

The Successful Vaccination of an IVIgG Naive CVID Patient with an mRNA COVID-19 Vaccine

Allergy & Rhinology
Volume 12: 1–3
© The Author(s) 2021
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/21526567211049744
journals.sagepub.com/home/aar



Maaz Jalil, DO¹ , John M. Abraham, BS²,
and Robert Hostoffer, DO³

Abstract

Introduction: Different subtypes of vaccines have been developed to help protect populations from COVID-19. Currently, three vaccines have been authorized by the United States Food and Drug Administration for emergency use to combat the COVID-19 pandemic. With COVID-19 vaccination rates increasing, it is important to know whether immunodeficient patients have the capacity to mount an immune response with the available vaccines.

Case Report: A 78-year-old female with Common Variable Immunodeficiency and anti-IgA antibodies who is naïve to IVIgG treatment responded positively to a COVID-19 mRNA vaccine. Successful seroconversion was proved by having positive COVID-19 spike protein IgG antibodies weeks after the vaccination. Her recent IgG, IgA, and IgM levels were all significantly reduced. Previously, she had no response to the polysaccharide pneumococcal vaccine, but did maintain titers after Tdap vaccination.

Discussion: Immunodeficient patients are a susceptible population during a pandemic. Unfortunately, there is a paucity of research on the infectivity, vaccination, and outcome of these patients during the COVID-19 outbreak. Our patient with CVID was able to respond to protein/toxoid vaccines, but did not respond to polysaccharide pneumococcal vaccine. After inoculation with an mRNA COVID-19 vaccine she was able to create COVID-19 spike protein IgG antibodies.

Conclusion: We present a case of successful vaccination to COVID-19 by an mRNA vaccine in an IVIgG naïve CVID patient.

Keywords

COVID-19, vaccination, CVID, immunodeficiency

Introduction

In December of 2019 unexplained cases of pneumonia were identified in Wuhan, China. By February 2020 The World Health Organization designated this novel coronaviridae variant, Coronavirus disease 19 (COVID-19) also known as Severe Acute Respiratory Coronavirus Syndrome-2 (SARS-COV-2). This enveloped, positive stranded RNA virus was not previously known to be highly pathogenic in humans until 2002 and 2003 when the first severe acute respiratory syndrome (SARS) was reported.¹ However, by March 2020, the COVID-19 outbreak was declared a global pandemic and the race for an effective vaccine was underway.²

There are three vaccines authorized by the Food and Drug Administration (FDA) for emergency use: Pfizer-BioNTech COVID-19 (BNT162b2) vaccine (Pfizer, Inc; Philadelphia, Pennsylvania), Moderna COVID-19 (mRNA-1273) vaccine (ModernaTX, Inc; Cambridge, Massachusetts), and Janssen COVID-19 (Ad.26.COV2.S)

vaccine (Janssen Biotech, Inc, a Janssen Pharmaceutical company, Johnson & Johnson; New Brunswick, New Jersey). Each of these vaccines have been proven effective in the aim to create immunity in light of the massive mortality rates worldwide. However, in our various subsets of immunodeficient patients, it is unknown whether these patients have adequate immune function to mount a protective and lasting response using the vaccines available against COVID-19.

¹University Hospitals, Cleveland Medical Center, Cleveland, Ohio, USA

²University of Medicine and Health Sciences, Basseterre, St. Kitts and Nevis

³Allergy/Immunology Associates Inc., Mayfield Heights, Ohio, USA

Corresponding Author:

Maaz Jalil DO, University Hospitals, Cleveland Medical Center, Cleveland, Ohio, USA5915 Landerbrook Drive, Suite 110, Mayfield Heights, OH 44124, USA.

Email: Mjalil570@gmail.com



Common variable immune deficiency (CVID), is appropriately named as one of the most prevalent primary immunodeficiencies. Classical presentations of CVID include recurrent infections and hypogammaglobulinemia. Due to the heterogeneity in presentation of this disease, multiple diagnostic criteria have been formulated. Generally, CVID is characterized by low levels of immunoglobulin G (IgG) along with suboptimal levels of immunoglobulin A (IgA) and/or M (IgM), as well as a diminished antibody response to vaccine challenges.³ In approximately 20% of patients a genetic predisposition can be identified. More likely the disease is due to multifactorial causes such as genetics and environmental factors. Due to the lack of antibody production and subsequent augmented ability in function, the efficacy of vaccines are often compromised. Herein, this case report with a review of the most updated literature aims to highlight the successful vaccination of a CVID patient using an mRNA vaccine.

Case Report

A 78-year-old female with a history of CVID, anti-IgA antibodies, pemphigus vulgaris, allergic rhinitis, asthma, and obstructive sleep apnea presented after vaccination with the Pfizer COVID-19 mRNA vaccine. Her medical history includes an initial diagnosis of Selective IgA deficiency in her 30s with positive anti-IgA antibodies. In 2004, when she was 61 years old, she started to have an increase in upper respiratory tract and gastrointestinal infections. A repeat immune work up found a global decrease in immunoglobulins with IgG of 444, IgM of 5, and IgA <16. A vaccine challenge with a pneumococcal polysaccharide vaccine and subsequent challenge with a conjugated pneumococcal vaccine showed nonresponse with 0 out of 14 titers protective before vaccination, and 0 out of 14 titers protective after vaccination. Given these findings, her diagnosis was advanced from Selective IgA deficiency to CVID, and she was started on prophylactic antibiotics. At the age of 66 her IgG level dropped to 262, IgM and IgA remained low. The risks and benefits of starting intravenous IgG (IVIgG) were discussed, including her increased risk for anaphylaxis with blood products given her anti-IgA antibodies; however, IVIgG was held, since clinically she had not deteriorated. Given the patient's immunodeficiency, we questioned whether the COVID-19 vaccination would be successful. The patient did not previously respond to pneumococcal polysaccharide vaccine, however she had positive tetanus and diphtheria titers- proving successful conversion after protein vaccines. COVID-19 Spike protein IgG antibody (Laboratory Corporation of America Holdings, Burlington, North Carolina) was obtained approximately six weeks after her vaccination series with the Pfizer COVID-19 mRNA vaccine, and was positive, confirming successful vaccination.

Discussion

There is a lack of information regarding COVID-19 infections and vaccinations in immunodeficient patients. Early reports have shown that CVID patients have fared similar to the general population during the COVID-19 pandemic, although larger studies are needed.⁴ Generally, CVID patients on IVIgG infusions are protected from certain vaccine preventable diseases since IVIgG products contain specific antibody titers to these diseases, and thus certain vaccination are not required. For novel diseases such as COVID-19, there may not be enough COVID-19 antibodies in donated plasma pools of IVIgG. Furthermore, CVID patients such as our patient described here who are not on IVIgG, still require protection from vaccine preventable diseases. Thus, the efficacy of vaccines in this population is important to characterize.

Our patient was found to have protective titers to diphtheria and tetanus, proving good seroconversion after being inoculated with toxoid protein vaccines. Protection against tetanus and diphtheria toxins involves inoculation with toxoids that activate type 2 helper T cells and B cells to produce specific immunoglobulins that will recognize and neutralize the target toxins in the future.^{5,6}

mRNA vaccines are a relatively newer subtype of vaccine. The Pfizer-BioNTech COVID-19 (BNT162b2) vaccine was issued an Emergency Use Authorization (EUA) by the FDA on December 11th, 2020.⁷ The vaccination is a two-shot series given intramuscularly 21 days apart. This vaccine encodes a membrane-anchored SARS-CoV-2 full length spike protein. In phase II/III clinical trials the vaccine was found to be 95% effective in preventing symptomatic infections.⁷

The mechanism of action of mRNA vaccines differs from other vaccine subtypes. An mRNA that encodes a target protein, in this case a COVID-19 spike protein, is introduced into the body. mRNAs are usually encased in liposomes or complexed in a manner to prevent degradation and to help the mRNA travel to the cytosolic translational machinery in cells.⁸ Once the mRNA is taken up, host cells start producing target proteins on their surface. This process has been shown to prime the adaptive and cellular immune systems. The Pfizer-BioNTech (BNT162b2) vaccine was shown to produce neutralizing antibodies, as well as expand populations and activate specific CD8+ T cells and Type 1 helper CD4+ T cells.⁹

After completing the Pfizer mRNA COVID-19 vaccine series, our patient was positive to the COVID-19 spike protein IgG antibody which confirms this type of vaccine's ability to induce a successful immune response in an IVIgG naive CVID patient. This suggests that CVID patients that respond to protein antigens such as tetanus may be successfully vaccinated with a mRNA vaccine.

Abbreviations:

COVID-19
SARS-COV-2
CVID
IVIgG
EUA
FDA

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval

Not applicable, because this article does not contain any studies with human or animal subjects.

Funding

The author(s) received no financial support for the research, authorship and/or publication of this article.

Author Contributions

Maaz Jalil D.O.: Conception and design of the study, data generation, analysis and interpretation of the data, and preparation and clinical revision of the manuscript.

John M. Abraham B.S.: Conception and design of the study, data generation, analysis and interpretation of the data, and preparation and clinical revision of the manuscript.

Robert Hostoffer D.O.: Conception and design of the study, analysis and interpretation of the data, and clinical revision of the manuscript.

Informed Consent

Not applicable, because this article does not contain any studies with human or animal subjects.

ORCID iD

Maaz Jalil  <https://orcid.org/0000-0003-3214-2970>

Trial Registration

Not applicable, because this article does not contain any clinical trials.

Supplemental material

Supplemental material for this article is available online.

References

1. Amawi H, Abu Deiab GI, Aljabali AA, Dua K, Tambuwala M M. COVID-19 pandemic: an overview of epidemiology, pathogenesis, diagnostics and potential vaccines and therapeutics. *Ther Delivery*. 2020;11(4):245–268.
2. Cucinotta D, Vanelli M. WHO Declares COVID-19 a pandemic. *Acta Biomedica*. 2020;91(1):157–160.
3. Yazdani R, Habibi S, Sharifi L, et al. Common variable immunodeficiency: epidemiology, pathogenesis, clinical manifestations, diagnosis, classification, and management. *Journal of Investigational Allergology Clinical Immunology*. 2020; 30(1):14–34.
4. Cohen B, Rubinstein R, Gans M, Deng L, Rubinstein A, Eisenberg R. COVID-19 infection in 10 common variable immunodeficiency patients in New York city. *J Allergy Clin Immunol*. 2021;9(1):504–507.
5. Murphy K, Weaver C. *Janeway immunology*. 9th ed. Garland Science; 2016.
6. Rabadi T, Brady MF. Tetanus toxoid. In: *StatPearls [Internet]*. StatPearls Publishing; 2021.
7. Oliver S, Gargano J, Marin M, et al. The advisory committee on immunization Practices' interim recommendation for Use of pfizer-BioNTech COVID-19 vaccine — United States, December 2020. *Morb Mortal Wkly Rep* 2020;69(50):1922–1924.
8. Zhao J, Zhao S, Ou J, et al. COVID-19: coronavirus vaccine development updates. *Front Immunol*. 2020;11:1–19.
9. Sahin U, Muik A, Vogler I, et al. BNT162b2 vaccine induces neutralizing antibodies and poly-specific T cells in humans. *Nature*. 2021;595(7868):572–577.