Clinical Study on the 2019 Novel Coronavirus (2019-nCoV) IgG/IgM Antibody Test Kit (Colloidal Gold Method)

1 Introduction

Since December 2019, continuous surveillance on influenza and relevant diseases had been carried out in Wuhan City, Hubei Province, and several patients with viral pneumonia had been found and diagnosed with viral pneumonia/pulmonary infection. Relevant viruses were typed for detection. On January 7, 2020, the laboratory detected a novel coronavirus. The "2019 novel coronavirus (2019-nCoV)" was identified in the viral pneumonia cases that occurred in Wuhan, and then named by the World Health Organization (WHO) on January 12 2020. The 2019-nCoV infected cases typically have symptoms like fever, fatigue, dry cough as the main respiratory syndrome, and gradually develop dyspnea. Severe patients presented with acute respiratory distress syndrome, septic shock, refractory metabolic acidosis, and coagulation dysfunction. Some patients had mild onset symptoms, but no fever. Most patients had good prognosis, while a few patients were critically ill and even died.

Generally, human body can produce IgM and IgG antibodies after being infected with the virus. IgM antibodies generally began to rise within 1 week of initial infection, and reached a peak after 2~3 weeks. IgG antibodies appeared later than IgM antibodies, generally around 14 days after infection, and reached a peak in the fifth week, which could last for 6 months and even several years. The IgG antibody titer, higher or lower by 4 times or above in the recovery stage than in the acute stage, was of clinical diagnostic significance for virus infection.

To validate its clinical effectiveness, according to the requirements of the *Technical Guidance for Clinical Trials of In Vitro Diagnostic Reagents* and *Key Points for Technical Review of the Registration of 2019-nCoV Antigen/Antibody Detection Reagents (Interim)*, a comparative study was carried out between the Vazyme reagent and the available clinical diagnostic results, and the relevant test data were obtained and statistically analyzed.

2 Clinical Trial Design

Following the *Provisions for In Vitro Diagnostic Reagent Registration*, *Technical Guidance for Clinical Trials of In Vitro Diagnostic Reagents* and *Key Points for Technical Review of the Registration of 2019-nCoV Antigen/Antibody Detection Reagents (Interim)*, comparative analysis was performed for the data and results, to evaluate the clinical performance of the test reagent. Test results were analyzed, and statistical results were obtained. Finally, the clinical report was completed.

The enrolled population was the patients suspected with 2019-nCoV pneumonia, and included continuous samples from patients with 2019-nCoV pneumonia at different stages. Clinical samples were numbered in the principle of complete randomization. The test results of the test kit were compared with the clinical diagnosis results, so as to evaluate the clinical application performance of the kit to be tested.

In addition, the nucleic acid test results used for clinical diagnosis were referenced and compared for the consistency, so as to fully evaluate the clinical performance of the antibody test reagent.

3 Clinical Study Results and Analysis

3.1 Sample inclusion

In this study, 570 cases were included, of which 201 cases were confirmed by clinical diagnosis and 369 cases were excluded. Continuous samples were collected from 15 patients at different time points.

3.2 Analysis of results

3.2.1 Comparative analysis of clinical diagnosis results with test reagent results

According to the number of cases confirmed or excluded upon clinical diagnosis results, the statistical results are shown in the following table:

		Clinical diagnostic results		Total
		Confirmed diagnosis	Exclusion	
Test reagent results	Positive (+)	184	11	195
	Negative (-)	17	358	375
Total number		201	369	570

Sensitivity: 91.54%; Specificity: 97.02%; Total clinical coincidence rate: 95.09%.

3.2.2 Comparative analysis of test reagent results with nucleic acid test results

A total of 570 samples had nucleic acid test results in this clinical trial. The nucleic acid test results were compared and analyzed as shown in the following table:

		Nucleic acid test results		Total
		Positive (+)	Negative (-)	
Test reagent results	Positive (+)	120	75	195
	Negative (-)	14	361	375
Total number		134	436	570

Positive coincidence rate: 89.55%; Negative coincidence rate: 82.80%; Total coincidence rate: 84.39%;

3.2.3 Analysis of results of continuous samples collected from the same patient at different time points

Statistical analysis of test results:

Test reagent results	Number of cases	Percentage
Earlier than the nucleic acid test results	2	13.3%
Same as the nucleic acid test results	11	73.33%
Later than the nucleic acid test results	2	13.3%

Summary: For the continuous samples collected from the patients with 2019-nCoV pneumonia at different time points, comparing the nucleic acid test results, the test reagents had equivalent detectability of 2019-nCoV infection and window period. Early detection can be carried out with nucleic acid, which is conducive to disease confirmation.

In the early detection of 2019-nCoV infection, the detectability of the test reagent was lower at the initial stage of the disease than at the middle and late stage because of the low antibody concentration. Moreover, as IgG detectability was low at the initial stage of the disease and IgM detectability was low at the recovery stage, combined antibody detection can improve the detectability for samples in different courses of disease.

4 Conclusion

This study was designed as a blinded clinical trial. The clinical performance of the 2019 novel coronavirus (2019-nCoV) IgG/IgM antibody test kit (colloidal gold method) researched and developed by Vazyme Medical Technology Co., Ltd. was investigated.

In this study, 570 serum samples were tested. A total of 570 cases were included for statistical analysis. The number of confirmed cases and excluded cases was 201 and 369, respectively. Fifteen patients had their samples collected continuously at different time points.

The consistency of the test reagent results with the clinical diagnosis results was analyzed. At the same time, the test reagent results and the nucleic acid test results were statistically analyzed with the results shown in the following table:

	Confidence interval of positive coincidence rate	Confidence interval of negative coincidence rate	Confidence interval of total coincidence rate
Test reagent results and clinical diagnosis results	91.54%	97.02%	95.09%
Test reagent results and nucleic acid test results	89.55%	82.80%	84.39%

In summary, this clinical study showed that 2019 novel coronavirus (2019-nCoV) IgG/IgM antibody test kit (colloidal gold method) researched and developed by Vazyme Medical Technology Co., Ltd. is of great value in clinical application for meeting clinical test requirements and its high clinical sensitivity and clinical specificity.