Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Letter to the Editor

Detection of immunoglobulin response to COVID-19 vaccination using a novel rapid fingerstick assay

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SUMMARY

Coronavirus Disease 2019 (COVID-19) emerged as a global pandemic resulting in significant mortality and morbidity. COVID-19 vaccines have been shown to be highly effective in preventing COVID-19 infections and significantly reducing disease severity and mortality. We report on a novel COVID-19 antibody assay using a unique platform to rapidly detect SARS-CoV-2 antibodies with a drop of fingerstick blood in a subject following COVID-19 vaccination. We show early detection of SARS-CoV-2 antibodies post vaccination and persistence of detectable antibodies for at least 6 months. Rapid point of care COVID-19 antibody tests might have a role in assessing the appearance and durability of immune response following COVID-19 vaccination.

1. Introduction

One and a half years have passed since the onset of the global Coronavirus Disease 2019 (COVID-19) pandemic resulting in more than 33,382,705 reported COVID-19 cases and 599,751 reported COVID-19 deaths in the United States (U.S.) as of June 22, 2021 [1]. NOW-Diagnostics, Inc., a Springdale, AR company, responded to the pandemic by adapting their patented lateral flow technology to develop a total antibody test to SARS-CoV-2, the ADEXUSDx® COVID-19 Test. In an increasingly populated field of lateral flow diagnostics, the ADEXUSDx® COVID-19 Test boasts a unique test platform that requires only a drop of fingerstick blood to yield a result. No sample pipettors, buffers, diluents, or in-demand reagents are required to perform the test. Herein, we describe the ADEXUSDx® COVID-19 Test and present results from a subject post COVID-19 vaccination with 6 months of follow up.

2. Methods

To perform the ADEXUSDx® COVID-19 Test, a sample (serum, dipotassium EDTA plasma, venous or capillary whole blood) is applied in the Sample Application Zone of the cassette to fill the Fill Zone. When enough sample is in the Fill Zone, the sample flows into a dry porous test strip composed of a plasma-separating membrane and a series of analytical membranes. The sample first passes through the plasma-separating membrane, which binds the erythrocytes in whole blood samples to prevent them from interfering with the test. The membrane also contains two separate colloidal gold conjugate materials: SARS-CoV-2 recombinant antigen conjugated with colloidal gold and rabbit IgG conjugated with colloidal gold. The SARS-CoV-2 specific antibody in the sample binds to the gold labeled SARS-CoV-2 recombinant antigen in the upstream region of the test strip and the complex is captured by immobilized SARS-CoV-2 antigen at the test line location as it flows downstream. The appearance of a visible test line indicates the sample contains a detectable level of SARS-CoV-2 antibody. Rabbit IgG conjugated with colloidal gold will flow past the test line region and bind to the polyclonal anti-rabbit antibody in the control line location of the analytical membranes, resulting in the appearance of a procedural control line. Test ("T") and Control ("C") Lines on each cassette are visually read for this qualitative test. The control line and the test line may differ in color intensity. The color intensity of the lines will increase slowly with time due to sample evaporation; the test result can be read as early as 15 min but must be read within 30 min to be valid. A line of any signal intensity at the test line indicates a positive result. If the test line is absent, the appearance of the control line assures that the sample was applied correctly, and that proper chromatography occurred in the test [2].

The sensitivity (true positive rate) of the ADEXUSDx® COVID-19 Test was previously validated using hundreds of serum and plasma samples sourced from persons naturally infected with SARS-CoV-2 who previously tested positive with an emergency use authorized COVID-19 RT-PCR test [2]. The specificity (true negative rate) of the test was also validated with serum and plasma samples sourced from persons prior to the onset of the pandemic [2]. The ADEXUSDx® COVID-19 Test was emergency use authorized (EUA201531) on May 24, 2021 as an *in vitro* lateral-flow immunoassay intended for qualitative detection of total antibodies to SARS-CoV-2 in human venous whole blood (dipotassium EDTA), plasma (dipotassium EDTA), serum, and fingerstick whole blood. The ADEXUSDx® COVID-19 Test is intended for use as an aid in identifying individuals with an adaptive immune response to SARS-CoV-2, indicating recent or prior infection. At this time, it is unknown for how long antibodies persist following COVID-19 infection and if the presence of antibodies confers protective immunity.

3. Results and discussion

A 46-year-old male healthcare worker (AHS) was vaccinated with the Pfizer–BioNTech COVID-19 vaccine, an mRNA-based COVID-19 vaccine developed by BioNTec. The Pfizer–BioNTech COVID-19 vaccine

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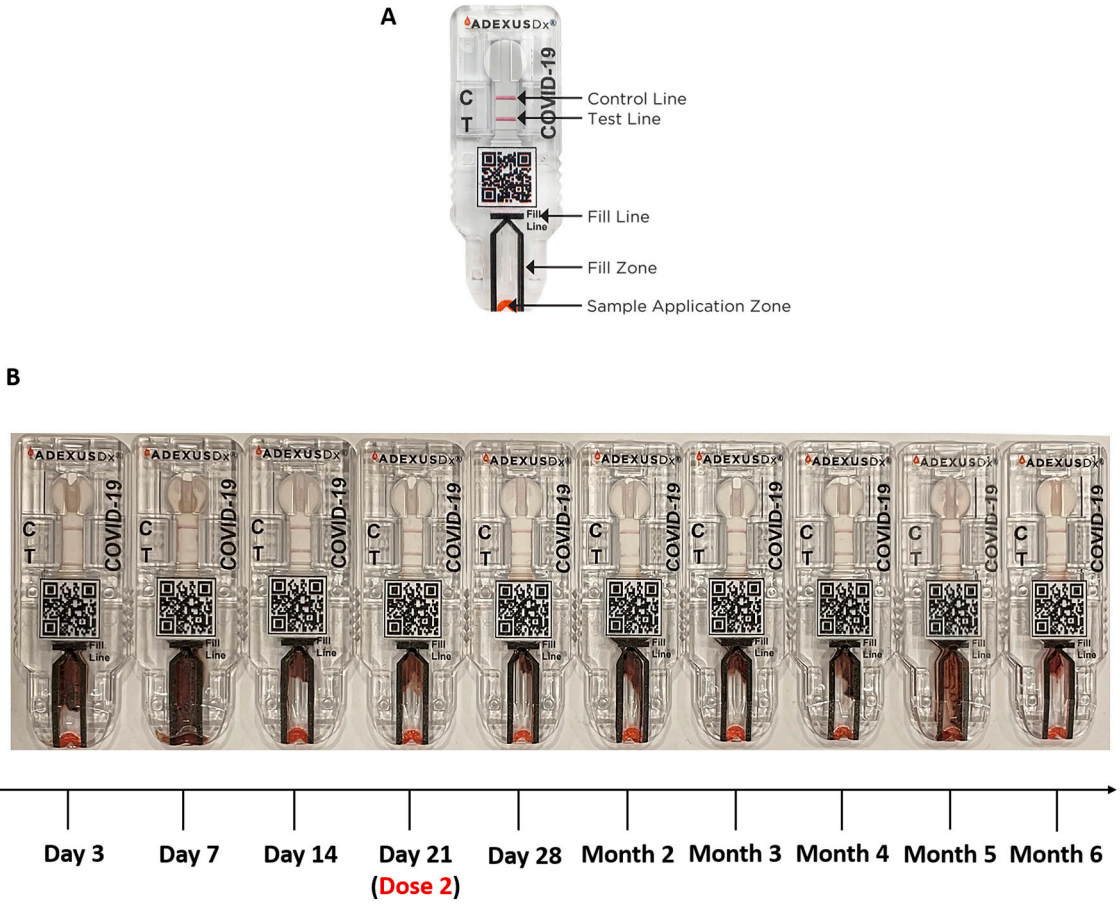

Fig. 1. (A) A schematic diagram depicting the ADEXUSDx® COVID-19 Test platform. Blood is applied to the Sample Application Zone until it reaches the Fill Line. Plasma diffuses beyond the Fill Line through a membrane. A visual "T" line indicates the presence of SARS-CoV-2 antibodies and a "C" line indicates a positive procedural control. (B) Detection of SARS-CoV-2 antibodies using ADEXUSDx® COVID-19 Test in a 46-year-old man following vaccination with the Pfizer–BioNTech COVID-19 vaccine. No antibodies were detected on Day 3 post vaccine Dose 1, but anti-SARS-CoV-2 started to appear on Day 7 and persisted at every time point through Month 6 (the last time point in this study).

has a reported efficacy of 95% for persons 16 years or older from 7 days after Dose 2 in participants without evidence of prior SARS-CoV-2 infection [3].

The study subject was vaccinated according to the recommended administration of the Pfizer–BioNTech COVID-19 vaccine, *via* intramuscular injection as a series of two doses (0.3 mL each) 3 weeks apart. Following his Dose 1 of 2, he was tested with the ADEXUSDx® COVID-19 Test on Days 3, 7, and 14. He then was tested on the day of Dose 2 (Day 21), Day 28, and thereafter one (1) time per month up to 6 months. On Day 3 following Dose 1, antibodies were not detected by the ADEXUSDx® COVID-19 Test. However, antibodies were detected on Day 7 and every testing point thereafter Fig. 1. The ADEXUSDx® COVID-19 Test detects antibodies to the receptor-binding domain (RBD) subunit S1 of the spike protein of the SARS-CoV-2 virus. The most protective antibodies develop against this portion of the spike protein S1 domain [4] and are induced by vaccination with the Pfizer–BioNTech COVID-19 vaccine [5]. Other antibody tests, designed to detect nucleocapsid antibodies, will not detect antibodies created by the vaccine. Research studies and clinical trials are underway to continue to assess performance data of the ADEXUSDx® COVID-19 Test post vaccination.

Vaccination schedules and responses to vaccines are variable. It remains to be seen how durable an antibody response to COVID-19 post vaccination is, and how long does a protective immune response persist following vaccination. Our report demonstrates the sensitivity of ADEXUSDx® COVID-19 Test in a single case, demonstrating evidence for an antibody response 7 days post receiving Dose 1 of Pfizer–BioNTech COVID-19 vaccine, and the persistence of this immune response for at least 6 months. It is unknown if detecting an antibody response with the ADEXUSDx® COVID-19 Test correlates with protective immunity post vaccination. Of course, the role of T cell mediated immunity following vaccination cannot be assessed using the antibody test discussed. However, the ADEXUSDx® COVID-19 Test appears to be promising to help detect and monitor immune response following COVID-19 vaccination.

Declaration of competing interest

BLC is the Chief Operating Officer, NOWDiagnostics, Inc. AHS declares no financial conflict of interest.

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