COVID-19 IgG/IgM Rapid Test Kit

Clinical Evaluation Report

Generic Name under clinical trial evaluation: COVID-19 IgG/IgM Rapid Test Kit

Trial Initiation Date: July 1, 2020, September 18, 2020

Trial Completion Date: July 3, 2020, September 18, 2020

Principal investigator (signature):

Clinical evaluation by (seal):

Chongqing Public Health Medical Center(Chongqing Infectious Disease Hospital)
Guangdong Provincial Nanshan Medical Innovation Research Institute

Product registration applicant (seal):

Hangzhou Zheda Dixun Biological Gene Engineering Co., Ltd.

Applicant address:

Rm.201-209, Bldg.2, No.568 Binkang Rd., Binjiang Dist., Hangzhou

Contact of applicant: Cheng Lin

Tel: 15700067903

Report date:

Raw data storage site:

Chongqing Public Health Medical Center (Chongqing Infectious Disease Hospital)
Guangdong Provincial Nanshan Medical Innovation Research Institute

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Study summary

Study purpose: To evaluate the clinical sensitivity, specificity and performance of detecting different types of samples of COVID-19 IgG/IgM Rapid Test Kit
by obtaining statistical data through the clinical trial.

Description of overall trial design and protocol: by comparing the detection results of the investigational in vitro diagnostic kit with the clinical diagnostic criteria for the 2019-nCoV-infected pneumonia and the determination results of the disease progress, calculate the statistical indicators of result compliance or difference degree, and then evaluate the investigational medical device based on the calculation. The statistical analyses of these trial results, including the clinical sensitivity, specificity and total coincidence rate of the investigational device, were conducted in a manner of fourfold table.

Study results: The clinical data was derived from the Chongqing Public Health Medical Center (Chongqing Infectious Disease Hospital) and the Guangdong Provincial Nanshan Medical Innovation Research Institute. The applicable populations involved in the data collection included suspected excluded cases and confirmed cases of new coronavirus pneumonia. The samples used included serum, plasma and whole blood. In the trial, specimens from a total of 270 cases were tested, including 191 clinically confirmed cases and 79 excluded cases.

The results of the Zheda Dixun kit relative to the clinical reference criteria were shown below:

	No. of cases	Sensitivity (%)	Specificity (%)	Total coincidence rate (%)
IgM	270	87.96	98.73	91.11
IgG	270	85.86	100	90.0
IgG/IgM combined test	270	98.43	98.73	98.52

Trial conclusion: In the detection of 2019-nCoV IgG/IgM antibodies, compared with the clinical diagnostic criteria, the Zheda Dixun kit achieves a sensitivity of 98.43%, a specificity of 98.73% and a total coincidence rate of 98.52%, indicating a high rate of compliance with the clinical reference criteria.

Abbreviation

CDC	Center for Disease Control and Prevention
NMPA	National Medical Products Administration
GCP	Good Clinical Practice
COVID	Coronavirus Disease
2019-nCoV	2019 novel coronavirus
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
IRB	Institutional Review Board
IgG	Novel coronavirus specific IgG
IgM	Novel coronavirus specific IgM
Clinical reference criteria	Clinical diagnosis criteria for pneumonia infected by new coronavirus
RT-PCR	Reverse Transcription-Polymerase Chain Reaction
Zheda Dixun kit	COVID-19 IgG/IgM Rapid Test Kit produced by Hangzhou Zheda Dixun Biological Gene Engineering Co., Ltd.

1. Introduction

1.1 Source, biological and physicochemical properties of samples

1.1.1 Sample source

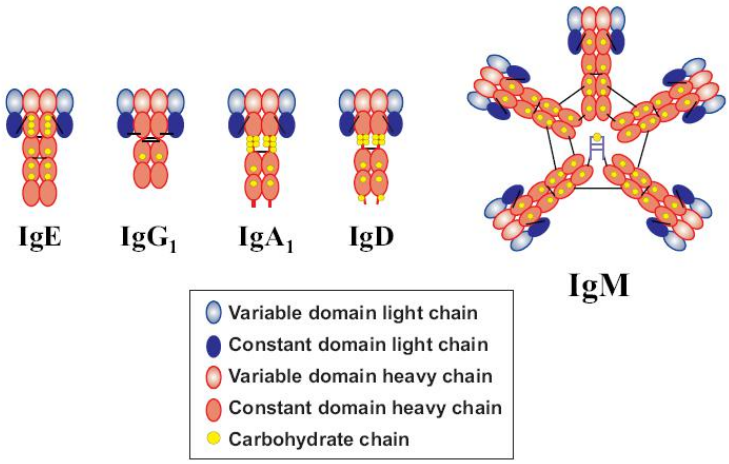
The samples used in the clinical trial were derived from patients who had pneumonia suspected of being infected by the new coronavirus and were treated at the clinical trial institutes.

A patient's blood was drawn intravenously to prepare a whole blood, plasma or serum sample.

1.1.2 Biological and physicochemical properties of 2019-nCoV IgG/IgM antibodies

Antibody: It is a special protein molecule in the serum that recognizes an antigen (including an antigen in the human body and a foreign antigen), and triggers an immune response after its binding to the antigen. Common antibodies in the human body include IgG, IgA, IgM, IgE, and IgD, where Ig is the abbreviation for immunoglobin.

The schematic diagram of these five immunoglobulins is presented below:



The characteristics of these five immunoglobulins are shown below:

Property	Immunoglobulin type									
	IgG1	IgG2	IgG3	IgG4	IgM	IgA1	IgA2	sIgA	IgD	IgE
heavy chain	γ_1	γ_2	γ_3	γ_4	μ	α_1	α_2	α_1/α_2	δ	ε
mean serum conc. (mg/ml)	9	3	1	0.5	1.5	3.0	0.5	0.05	0.03	0.00005
sedimentation constant	7s	7s	7s	7s	19s	7s	7s	11s	7s	8s
mol. wt ($x10^3$)	146	146	170	146	970	160	160	385	184	188
half-life (days)	21	20	7	21	10	6	6	?	3	2
% intravascular distribution	45	45	45	45	80	42	42	trace	75	50
carbohydrate (%)	2-3	2-3	2-3	2-3	12	7-11	7-11	7-11	9-14	12

After a SARS-CoV-2 virus invades the human body, the coat protein (S protein, N protein, etc.) of SARS-CoV-2 will arouse an immune response, thereby producing antibodies. The possibility of infection of SARS-CoV-2 can be determined through the detection of antibodies specific to the virus. After SARS-CoV-2 invades the human body, antibodies of different subtypes such as IgG, IgM, and IgA will be produced. Among them, IgM and IgG antibodies are commonly used for disease diagnosis. Due to individual differences, the time it takes for different individuals to produce antibodies after infected with pathogenic microorganisms varies. Generally, IgM antibodies occur around 7 days after infection, while IgG antibodies around 14 days.

1.2 Clinical intended use, target indication & population, current clinical or laboratory diagnostic methods for these indications, etc.

1.2.1 Clinical intended use of investigational IVD kit

The COVID-19 IgG/IgM Rapid Test Kit is intended for the qualitative detection of IgG/IgM antibodies against SARS-CoV-2 in human serum, plasma and whole blood samples. It is only used as a supplementary test indicator for suspected cases with a negative nucleic acid test result for COVID-19, or used in combination with the nucleic acid test in diagnosis of suspected cases. It is not used as a basis for confirming or excluding COVID-19-infected pneumonia, and not intended for screening in the general population.

1.2.2 Target indication & population

Suspected COVID-19 cases.

1.2.3 Current clinical testing method

At present, laboratory tests for COVID-19 mainly include pathogenic tests and serological tests, in addition to the general blood routine examination. For the pathogenic test, 2019-nCoV nucleic acids in samples such as nasopharyngeal swabs, sputum and other lower respiratory secretions, blood, and feces are detected by mainly adopting the RT-PCR or/and NGS method. Detection of lower respiratory tract specimens (sputum or airway aspirates) can provide a more accurate result. In actual detection, the selection of specimens and the standardization of the sampling operation directly affect the accuracy of nucleic acid detection. Fort the serological test, 2019-nCoV-specific IgM, IgG and other antibodies in patients' blood samples are detected by using immunological methods such as chemiluminescence immunoassay, enzyme-linked immunoassay, and colloidal gold chromatography. Based on testing principles, the following two main methods are adopted for serological testing reagents: one is the double antigen sandwich method, in which the total antibodies against 2019-nCoV are detected; the other is the indirect method or the capture immune method, for detecting 2019-nCoV specific IgM, IgA, and IgG antibodies.

2. Clinical study purpose

To examine the clinical performance of the COVID-19 IgG/IgM Rapid Test Kit (colloidal gold method) produced by Hangzhou Zheda Dixun Biological Gene Engineering Co., Ltd., including its clinical sensitivity (positive coincidence rate), specificity (negative coincidence rate) and performance of detecting different types of samples.

3. Clinical study results and analyses

3.1 Consistency with clinical reference criteria

IgM		Clinical diagnosis criteria		Total
		Confirmed	Excluded	
Zheda	Positive	168	1	169

Dixun kit	Negative	23	78	101
Total		191	79	270

Positive coincidence rate=168/191×100%=87.96% (95%CI 82.3%-92.1%)
Negative coincidence rate=78/79×100%=98.73% (95%CI 92.2%-99.9%)
Total coincidence rate＝(168+78)/270×100%=91.11% (95%CI 87.1%-94.0%)

IgG		Clinical diagnosis criteria		Total
		Confirmed	Excluded	
Zheda	Positive	164	0	164
Dixun kit	Negative	27	79	106
Total		191	79	270

Positive coincidence rate=164/191×100%=85.86% (95%CI 79.9%-90.3%)
Negative coincidence rate=79/79×100%=100% (95%CI 94.2%-100%)
Total coincidence rate＝(164+79)/270×100%=90.0% (95%CI 85.8%-93.1%)

IgG+IgM		Clinical diagnosis criteria		Total
		Confirmed	Excluded	
Zheda	Positive	188	1	189
Dixun kit	Negative	3	78	81
Total		191	79	270

Positive coincidence rate=188/191×100%=98.43% (95%CI 95.1%-99.6%)
Negative coincidence rate=78/79×100%=98.73% (95%CI 92.2%-99.9%)
Total coincidence rate＝(188+78)/270×100%= 98.52% (95%CI 96.1%-99.6%)

3.3 Clinical study results

3.3.1 The results of the Zheda Dixun kit relative to the clinical reference criteria through clinical verification are shown below:

	No. of cases	Sensitivity (%)	Specificity (%)	Total coincidence rate (%)
IgM	270	87.96	98.73	91.11
IgG	270	85.86	100	90.0
IgG/IgM combined testing	270	98.43	98.73	98.52

4. Discussion and conclusion

In the detection of 2019-nCoV IgG/IgM antibodies, compared with the clinical diagnostic criteria, the Zheda Dixun kit achieves a sensitivity of 98.43%, and a specificity of 98.73% and a total coincidence rate of 98.52%, indicating a high rate of compliance with the clinical reference criteria.