

COVID-19 Neutralization Antibody, Serum or Plasma (Lab Tests and Diagnostic Procedures)

Comment

The FDA has noted that unauthorized **fraudulent** COVID-19 test kits are being sold online. The FDA advises consumers and health professionals to be cautious of websites and stores selling products that claim to prevent, diagnose, treat, or cure COVID-19 ([FDA 2020](#)). Consumers and health care professionals can help by reporting suspected fraud to the [FDA's Health Fraud Program](#) or the [Office of Criminal Investigations](#).

Note: In May 2021 the FDA released a statement that SARS-CoV-2 antibody testing should be used only for identifying individuals who have developed an adaptive immune response due to exposure to the virus. At this time antibody testing **should not be used to determine immunity or protection against the virus, including vaccine-induced antibody response.**

Note: In January, 2022 the FDA issued a statement to stop the use of Empowered Diagnostics ImmunoPass COVID-19 Neutralizing Antibody Rapid Test an over-the-counter rapid test. The test has been distributed with labeling indicating authorization by the FDA, but not has been authorized, cleared, or approved by the FDA for distribution or use in the US. There is concern about the risk of false results when using this assay ([FDA 2022](#)).

Related Information

- [COVID-19 Antibody \(IgG\), Quantitative, Serum or Plasma](#)
- [COVID-19 Antibody \(IgG\), Semi-quantitative, Serum or Plasma](#)
- [COVID-19 Antibody \(IgG\), Serum, Plasma, or Whole Blood](#)
- [COVID-19 Antibody \(IgM\), Serum or Plasma](#)
- [COVID-19 Antibody Total, Oral Fluid](#)
- [COVID-19 Antibody Total, Serum, Plasma, or Whole Blood](#)
- [COVID-19 Antibody, IgG/IgM Rapid Test, Serum, Plasma, or Whole Blood](#)
- [COVID-19 Antigen, Upper Respiratory Specimen](#)
- [COVID-19, PCR, Respiratory Specimen](#)
- [COVID-19, PCR, Saliva](#)
- [Influenza A/B, SARS-CoV-2, Respiratory Syncytial Virus, PCR](#)
- [Influenza and SARS-CoV-2 Antigen, Upper Respiratory Specimen](#)
- [Influenza SARS-CoV-2 Multiplex Assay, PCR, CDC](#)
- [Respiratory Panel, PCR, Nasopharyngeal](#)

- T-Detect COVID Test, Whole Blood

Overview

At the end of 2019, a novel coronavirus was identified as the cause of several cases of pneumonia in Wuhan City, Hubei Province, China. Initially linked to a large seafood and animal market suggesting animal-to-human spread, person-to-person transmission was quickly confirmed (Li Q 2020). The virus spread rapidly worldwide and in January 2020, the World Health Organization (WHO) declared the outbreak a "public health emergency of international concern." On March 11, 2020, the WHO publicly characterized COVID-19 as a pandemic. Currently, more than 400 million infections have been confirmed globally in over 200 countries and territories with over 6 million deaths ([WHO situation rept 2022](#)).

The novel virus has been named **severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)** and the disease it causes has been named **coronavirus disease 2019, or COVID-19**. The virus spreads by contact with respiratory fluids (droplets or aerosol) produced when an infected person exhales (eg, breathes, speaks, coughs, sneezes, or sings). These droplet/aerosol particles can be

- inhaled directly into lungs
- directly deposited on exposed mucous membranes (eyes, mouth, nose)
- transferred to mucous membranes by hands contaminated with virus-containing respiratory fluids or by indirectly touching surfaces with virus on them ([CDC SARS-CoV-2 Transmission 2021](#))

COVID-19 symptoms typically appear within 2 to 14 days (median of 5 days) of exposure and include **fever, chills, fatigue, cough, shortness of breath, myalgia, recent loss of taste or smell, vomiting or diarrhea, and/or sore throat**. Sickness ranges from a mild respiratory illness to severe disease including respiratory failure, septic shock, or other organ failure. Most fatalities have occurred in patients with underlying comorbidities, with overall global fatalities around 2 to 3 percent ([WHO situation rept 2021](#)). The CDC currently estimates that about 30% of COVID-19 infections are asymptomatic, and 50% of transmission occurs prior to symptom onset ([CDC Pandemic Planning 2021](#)).

SARS-CoV-2 infection is diagnosed by direct detection of nucleic acid or the slightly less sensitive direct detection of SARS-CoV-2 nucleocapsid protein antigen. These tests are supported by antibody detection (total, IgG, and/or IgM) assays which provide evidence of immune response. Most of the current clinical lab tests detect the presence of binding antibodies. Binding antibodies (or nonneutralizing antibodies) recognize and bind to a pathogen or virus, but do not necessarily decrease the infection or cause destruction. Neutralizing antibodies interfere with pathogen entrance into host cells thus preventing pathogen replication.

Following infection with SARS-CoV-2, most individuals mount a cell-mediated response and production of SARS-CoV-2-specific antibodies. Some of these antibodies are specific to the receptor-binding domain (RBD) of the viral spike protein and are associated with neutralizing activity (Premkumar 2020; Wölfel 2020). Neutralization tests determine the ability of the antibodies to prevent infection in vitro. Traditional neutralization tests involve the use of live virus or pseudovirus incubated with serum or plasma containing the "suspect" antibodies. Testing can take up to 5 days and must be performed in a BSL-3 or BSL-2 laboratory. This assay is a modified ELISA detection assay that mimics virus neutralization by using purified SARS-CoV-2 receptor binding domain (RBD) conjugated to horseradish peroxidase and

purified human ACE2 receptor to detect antibodies that prevent the binding of RBD to the ACE2 receptor. Results can be available in approximately 60 minutes.

Use/Indications

Identifying adaptive immune response, indicating recent or prior SARS-CoV-2 infection. At this time it is not known whether presence of neutralizing antibodies indicates immunity and caution is urged about its utility at this point in the pandemic.

Test Includes

Qualitative direct detection of total neutralizing antibodies to SARS-CoV-2. This test focuses on antibodies specific for the "spike" protein that prevent the virus from binding to the ACE2 receptor and entering host cells thus preventing viral replication. The assay mimics the binding of the virus to the ACE2 receptor by using just the purified protein.

Contraindications

This test should not be used for blood donor screening.

Specimen

Serum or plasma

Container(s)

- Serum separator tube or lavender top (EDTA) tube

Alternate Container(s)

- Confer with testing laboratory for appropriate alternate container(s).
- Green top (lithium heparin) tube
- Light blue top (sodium citrate) tube

Volume / Minimum Volume

Tube filled to capacity or 1 mL blood (0.5 mL serum or plasma)

Collection

Prior to specimen collection, patient identity should be confirmed using two independent identifiers; use of a patient identification arm band or similar system is recommended. Specimen label(s) should include the two independent identifiers and the date of collection. There should be a method to identify the individual collecting the specimen. The specimen container(s) should be labeled in the presence of the patient after specimen is collected. Container(s) should **not** be pre-labeled. Use computer-generated label(s), if available, to avoid transcription errors.

Routine venipuncture, using appropriate personal protective equipment; transport to laboratory immediately.

Processing and Storage

- Allow serum separator tube to clot for 30 minutes at room temperature. Centrifuge and transfer serum into clean, plastic vial. Run assay immediately or freeze specimen at -20°C.
- Centrifuge lavender top (EDTA) tube within 30 minutes of collection and transfer plasma into clean, plastic vial. Run assay immediately or freeze specimen at -20°C.

Causes for Rejection

Specimen with microbial growth; gross hemolysis

Methodology

Modified ELISA assay; detection of neutralizing antibodies that block interaction of purified SARS-CoV-2 receptor binding domain (RBD) with purified human ACE2

Normal Values/Findings

Negative; neutralizing antibodies for SARS-CoV-2 not detected

Positive; neutralizing antibodies for SARS-CoV-2 detected

Interpretative Information

Results of the test should not be interpreted as having any level of immunity from the virus or protection from reinfection. Results should not be used to diagnose or exclude acute SARS-CoV-2 infection.

Limitations

- Negative results do not rule out SARS-CoV-2 infection. A negative result can occur if antibody level is below the assay limit of detection, or if antibodies are not present during disease stage in which the sample was collected (eg, too early in the infection cycle or due to a decline in titer over time). For patients who have been in contact with known infected individuals, have been in areas with high prevalence of active infection, or are experiencing symptoms consistent with COVID-19, a molecular diagnostic test is necessary to rule out infection.
- Immunocompromised patients may have a delayed antibody response to COVID-19 and produce levels of antibody which may be below the detection level of assay. Results should be interpreted with caution.
- False positive results may be due to cross-reaction with non-SARS-CoV-2 coronavirus strains including HKU1, NL63, OC43, 229E (GenScript 2020).
- False positive results may be due to cross-reaction with SARS-CoV-1 neutralizing antibodies (GenScript 2020).
- False positive results may be due to cross-reaction with rheumatoid factor (InBios 2021).
- It is not known at this time if the presence of SARS-CoV-2 antibodies confers immunity to reinfection.

Diagnostic Role

Understanding the antibody response to SARS-CoV-2 is not completely established. When more information is acquired, the potential of serology testing may include:

- Identification of convalescent plasma donors; selecting optimal units for therapy
- Determining seroprevalence or immunity levels in the community
- Possible verification of vaccine response
- Humoral protective immunity in recovered patients (Tan 2020)
- Investigation of asymptomatic infection rate (Tan 2020)

Note: At this time, it is unknown for how long antibodies persist following infection and if the presence of antibodies confers protective immunity.

Additional Information

A coronavirus contains 4 structural proteins: Spike (S), envelope (E), membrane (M), and nucleocapsid (N) proteins. S protein plays the most important roles in viral attachment, fusion, and entry to host cells, and serves as a target for development of antibodies, entry inhibitors, and vaccines. The S protein binds to the host cell receptor ACE2 through the receptor-binding domain (RBD), mediating viral entry into host cell; viral replication follows.

For more information, interim guidance has been issued by the United States [CDC](#) and the [World Health Organization](#).

See: [Interim Guidelines for COVID-19 Antibody Testing](#)

See: [Guidance for Healthcare Workers about COVID-19 \(SARS-CoV-2\) Testing](#)

See: [Information for Laboratories](#)

See: [Interim Laboratory Biosafety Guidelines for Handling and Processing Specimens Associated with Coronavirus Disease 2019 \(COVID-19\)](#)

See: FDA [Emergency Use Authorizations](#)

Index Terms

COVID Neutralization Antibody; COVID Neutralizing Antibodies; COVID-19 Blocking Antibody Test; COVID-19 Neutralizing Antibodies; SARS-CoV-2 Neutralizing Antibody Test; Surrogate Virus Neutralization Test; sVNT

Applies to

cPass SARS-CoV-2 Neutralization Antibody Detection Kit; cPass™ Neutralization Antibody Detection; Pandemic; Pneumonia of Unknown Etiology; RBD; SCoV-2 Detect Neutralizing Ab ELISA; Spike Protein Receptor Binding Domain

References

Centers for Disease Control and Prevention (CDC). COVID-19 Pandemic Planning Scenarios. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/planning-scenarios.html>. Updated March 19, 2021. Accessed March 23 2021.

Centers for Disease Control and Prevention (CDC). COVID-19. Scientific Brief: SARS-CoV-2 Transmission. <https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/sars-cov-2-transmission.html>. Updated May 7, 2021. Accessed July 30, 2021.

Huang Y, Yang C, Xu XF, Xu W, Liu SW. Structural and functional properties of SARS-CoV-2 spike protein: potential antiviral drug development for COVID-19. *Acta Pharmacol Sin*. 2020 Sep;41(9):1141-1149. doi: 10.1038/s41401-020-0485-4. Epub 2020 Aug 3. [\[PubMed 32747721\]](#)

Li Q, Guan X, Wu P, et al. Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia [published online January 29, 2020]. *N Engl J Med*. [\[PubMed 31995857\]](#)

Premkumar L, Segovia-Chumbez B, Jadi R, Martinez DR, Raut R, Markmann A, Cornaby C, Bartelt L, et al. The receptor binding domain of the viral spike protein is an immunodominant and highly specific target of antibodies in SARS-CoV-2 patients. *Sci Immunol*. 2020 Jun 11;5(48):eabc8413. doi: 10.1126/sciimmunol.abc8413. [\[PubMed 32527802\]](#)

Tan CW, Chia WN, Qin X, et al. A SARS-CoV-2 surrogate virus neutralization test based on antibody-mediated blockage of ACE2-spike protein-protein interaction. *Nat Biotechnol*. 2020 Sep;38(9):1073-1078. doi: 10.1038/s41587-020-0631-z. Epub 2020 Jul 23. [\[PubMed 32704169\]](#)

Tai W, He L, Zhang X, Pu J, Voronin D, Jiang S, Zhou Y, Du L. Characterization of the receptor-binding domain (RBD) of 2019 novel coronavirus: implication for development of RBD protein as a viral attachment inhibitor and vaccine. *Cell Mol Immunol*. 2020 Jun;17(6):613-620. doi: 10.1038/s41423-020-0400-4. Epub 2020 Mar 19. [\[PubMed 32203189\]](#)

US Food & Drug Administration (FDA). Beware of Fraudulent Coronavirus Tests, vaccines and Treatments. https://www.fda.gov/consumers/consumer-updates/beware-fraudulent-coronavirus-tests-vaccines-and-treatments?utm_campaign=FDA%20MedWatch%20-%20Fraudulent%20Coronavirus%20Tests%2C%20Vaccines%20and%20Treatments&utm_medium=email&utm_source=Eloqua. Current November 20,2020. Accessed December 2, 2020.

US Food and Drug Administration (FDA). Coronavirus (COVID-19) Update: FDA Authorizes First Test that Detects Neutralizing Antibodies from Recent or Prior SARS-CoV-2 Infection. <https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-authorizes-first-test-detects-neutralizing-antibodies-recent-or>. November 6, 2020. Accessed November 12, 2020.

US Food & Drug Administration (FDA). FDA Advises Against Use of SARS-CoV-2 Antibody Test Results to Evaluate Immunity or Protection From COVID-19, Including After Vaccination. <https://www.fda.gov/news-events/press-announcements/fda-brief-fda-advises-against-use-sars-cov-2-antibody-test-results-evaluate-immunity-or-protection>. Published May 19, 2021. Accessed May 20, 2021.

US Food and Drug Administration (FDA). GenScript USA Inc. cPass™ SARS-CoV-2 Neutralization Antibody Detection Kit [Emergency Use Authorization]. <https://www.fda.gov/media/143583/download>. Updated November 6, 2020. Accessed November 12, 2020.

US Food and Drug Administration (FDA). InBios SCoV-2 Detect™ Neutralizing Ab ELISA [Emergency Use Authorization]. <https://www.fda.gov/media/153504/download>. Effective date October 22, 2021. Accessed October 27, 2021.

US Food & Drug Administration (FDA). Stop Using Empowered Diagnostics COVID-19 Tests: FDA Safety Communication <https://www.fda.gov/news-events/press-announcements/fda-roundup-february-1-2022>. Published January 28, 2022. Accessed February 2, 2022.

Wölfel R, Corman VM, Guggemos W, Seilmaier M, Zange S, Müller MA, et al. Virological assessment of hospitalized patients with COVID-2019. *Nature*. 2020 May;581(7809):465-469. doi: 10.1038/s41586-020-2196-x. Epub 2020 Apr 1. [\[PubMed 32235945\]](#)

World Health Organization (WHO). Coronavirus disease 2019 (COVID-19). Situation reports. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/>. Updated March 21, 2022. Accessed March 22, 2022.

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