism risk factor that presented with extensive pulmonary embolism following administration of second dose of Pfizer- BNT162b2 mRNA COVID-19 vaccine. Thrombolytic therapy with Altaplase and anticoagulation with Enoxaparin and Apixaban led to the resolution pf symptoms. This case highlights the importance of watchfulness for uncommon adverse effects following vaccination, and the need for thorough assessment and management of these side effects.

Patient consent

Written informed consent was obtained from the patient for the publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Ethical approval

Not required as we have acquired consent from the patient.

REFERENCES

[1] Gautam S, Hens L. COVID-19: impact by and on the environment, health and economy. Envir, Developm Sustainabil 2020;22:4953–4.

[2] Sarkar M, Madabhavi IV, Quy PN, Govindagoudar MB. COVID-19 vaccine-induced immune thrombotic thrombocytopenia: a review. Ann Thorac Med 2022;17(1):1–3.
[3] Connors JM, Levy JH. Thromboinflammation and the hypercoagulability of COVID-19. J Thromb Haemost 2020;18(7):1559–61.
[4] Wise J. Covid-19: European countries suspend use of Oxford-AstraZeneca vaccine after reports of blood clots.
[5] Cheong KI, Chen CF, Chen JS, Wu YW, Chiu KM, Tu CM. Acute pulmonary embolism following moderna mRNA-1273 SARS-CoV-2 vaccination: a case report and literature review. Acta Cardiologica Sinica Jul 2022;38(4):539.
[6] Naseer S, Khalid S, Parveen S, Abbass K, Song H, Achim MV. COVID-19 outbreak: impact on global economy. Front Public Health 2023;10:1009393.
[7] Stasi C, Fallani S, Voller F, Silvestri C. Treatment for COVID-19: an overview. Eur J Pharmacol 2020;889:173644.
[8] COVID W. 19-Landscape of novel coronavirus candidate vaccine development worldwide. COVID-19 Vaccine Tracker Landscape 2021.
[9] Kaur RJ, Dutta S, Bhardwaj P, Charan J, Dhingra S, Mitra P, et al. Adverse events reported from COVID-19 vaccine trials: a systematic review. Indian J Clin Biochem 2021;36(4):427–39.
[10] Menni C, Klaser K, May A, Polidori L, Capdevila J, Louca P, et al. Vaccine side-effects and SARS-CoV-2 infection after vaccination in users of the COVID Symptom Study app in the UK: a prospective observational study. Lancet Infect Dis 2021;21(7):939–49.
[11] Mani A, Ojha V. Thromboembolism after COVID-19 vaccination: a systematic review of such events in 286 patients. Ann Vasc Surg 2022;84:12–20.
[12] Marietta M, Coluccio V, Luppi M. Potential mechanisms of vaccine-induced thrombosis. Eur J Intern Med 2022;105:1–7.
[13] Nicholson M, Goubran H, Chan N, Siegal D. No apparent association between mRNA COVID-19 vaccination and venous thromboembolism. Blood Rev 2022;56:100970.
[14] Carli G, Nichele I, Ruggeri M, Barra S, Tosetto A. Deep vein thrombosis (DVT) occurring shortly after the second dose of mRNA SARS-CoV-2 vaccine. Intern Emerg Med 2021;16:803–4.
[15] Atoui A, Jarrah K, Al Mahmasani L, Bou-Fakhredin R, Taher AT. Deep venous thrombosis and pulmonary embolism after COVID-19 mRNA vaccination. Ann Hematol 2022;101(5):1111–13.
[16] Yasmin F, Najeeb H, Naeem U, Moeed A, Atif AR, Asghar MS, et al. Adverse events following COVID-19 mRNA vaccines: a systematic review of cardiovascular complication, thrombosis, and thrombocytopenia. Immunity, Inflammat Dis 2023;11(3):e807.