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Serological Tests for Diagnosis Corona virus (COVID-19):Review Article

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Abstract

The outbreak of COVID-19 had a significant effect on general populations and workers in public health particularly since beginning outbreak of the disease. The collection of respiratory tract sample at the right time is necessary for serological diagnosis. Aserological retrospective study can be helpinvestigationof continuing outbreak and assessment of the attack rate. The analytic antibodytechniques are considered as supplementary tools and the results must be interpreted using serological tests. Serum samples can be support diagnosis serological tests after validated with world health organization(WHO). The persons who recovered after infection can be founded antibodies in their blood and have usually developed an immune response to the virus. Finally, antibodies can be detected COVID-19 and diagnosis in the mid and terminal stage for disease by using serological tests.

Keywords: COVID-19, SARS-COV-2, Coronavirus, Serological tests, Diagnosis.

1. Introduction

During December2019, several cases of pneumonia came out in Wuhan, China. An unknown virus was discovered and was isolated from the human epithelial cells way stream called SARS-CoV-2 that cause Coronavirus Disease (COVID-19)[1]. Coronavirus contains single-strand RNA belonging to genus Nestiviridae, Coronaviridae,and Orthokinovirussubfamily[2].The epidemiological examinationachieved through the Chinese Centre aimed atDiseaseControl&Prevention(CCDC),80.9% of the statusesareslight/moderate pneumonia.As the Centre is giving a picture daily about the rate of mortality COVID-19, according to link (www.worldometers.info/coronavirus/)[3].A characteristic manifestation that note of most patients includes fever, sore breathing and caught, etc.

There are two types available for diagnosis COVID-19:

1-A virus-related test used a present contagion.

2-An antibody test used in a historical infection.

A current infection might not show in an antibody test because infection takes 1-3 weeks to become antibodies in the body.Giving antibodies against the coronavirus that causes (COVID-19) might give protection from obtaining new infections with the virus. These antibodies might give long protection. To obtain the current tested for COVID-19 infection, the viral test is using[4]. The people who have mild symptoms can gain recovery without health care and stay at home for a period of 14 days. The rules antibody testing that usesfor diagnosis COVID-19 in clinical and public health frameworks[5]. The data will tell guidelineserological testing is rapidly developing[6].Recommendations about the use of serological tests to provide protective immunity between peoples infected recently with

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COVID-19, it will become available as updated new information. Serological methods have been sophisticated and can use to monitor for response to COVID-19. Serological tests for COVID-19 have use license by the U.S. Food and Drug Administration (FDA), their performance has reviewed autonomously.

Presently, there is no specific feature of examinations for IgG and IgM or entire antibody. Results are significant to reduce false-positive testsby selecting an examination with high specificity and experimentation inhabitantsby a high probability of prior exposure to COVID-19. After symptom beginning, antibodies usually become detectable 1-3 weeks and evidence indicates that infections probably greatly decrease and immunity from future infection has sophisticated.However, needed more data when modified recommendation public health depended on serological tests. Almost all individuals immune-competent will evolve immune response after COVID-19 infection that expansion of IgM and IgG antibodies are beneficial for estimating antibodies response because of tiny amounts of IgA response in the blood[7]. Antibodies can be detected for some persons in the disease onset. The infection with COVID-19 is rare because IgM and IgG antibodies emerge in serum after the onset of disease within 2-3 weeks. Therefore, uncovering of IgM without IgG is unusual. Antibodies IgM and IgG stay demonstrable after infection is not recognized[8].

In infectious diseases, neutralizing antibodies prevent viral growth and replication in a laboratory which correlates present these antibodies in the future to prevent infection[9]. Repetition of COVID-19 disease manifest to bevery unfamiliar, the attendance of antibodies mightdiscuss immunity at the smallestshort-term against the infectionwith COVID-19. Thus, the post-development of antibodies and primary infection got protection from reinfection. Furthermore, antibody inpersonsrelateswith a development remarked reduction in virus-relatedloadintherespiratory tract [10]. The presence of these observation indicates antibodies may decrease the infection and offer protection from recurrent infection. However, there is no final data and still unclear whether individuals with antibodies have protected against recurrent infection with COVID-19[11].

2. Antibody Testing

There are two main antigenic targets of coronavirus COVID-19 that aredetectedspikeglycoprotein(S) and nucleocapsidphosphoprotein(N). The S proteinis to enter the virusandis existonthevirussurface, while the Nproteinis that interacts with RNA and expressed immunodominant protein. Several forms of S protein like the receptor-binding domain(RBD) are utilizedasantigens. TheNprotein is more preserved across coronavirus than S and RBD are more preserved than S[12].

2.1.Types of Antibody Testing

The different assays that determine features of immune response and the functions of antibodies canbe used. In general, Thetestscanbetodetect whichever neutralizing or binding antibodies[13].

- **Binding antibody detection:**Theses tests can be performed in minimum level biosafety laboratories and use purified proteins coronavirus. An individual's antibody kinds can be determined with use specific reagents. Generally, the first type of antibodies areIgMgenerated after the infection and are useful for detecting new infection, whereasIgGevolves afterwardIgMand maybe stay measurable for several months.IgG can be revealed in mucus

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secretion and blood, therefore is important in mucosal immunity during its significance in COVID-19 is still to be determined. Depending on theseexaminationscanbe completedfastfewerthan one hour in anareaframework and in a fewhoursinalaboratory[14]. The tests of antibodies can be detectedintotwo wide groups:

***Periodofcare (POC)tests**: In general, lateralflow devices can detectIgGorIgGandIgMin whole blood, plasma, serum,andsaliva. Some point of caretests features used the entireblood obtained by finger instead of venipuncture[15].

***Laboratory tests:**antibody detect by using methods ELISA (Enzyme-Linked Immunosorbent Assay)or CIA(chmiluminescent immunoassay), that required some assays specialized instruments and trained laboratorians. Depending on IgG, IgM, andIgA and their reagents canbedetected individually or jointasanentire antibody[16].

-Neutralizing antibody detection:neutralization tests have not yet licensed by the FDA on COVID-19. The ability of antibodies determines by neutralization tests to prevent infection COVID-19 in vitro.Thetest performs by plasma or serum incubation by the livingvirusfollowedthroughinfectionandincubationofcells. The test requires laboratories either Biological Safety Level (BSL-2 or BSL-3), according to a type of virus to use[17].

Neutralization test can be divided two into types:

-Virus neutralization tests (VNT): for example the microneutralization and plaque reduction neutralization test(PRNT), from a clinical isolate using a coronavirus or recombinant coronavirus expressing receptor proteins. The testing needs to laboratory level 3 or BSL-3 and may take up approximately five daystoperform[18].

- Pseudovirus neutralization tests (PVNT):pseudovirusesusage recombinants that contain the S protein of coronavirus-19.According to the type strain used testingcanbe conducted inBSL-2laboratories[19].

3. FDA-licensed serology tests

Serological tests licensed,FDA requires to receive Emergency Use Authorization (EUA) commercially marketed. The authorization gives developers voluntarily but tests that do not require FDA which is not commercially marketed.Several agencies- including FDA are evaluating many serology tests using samples(serumorplasma) throughout the present COVID-19 epidemic[20].All tests presently licensed are considered qualitativeproviding anoutcomethatis (positive, negative, or unknown) instead of quantifiable that provides a quantitative assessment about antibodylevels.Together laboratory and fastserologic tests are demonstrated a laboratory-based immunoassay and a color change on a paper strip thatletfor the treatment ofmanysamplessimultaneously. The setting of the test depended on the FDAdetermination of convenientregulation for usagethroughout the communityhealthemergency.

4. Optimizing Testing Findings

4.1. Test execute

Characteristics of thetest executionarespecifiedbyusing a specific group ofnegativeandpositivesamples, these tests depended onthesensitivityandspecificityoftheexamines[21]. Additionally, the prediction values of a test must take into consideration because these values can be to affect the total result of testing.

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The positive predictive value may indicate to likelihood individuals with a positive result are really antibody positive. The negative predictive value may indicate to likelihood individuals with a negative result are really antibody negative. The predictive value positive and negative result of the test is determined depending on the percentage of really antibody-positive of the tests population and thesensitivityandspecificityof the tests[22]. For example:

- The positive predictive value increases in high prevalence surroundings this is more probablethatindividualswhotestpositiveare actually antibodypositive if this testis carried out inapopulacewithdecreaseprevalence.Oncethe proportion prevalence inapopulace is low,thepositive in predictive value decreases because exist aremorefalse-positive outcomes.

-The same with the predictive value negative is likewise influenced by the prevalence. Inahighprevalencecondition, the negativepredictivevaluedecreases while the positive predictive value increases in a low prevalence condition.

COVID-19 outbreak in crowded aliveamenitiestherefore theprevalenceofcontagion in the populace is highly significant. The serological test maybe leads to results false-positive and morefalse-negativeresults[23].

5. Testing approaches

In general, antibodies in most populations seem likely low. For instance, theprevalencedoes not exceed 5%,atestby 95% specificity and 90% sensitivity will result in apositivepredictive value less 50%. In other meaning, those testing positive if less than half will really have antibodies. On the other hand prevalence antibody, more than 52% will result in a positive predictive value of more than 95% in the same test in a population, this means the proportion of singlein20 populations testing positive determinationhave a false-positivetestoutcome[24].

There are three plansthat canbesecondhand to enhance positivepredictive value:

1-Selecting atest leads to highspecificity, maybe 99.5% or more will result in ahighpositiveprognosticvalue in inhabitantstriedwithaprevalence of more than 5%.

2-A test concentrates on persons have with pretest likelihood of SARS-COV-2, suchusindividuals have symptoms similar to COVID-19.

3-An orthogonaltestingprocedure to employees in thoseindividuals who a first positive test with a second test. Efficient orthogonal algorithms depend on one test a patient sample with two tests.

6. Determination of serologic tests

At current, the immunological associations of SARS-COV-2 has not been well identified. Many research centers and the medical community are working to determine the preventive against COVID-19 by using positive serologic tests. The assessing levels of antibodies include protection from infection one more time based on many factors related with the development of antibody response and period this protection[25]. The kinetic response of the antibody,its longevity, the protective from reinfection, the titer protective of neutralizingantibody, andthe association of boundantibodytiterstoequalization. Some studies demonstrate in the short term on animals, the demonstration on human in long term need a future study. Therefore, the existence of antibodies cannot be equalized with a person's immunity from COVID-19 infection[26]. Some tests may display across reaction with another coronavirus such as a popularcold. This might outcome infalse-positivetestconsequences.

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Antibodies in certain individuals may not progressdetectableafterward COVID-19 infection[27]. In some cases, antibody levels might disappear over time to undetectable levels. Antibodies IgMandIgGarenotexistenceinitialcontagion. Hence, outcomes of the serological test do not indicate to appearance or nonappearanceofexisting or priorinfectionwith COVID-19[28].

7. References for Usage of Serologic Tests

Serological recommendations are developing rapidly because information affects, positive serological tests refer to preventive immunity or a decrease in mobility between patients recently.Thesereferenceswillbemodernized whenever novelevidenceis obtainable[29].

7.1.Testing strategy and choiceoftest

• According to Emergency Use Authorization(EUA), serological tests must be licensed because are better for public health or clinical use provided that is reviewed data by the FDA.

• If serological tests were positive or negative must beexplained in the settingofthepredictivestandards.

• Improvement of the positivepredictivevalue when the results are returned to persons.

Conflict of interest: no conflict of interest.

Ethics approval: none.

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