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Review Article

# A review: Acquired immunodeficiency syndrome (AIDS)

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ABSTRACT

AIDS is one of the worst diseases in the world. Human immunodeficiency virus (HIV) is a type of lentivirus that causes HIV and AIDS. Symptoms of AIDS are usually caused by an infection by viruses, bacteria, fungi, and viruses usually controlled by the body's immune system to destroy HIV. Prevention is the only strategy available to treat HIV/AIDS, so it is important to raise awareness about this among young people. This study, this report on HIV analyzed detailed information on biology, pathology, signs and symptoms, problems, diagnosis, treatment, types of interacting infections, and vaccines.



## 1. Introduction

HIV stands for Human Immunodeficiency Virus. AIDS stands for Acquired Immunodeficiency Syndrome.

It is contagious only to humans and can spread from one person to another, not just animals. It is not spread by mosquitoes, bats, or other animals. The body, its task is to protect the body from bacteria, viruses, etc. have an immune system to protect but people with HIV cannot fight the virus. Bacteria are the smallest, simplest things that don't work outside the body and work while inside the body.

It is not hereditary, meaning it cannot be passed from one generation to the next. It can be transmitted from a sick person to a healthy person. It weakens the body. It causes CD4+ cell deficiency in the immune system. It is a disease.Figure 1

HIV is the virus that causes AIDS. It is CD4+ cells, also known as white blood cells, helper cells, or T cells, that protect us from infection. [1]

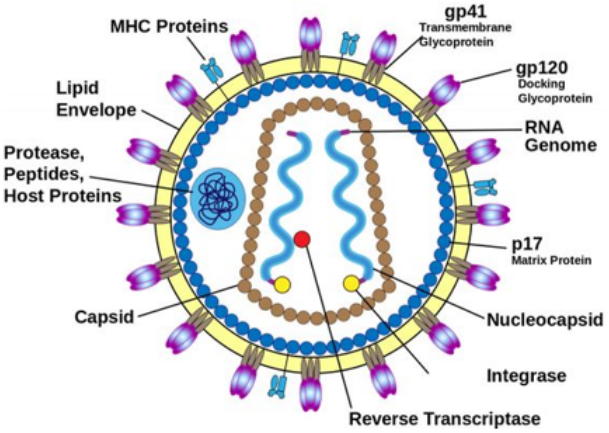


**Fig. 1:** Structure of HIV

HIV's interaction with the immune system is complex and includes mainly cytotoxic T lymphocytes (CTL, CD8+ t cells) and CD4+ helper lymphocytes (CD4+ cells), although

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other immune cells also include blocking organisms such as macrophages, Harmful cells, and NK cell state responsibility. The host produces antibodies against many types of HIV, but it is the action of CTLs and CD4+ cells that initiates protection against HIV.[2]

HIV interferes with the body's ability to fight disease-causing bacteria. This can lead to certain cancers and diseases such as pneumonia and meningitis. Physical barriers such as latex condoms are recommended to reduce the sexual transmission of HIV. Spermicides, when used alone or in combination with condoms such as a diaphragm, increase male-to-female transmission of genital infections and should not be considered an immune system.[3]

Bacteria can be isolated from body fluids, blood, semen, genitals, saliva, breast milk, tears, urine, cerebrospinal fluid, and peritoneal fluid. Mosquitoes are also not responsible for the transmission of HIV.[4]

AIDS is an infectious disease in which CD4+ counts are less than 200/$\mu$L (or CD4+ cells are less than 14% of lymphocytes). HIV is referred to as if it is one virus but now it seems to have changed its structure over some time and at various places. Currently, HIV-1 is commonly known as the causative virus of AIDS, however, a variant of HIV-1 (more prevalent in West Africa) has been isolated.HIV-2 is less virulent than HIV-1 and the disease (Immunodeficiency state) produced by HIV-2 is less severe compared to HIV-1. HIV genome has at least eight genes of which three (gag, pol, env) govern the viral structure while the rest of five [tst, rev, vif, nef, vpu (HIV-1) and vpx (HIV-2)] are regulatory genes.[5]

By the end of 2002, more than 900,000 cases had infected 60 million people worldwide, and nearly 20 million adults and children had died from the disease. There are currently about 42 million people living with HIV/AIDS, 70 percent of whom are in Africa and 15 percent in Asia; The majority of adults in sub-Saharan Africa are greater than 8 percent. AIDS is currently reported in more than 193 countries worldwide, and the number of people living with HIV in Africa and Asia is high and growing.[6]

## 2. Etiology

The symptoms of HIV and AIDS vary according to the stage of the infection. You may not have any symptoms when you first become infected with HIV, but develop a flu-like illness 2 to 6 weeks after infection. The main signs and symptoms of the disease include fever, headache, sore throat, swelling and redness, and other illnesses that may send you signs that you have HIV. The virus multiplies in the lymph nodes and gradually begins to destroy the T group (CD4 lymphocytes) and white blood cells that make up the immune system of the whole body. There may be no symptoms for eight or nine years or more.

But as the virus continues to spread and destroy the immune system, it can cause chronic symptoms such as swollen lymph nodes, diarrhea, weight loss, fever, cough, and difficulty breathing. The final stage of HIV, which occurs 10 years or more after initial infection, will begin with some more severe symptoms before the disease meets the definition of AIDS. In 1993, the Centers for Disease Control and Prevention (CDC) redefined AIDS as an HIV infection characterized by positive antibodies to one of the following:

1. Contagious disease exposure test.
2. One CD4 lymphocyte count is 200 or less the normal range is 600 to 1000[7]

## 3. Pathogenesis

When infected with HIV, the virus replicates in the peripheral blood. HIV, a retrovirus, has an RNA genome inserted into the host cell's DNA. Continuous reproduction leads to cell death. HIV attaches to the lymphocytes by binding with a receptor protein CD4 using the viral surface membrane glycoprotein 120. Cells with the CD4 receptor are often called CD4+ cells or T helper lymphocytes, and these cells are the main targets of the disease. These helper T lymphocytes are used to activate and regulate other cells of the immune system, such as beta lymphocytes (antibody-producing), macrophages, and cytotoxic (CD 8+) T lymphocytes. The gradual reduction in the CD4 cell population fails in immune function, especially cell-mediated immunity. The impaired cell-mediated immunity, which typically protects against intracellular parasites like viruses, protozoa, and mycobacteria results in infection with capsulated bacteria.

## 4. Transmission

Humans are the only known reservoir of HIV and transmission of infection essentially requires the exchange of various body fluids like semen, vaginal secretions, milk, or blood.

The well-established routes are:

### *4.1. Sexual contact*

This is considered to be the best route, especially among young people (ages 15-24) who have about half or all of the new HIV infections worldwide. The presence of HIV in blood or semen helps the spread of the infection through intimate sexual contact including homosexual, bisexual, and heterosexual contact. The torn, damage to genital skin or mucous membrane, presence of other sexually transmitted diseases (e.g. syphilis), lack of circumcision in males, and vigorous sexual activity facilitate the spread of infection.

#### *4.1.1. Blood transmission*

Transmission via whole blood and isolated blood product is the second most frequent route. The rapid spread of

infection is seen in hemophiliacs, as they regularly require blood or blood products. Intravenous drug abusers may have HIV infection as a result of the practice of "needle sharing". These people are a major reason, for heterosexual transmission too.

#### *4.1.2. Mother to child*

Mother-to-child HIV transmission (materno-foetal transmission) can take place during pregnancy (in utero), delivery, or breastfeeding. Organ donation by the infected person may lead to transmission of the disease.

In the absence of treatment, the transmission rate between mother and child is 25%. However, if there is treatment, this rate can be reduced to 1%. Breastfeeding is also a risk factor for the baby. HIV-2 is less likely to be transmitted through MTCT (mother-to-child transmission) and sexually than HIV-17.

#### *4.1.3. Transplantation of infected tissue or organ*

The risk of transplant-related HIV infection is low. All organ and tissue donors are screened for risk factors and tested for HIV and other infectious diseases that can be transmitted through transplantation.

#### *4.1.4. Use of contaminated clotting factors by hemophiliacs*

Hemophilia patients receiving untested and unscreened clotting factors are at extreme risk for contracting HIV via the blood products.[8]

## 5. Clinical Manifestations

The unique feature of AIDS is, clinical manifestations are not directly caused by the causative agent but are the result of the suppressed immune system. Most of the symptoms are due to secondary opportunistic infections. The appearance and severity of clinical features are variable from person to person based upon the stage of the infection. Initially, an infected person may be in a latent period for a few months, followed by the development of certain manifestations like fever, tender lymphadenopathy, etc. The person in the latent period can become contagious and transmit the infection. These symptoms may disappear after a few days and the person is symptom-free for a specific duration. Some patients later develop certain persistent manifestations like long-lasting fever, weight loss, continuous diarrhea, oral candidiasis, multi-dermatomal herpes zoster, viral hairy leukoplakia of the tongue, anemia, swollen lymph nodes, and unwell feeling, a condition termed as AIDS-related complex.

The Indian and global HIV cases and deaths are rising rapidly. The cases and deaths occur due to HIV in recent five years is mentioned in (Table 1).

**Table 1:** Global and Indian status of HIV cases and deaths.

| Year | Worldwide | | Indian | |
|---|---|---|---|---|
| | Cases | Deaths | Cases | Deaths |
| 2018 | 39.6 million | 7,70,000 | 23,93,672 | 21,571 |
| 2019 | 39.7 million | 6,90,000 | 23,92,008 | 21,252 |
| 2020 | 39.2 million | 6,80,000 | 23,97,884 | 21,084 |
| 2021 | 39.9 million | 6,50,000 | 24,01,284 | 41,968 |
| 2022 | 40.1 million | 6,40,000 | 13,80,000 | 31,940 |

## 6. Disease

Human immunodeficiency virus infection and acquired immunodeficiency syndrome (HIV/AIDS) are a group of conditions caused by retrovirus.[9] Do not vomit unless contaminated with stool, nose, saliva, sputum, sweat, tears, urine, or blood.[10] HIV/AIDS is considered a contagious disease Center.[11] Studies show that HIV can be transmitted through unprotected sex if the HIV-positive partner regularly carries the virus showing that it is not contagious.[12] HIV is usually transmitted from mother to child through unprotected sexual intercourse (including anal and genital sex), contaminated blood, hypodermic needles, and from mother to child during pregnancy, childbirth, or breastfeeding.[13] Some bodily fluids, such as saliva, sweat, and tears, are not contagious. Oral sex carries a small risk of transmission.[14]

Without specific treatment, about half of all people will get AIDS within ten years. The most common complications are Pneumocystis pneumonia (40%), cachexia as HIV wasting syndrome (20%), and esophageal candidiasis. Other symptoms include recurrent respiratory distress.[15]

## 7. Symptoms

Symptoms vary according to the stage of the disease.Figures 2 and 3

### *7.1. Primary/Acute HIV*

Some people infected with HIV develop flu-like symptoms 2 to 4 weeks after the virus enters the body. This infection called the initial HIV infection (infection), can last for several weeks.

### *7.2. Clinical latent/Chronic HIV*

During this infection period, HIV remains in the body and the white blood cells. This phase can last for years with antiretroviral therapy (ART)

#### *7.2.1. Symptomatic HIV*

As the virus continues to spread and destroy your immune system, cells that help fight infection, you may have a mild infection or experience symptoms for a long time.

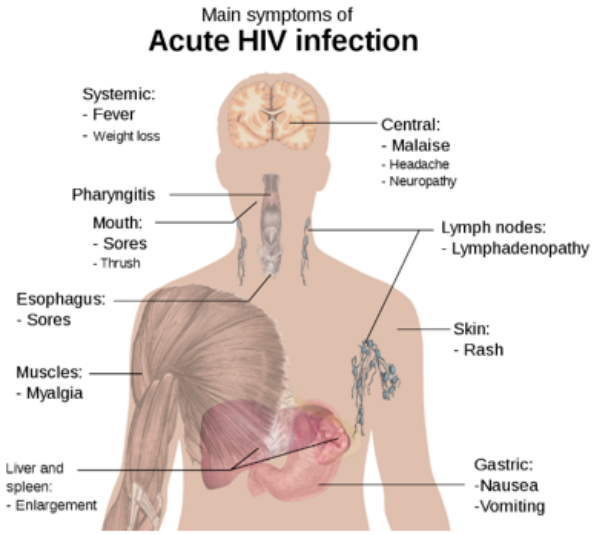


**Fig. 2:** Main symptoms of acute HIV infection

*7.2.2. AIDS progression*

Better access to antiretroviral therapy reduces deaths. When AIDS occurs, your immune system is severely compromised, making you more susceptible to infections that normally do not affect people with healthy immune systems. [16]

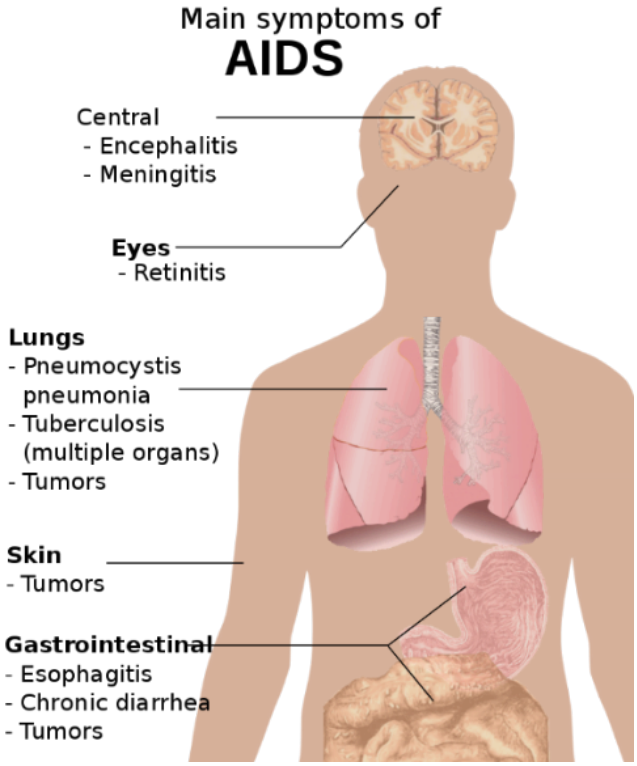


**Fig. 3:** Main symptoms of AIDS

## 8. Structure of Virus

It is around 100 to 120 nm in diameter and roughly spherical. Retrovirus is a 20-enveloped virus of the lentiviral subfamily. HIV is different from other retroviruses. There are two viral RNA strands in the nucleus surrounded by a protein sheath. The outer envelope contains a lipid matrix into which specific glycoproteins are embedded, and these buttons are responsible for attachment to cells.

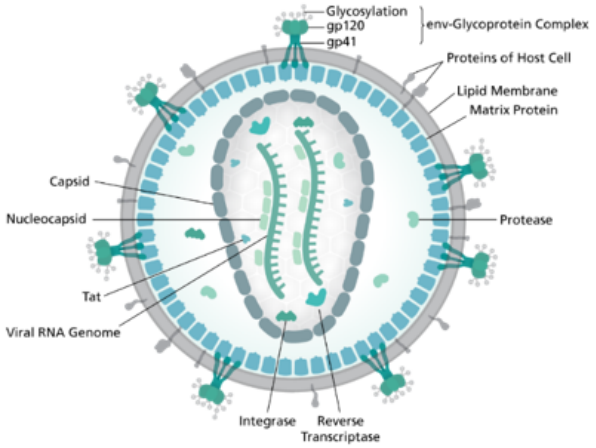


**Fig. 4:** HIV virion structure

The outer shell of this virus contains a protein known as the envelope (env), which consists of an outer layer containing glycoprotein (GP) 120 and root gp41. The virus envelope contains the HIV called p17 (substrate), the viral core, or the capsid, which contains another viral protein, p24 (core antigen). The three main structural genes are:Figure 4

1. *Group-specific antigen (Gag):* The Gag protein encoded by the Gag gene provides the structure of the virus.
2. *The envelope (Env)* gene encodes the envelope proteins gp160 and gp41. These polyproteins will be cleaved by proteases into the envelope glycoproteins gp120 and gp41. Gp41 is a transmembrane glycoprotein antigen that binds to gp120, which is involved in both the fusion and binding of HIV to the host's CD4 antigen.
3. *Polymerase (Pol)* encodes the p66 and p51 subunits of reverse transcriptase and p31 encodes an endonuclease. They are responsible for converting RNA to DNA, integrating DNA into the cell's DNA, and removing protein precursors. In the first step, HIV binds to an infected cell. The binding site is the CD4 antigen.

## 9. Diagnosis

Several types of tests test blood for HIV. This new test detects the presence of HIV antigen (a protein) up to 20

days before the test. The effectiveness of the diagnosis is described as follows:

### *9.1. Sensitivity test*

Percentage of positive results in the presence of HIV infection.

### *9.2. Specificity test*

Percentage of negative results in the absence of HIV. All diagnoses have limitations.

### *9.3. False positive test*

Tests indicate the presence of HIV in an uninfected person.

### *9.4. False negative test:*

The test indicates that the patient does not have HIV. Tests should be sensitive and specific.

### *9.5. Antibody tests*

#### *9.5.1. Enzyme-linked immunosorbent assay (ELISA)*

The enzyme-linked immunosorbent assay (ELISA) was the first screening test. ELISA tests use blood, oral fluid, or urine to detect HIV antibodies. If the result from either of these tests is positive, will need to take another test called a Western blot test. It can take up to two weeks to confirm a positive result.

#### *9.5.2. Western blot test*

The western blot is an antibody detection test. The viral proteins are separated first, immobilized, and the binding of serum antibodies to specific HIV proteins is visualized.

### *9.6. Antigen tests*

These tests can be used to diagnose HIV infection earlier from 1-3 weeks after first being infected with HIV.

### *9.7. Polymerase chain reaction (PCR)*

This test detects the genetic material of HIV in the blood within 2-3 weeks of infection. Babies born to HIV-positive mothers are tested with a special PCR test that can determine whether the babies have HIV themselves.[17]

## 10. Therapeutic Approaches to HIV Infection

Exposure to HIV infection does not always lead to HIV infection and some people remain healthy throughout their life even after HIV infection. The chances of the development of AIDS are lesser in the initial years after infection and gradually increase hence appropriate drug therapy as early as possible can delay the onset of AIDS and simultaneously can impart quality life to the patient. The current management strategy can be summarized under the following heads:

1. Evaluation and Staging
2. Patient's Counseling
3. Pharmacotherapy
4. Prophylaxis
5. Prevention of Transmission[18]

## 11. Therapy

Treatment of HIV/AIDS usually involves the use of multiple antiretroviral drugs to prevent HIV infection.[19] The use of multiple drugs targeting different types of viruses, known as highly active antiretroviral therapy (HAART), can reduce the overall HIV burden in patients, control the immune system, and prevent infections that often lead to death.[20] HAART also prevents HIV infection between zero-incompatible homosexual and heterosexual couples as long as the HIV-positive partner keeps the virus under control.[21]

### *11.1. Combination therapy*

The life cycle of HIV is about 1.5 days from the moment the virus enters a cell by multiplying, multiplying, releasing more virus, and spreading to other cells. Brain.[22] When HIV converts its RNA into DNA by reverse transcription, it does not have an enzyme. It's short lifespan and high error rate cause the virus to mutate very quickly, resulting in a high genetic mutation rate. Most mutations are benign or negative for the parent's disease.

The higher the copy number of the virus, the more likely it is to respond to the drug.[23]

The combination usually includes three drugs from two different classes.[24] This combination of the three drugs is often called a triple cocktail.[25] Because HIV is mutated, patients who start regular antiretroviral therapy can take precautions. Patients using the medication can follow their controls without medication.[26]

In recent years, pharmaceutical companies have combined this process into one tablet at a time. This makes taking the drug easy and consistent (adaptive),[27] thereby producing the long-term effects of the drug.

### *11.2. Highly active antiretroviral therapy (HAART)*

Currently, more than twenty-five drugs, including combination drugs, are used for the treatment of HIV-1 in clinical practice. This particular HIV treatment gives people the chance to live a better life by improving quality and prolonging life. Ensuring and maintaining immunity against the disease and recovery are the main goals of treatment. In addition, the reduction in pill burden, dosing frequency, and adverse effects of the drug in advanced therapy leads to simplification of therapy however drug-drug interaction, viral resistance, and immunologic failures

are some important limitations. The decision of early or delayed therapy to get maximum output clinically with minimum side effects is usually based upon potential benefits and risks associated with the therapy. Discussing the pros and cons with the patient and/or family members can make it easier.[28]

## 12. Prevention

1. *Abstain:* Not having genital, anal, or oral sex is the surest way to prevent HIV transmission. Ignoring or delaying sexual intercourse can reduce the risk of transmission, especially among young people who have not yet started having sex.
2. *Drug use and needle sharing:* Injecting drug use is an important factor in the spread of HIV. Needle replacement programs are used to reduce the number of drug-related illnesses.
3. *Exposure to body fluids:* HIV infection can be controlled by taking precautions to prevent blood contamination. Medical personnel should use restraints. Regular and thorough skin cleansing can reduce the risk of infection.
4. *In Pregnancy:* Anti-HIV drugs can harm the unborn child, but good treatment can prevent mother-to-child transmission of HIV. Bottle feeding if the mother is infected.[29]

## 13. Classification of Antiretroviral Drugs

A combination regimen includes two nucleoside reverse transcriptase inhibitors (NRTI) and a non-nucleoside reverse transcriptase inhibitor (NNRTI), a protease inhibitor (PI) or integrase inhibitor (also Enzyme Nuclear Chain Transfer Inhibitor or INSTI) as the "core".[30]

### *13.1. Entry inhibitors/fusion inhibitors*

Entry inhibitors interfere with HIV-1 binding, fusion, and entry into the brain by blocking one of several targets. Maraviroc works by targeting the co-receptor CCR5. In rare cases, individuals may develop mutations in the CCR5 delta gene for drug resistance or disease delay which may be overcome if the CXCR4 type HIV variant becomes dominant.[31]

*Examples:* Maraviroc, Enfuvirtide

### *13.2. Nucleoside reverse transcriptase inhibitors (NRTI)*

Nucleoside reverse transcriptase inhibitors (NRTI) and nucleotide reverse transcriptase inhibitors (NRTI) are nucleoside and nucleotide analogs that inhibit reverse transcriptase and act as competitive substrate inhibitors. NRTIs are incorporated into DNA strands. This prevents other nucleosides from binding due to the absence of a 3' OH group.

Examples: Azvudine

### *13.3. Non-nucleoside reverse transcriptase inhibitors (NNRTI)*

Non-nucleoside reverse transcriptase inhibitors (NNRTI) inhibit reverse transcriptase by binding to the allosteric site of the enzyme, acting as non-competitive inhibitors of reverse transcriptase and affecting substrate reverse transcriptase (nucleoside reverse transcriptase) connecting near active site.[32] HIV-2 is inherently resistant to NNRTIs.[33]

*Examples:* Nevirapine, Efavirenz, Loviride, Delavirdine

### *13.4. Integrase inhibitors*

Integrase inhibitors (also called integrase nuclear helix transfer inhibitors or INSTIs) inhibit the bacterial enzyme integrase, which is responsible for the integration of bacterial DNA into bacterial DNA.[34]

*Examples:* Raltegravir

### *13.5. Protease inhibitor*

Protease inhibitor blocks viral proteases required for the production of mature virions after budding from the host membrane. These drugs prevent the degradation of gag and gag/pol precursor proteins. Resistance to some protease inhibitors is high. Developed a second drug as effective as other anti-HIV drugs.[35]

*Examples:* Amprenavir, Lopinavir, Indinavir, Saquinavir, Ritonavir

## 14. Conclusion

AIDS has a profound long-term impact on society, social institutions, and cultural structures. Treatment mainly concerns the use of antiretroviral therapy, safer sex practices, infusion of screened blood, and avoidance of contact with infected articles.

As the number of people living with HIV on ART continues to increase, so does the pressure to tailor lifelong prevention strategies for them. Most HIV prevention (and condom use) guidelines developed by international organizations guide national governments, nonprofits, and the private sector. This study, this report on HIV infection analyzed detailed information on biology, pathology, signs and symptoms, complications, diagnosis, disease treatment, type of infection, and antibiotics.

## 15. Source of Funding

None.

## 16. Conflict of Interest

None.

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