

A Review: AIDS

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ABSTRACT

AIDS is a syndrome in which the body undergoes the loss of cellular immunity which lower the body's ability to fight against disease. The cause of AIDS is a retrovirus called Human Immunodeficiency Virus (HIV). The symptoms of AIDS usually start from 3-6 weeks and are mild symptoms like fever, rash, swollen glands, and body ache which are followed by characteristic AIDS symptoms which may appear within 10 years of infection. In world till 2017 genome sequencing of the virus, sub typing of the virus, recombinant forms of the virus has been deeply discovered and studied which helps in better diagnosis and in choosing the strategies for treatment. The objective of this review is to give a brief history and current picture of HIV prevalence and describe its pathophysiology and modes of transmission. And how it is diagnosed, sign and symptoms, treatment and how it can be prevented.

KEYWORDS: syndrome, immunity, diagnosed, pathophysiology, treatment

INTRODUCTION

AIDS or Acquired Immune Deficiency Syndrome is a disease caused by the HIV virus. In this condition, a person's immune system becomes too weak to fight any kind of infection or disease. AIDS is usually the last stage of HIV infection; a stage where the body can no longer defend itself and thus spawns various diseases. AIDS, when untreated, leads to death. AIDS is an advanced HIV infection or late-stage HIV. Someone with AIDS may develop a wide range of health conditions like – pneumonia, thrush, fungal infections, TB, toxoplasmosis.

There is also an increased risk of developing a medical illness like cancer and brain illnesses. CD4 count refers to the number of T-lymphocytes in a cubic millimetre of blood. A person may be referred to as —AIDS-affected when the CD4 count drops below 200 cells per cubic millimetre of blood. AIDS is a virus infection; the symptoms related to acute HIV infection can be similar to flu or other viral illnesses. There is no specific or perfect cure for AIDS, but with proper diagnosis, treatment and support, one can fight it and live a relatively healthy and happy life. One needs to take treatment correctly

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and deal with any possible side-effects. Medicines are used to stop the virus from multiplying. One major treatment for HIV/AIDS is called antiretroviral therapy (ART).

ETIOLOGY AND PATHOPHYSIOLOGY

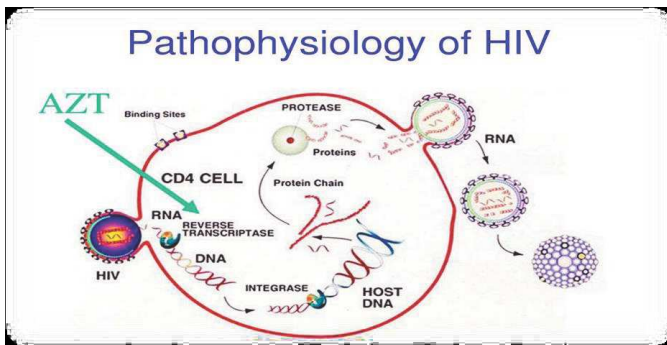
The first cases of acquired immunodeficiency syndrome (AIDS) in the United States were reported in 1981. Soon thereafter, HIV, which is an RNA virus of the Retroviridae family, was identified as the underlying pathogen. HIV probably entered the human population by cross-species transmission of the ancestral virus found in wild chimpanzees in Central Africa. The spread of HIV in Africa corresponds to urbanization and occurred before the recognition of AIDS.

HIV is a bloodborne pathogen acquired in non-occupational settings most readily either across mucous membranes or parenterally by 5 prime modes of transmission:

- unprotected penetrative sex between men,
- unprotected heterosexual intercourse,
- injection drug use,

- unsafe blood and blood by-products (primarily in developing countries), and mother to child spread during pregnancy, delivery, or breast feeding.

The estimated per exposure risk of HIV transmission following (1) receptive anal intercourse is 1 to 30%; (2) insertive anal or receptive vaginal intercourse it is 0.1 to 10%; (3) insertive vaginal intercourse it is 0.1 to 1%; and (4) injection drug use with needle sharing it is 0.67 per needle-sharing contact.⁵ The risk increases with advanced HIV disease, cervical or anal dysplasia, circumcision status, and the presence of genital ulcer disease. Data are lacking on transmission of HIV via oral sex.



Helper T cell Activation and Action

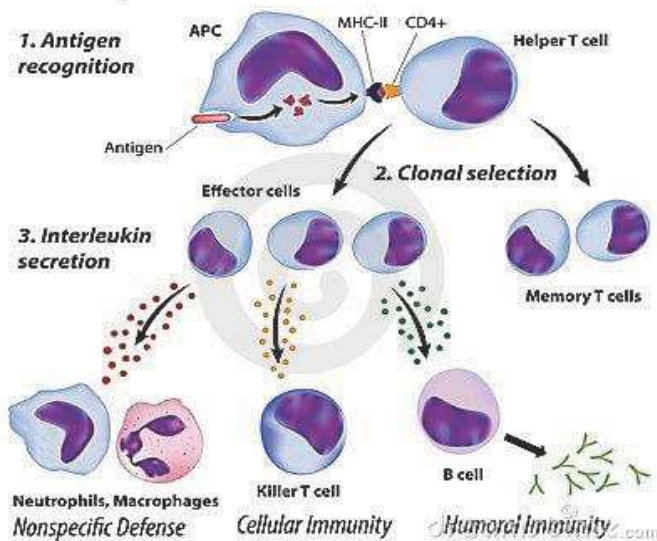


Image: Diagram of Helper T Cell

HIV has the same general life cycle as other viruses. Infection begins when a virion attaches to a host cell. CCR5 and CXCR4 are the two major co-receptors used by HIV-1. The viral strains can be classified on the basis of which co-receptor they use as CCR5-tropic, CXCR4-tropic, or mixed-tropic. CCR5-tropic strains predominate during early stages of infection and remain dominant in 50-60% of late stage disease.⁶ Capsid- or envelop-related viral proteins mediate attachment.

Viral entry into the host cell is mediated by other viral proteins which promote the fusion of the viral capsid or envelop with host cell membrane. Once the virus has gained entry into the host cell, it loses its capsid

proteins by the process known as uncoating. The viral nucleic acid now becomes available for replication, which requires the generation of protein kinase-dependent nucleoside triphosphates (ribo- or deoxyribo-) to be incorporated into the new viral genome by viral or host cell polymerases.

In most instances the viral DNA or RNA is replicated and then transcribed into a mRNA. Since HIV is an RNA retrovirus, uncoating is followed by reverse transcription, i.e., the viral RNA is first copied into DNA and then it is transcribed into a mRNA. Next, the newly synthesized mRNA is translocated to host cell ribosomes. Viral proteins synthesized by host cell ribosomes are then assembled with the duplicate viral genome. Assembly is followed by the process of maturation.

PATHOGENESIS OF HIV INFECTION OR AIDS HIV

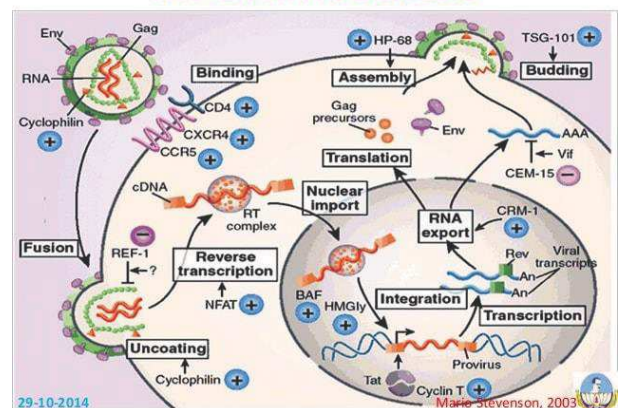
AIDS can infect many tissues. There are 2 major targets of HIV infection: 1) The immune system. 2) Central nervous system. HIV possesses the enzyme reverse transcriptase and consists of lipid bilayer membrane surrounding the capsid. Its surface glycoprotein molecule has strong affinity for CD4 receptor protein found in helper –T cells.

HIV enters the body and attaches to CD4 receptors and co-receptors such as CCR-5 or CXCR-4 and membrane fusion also occur. After penetrating the host cell, virus sheds its outer coat and releases its genetic material and replication enzymes. They are

- Integrase
- Reverse transcriptase
- Protease.

Using reverse transcriptase enzyme, the viral RNA is converted into DNA. The viral DNA is then integrated into the host genome in the cell nucleus. When it undergoes transcription and translation, enabling the production of new viral protein, new virus particles are then assembled and mature into infectious virions under the influence of protease enzyme.

HIV-1 PATHOGENESIS



LIFE CYCLE OF HIV AND AIDS

HIV infects a type of white blood cell in the body's immune system called a T-helper cell (also called a CD4 cell). These vital cells keep us healthy by fighting off infections and diseases. HIV cannot reproduce on its own. Instead, the virus attaches itself to a T-helper cell and fuses with it (joins together). It then takes control of the cell's DNA, makes copies of itself inside the cell, and finally releases more HIV into the blood. HIV will continue to multiply and spread throughout the body – a process called the HIV lifecycle.

In this way, HIV weakens the body's natural defences and over time severely damages the immune system.

Stages of the HIV lifecycle

Binding and fusion (attachment)

HIV attaches to a T-helper cell. It then fuses to it and releases its genetic information into the cell. The types of drugs that stop this stage of the lifecycle are called fusion or entry inhibitor drugs – because they stop HIV from entering the cell.

Reverse transcription (conversion) and integration

Once inside the T-helper cell, HIV converts its genetic material into HIV DNA, a process called reverse transcription. The new HIV DNA then enters the nucleus of the host cell and takes control of it. The types of drugs that stop this stage of the lifecycle are called NRTIs (nucleoside reverse transcriptase inhibitors), NNRTIs (non-nucleoside reverse transcriptase inhibitors) and integrase inhibitor drugs.

Transcription and translation (replication)

The infected T-helper cell then produces HIV proteins that are used to produce more HIV particles inside the cell.

Assembly, budding and maturation

The new HIV is put together and then released from the T-helper cell into the bloodstream to infect other cells; and so the process begins again. The type of drugs that stop this stage of the lifecycle are called protease inhibitor (PI) drugs.

MODE OF TRANSMISSION

HIV infection is a contagious disease and can be transmitted from person to person. It is most commonly transmitted by having sex without a condom or by sharing needles infected with the virus. HIV is found in all the body fluids including saliva, nervous system tissue and spinal fluid, blood, semen, pre-seminal fluid (which is the liquid that comes out before ejaculation), vaginal secretions, secretions from the anus or anal lining walls, tears and breast milk. Only blood, semen, and breast milk have been shown to transmit infection to others. The virus does not spread via air like flu.

Methods of HIV transmission

In most countries worldwide the common methods by which this disease is transmitted includes:

Having unprotected or condom-less vaginal, oral and anal sex especially with high risk groups like those who are injection drug abusers or are likely to have HIV infection.

Sharing needles for injections with other drug users and patients who are likely to be HIV positive.

Sharing sexual toys and objects with an infected person

Among healthcare workers who can accidentally prick themselves with an infected needle.

The risk is extremely low.

From an infected mother to her baby before or during birth. Transmission may also occur via breast milk during lactation. If the mother is treated with anti-HIV medications, the risk of transmission is low.

Via transfusion of blood contaminated with HIV. This is very rare these days since blood is screened for HIV before being transfused.

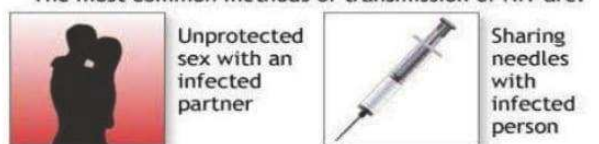
Getting a surgical operation with unsterile instruments that may have been used on HIV positive individuals.

Being exposed to blood, organs or products of an infected person. This is common among healthcare workers.

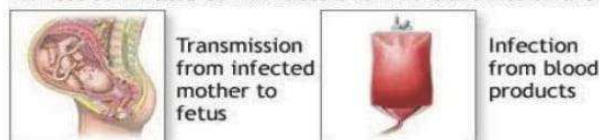
Those who get tattoos or body piercing with shared needles or improperly sterilized devices.

MODE OF TRANSMISSION

The most common methods of transmission of HIV are:



Almost eliminated as risk factors for HIV transmission are:



COMMON SIGN AND SYMPTOMS:

The symptoms of HIV and AIDS vary, depending on the phase of infection.

Primary infection (Acute HIV)

Some people infected by HIV develop a flu-like illness within two to four weeks after the virus enters the body. This illness, known as primary (acute) HIV infection, may last for a few weeks. Possible signs and symptoms include:

- Fever
- Headache
- Muscle aches and joint pain
- Rash
- Sore throat and painful mouth sores
- Swollen lymph glands, mainly on the neck
- Diarrhea
- Weight loss
- Cough
- Night sweats

These symptoms can be so mild that you might not even notice them. However, the amount of virus in your bloodstream (viral load) is quite high at this time. As a result, the infection spreads more easily during primary infection than during the next stage.

Clinical latent infection (Chronic HIV)

In this stage of infection, HIV is still present in the body and in white blood cells. However, many people may not have any symptoms or infections during this time. This stage can last for many years if not receiving antiretroviral therapy (ART). Some people develop more severe disease much sooner.

Symptomatic HIV infection

As the virus continues to multiply and destroy your immune cells — the cells in your body that help fight off germs — may develop mild infections or chronic signs and symptoms such as:

- Fever
- Fatigue
- Swollen lymph nodes — often one of the first signs of HIV infection
- Diarrhea
- Weight loss
- Oral yeast infection (thrush)
- Shingles (herpes zoster)
- Pneumonia

PREVENTION

Individuals can reduce the risk of HIV infection by limiting exposure to risk factors. Key approaches for HIV prevention, which are often used in combination, include:

- male and female condom use
- testing and counselling for HIV and STIs
- testing and counselling for linkages to tuberculosis (TB) care
- voluntary medical male circumcision (VMMC)
- use of antiretroviral drugs (ARVs) for prevention
- harm reduction for people who inject and use drugs and
- elimination of mother-to-child transmission of HIV.

DIAGNOSIS

HIV can be diagnosed through blood or saliva testing. Available tests include:

Antigen/antibody tests. These tests usually involve drawing blood from a vein. Antigens are substances on the HIV virus itself and are usually detectable — a positive test — in the blood within a few weeks

Antibodies are produced by your immune system when it's exposed to HIV. It can take weeks to months for antibodies to become detectable. The combination antigen/antibody tests can take two to six weeks after exposure to become positive.

Antibody tests. These tests look for antibodies to HIV in blood or saliva. Most rapid HIV tests, including self-tests done at home, are antibody tests. Antibody tests can take three to 12 weeks after you're exposed to become positive.

Nucleic acid tests (NATs). These tests look for the actual virus in your blood (viral load). They also involve blood drawn from a vein. If you might have been exposed to HIV within the past few weeks, your doctor may recommend NAT. NAT will be the first test to become positive after exposure to HIV.

Several tests can help our doctor determine the stage of your disease and the best treatment, including:

CD4 T cell count: CD4 T cells are white blood cells that are specifically targeted and destroyed by HIV. HIV infection progresses to AIDS when CD4 T cell count dips below 200.

Viral load (HIV RNA): This test measures the amount of virus in our blood. After starting HIV treatment the goal is to have an undetectable viral load. This significantly reduces chances of opportunistic infection and other HIV-related complications.

Drug resistance: Some strains of HIV are resistant to medications. This test helps doctor determine if our specific form of the virus has resistance and guides treatment decisions.

TREATMENT

Currently, there's no cure for HIV/AIDS. Once we have the infection, our body can't get rid of it. However, there are many medications that can control HIV and prevent complications.

These medications are called antiretroviral therapy (ART). Everyone diagnosed with HIV should be started on ART, regardless of their stage of infection or complications.

ART is usually a combination of three or more medications from several different drug classes. This

approach has the best chance of lowering the amount of HIV in the blood. There are many ART options that combine three HIV medications into one pill, taken once daily.

Each class of drugs blocks the virus in different ways. Treatment involves combinations of drugs from different classes to:

- Account for individual drug resistance (viral genotype)
- Avoid creating new drug-resistant strains of HIV
- Maximize suppression of virus in the blood
- Two drugs from one class, plus a third drug from a second class, are typically used.

The classes of anti-HIV drugs include:

Non-nucleoside reverse transcriptase inhibitors (NNRTIs) turn off a protein needed by HIV to make copies of itself. Examples include efavirenz (Sustiva), rilpivirine (Edurant) and doravirine (Pifeltro).

Nucleoside or nucleotide reverse transcriptase inhibitors (NRTIs) are faulty versions of the building blocks that HIV needs to make copies of itself. Examples include abacavir (Ziagen), tenofovir (Viread), emtricitabine (Emtriva), lamivudine (Epivir) and zidovudine (Retrovir). Combination drugs also are available, such as emtricitabine/tenofovir (Truvada) and emtricitabine/tenofovir alafenamide (Descovy).

Protease inhibitors (PIs) inactivate HIV protease, another protein that HIV needs to make copies of itself. Examples include atazanavir (Reyataz), darunavir (Prezista) and lopinavir/ritonavir (Kaletra).

Integrase inhibitors work by disabling a protein called integrase, which HIV uses to insert its

genetic material into CD4 T cells. Examples include bictegravir sodium/emtricitabine/tenofovir alafenamide fumar (Biktarvy), raltegravir (Isentress) and dolutegravir (Tivicay).

Entry or fusion inhibitors block HIV's entry into CD4 T cells. Examples include enfuvirtide (Fuzeon) and maraviroc (Selzentry).

RISK FACTOR

The most common risks are:

Having Unprotected Sex

Most people get HIV by having sex. During sex, the genitals, rectum, and mouth allow the virus to enter the body. Any time you have sex, use a condom or other protection. Using condoms all the time will lower our risk. Keep in mind that sex is any act that involves exchanging bodily fluids.

Chances of HIV are also higher for:

- Men who have sex with men

- Having a partner who is at high risk or already has HIV
- Having many sex partners
- Sex with someone who has many partners
- Regular exposure to blood or bodily fluids with HIV
- Having a mother with HIV when you were born
- Living in or staying in places where HIV infection is common
- Having an uncircumcised penis

Drug Use

Using needles to inject drugs makes chances of HIV higher. This is mainly true if they're dirty needles or share them with others. Even a small amount of blood with HIV can be passed .

Having Certain Health Problems

Having a sexually transmitted infection (STI) makes your risk of HIV higher. The most common ones are:

- Genital herpes
- Chlamydia
- Gonorrhea
- Genital warts
- Syphilis
- Having sex with someone with HIV makes our risk higher if we have a vaginal infection or an STI.

Blood Products

Blood banks didn't test for HIV until 1985. There was no way of knowing if the blood had HIV in it. The infection was passed through blood transfusions.

CONCLUSION

In view of the above facts we have learn about seriousness, causes, treatment, diagnosis, mode of transmission, and its preventive measures of AIDS which is considered as one of the deadliest diseases in the world. Though AIDS is a disease, which cannot be cured or eradicated from society, the only solution to overcome AIDS lies in its prevention and awareness.

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