EVALUATION OF A NOVEL SEMI-QUANTITATIVE CHEMILUMINESCENT IMMUNOASSAY FOR THE MEASUREMENT OF SARS-COV-2 ANTIBODIES IN CORONAVIRUS DISEASE (COVID-19) PATIENTS

Inova Diagnostics
A Werfen Company

Christina Shum[1], Adam Whitman[1], Emily FitzGerald[1], Roger Albesa[1], Michael Mahler[1]

1 Research and Development, Inova Diagnostics, San Diego, CA, USA

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KEY MESSAGES

- Excellent clinical performance effectively discriminating COVID-19 samples from disease controls
- The chemiluminescent immunoassay proves to be highly precise and specific

INTRODUCTION

The current coronavirus disease 2019 (COVID-19) is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[1] Collecting samples by nasopharyngeal and throat swabs to detect viral RNA is the standard approach for screening. However, several studies have demonstrated that measuring antibodies against SARS-CoV-2 from patients who have been exposed to the virus could be a very useful tool in managing the pandemic and stratifying patients' likelihood of immunity. The objective of this study is to evaluate a novel semi-quantitative chemiluminescent immunoassay (CIA) for the measurement of anti-SARS-CoV-2 IgG using serum or plasma samples from patients with confirmed COVID-19 diagnosis as well as a variety of diseased controls.

METHODS

174 samples were tested; 35 samples from COVID-19 patients confirmed to have the disease by polymerase chain reaction (PCR) test, as well as 139 control samples from patients with various other relevant respiratory illness or infections (n=89) and from healthy individuals that were collected prior to September 2019 (n=50). All samples were tested by the novel full automated QUANTA Flash® SARS-CoV-2 IgG CIA on the BIO-FLASH instrument (Pre-EUA, Inova Diagnostics, San Diego, CA, USA). Qualitative correlations were calculated, and clinical performance was assessed. Assay precision was evaluated by running samples in duplicate over 5 days.

RESULTS

The results derived from the clinical evaluation are summarized in Table 2. Receiver operating characteristic (ROC) curve analysis demonstrated good discrimination of the assay (Figure 2). Among the COVID-19 samples one tested negative for anti-SARS-CoV-2 IgG. That sample was collected ten days after the PCR confirmation. The assay precision evaluation reveals a coefficient of variability that ranges from 3.1-5.8%.

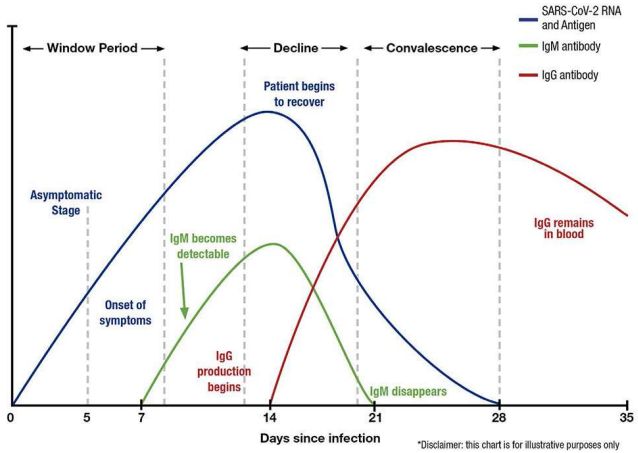

Figure 1 Graph indicating the shift in detectable viral RNA and IgG and IgM antibodies over the course of infection.

Table 1 Clinical significance of test results for PCR and antibody detection that correlates with Figure 1 above.

Test Results			Clinical Significance
RT-qPCR	IgM	IgG	
+	–	–	Patient may be in window period of infection
+	+	–	Patient may be in early stage of infection
+	+	+	Patient may be in active phase of infection
+	–	+	Patient may be in late or recurrent stage of infection
–	+	–	Patient may be in early stage of infection. RT-qPCR result may be false-negative
–	–	+	Patient may had had a past infection, but recovered
–	+	+	Patient may be recovery stage of infection, or RT-qPCR result may be false-negative

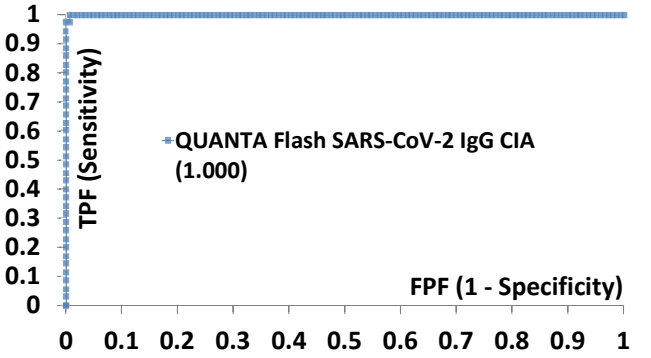

Figure 2 ROC Curve analysis of the clinical performance of the assay. Area under the curve notated in parenthesis in the legend.

Table 2 Clinical analysis of the novel assay.

Performance Characteristic	QF SARS-CoV-2 IgG CIA
Sensitivity in COVID-19 samples (n=35) (95% CI)	97.1% (85.5 – 99.5%)
Specificity in control samples (n=139) (95% CI)	100.0% (97.3 - 100.0%)
Likelihood + (95% CI)	+∞ (36.12 - +∞)
Likelihood - (95% CI)	0.03 (0.01 – 0.15)
Odds Ratio (95% CI)	+∞ (626.64 - +∞)
Area under the curve (95% CI)	1.000 (0.999 – 1.000)

CONCLUSION

In this study, the novel QUANTA Flash SARS-CoV-2 IgG CIA tested on the automated BIO-FLASH instrument demonstrated excellent clinical performance in COVID-19 patients versus controls. The novel CIA method measuring anti-SARS-CoV-2 IgG provides high precision and reliability in addition to good sensitivity and specificity. Further studies on the role of this assay in assessing immunity are warranted.

REFERENCES

1. Hui DS, I Azhar E, Madani TA, Ntoumi F, Kock R, Dar O, et al. The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health—The latest 2019 novel coronavirus outbreak in Wuhan, China. International Journal of Infectious Diseases. 91: 264–266. doi:10.1016/j.ijid.2020.01.009. PMC 7128332. PMID 31953166. (February 2020)