GENETRACK Diagnostics

Human Immunodeficiency Virus (HIV)

WHAT IS HIV?

Human immunodeficiency virus (HIV) is a sexually transmitted infection, which occurs by contact or transfer of blood, semen, pre-ejaculate, and vaginal fluids. HIV can also be transmitted from an infected mother to her infant during pregnancy, childbirth, or through breast milk. HIV infects immune system cells, such as macrophages, dendritic cells and helper T cells (specifically CD4+ cells) (1). In the absence of effective treatment, the number of CD4+ cells decline, eventually leading to a loss of cell-mediated immunity, and the development of acquired immunodeficiency syndrome (AIDS) (2).

There are two types of HIV. HIV-1 is the virus that was initially discovered. It is more virulent and infective than HIV-2, and is associated with most of the HIV infections around the world (3). HIV-2 is not transmitted as easily and is predominantly confined to infections in West Africa (4).

SYMPTOMS

Many individuals are unaware that they have HIV in the first few months, as they do not display any symptoms, or only experience mild symptoms (e.g. headache, sore throat, fatigue) that can easily be confused with other illnesses. Despite the lack of symptoms, this initial phase of acute HIV infection is when HIV is most infectious (5). As the viral load increases, other symptoms appear, including swollen lymph nodes, weight loss, high fever, diarrhea, mouth ulcers, muscle aches, and persistent coughing (6).

The second stage of HIV infection is known as clinical latency (or chronic HIV infection). The virus is still multiplying during this stage, but only at very low levels, and many individuals do not show any symptoms. However, without HIV treatment, individuals in this stage can still transmit HIV (6).

HIV targets cells of the immune system reducing the ability to fight other infections and eventually progressing to AIDS (stage 3 of HIV infection) in untreated individuals. The symptoms of AIDS include rapid weight loss, extreme fatigue, pneumonia, skin discoloration, memory loss, depression, and increased susceptibility to other infections such as tuberculosis, severe bacterial infections, and certain cancers (6).

PREVALENCE

HIV is a major global public health issue with an estimated 38 million individuals worldwide living with HIV at the end of 2019 (5). The virus has claimed almost 33 million lives so far, but diagnostic techniques and effective treatments now enable many infected individuals to live long and healthy lives (5). Over 66% of HIV cases (25.7 million) are in Africa, but there are also specific populations around the world who are at increased risk of HIV, including men who have sex with men, injecting drug users, individuals in correctional facilities, sex workers (and their clients), and transgender individuals (5).

In the United States, there are an estimated 1.2 million individuals living with HIV, with approximately 14% being unaware of their HIV status (6). In 2018, 37,968 individuals were diagnosed with HIV, which is a 7% decrease from 2014 (7). Of these new diagnoses, 69% were among gay, bisexual, and other men who have sex with men, 7% were among injecting drug users, and 24% were among heterosexuals (7). African Americans and Hispanics are disproportionately affected by HIV, and HIV diagnosis rates are highest in the South (7).

DIAGNOSIS

HIV infections are usually diagnosed by the detection of HIV antigens and antibodies in a blood sample. The HIV p24 antigen is a structural component of the viral particle and can usually be detected in the blood of an infected individual from 2-3 weeks after infection. However, p24 antigen levels in the blood begin to decrease 3-4 weeks post-exposure until no longer detectable (8). HIV antibodies are produced by an infected individual in response to the viral infection. They are usually not detectable until 4-6 weeks after exposure, or up to 3-6 months in some cases, but then generally remain detectable (9; 10).

It is important to note that there is a window period of up to four weeks for this test. During this period, HIV diagnostic tests may produce a negative result, although infected individuals can still transmit the virus to others. Follow-up testing is recommended for any individuals with a negative result who may have been exposed to HIV (5).

TREATMENT AND MONITORING

Although there is no cure for HIV, effective antiretroviral therapy (ART) ensures that infected individuals can live relatively normal lives and prevents the transmission of HIV. When ART is taken every day, it reduces the replication of HIV in the blood to an undetectable level. At the end of 2019, an estimated 59% of individuals on ART had achieved suppression of the HIV virus with no risk of transmitting the virus to others (5). Routine viral load and CD4+ T cell monitoring is important to ensure that treatment is effective and maintaining viral load at undetectable levels in the blood (5). Individuals at risk for HIV can take HIV medication called pre-exposure prophylaxis (PrEP), which is highly effective for preventing HIV (8).

TESTING RECOMMENDATIONS

The CDC recommends that everyone between 13 and 64 years of age should get tested at least once as part of routine health care. Individuals in higher risk populations (e.g. men who have sex with men, injecting drug users, sex workers) should be tested at least annually. HIV screening is recommended in the routine panel of prenatal screening tests for all pregnant women (8; 9).

Individuals who have been potentially exposed to HIV should be tested immediately (although likely negative within the first two weeks), and then tested again at six weeks, three months, and six months (10; 11).

TEST INFORMATION

When an individual is infected with HIV, the p24 antigen (a viral core protein from HIV) is usually at detectable levels in the blood within 2-3 weeks of exposure, while antibodies to HIV take longer to reach detectable levels. This test is a fourth generation test that detects antibodies to HIV-1 and HIV-2, as well as the p24 antigen. The detection of the p24 antigen reduces the window period post-exposure, which can be as long as three months for those tests that only detect antibodies.

The specific performance characteristics of the automated assay used for this HIV test are included in the Alinity i HIV Ag/Ab Combo package insert. In summary, the specificity (true negative rate) of 5340 blood donor specimens was 99.93% and the sensitivity (true positive rate) of 635 HIV-positive specimens was 100%. This assay is unaffected by bilirubin ≤ 20 mg/dL, triglycerides ≤ 3000 mg/dL, protein ≤ 12 mg/dL, and hemoglobin ≤ 500 mg/dL.

TEST PROCEDURE

Correct specimen collection and handling is required for optimal assay performance.

This test requires a blood sample from a finger prick. All supplies for sample collection are provided in this kit. First wash and dry hands. Warm hands aid in blood collection. Clean the finger prick site with the alcohol swab and allow to air dry. Use the provided lancet to puncture the skin in one quick, continuous and deliberate stroke. Wipe away the first drop of blood (as it may be contaminated with tissue fluid or skin debris). Massage finger to increase blood flow at the puncture site and hold in a position that gravity facilitates the collection of blood on the fingertip. Transfer the blood to the blood collection card or blood collection tube (microtainer).

Avoid squeezing or 'milking' the finger excessively. If blood flow stops, perform a second skin puncture on another finger, if more blood is required.

Dispose of all sharps safely and return sample to the laboratory in the provided prepaid return shipping envelope. Dried blood spots can be refrigerated or kept at room temperature for up to 14 days.

Upon receipt at the laboratory, the blood sample is analyzed by the fully automated Alinity i HIV Ag/Ab Combo chemiluminescent microparticle immunoassay on the Alinity ci series analyzer. This assay simultaneously detects the HIV p24 antigen and antibodies to HIV-1 (group M and group O) and HIV-2. The amount of p24 antigen and/or antibodies to HIV-1 and/or HIV-2 are measured in relative light units by a chemiluminescent reaction.

SPECIAL INSTRUCTIONS

For individuals receiving anticoagulants, collect specimen prior to heparin therapy.

TEST INTERPRETATION

A reactive result indicates that HIV p24 antigen and/or HIV antibodies may be present in the specimen tested. Confirmatory follow-up testing through a health-care provider is required to be sure of an accurate HIV diagnosis.

A negative result indicates that HIV p24 antigen and HIV antibodies were not detected in the specimen tested. This may be due to sample collection during the window period post-exposure. Retesting is recommended if potential exposure to HIV has occurred.

An indeterminate result indicates that a new specimen should be tested.

DISCLAIMERS/LIMITATIONS

This test is not intended for use in medico-legal applications. Test results are intended for screening for HIV and should be interpreted in conjunction with other laboratory and clinical information.

Correct specimen collection and handling is required for optimal assay performance.

A negative result does not exclude the possibility of infection. False-negative test results may occur due to specimen collection during the window period post-exposure when p24 antigen and HIV antibody levels are below detectable limits.

A reactive result does not confirm an HIV diagnosis. Confirmatory follow-up testing through a health-care provider is required to be sure of an accurate HIV diagnosis.

False results may occur in specimens from individuals that have received preparations of mouse monoclonal antibodies for diagnosis or therapy. Additional clinical or diagnostic information may be required for these specimens.

Assay interference may occur in specimens from individuals routinely exposed to animals or to animal serum products. Additional clinical or diagnostic information may be required for these specimens.

Serum and plasma specimens should be free of fibrin, red blood cells, and other particulate matter. Serum specimens from patients receiving anticoagulant or thrombolytic therapy may contain fibrin due to incomplete clot formation.

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