

HIV-An Infectious Disease that Imposes Threat to Life

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ABSTRACT

HIV/AIDS is one of the fatal diseases within the world and is caused by human immunodeficiency virus. Aids initially cause immune system failure resulting in infection and risk of cancers. HIV infection caused by blood transfusion and by using contaminated syringes, HIV is present in body in 2 forms – Free virus & within infected immune cells. CD4T- cells are infected by HIV and reduce its numbers by breaking down T-cells. Most of the symptoms of HIV are opportunistically caused by bacteria, virus, fungi etc. The infection is smaller than 1% per annum in couples who used condoms. Female condoms may provide equal level of protection. The treatment of antiretroviral drugs has changed AIDS from a life-threatening disease to a feasible disease. Research has known how the virus replicates, manipulates, and hides in infected persons. Although our understanding is increased about the virus yet, a cure and vaccine remain tough.

Keywords: CD-4, HIV, AIDS, Transmission, Symptoms, T- cells.

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INTRODUCTION

HIV- means Human Immunodeficiency Virus.

AIDS: means Aquired Immunodeficiency Syndrome.

HIV –A kind of virus that destroys and impairs immune cell functions; the one who is infected from this virus starts to become immune-o-deficient.

AIDS: Acquired Immunodeficiency Syndrome is the chronic and last stage of HIV infection which damages our system so badly that it's considered in the concert of life-threatening disease. It may be transmitted through blood transfusion, sharing needles, during pregnancy or delivery, or infant feeding.^{1]}

[HIV]- HIV and SIV belong to the identical genus i.e. Lentivirus. SIV originated from Monkey in 1920 and transmitted to Humans thus got its name as HIV in human. HIV is chargeable for AIDS (Acquired Immunodeficiency Syndrome). It's thought that current epidemic started within the mid to late 1970. As per studies and data available by 1980, HIV may have already spread to 5 continents: Europe, North America, South America, Africa. In 1991, AIDS was first acknowledged within the US. The Homosexual and Black Community is at greater risk as compared with White.²

Human immunodeficiency Virus (HIV) mainly has two types HIV-1 (most common) and HIV-2 (relatively less common and fewer infectious). Around 38.6 million people are infected with HIV-1 or HIV- type 1, and about 25 million people have died due to such a communicable disease. In 2015, a worldwide health survey was conducted by WHO, 36.7 million people were infected with HIV, causing 1.1 million deaths in 2015.³

HIV-2 or HIV- type 2, is principally identified in Western Africa and other countries moreover Comparatively HIV-2 is smaller amount infectious than HIV-1. Antiretroviral drugs are active against HIV-2 virus.

It results from different cross-species transmission events.⁴

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STRUCTURE

Gp120

The digit 120 represents its molecular weight, which is essential due to the entry of virus into the human cell to attach to the surface receptors.

GP41

It is a pack of viruses that replicate in host cell through reverse transcriptase. It consists of a protein complex of retroviruses that includes human immunodeficiency virus. Its main intention is to target host cell.

Viral Envelope

The envelope that binds the virus is called viral envelope.

P17

It is also called viral core, which is made of protein. Its structure is bullet-shaped. There is a requirement of three enzymes for the replication of HIV virus.

P24

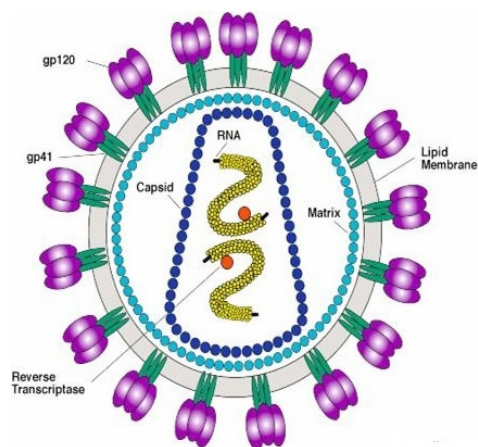
It is component of HIV capsid

Protease

It is a kind of retroviral aspartyl protease that is necessary for the life cycle of HIV, and causes AIDS. This enzyme synthesized

Table 1: Table showing no of people living with HIV, new HIV infections, AIDS related deaths and people who have access to antiretroviral therapies from 2000 to 2021.

People accessing antiretroviral	AIDS-related deaths	New HIV infections	People living with HIV
560 000 [560 000–560 000]	1.5 million [1.1 million–2.2 million]	2.9 million [2.0 million–3.9 million]	25.5 million [20.5 million–30.7 million] 2000
2.0 million [2.0 million–2.0 million]	1.9 million [1.3 million–2.7 million]	2.4 million [1.7million–3.4 million]	28.6 million [23.0 million–34.3 million] 2005
7.8 million [6.9 million– 7.9 million]	1.3 million [910 000– 1.9 million]	2.1 million [1.5 million–2.9 million]	31.1 million [25.0 million–37.3 million] 2010
17.1 million [14.6 million–17.3 million]	900 000 [640 000– 1.3 million]	1.8 million [1.3 million–2.4 million]	34.6 million [27.7 million–41.4 million] 2015
19.3 million [16.6 million–19.5 million]	850 000 [600 000– 1.2 million]	1.7 million [1.2 million–	35.3 million [28.3 million–42.2 million] 2016
21.5 million [19.6 million–21.7 million]	800 000 [570 000– 1.2 million]	1.7 million [1.2 million–2.3 million]	35.9 million [28.8 million–43.0 million] 2017
23.1 million [21.9 million–23.4 million]	750 000 [530 000– 1.1 million]	1.6 million [1.1 million–2.2 million]	36.6 million [29.3 million–43.8 million] 2018
25.5 million [24.5 million–25.7 million]	720 000 [510 000– 1.1 million]	1.5 million [1.1 million–2.1 million]	37.2 million [29.8 million–44.5 million] 2019
27.5 million [26.5 million–27.7 million] / *28.2 million	680 000 [480 000– 1.0 million]	1.5 million [1.0 million–2.0 million]	37.7 million [30.2 million–45.1 million] 2020/ *june2021

**Figure1:** Structure of HIV

new polyproteins appropriately to produce nature protein components of infectious HIV virion.

Integrase

Retrovirus produces an enzyme that allows the virus's genetic material to integrate itself into the DNA of the host cell.

RNA

Most viruses keep their genetic material in DNA, but these retroviruses consist of RNA.⁵

VIRUS CLASSIFICATION

GROUP	GROUP VI (SSRNA-RT)
ORDER	UNASSIGNED
FAMILY	RETROVIRIDAE
SUBFAMILY	ORTHORETROVIRINAE
GENUS	LENTIVIRUS
SPECIES	HUMAN IMMUNODEFICIENCY VIRUS I HUMAN IMMUNODEFICIENCY VIRUS II

HIV LIFE CYCLE

- **Entry to human cells** - inside the human cells; HIV is the only virus which makes copy of itself forming a new virus. CD4 is a protein which is present on the cell surface. When the virus enters into the cells the process is initiated. This virus attacks on CD4 receptors and diffuses the immunity cells i.e.-T-helper cells making immune system weak
- **Reverse Transcription** - Reverse transcriptase is an enzyme which helps in the reverse transcription i.e. transformation of viral RNA to complementary. Transcription and Translation process is done when the DNA is transported to cell's nucleus.
- **Assembly Building and Maturation** - copies of HIV assemble together with newly formed HIV protein and enzyme to form new viral particles which are then shed from the original CD4 cells. The long chain of HIV- protein breaks into smaller pieces by the protease. The newly generated virus is capable of targeting and infecting these other CD4 cells.⁶

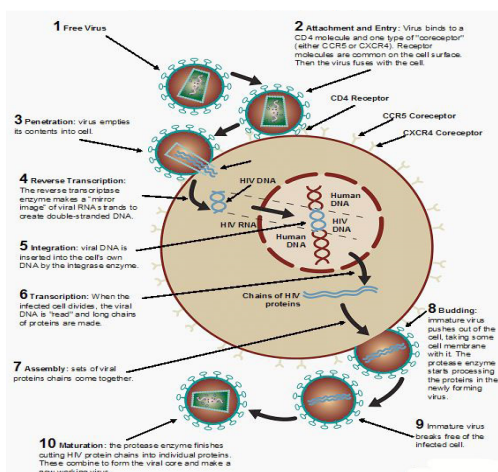


Figure 2: Figure showing steps involved completing the life cycle of virus i.e. Antiretrovirus

Symptoms of Acute HIV

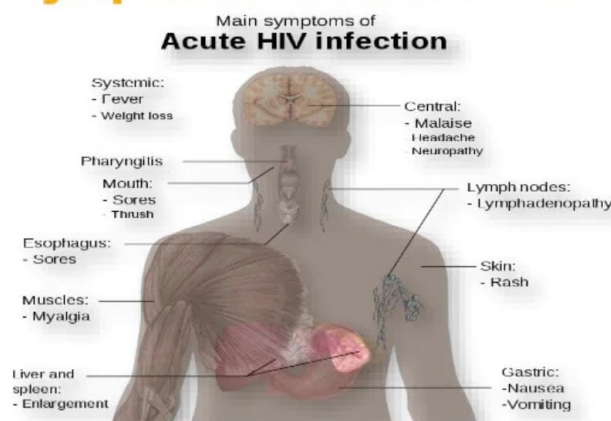


Figure 3: Shows symptoms of acute HIV Infection

TRANSMISSION

HIV is transmitted usually by three ways:

It usually occurs by sexual contact, by blood through transfusion blood products or contaminate needles or by passage from mother to child. Although homosexual contact is the main source of HIV in the United States, "hetero sexual transmission is the most important means of HIV spread worldwide today." In developed countries it's treatment by blood products and donor screening has almost eliminated the risk of HIV from contaminated products whereas in the under progress countries, contaminated blood and the needles is the main source of infection. Usually thirteen to the thirty people of women who are pregnant will pass the HIV infection to their babies. The transmission can occur either before or during birth. Colostrums will contain high level of virus. Most of the time HIV is not spread by feral-oral route, aerosols, insects, carrying household items, hugging etc. The healthcare workers are at more risk as they are in directly contact with needle sticks. Saliva also contains minute quantity of virus but it cannot be spread by kissing. It can be transmitted through blood, semen, virginal secretions, and coliseum.

Activities that allow HIV transmission

- Unprotected sexual contact
- Direct blood contact
- Mother to baby⁷

CAUSES

This usually occurs by sexual contact from one person to another. When a person becomes infected with HIV virus, the body defence system becomes weak and it cannot fight with the infection.

This is generally caused by

- Sharing drug needles or syringes.
- Sexual contact which includes oral, vaginal or oral.
- Other Sexually transmitted diseases like syphilis, herpes and gonorrhoea increases the risk of infection by HIV during unprotected sexual contact with infected partner.

- Babies can be infected if the mother is HIV positive during birth, pregnancy and breast feeding.

SYMPTOMS

The evidence shows that 70–90% of peoples who are suffering from HIV experience flu like symptoms within some days of incubation.

The Most Common Symptoms are:

- Cough and shortness of breath
- Skin rashes and itching
- Severe sore throat
- Peumonia
- Swollen in the lymph glands
- Ulcers and White curd patches on tongue & throat

The Major Symptoms are:

- Pulmonary Infection
- Short term state of mind
- Chronic diarrhea
- Prolonged fever

HIV Can Not Be Transmitted By Following Ways

- By Coughing and Sneezing
- By Food or Water
- Through By Coughing and Sneezing
- By Food or Water
- Through tears and sweat
- By sharing cups, plates and utensils with an infected persons
- By touching , hugging & kissing an infected individual
- By living with infected individuals.
- Through sharing bathrooms and toilets with an infected individuals
- Through mosquitoes, fleas, and other insects

Diagnosis of HIV

The HIV may be examined by detecting specific antibodies, antigens or both. The foremost general test used for screening is serological tests. It always completes in 20 minutes.

Rapid test are used for surveillance, screening and diagnosis and might be done on plasma, serum while blood or saliva by health- care providers.⁸

Followings are the tests that may be detected HIV:

- **Home Test**- The house test is approved by food and drug administration. Chew a chewing gum and collect the saliva from upper and lower gums. If it's positive immediately consult your doctor and if it's negative it must be repeated.
- **Test to Tailor treatment** – During which following test are done for the detection of HIV.
 - **CD4-Cell count**- CD4 cells are a kind of WBCs that are targeted to specific and may be destroyed by HIV.
 - **Viral load** – The number of virus present within the blood is finished by this method
 - **Drug Resistance** – This test determine the strain that's infected in our body is resistant to any HIV or not.⁹

Treatment of HIV (Anti Retroviral Agents)

For the viral suppression antiretroviral treatment is that the most suitable choice. The drug which is employed within the treatment of HIV which isn't eliminated. Within the HIV – viral suppression, the longer duration of treatments needed. There are 21 antiretroviral drug are utilized in this 20 antiretroviral drugs are approved by US Food and Drug administration these drugs inhibited the viral polymerase or protease.¹⁰

- Entry Inhibitors
- Reverse Transcriptase Inhibitors
- Protease Inhibitors
- Fusion/Entry inhibitors

Entry Inhibitors

Don't let HIV enters healthy T-Cells within the body.

E.g.- Enfuvirtide (Fuzeon).

Reverse Transcriptase Inhibitors

- Nucleoside Reverse transcriptase inhibitors-(NsRTIs) - They destruct the viral DNA by getting into it and stops the transcription of RNA to DNA.
- Block the HIV replication and infection of latest cells without effecting already infected cells.
- E.g. - Lamivudine, Abacavir, Stavudine, Didanosine.
- **Non Nucleoside reverse transcriptase inhibitors**
Similar effect as NsRTIs.it destroys the DNA of virus by directly binding to reverse transcriptase.
- Do not require activation through phosphorylation.
- Along with NRTIs or Protease inhibitors provides synergistic effects against HIV.

E.g.- Nevirapine, Efavirenz

Protease Inhibitors (PI's)

Protease inhibitors act by binding to the viral protease and thus prevents the proper cleavage of viral protein.

- It is a viral enzyme which breaks poly protein into structural proteins and enzymes responsible for final grouping of recent infectious virions.
- E.g.**- Saquinavir, Ritonavir, Nelfinavir

Fusion/Entry inhibitors

It is bound to gp41 subunit of viral envelope glycoprotein and prevents the entry of HIV into CD4 cells by disturbing the fusion of viral and cellular membrane.

Used for treatment of advanced HIV infection that might not respond other therapies.

E.g. - Enfuvirtide¹¹

WHO recommendation of ART

When to start- Anyone, including young's people, adults, and pregnant women with HIV infection and CD4 counts of <350 cells/mm³ should start ART whether or not they don't have any clinical symptoms, and people with the advanced clinical disease should start ART no matter CD4 cells count.¹²

WHAT TO START

First line therapy should consist of-

- Non Nucleoside Reverse Transcriptase Inhibitors (NNRTIs)- It should be consist of Drug Named – Zidovudine (AZT)
- Nucleoside Reverse Transcriptase Inhibitors (NRTIs)- It should be consist of drug named – Tenofovir (TDF)

Second-line ART should consist of

- A ritonavir-boosted PI + NRTIs (2), which should be AZT or TDF, in step with what was utilized in first-line therapy.
- Ritonair-boosted atazanavir (ATV/r) or lopinavir/ritonavir (LPV/r) is one in every of the foremost usable PIs.¹³

Prevention of HIV

- Take blood from licensed blood bank having stamp of HIV FREE on that.
- Avoid single unit insertion and sharing of needles.
- Used disposable syringes.

Safer Sex Practices

- Abstinence
- Delay first intercourse
- Avoid more no. of partners
- Be faithful to your partners
- Masturbation
- Non Penetrative Sex
- Proper use of condom
- Generate awareness on hiv & sexual activity¹⁴

Population Especially at Risks

- Individuals who uses contaminated needles & syringes.
- Individual who incorporates a sexually transmitted infections (STIs).
- Persons who has anal sex with her/his partners
- An individual who exchanges sex for money or drugs
- Persons who as many sex partners.
- An individual who live life separated from spouse because of professional duties like-truck drivers, laborers & migrants).¹⁵

CONCLUSION

The Main Aim of HIV prevention programs is to specialize in reducing risk for people infected by HIV. In line with the

review of 55 states and cities applications to the CDC, in 1999 for funds of HIV prevention program, only 18 individuals were listed as a priority population for the program in prevention of HIV. HIV infection may only occur in people infected with the virus although many of us in the US are at behavioral risk for infection. The infection of HIV is decreasing because of ART and so does the need for lifelong prevention programs. The opportunities for HIV-1 testing will grow as excess Anti-retroviral treatment increases. Voluntary counseling and testing services can act as a point of entry in the prevention care program For HIV.

ABBREVIATIONS

HIV	(Human Immunodeficiency Virus)
AIDS	(Acquired Immuno Deficiency Syndrome)
Gp-120	(Glycoprotein-120)
P17	(Matrix Protein)
CD4	(Cluster of differentiation 4)
DNA	(Deoxy ribo nucleic acid)
SIV	(Simian Immunodeficiency Virus)
ART	(Anti-retroviral Therapy)
WBCs	(White Blood Cells)
WHO	(World Health Organisation).

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