**Introduction**

HIV infects cells of the immune system and the central nervous system. The main cell HIV infects is T helper cell which is a crucial part of the immune system, because it co-ordinates the actions of other cells of the immune system. A large reduction in the number of T helper cells seriously weakens the immune system.

**4.1.1. Exposure vs. Infection**

When HIV+ individual encounters an uninfected person, this does not always result in [transmission of HIV](https://sodel4.jkuat.ac.ke/mod/lesson/view.php?id=44454) to the uninfected person. Only a fraction of the exposed people will be infected. Different kinds of exposure between infected & uninfected individuals have different probabilities of leading to infection. Those who are exposed & become infected do not show sign of illnesses right away.

**4.1.2. Infection vs. Disease**

Among individuals who become infected with HIV, not everybody will develop physical symptoms. Most viral infections don’t show physical symptoms, but most people infected with HIV ultimately develop some disease symptoms. These disease symptoms are caused by damage or destruction of cells & tissues in the infected person. In some cases the damage may result from direct killing of cells by virus. In the case of AIDS, most of physical symptoms are the indirect result of damage to the immune system by HIV. Factors such as age, sex, genetic make-up, nutrition, environmental factors, & encounters with other infectious agents can influence the exact nature of the symptoms in a particular individual.

**Stages of HIV Infection**

There are four stages of HIV infection and they include:

* Primary H IV infection: Window Period & Sero Conversion
* Clinically asymptomatic stage,
* Symptomatic HIV infection,
* Progression from HIV to AIDS.

**4.2.1. Primary HIV infection**

This is the initial stage where one obtains the virus through the various modes of transmission. It can be divided into:

**1. Window period -** This stage of infection lasts for a few weeks to about 3 months and is often accompanied by ashort flu-like illness or no signs. HIV cannot be detected in blood screening although HIV is present in blood & the blood in not 100% free of HIV. The virus cannot be seen in the first 21 days. During this time a person can still transmit the virus to another person. It is the most crucial stage.

**2. Sero conversion -** This is the development of the antibodies. Immune system begins to respond to HIV by producing HIV antibodies and cytotoxic lymphocytes. If an HIV antibody test is done before seroconversion is complete then it may not be positive. In this stage a person may have flu like illnesses, fever, fatigue, sore throat, joint pains & lymphadenopathy Some will not experience any illnesses at this stage.

**4.2.2. Clinical asymptomatic HIV infection/ Latent phase**

The presence of HIV without major symptoms. Although there may be swollen glands. The level of HIV in the peripheral blood drops to very low levels but people remain infectious. HIV antibodies are detectable in the blood, so antibody tests will show a positive result. HIV is not dormant during this stage, but is very active in the lymph nodes. Large amounts of T helper cells are infected and die and a large amount of virus is produced. This period can last for many years (5 – 15 years)

Initial Infection Symptoms include:

* Mononucleosis-like illness (sore throat, swollen glands, fever) & skin rash
* Encephalopathy i.e. Brain infections - brain swelling & inflammation of the brain lining or meninges
* This causes headache, fever, brain functions impairment, difficulty in concentration, remembering or solving problems
* Personality changes may also occur NB: Asymptomatic period – some type of balance exist between HIV infection & the immune system in the infected person

**4.2.3. Symptomatic HIV infection/AIDS Related Complex (ARC) phase**

Over time the immune system loses the struggle to contain HIV due to the following main reasons:

* The lymph nodes and tissues become damaged or ’burntout’ because of the years of activity;
* HIV mutates and becomes more pathogenic, i.e. stronger and more varied, leading to more T helper cell destruction;
* The body fails to keep up with replacing the T helper cells that are lost. As the immune system fails, so symptoms develop. Initially many of the symptoms are mild, but as the immune system deteriorates the symptoms worsen. When the viral load reaches a critical amounts, the immune system is suppressed to such a degree that other infections which under normal circumstances will not be difficult to resist gain entrance i.e. opportunistic infections. Opportunistic infections – they take advantage of the impairment of the immune system & sometimes are caused by organisms that don’t cause infections/ diseases in man. Symptoms of HIV infection in this stage. Two or more of the following signs / symptoms may occur:

– Chronic fever

– Lethargy (fatigue/ tiredness)

– Continuous diarrhea

- Eczema (allergy of the face)

 – More than 10% weight loss

- Psoriasis (itchy pimples)

– Lymphadenopathy

– Dermatitis (itchy skin)

– Night sweats

– Oral candidiasis (sores in mouth)

– Dementia (short term memory loss)

Incubation period - is the length in time between initial infection & becoming symptomatic. It varies between people & depends on a length of factors

**4.2.4. Progression of HIV to AIDS**

As the immune system becomes more and more damaged the illnesses that present become more and more severe leading eventually to an AIDS diagnosis. It’s the most advanced stage of HIV infection. At this time when CD4 cell count has gone down below 200 CD4 cells/ml, HIV develops to one or more severe opportunistic infections or cancer. The infection / cancer may be life threatening due to the weakened immune system.

• Common symptoms in this stage/ Initial Disease Symptoms

An infected individual may have symptoms from more than one of these classes;

1. HIV wasting syndrome: - Sudden unexplained loss in body weight ( >10% of total body weight), unexplained chronic diarrhea (>1 month), Chronic weakness, unexplained prolonged fever usually at night that causes night sweats (>1 month) and brain damage due to high temp that causes fevers
2. Lymphadenopathy syndrome (LAS)/ persistent generalized lymphadenopathy (PGL): Lymph glands enlargement is persistent. They swell in groin, armpits, head & neck but are not painful. Some infected people may experience both LAS & Wasting Syndrome
3. Neurologic disease - direct damage of the brain by HIV or by other agent. Damage of parts of the nervous system can also cause different neurologic symptoms.

(a)    Dementias - Impaired mental functions, forgetfulness, loss of mental functions. Difficulty reasoning & performing mental tasks. Depression, social withdrawals & personality changes. Unable to care for themselves eventually. Coma & death may follow.

(b)    Spinal cord damage/ swelling (myelopathy) - Spinal cord transmits nerve impulses to the muscles of the body. Because of this, damage may result in weaknesses or paralysis of voluntary muscles/ limbs.

(c)    Peripheral nerve swelling/ damage (neuropathy) - these nerves sense pain. When damaged can cause burning or stinging sensations in the hands or feet or occurrence of numbness

NB: individual patients may experience a mixture of any of these illnesses Others include: Coughs & gasping of breath, Seizure- lack of coordination, Difficulty or pain during swallowing, Psychotic symptoms - mental confusion & forgetfulness, Loss of vision, Severe headache, Nausea, Abdominal crump & vomiting, Extreme fatigue, Cancers-m of blood, and Coma. HIV+ patient can die any moment at this stage.

**4.2.5. Other complications in HIV Patients**

This manifest when immune system is weak and they include: 1. Common brain infections - Tumors, Swelling of the brain, Nerve damage. They can cause Headache & confusion, Poor coordination of feet, Blindness, Enlarged lymph nodes, Fever, sore throat, weaknesses 2. Common skin infections - When immune system is damaged in HIV patients the skin conditions tend to persist more & they become difficult to treat. In most cases these conditions are caused by bacteria, viruses or fungi.

**4.2.6. Factors that lead to faster development of HIV infection to full- blown AIDs**

1. Age - Persons who get infected after the age of 35years move faster from HIV infection to full blown AIDS than those who get infected in their mid 20s. Children who get infected at birth die faster simply because their immune system is not well developed at their tender age.
2. Type of HIV contracted - There are two well known types: HIV1 and HIV2. HIV1 is harsher on people hence kills faster than HIV2.
3. Mode of transmission - HIV got through blood transfusion kills faster than one got through sexual contact. This is because the amount of virus channeled into the bloodstream is in large quantity.
4. Ill - health & other types of infections - People who are already sick & then get infected move faster than those infected when healthy. Tropical diseases such as malaria, typhoid & intestinal worms makes patients to develop AIDS faster
5. Nutritional status - Those infected & are not eating enough of well-balanced foods are more likely to develop AIDS faster
6. Lifestyle - People who expose themselves to re-infection with other strains of HIV or STIs / STDs and other illnesses move faster from HIV to AIDS
7. Opportunistic infections - If they are not competently treated, then the HIV+ person develops AIDS faster.

**Opportunistic Infections**

Examples of fungal infections:

* PCP - Inflammation of the lungs caused by infection with fungus called Pneumocystis carinii. Inflamed areas of lungs appear as white spots in x-rays. It’s the leading cause of death in AIDS patients i.e. about 50% of AIDS patients will eventually develop PCP
* Candida - Fungus is similar to baker’s yeast. It is found on skin & mucosal surfaces (mouth, vagina). In mouth they appear like white plaques that feel furry. Antifungal e.g. mycostatin can be used. They are difficult to completely eliminate. They can spread to oesophagus & cause painful burning sensation when eating i.e. oesophagitis. 50% of AIDS patients will experience candidacies.
* Systemic mycosis - Soil fungus that can cause generalized infections in AIDS patients. Exist in either mold like or yeast like form & are called dimorphic. There are of 3 types - Histoplasmosis, Coccidiomycosis, & Cryptococcus. They cause lung infections in healthy patients. In AIDS patients, the brain, skin, bone, liver & lymphatic tissue may also be highly infected.

Example of Bacterial infections - Components of I.S. responsible for controlling the common bacteria are less affected by HIV infection, thus adult AIDS patients do not generally suffer infections with common bacteria

* Mycobacterium - Infection with Mycobacterium avium intracellular is most common in AIDS patients. It does not cause disease in healthy people but it causes TB-like disease in the lungs of AIDS patients. Also causes infection of BM & presence of bacteria in blood at high levels. Patients will have fevers & low no. of white blood cells. Mycobacterium tuberculosis that causes TB is also common in AIDS patients.

Example of Viral infections:

* Cytomegalovirus (CMV) - Common virus that infect people inn childhood with no symptoms but may cause mononucleosislike illness (sore throat, swollen glands, fevers) in adults. Congenital infections(fetus) can also lead to permanent brain damage. In AIDS patients CMV infect retinas of the eyes causing blindness & also adrenal glands leading to hormonal imbalance. CMV can cause pneumonia, fevers, rash & gastroenteritis in AIDS patients. CMV pneumonia in patients with PCP is fatal
* Varicella (shingles) - Painful rash condition that occurs on human trunk. Latent varicella zoster (that causes chicken pox in childhood) is reactivated when the I.S. is compromised. Antiviral drugs e.g. acyclovir is sometimes used to control shingles

Example of Protozoan infections:

* Cryptosporidium gastroenteritis - It is caused by protozoan called cryptosporidium. It infect lining of the intestinal tract & causes diarrhea (gastroenteritis). In normal/ healthy people diarrhea lasts a few days but in AIDS patients it is prolonged & severe. That is about 20-50 watery stools per day accompanied by abdominal cramps & H 1100 Introduction to HIV/AIDs weight loss
* Toxoplasmosis - It is caused by Toxoplasma gondii that causes asymptomatic infections in healthy adults. In AIDS patients it causes brain infections with symptoms similar to brain tumors (e.g. convulsions, dementias).
* Examples of Cancers:
* Kaposi’s sarcoma (KS) - Are tumors of blood vessels. In non - AIDS patients KS is seen in older men of Jewish ancestry. Initially few tumors appear as pink, purple or brown skin lesions located on arms or legs. Eventually they spread & become widely distributed in most linings of the body. They are difficult to control if they spread to the lungs. Chemotherapy can eradicate them.
* Lymphomas - Cancers derived from B cells of immune system are the common type of lymphomas in AIDS patients. Epstein-Barr virus causes mononucleosis but it can also transform normal B cell into cancer cell. Unusual lymphoma that spread to the brain also occur in AIDS patients.
* Cervical cancers - Its common in female AIDS patients. Infections with certain strains of Human Papilloma Virus (HPV) that cause warts in the genital tract is an underlying cause of cervical cancer. Cancer caused or induced by HPV develops faster when immune system is compromised in AIDS patients.
* Hairy leukoplakia - Abnormal condition of the mouth in which white plaques appear on the surface of the tongue. This is due to abnormal growth of papillae cells of the tongue. They can’t be scrapped off. They resemble cancer cells.
* **Tris Base**: Maintains stable pH.
* **Glycine**: Maintains pH and conductance.
* **SDS**: Denatures proteins, imparts uniform charge.
* **Methanol**: Stabilizes proteins, improves binding to membrane.
* **Water**: Solvent.
* **Non-fat Dry Milk/BSA**: Blocks non-specific binding sites.
* **Saline (NaCl)**: Maintains ionic strength and osmotic balance.
* **Tween 20**: Reduces non-specific binding and protein-protein interactions.