Revista Biomédica

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Comunicación breve

A single BNT162b2 dose protects against SARS-CoV-2: A case report of a family cluster of COVID-19.

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RESUMEN

Una sola dósis de BNT162b2 protege contra SARS-CoV-2: Reporte de un caso en un grupo familiar de COVID-19

Introducción. La enfermedad del Coronavirus 2019 (COVID-19) es una enfermedad infecciosa causada por el virus "Síndrome respiratorio agudo severo Coronavirus 2" (SARS-CoV-2). Este virus generó una pandemia en 2020 y ha afectado a millones de personas en todo el mundo. Ante la necesidad de prevenir su contagio, la vacuna BNT162b2 fue aprobada en México en diciembre de 2020 y comenzó a administrarse en trabajadores de la salud.

Reporte de caso. Presentamos aquí, dos trabajadores de la salud vacunados con una sola dosis de BNT162b2, que viven en un núcleo familiar con alta tasa de transmisión del SARS-CoV-2. Estos trabajadores de la salud, identificados en el manuscrito como pacientes E y F, estaban asintomáticos y su prueba de RT-PCR en tiempo real para SARS-CoV-2 resultó negativa, mientras que el resto de la familia (pacientes A - D) fueron positivos para SARS-CoV-2. Los títulos de anticuerpos IgG anti-Spike del paciente F (después de la segunda dosis; 1080 Au/mL) resultaron mayores que los del paciente E (antes de la segunda dosis; 37.1 Au/mL).

Discusión. Hasta donde sabemos, este es el primer informe de caso del efecto protector de una sola dosis de la vacuna BNT162b2 en el contexto de altas tasas de transmisión dentro de un núcleo familiar. A pesar de los cambios inducidos por BNT162b2 en los títulos de anticuerpos con vacunación de dosis única o doble, una dosis única de BNT162b2 demostró ser suficiente para la inmunización de pacientes contra COVID-19.

Historial del artículo
Recibido: 24 jun 2021
Aceptado: 03 ago 2021
Disponible en línea: 1 sep 2021

Palabras clave
COVID-19, SARS-CoV-2, Vacuna, BNT162b2, Anticuerpos

Keywords
COVID-19, SARS-CoV-2, Vaccine, BNT162b2, Antibody

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 https://doi.org/10.32776/revbiomed.v32i3.912

ABSTRACT

Background. Coronavirus 2019 (COVID-19) disease is an infectious disease caused by the virus "Severe Acute Respiratory Syndrome Coronavirus 2" (SARS-CoV-2). This virus generated a pandemic in 2020 and has affected millions of people worldwide. Facing the need to prevent its contagion, the vaccine BNT162b2 was approved in December 2020 in Mexico and started being administered to healthcare workers.

Case presentation. We presented two healthcare workers vaccinated with one single dose of BNT162b2, who lives in a family nucleus with a high transmission rate of SARS-CoV-2. These healthcare workers, identified in the manuscript as patients E and F, were asymptomatic and their real-time RT-PCR test for SARS-CoV-2 resulted negative, while the rest of the family (patients A-D) were SARS-CoV-2 positive. The antibody titers IgG anti-spike of patient F (after the second dose; 1080 Au/mL) turned out greater than patient E (before the second dose; 37.1 Au/mL).

Discussion. To our knowledge, this is the first case report of the protective effect of a single BNT162b2 vaccine dose in the context of high transmission rates within a family nucleus. Despite changes induced by BNT162b2 in the antibody titers with single or double dose vaccination, a single dose of BNT162b2 showed to be sufficient for immunization of patients against COVID-19.

INTRODUCTION

The coronavirus disease (COVID-19) is caused by the severe acute respiratory syndrome coronavirus (SARS-CoV2). The first cases were observed in Wuhan from a zoonotic transmission in December of 2019 (1). The SARS-CoV-2 infection becomes a pandemic announced by WHO in March 2020, and its disease COVID-19 has left severe effects on human health and economics (2). Although SARS-CoV-2 in the majority of the cases generates an asymptomatic or mild symptomatic infection, in people with underlying conditions like obesity, diabetes, and high blood pressure, among others, becomes severe and sometimes deathly (3). Unfortunately, at the beginning of the pandemic, there were no effective antivirals or vaccines available to treat or prevent COVID-19. In September 2020, numerous vaccine prototypes were developed and some of them entered clinical trials (Adenovirus Type 5 VECTOR, AZD1222, and BNT162b2) (4). On 2 December 2020, BNT162b2 (Pfizer/BioNTech, Comirnaty) received a temporary emergency use authorization (EUA) in the United Kingdom and before December 14th 2020 had already been approved for emergency use in Bahrain, Canada, Mexico, Saudi Arabia, and the USA (5). In Mexico, the vaccination campaigns with BNT162b2 started the December 24th of 2020 in healthcare workers (6). The vaccine BNT162b2 generates an immunologic response against the S1 spike protein and the standard effectiveness of the BNT162b2 vaccine validated in clinical trials includes two doses administered to patients three weeks apart from each other (7). Recently, many reports have described high antibody titers in healthcare workers after applying single or double doses of BNT162b2, which has been associated with the effectiveness of this vaccine in preventing the symptomatic disease in clinical trials (8, 9). However, follow-up in the population outside the clinical trials to evaluate the protection of the first BNT162b2 dose alone in exposed individuals has not been reported yet. We presented here a cluster of cases of a health worker family in which the health workers appear to get a protective effect enough to avoid infection since the first dose of the BNT162b2 vaccine.

Cases report.

This study presents a total of six cases from 1 family unit with SARS-CoV-2. Patients were informed about the objective of the research and signed written informed consent. We named the cases from A to F according to the order of illness onset (Figure 1). The first case (patient A) was a 60 years old male from Villahermosa, Tabasco, México, without a preexisting medical condition. Patient A started with symptoms on February 12th 2021 after 5 days from contact with a positive case. The symptoms of patient A were fever, cough, headache,

 https://doi.org/10.32776/revbiomed.v32i3.912

myalgia, arthralgia, and conjunctivitis. Patient A gets a confirmation of SARS-CoV-2 infection by antigen and real-time RT-PCR tests on February 15th. The same day laboratory inflammation markers were requested and showed elevated levels of: ferritin 444 ng/mL (normal 11.1–264 ng/mL), interleukin-6 (IL-6) 10.08 pg/mL (normal 0.00-7.00 pg/mL) and monocytes 12% (normal 2-9%) (Table 1). This levels continuously increased during the days February 18th and 22nd with levels of ferritin 588 and 782 ng/mL (normal 11.1–264 ng/mL), IL-6 8.19 pg/mL (normal 0.00-7.00 pg/mL), and monocytes 11% (normal 2-9%). Moreover, he developed leukopenia 3730 and 4020 cel/UL (normal 4500-11000 cel/UL) (Table 1). No medications were indicated due to stable viral signs.

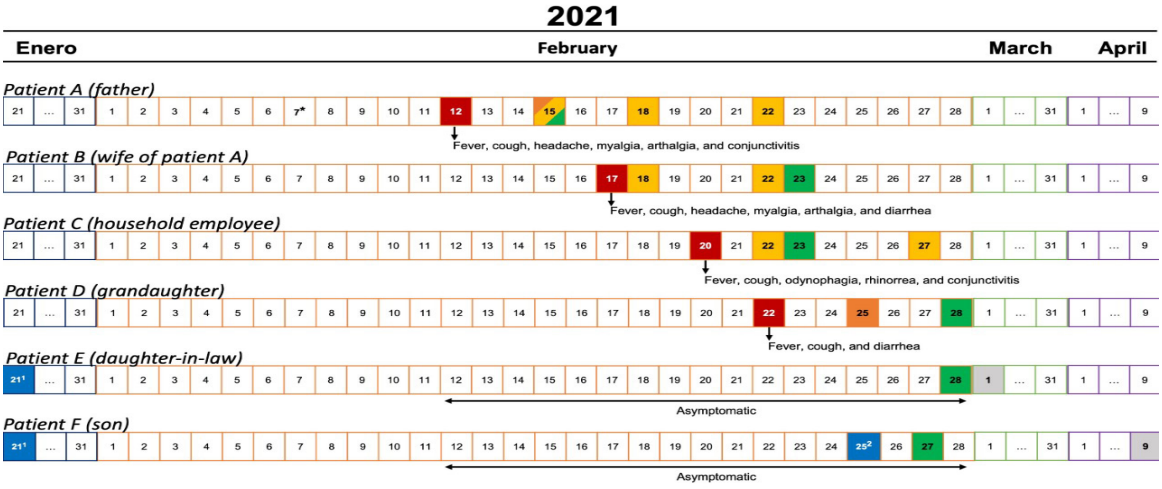

Figure 1. Chronology of vaccination, symptom's onset, and laboratory tests of the family nucleus. Blue square: Immunization with BNT-162B2, [1] first dose, [2]second doses; * contact with a positive case; Red squares presence of symptoms; Orange square SARS-CoV-2 antigen test; Yellow squares clinical analysis laboratory; Green squares SARS-CoV-2 RT-PCR test; Grey squares quantitative measurement of Anti-SARS-CoV-2.

Table 1. Illustrates the outcomes of laboratory tests of patients A, B and C; in bold out-of-range values.

	Clinical analysis laboratory							
	Patient A (father)			**Patient B (wife patient A)**		**Patient C (household employee)**		**Reference values**
Date	02.15.2021	02.18.2021	02.22.2021	02.18.2021	02.22.2021	02.22.2021	02.27.2021	
Leucocytes	6130 cel/uL	**3730 cel/uL**	**4020 cel/uL**	**2970 cel/uL**	**2910 cel/uL**	9350 cel/uL	8010 cel/uL	4500-11000 cel/uL
Lymphocytes	22 %	44 %	40 %	18 %	42 %	28 %	35 %	21-51 %
Monocytes	**12 %**	**11 %**	**11 %**	**18 %**	**14 %**	9 %	9 %	2-9 %
Platelets	215000 cel/uL	201000 cel/uL	216000 cel/uL	190000 cel/uL	197000 cel/uL	327000 cel/uL	246000 cel/uL	130000-400000 cel/uL
Ferretin	**444 ng/mL**	**588 ng/mL**	**782 ng/mL**	89 ng/mL	116 ng/mL	71 ng/mL	108 ng/mL	11.1-264 cel/uL
D-dimer	370 ng/mL	230 ng/mL	290 ng/mL	**730 ng/mL**	390 ng/mL	100 ng/mL	293 ng/mL	< 600 ng/mL
Procalcitonin	0.03 ng/mL	0.02 ng/mL	0.01 ng/mL	0.03 ng/mL	0.01 ng/mL	0.01 ng/mL	----------	< 0.5 ng/mL
Interleukin-6	**10.0 pg/mL**	4.64 pg/mL	**8.19 pg/mL**	4.66 pg/mL	3.79 pg/mL	**7.83 pg/mL**	**15.9 pg/mL**	0.00-7.00 pg/mL

 https://doi.org/10.32776/revbiomed.v32i3.912

Five days after patient A presented first symptoms, patient B (wife of patient A) a 52-year-old Mexican female started with symptoms (fever, cough, headache, myalgia, arthralgia and diarrhea). Moreover, she reported conjunctivitis, anosmia, dysgeusia even, dyspnea, cyanosis, and chest pain. Although this patient not required hospitalization or supplementary oxygen, clinical laboratory markers of inflammation (February 18th and 22nd) showed alterations in D-dimer 730 ng/mL (< 600 ng/mL), with a leukopenia that remained in 2970 cel/UL and 2910 cel/UL (4500-11000 cel/UL) and an increase in the percentage of monocytes 18% and 14% (Table 1). The laboratory inflammation markers were performed also in patient C (household employee), a 37-year-old female who lives with patients A and B and who presented on February 20th mild symptoms (fever, cough, odynophagia, rhinorrhea, and conjunctivitis). However, clinical laboratory results of patient C (February 22nd and 27th) didn't show significant abnormalities, except for increased IL-6 levels 7.83 pg/mL and 15.91 pg/mL (normal 0.00-7.00 pg/mL) (Table 1). The real-time RT-PCR test for SARS-CoV-2 was positive in patients B and C on February 23rd 2021.

On February 22nd, patient D (granddaughter) a 2-year-old female presented fever, cough, and diarrhea. In this patient SARS-CoV-2 antigen test was positive on February 25th of 2021, and was confirmed by SARS-CoV-2 real-time RT-PCR test on February 28th 2021. Patient E (daughter-in-law) and patient F (son), parents of patient D are healthcare workers, a 31-year-old female and 30-year-old male, respectively. These patients were inoculated with the first dose of the BNT162b2 vaccine on January 21st 2021, but only contact F received the second dose on February 25th 2021. Both patients were asymptomatic by the entire family follow up, nevertheless, we tested for SARS-CoV-2 by real-time RT-PCR on the same day of patient D and resulted negative. To measure the response to the single or double dose of the BNT162b2 vaccine, we measure the antibodies titers by Liaison SARS-CoV-2 S1/S2 IgG. We tested patient E before the second dose and 39 days after the first dose, and patient F 43 days after the second dose. We found for patient E a titter of 37.1 Au/mL and for patient F 1080 Au/mL of IgG antiSpike.

DISCUSSION

BNT162b2 vaccine is a modified RNA formulated with lipid nanoparticles encoding the full-length S protein of SARS-CoV-2, modified by two proline mutations to enclose it in the prefusion conformation. The study of phase 2 of this vaccine found that two-dose of BNT162b2 (30 μg per dose) given three weeks apart was safe and 95% effective against COVID-19. However, during the time interval between the first and second doses, the observed vaccine efficacy against COVID-19 was 52% (10). Moreover, studies in the United States and Germany healthy population showed that two 30-μg doses of BNT162b2 elicited high SARS-CoV-2 neutralizing antibody titers and antigen-specific CD8+ and Th1-type CD4+ T-cell responses (11). To date, limited data are available on the efficacy of a single dose of the BNT162b2 vaccine. Recently published papers suggest that 12 days after the first inoculum with BNT162b2 the titers antibody increased in both infection-naïve individuals, as well as previous SARS-CoV-2 infected individuals, but the antibody titers were 10 to 45 times as high in persons with evidence of previous SARS-CoV-2 infection (12, 13, 14). We presented here, two cases report of vaccinated individuals with one single dose of BNT162b2, who lives in a family nucleus with a high transmission rate. We found no infection by SARS-CoV-2 in the vaccinated cases and were confirmed through of presence of S-protein IgG antibody. Interestingly, the antibody titers in patient F were measured after the second vaccine dose, showing an increase (1080 Au/mL) concerning patient E, which was measured before the second vaccine dose (37.1 Au/mL). Our cases agree with Tauzin et al. (15), who found RBD and Spike antibodies with Fc-mediated effector functions, as well as Th1-type CD4+ T-cell responses, three weeks after a single BNT162b2 dose in patients with SARS-CoV-2. As expected the antibodies titter were higher in the patient with two vaccine doses, as previously showed Krammer et

 https://doi.org/10.32776/revbiomed.v32i3.912

al. (13) who observed SARS-CoV-2 IgG responses within 9 to 12 days after the first vaccination and an increase of the antibody titers (3 times more) after the second vaccine dose. To our knowledge, this is the first case report of the protective effect of a single BNT162b2 vaccine dose in the context of high transmission rates within a family nucleus.

CONCLUSION

In this report, we observed that despite changes induced by BNT162b in the antibody levels with single- and/or double-dose vaccination, a single dose could have been sufficient for the immunization of individuals.

Declaration of competing interest

The authors declare that they have no competing interests.

ACKNOWLEDGMENTS

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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