

HIV & AIDS

By

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Objectives

The students should be able to know:

- HIV main structural components
- Mode of transmission
- Stages of HIV infection
 - Main clinical features of each stage of HIV infection
 - Serological profile during the stages of HIV infection
- Diagnosis
- Management & treatment

Outline

- Introduction to HIV & AIDS
- HIV main structural components & life cycle
- Mode of transmission
- HIV pathogenesis
- Stages of HIV infection
- Persistent generalized lymphadenopathy (PGL)
- AIDS related complex (ARC)
- Serological profile
- Diagnosis
- Management & treatment

Human immunodeficiency virus (HIV)

- Is a retrovirus that causes human AIDS, and was initially identified in 1983.
- HIV infects mainly CD4+ T cells, macrophages, and dendritic cells which express the surface receptor CD4.
- Destroying CD4+ T cells leads to severe immunologic impairment and eventually death.

Acquired immunodeficiency syndrome (AIDS)

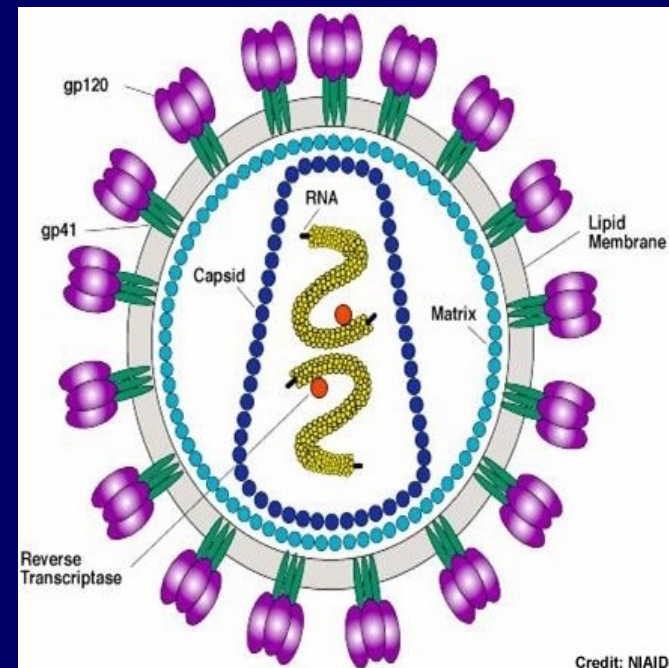
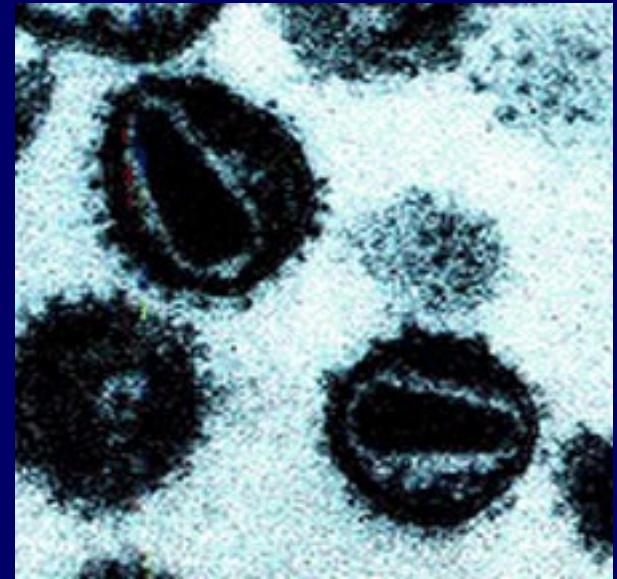
- Is the end stage of the disease that is associated with CD4+ T cell depletion, multiple or recurrent opportunistic infections, and unusual cancer (Kaposi sarcoma).

Characteristics of HIV

- Family of *Retroviridae*.

Virion consist of:

- Glycoprotein envelope (gp120, gp41).
- Matrix layer (p17).
- Capsid (p24).
- Two copies of ss-RNA.
- Enzymes:
 - Reverse transcriptase: converts viral RNA into DNA.
 - Integrase: integrates viral DNA with host DNA (provirus), persisting infection.
 - Protease: viral protein maturation.



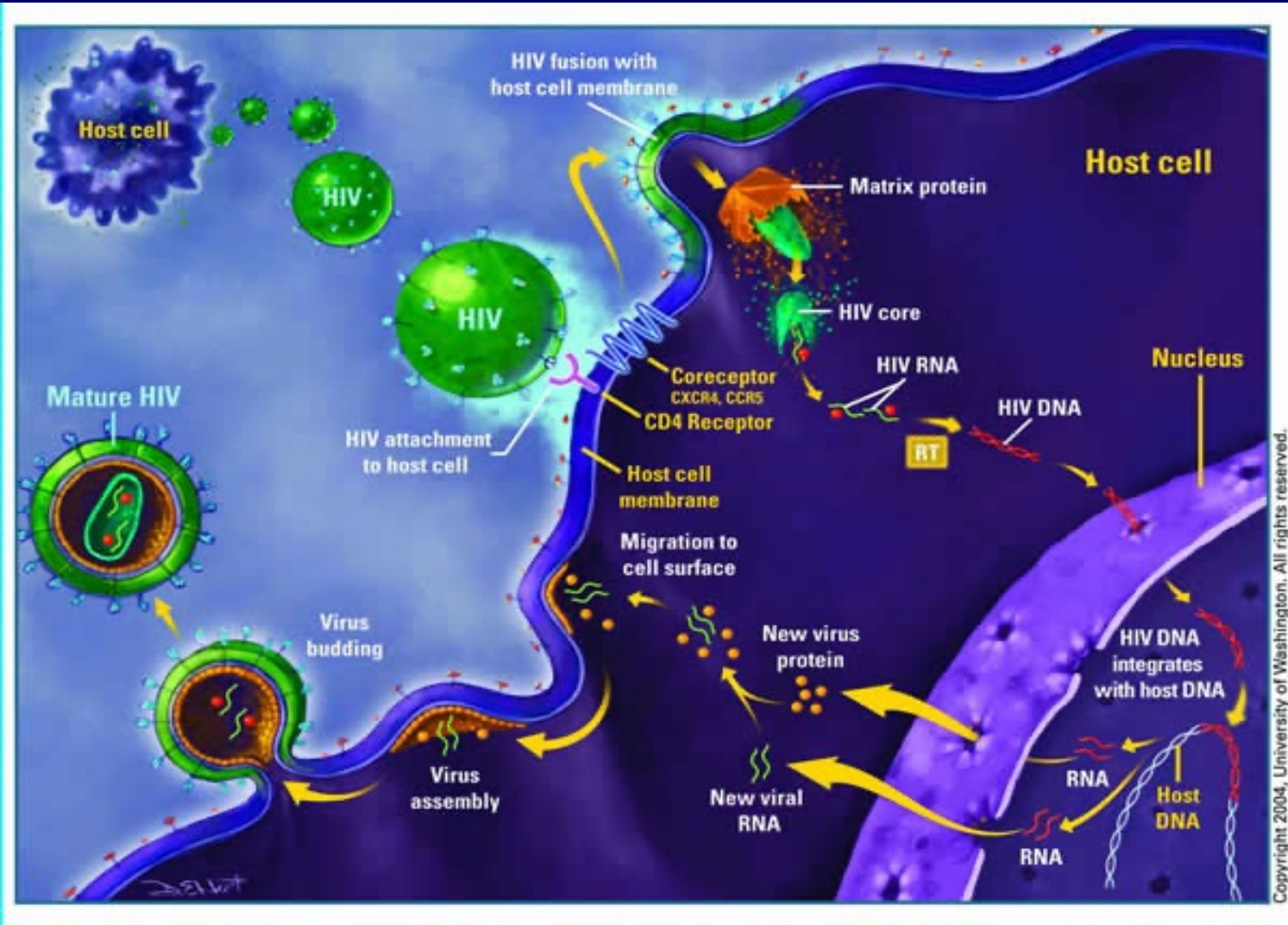
HIV

HIV is **easily** inactivated by treatment for 10 min at 37°C with any of the following disinfectant as 50% Ethanol, house hold bleach & 35% Isopropanol.

There are two HIV species known to cause AIDS in humans HIV-1 and HIV-2, and the overall sequence homology between HIV-1 & HIV-2 is less than 50%.

- HIV-1:
 - Causes HIV infection worldwide.
 - Highly virulent.
 - Highly susceptible to mutations.
- HIV-2:
 - Causes the infection in specific regions e.g. West Africa.
 - Relatively less virulent.
 - Relatively less susceptible to mutations.

HIV life cycle



Transmission of HIV

1- Sexually (unprotected sex):

- The virus is present in blood, semen and vaginal secretions.

2- Parenterally:

- Direct exposure to infected blood or body fluids (e.g. receiving blood from infected donor).
- Using contaminated or not adequately sterilized tools in surgical or cosmetic practice (dental, tattooing, body piercing).

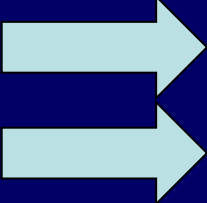
Sharing contaminated needles, razors, or tooth brushes.

3- Perinatally (from mother to baby):

- Infected mothers can transmit HIV to their babies trans placentally (25%), but Treatment of the mothers with the reverse transcriptase inhibitor (Zidovudine) during pregnancy can reduce transmission in most cases.
- Virus spread to child perinatally mainly (50%) during delivery, but given the reverse transcriptase inhibitor (Nevirapine) as single dose during delivery can reduce the transmission, Breastfeeding is also an important way of perinatal transmission (25%).

Stages of HIV infection

The course of HIV infection is divided into 3 stages based on **CD4+ T cell count and presence of opportunistic infections:**

- The acute phase
- The chronic phase  1- (PGL)
2- (ARC)
- AIDS (the end stage of the disease)

Acute phase:

- Incubation period 2 weeks and lasts for about 12 weeks.
- Mostly asymptomatic, but in about 25-65% of the cases, patients may develop symptoms resemble infectious mononucleosis or Flu (fever, headache, anorexia, fatigue, lymphadenopathy, skin rash) which resolved in 2 weeks.
- Rapid viral replication (high viral load $>10^6$ copies/mL).
- Gradual decrease in CD4+ T cell count.

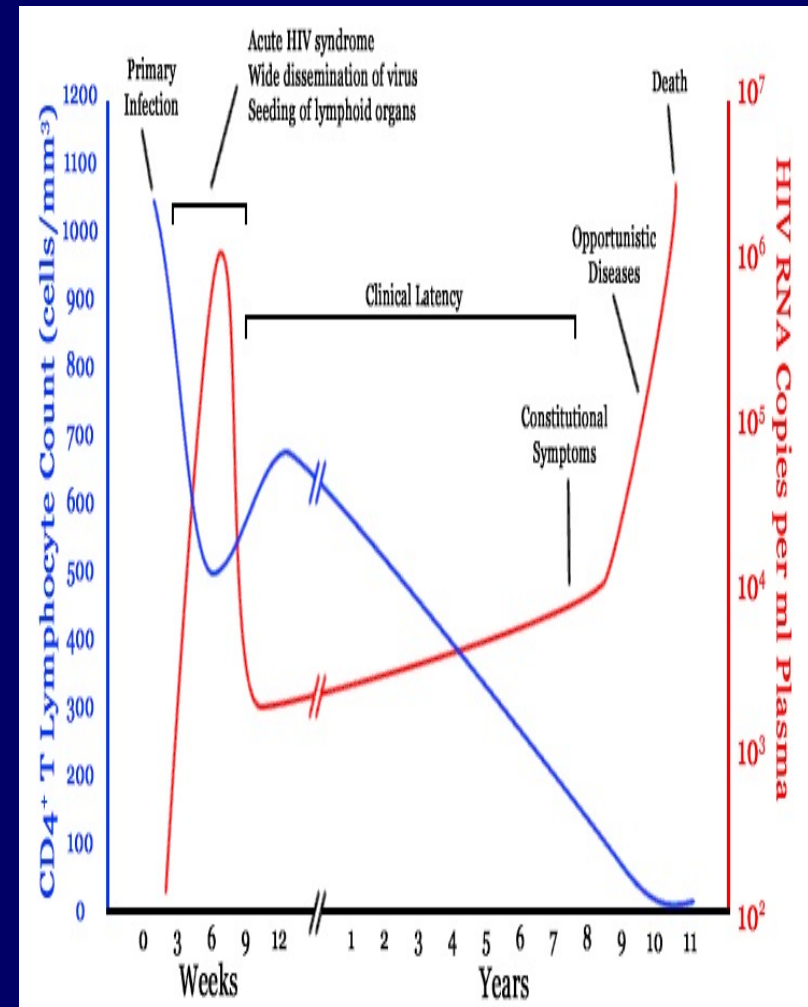
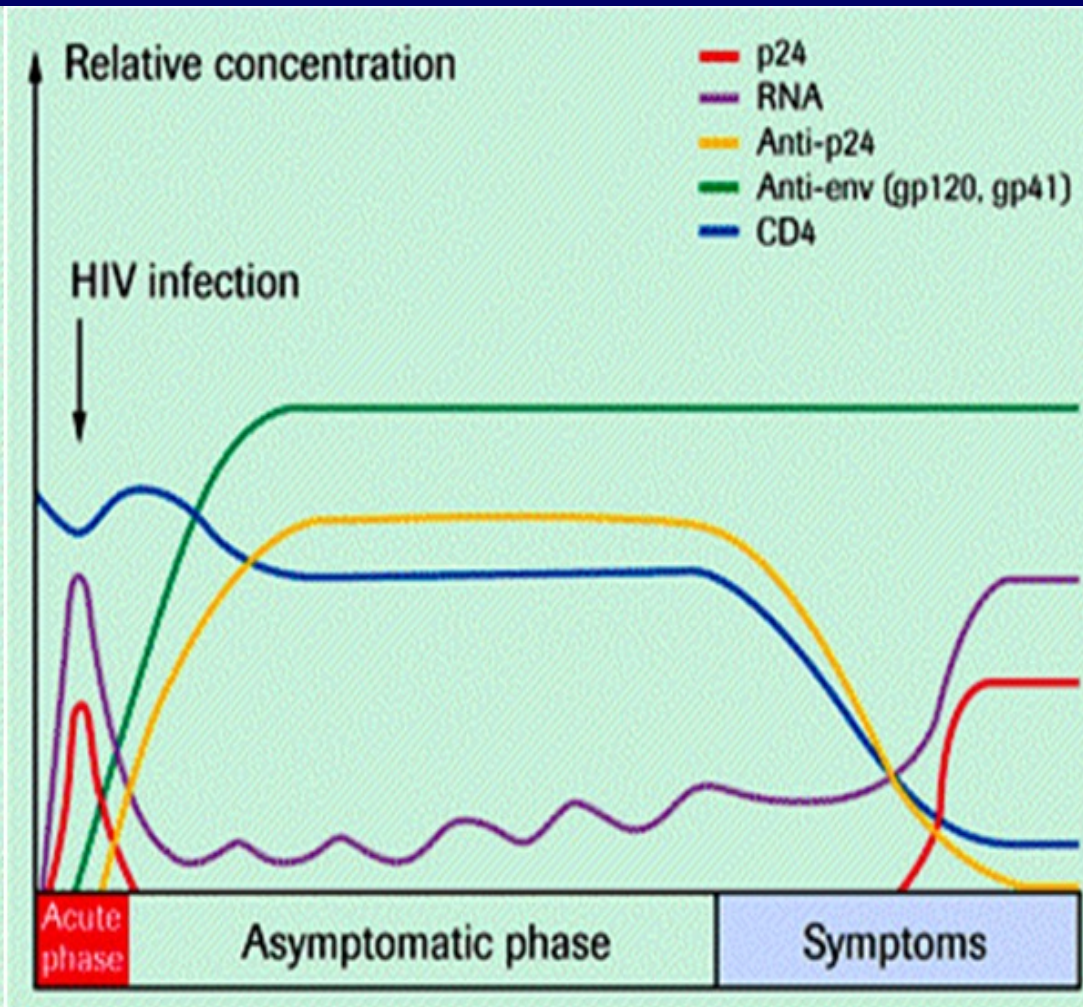
Blood markers in the acute stage:

Normal to slightly decrease no of **CD4+ T cells**.

- Appearance of **the viral RNA**, and then **the core antigen (p24 antigen)** which indicate active viral replication.
- Appearance of two antibodies, **Anti-envelop (Anti-gp12 & Anti-core (Anti-p24))**.
- **The 1st choice marker for detection HIV in the acute phase is HIV RNA.**



Serological profile of HIV infection



Chronic phase:

- Lasts for about > 10 yrs in adults, and 5 years in children.
- Totally asymptomatic but the patients is still **contagious**.
- Relatively low viral load ($<10^4$ copies/mL).
- CD4+ T cell count decrease but still > 200 cells/mm³.
- **At the end of this stage, two syndromes appear:**
 1. **Persistent generalized lymphadenopathy (PGL).**
 2. **AIDS-related complex (ARC).**

1-Persistent generalized lymphadenopathy (PGL)

Is defined as enlargement of lymph nodes for at least 1 cm in diameter in the absence of any illnesses or medications that known to cause PGL.

Clinical features:

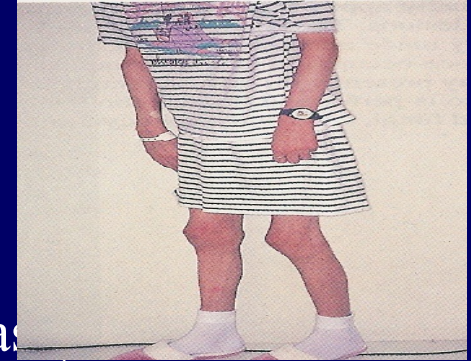
- In two or more lymph nodes **out** of the inguinal area.
- Persists for at least 3 months.



2-AIDS-related complex (ARC)

Is a group of clinical symptoms that come before AIDS and may include the following:

- 1-Fever of unknown origin that persists > 1 month.
- 2-Chronic diarrhea, persisting > 1 month.
- 3-Weight loss > 10% of the original weight (slim disease)
- 4-Fatigue, night sweating, and malaise.
- 5- Neurological disease as myelopathy and peripheral neuropathy.

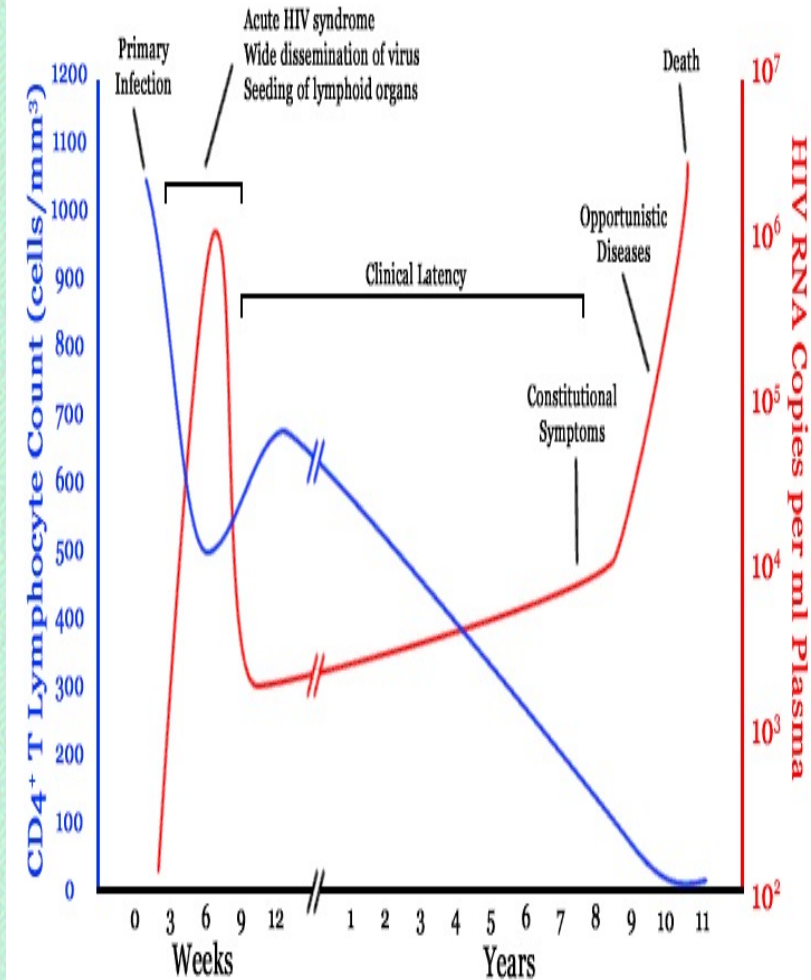
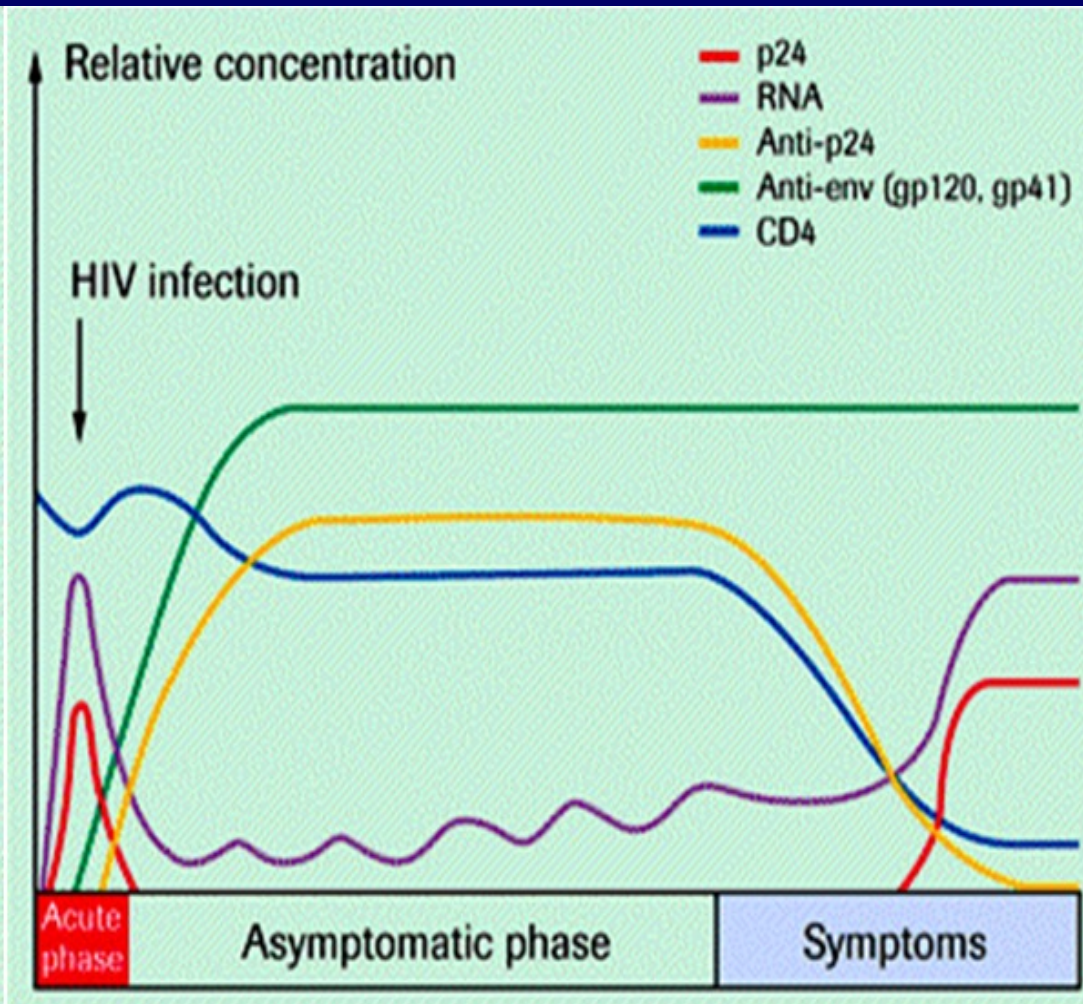


Blood markers in the chronic stage:

Viral load (**HIV RNA**) increases gradually, but **HIV core antigen (p24)** may not appear in blood.

- Anti-envelop (**Anti-gp120**) & Anti-core (**Anti-p24**) are positive.
- **CD4+ T cell** count **gradually decreased** but still more than >200 cells/mm³

Serological profile of HIV infection



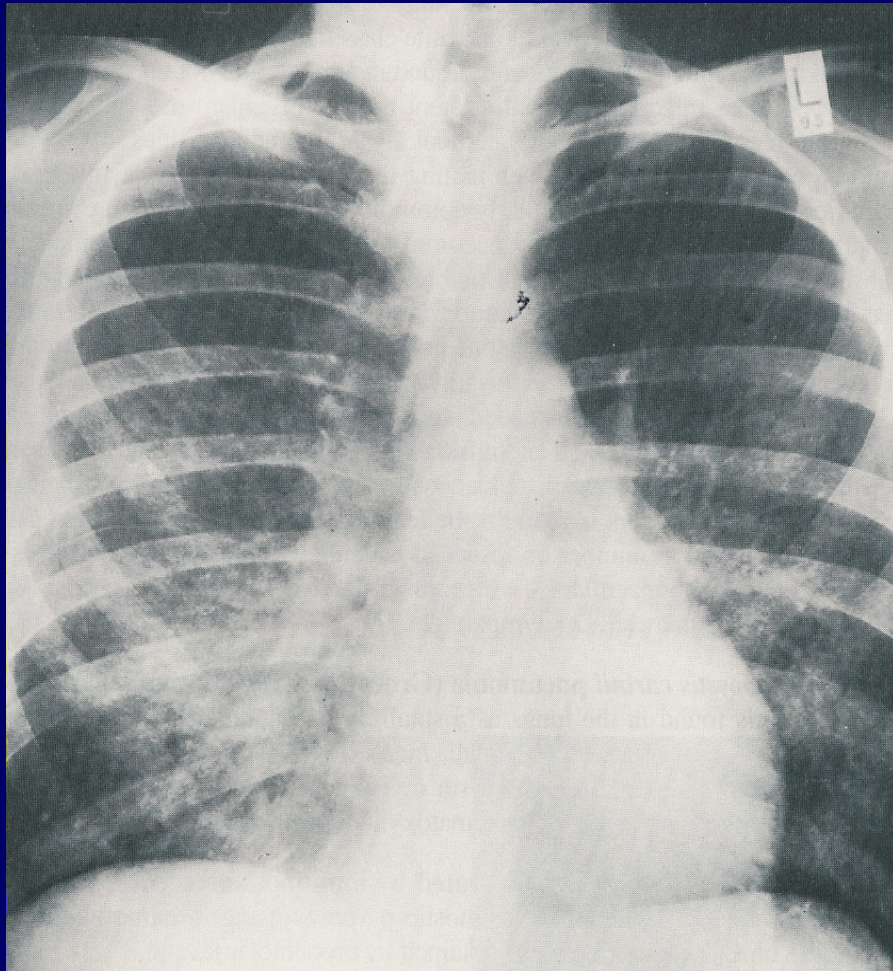
AIDS phase:

- The end stage of the disease.
- Continuous viral replication (high viral load).
- Marked decrease in CD4+ T cell count **< 200 cell/mm³**.
- Defects in cellular immunity.
- **Persistent or frequent multiple opportunistic infections as;**
- **Viral : CMV ,EBV.**
- **Bacterial: Mycobacterium, Mycoplasma.**
- **Protozoa: Toxoplasma, cryptosporidium.**
- **Fungi :Pneumocystis carnie, disseminated candida infection.**

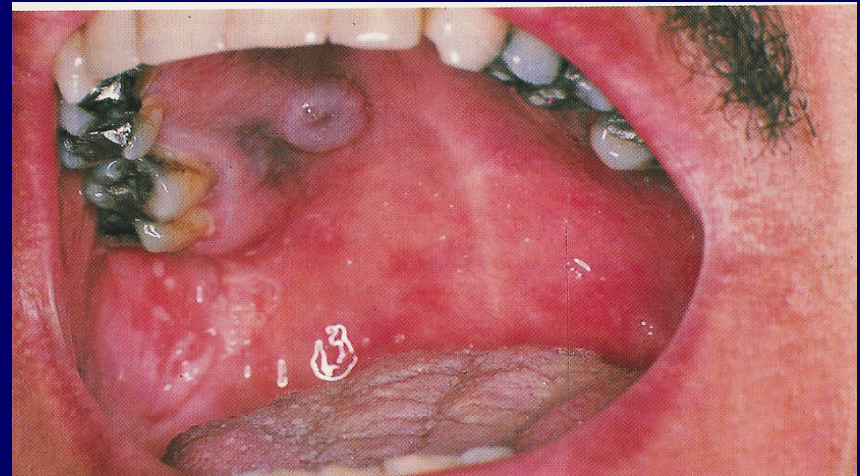


Unusual cancer (Kaposi sarcoma).

Pneumocystis pneumonia

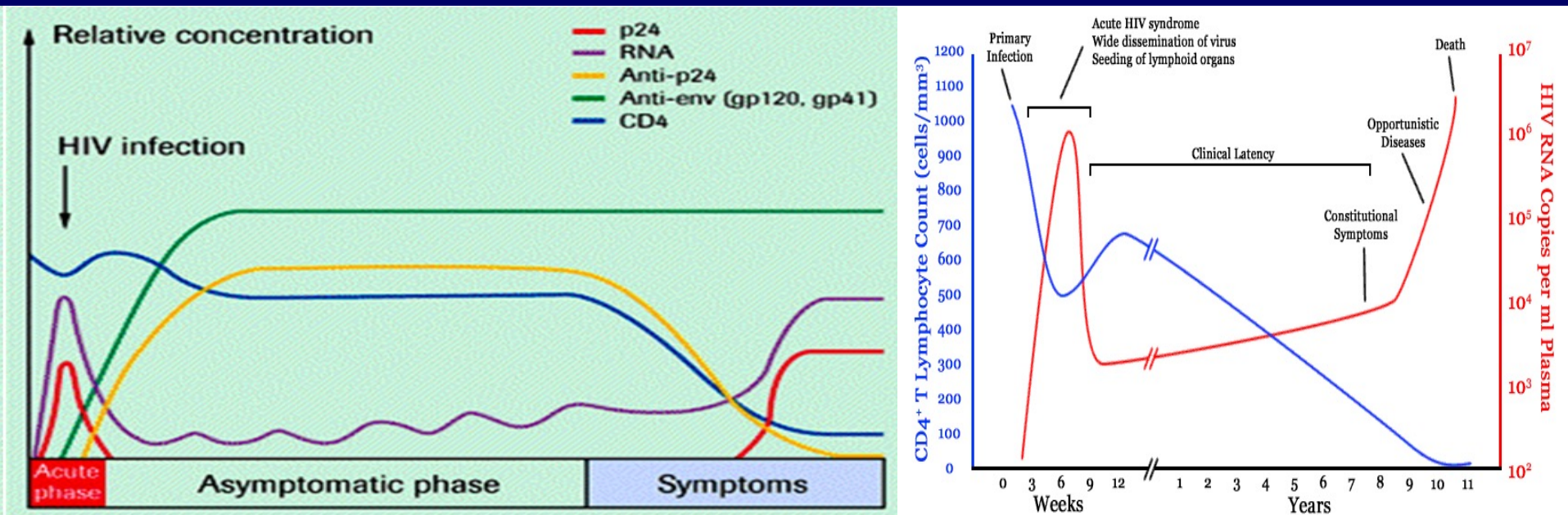


Kaposi sarcoma



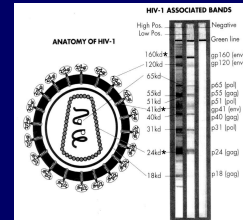
Serological profile of HIV infection

- High viral load (**HIV RNA**), and **HIV core antigen (p24)** appears in blood.
- Detection of both HIV RNA & the antigen p24 indicative of active viral replication.
- **Anti-envelop (Anti-gp120) & Anti-core (Anti-p24) are positive.**
- **CD4+ T cell count decreased to very low levels (<200 cells/mm³).**



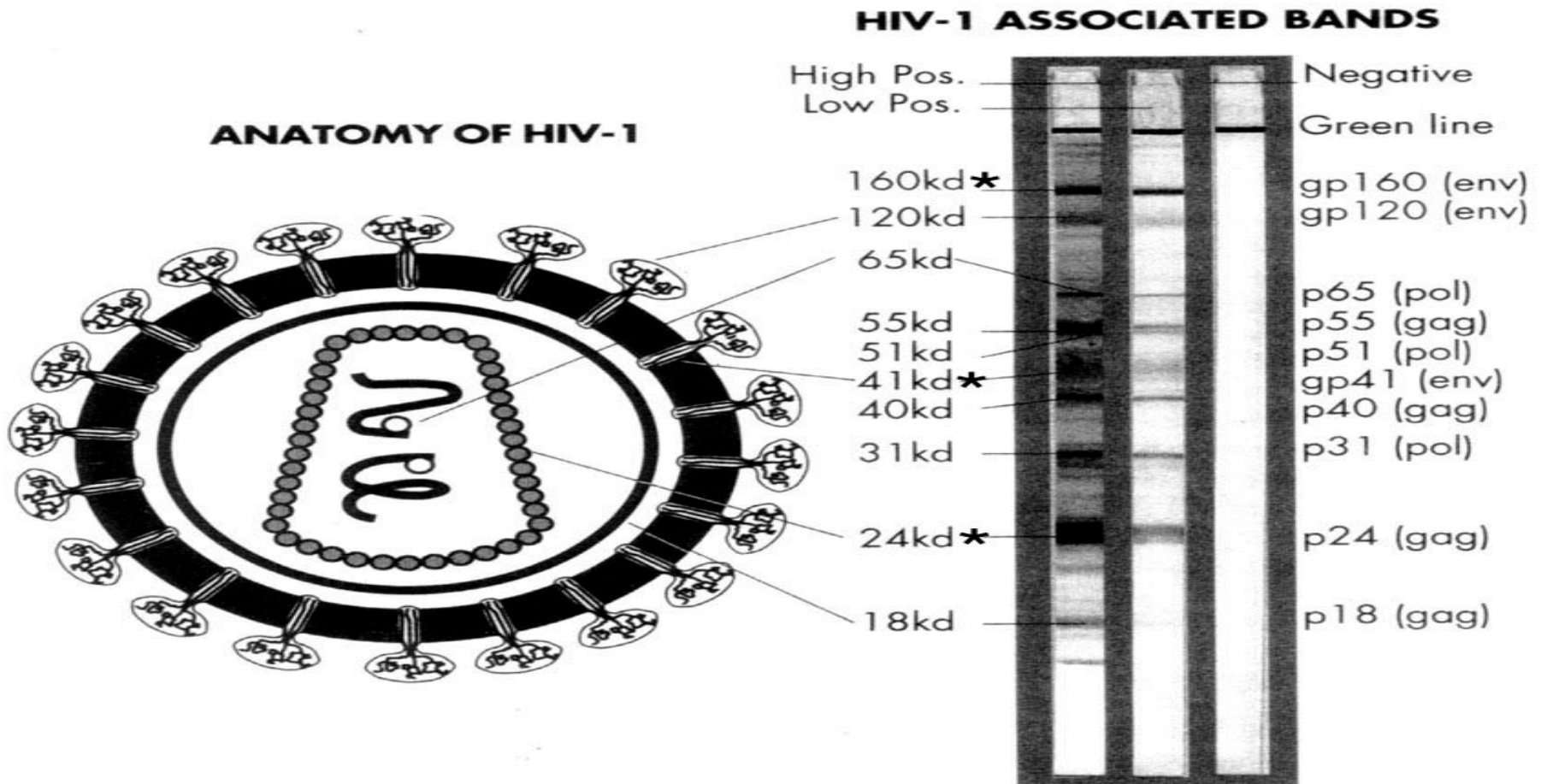
How to diagnose an HIV patient?

- Patient's history with or without clinical symptoms may give hints for a physician whether the patient has ever exposed to HIV or not.
- Screening patient's serum by **ELISA** for both (**HIV Ag & HIV Ab**) if the result is **+ve we** repeated the specimen twice in duplicate if still giving **+ve result will do confirmatory tests (Western Blot)**.
- Blood viral load by PCR is also used as confirmatory test and to follow up patients response to treatment.



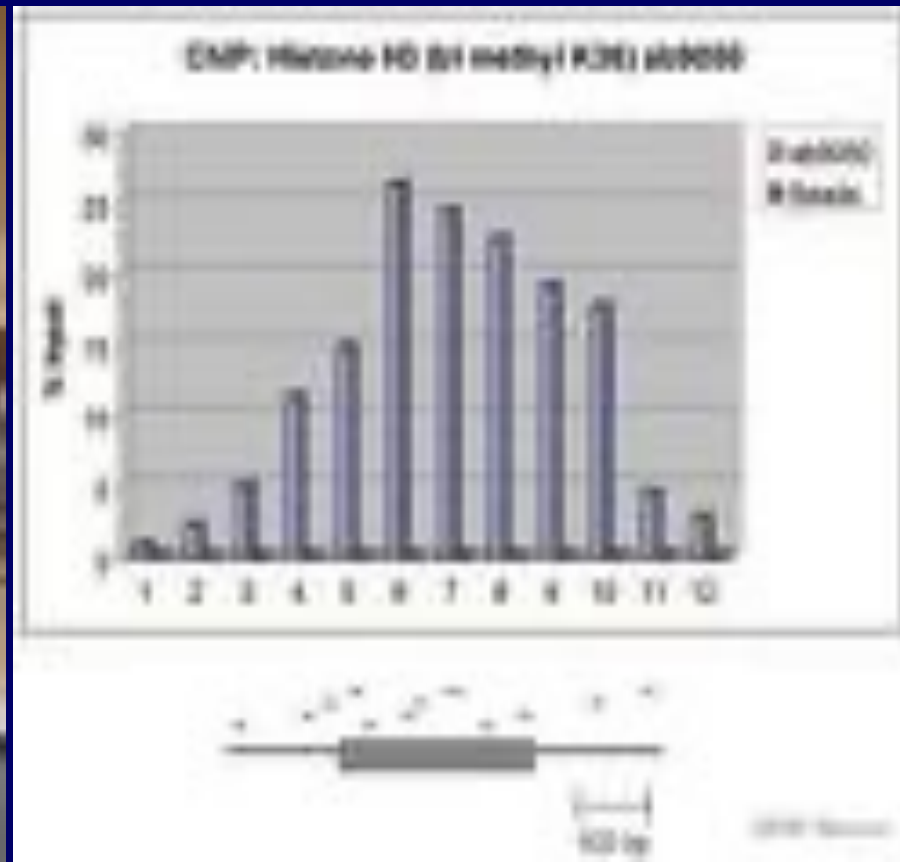
Western Blot

To confirm the presence of Anti-HIV to the structural proteins of the virus by **ELECTROPHORESIS**



PCR

For detection of **HIV RNA** in the blood (viral load) this test is important for HIV diagnosis in infant of infected mother and also to monitor the antiviral treatment



Management & prevention

No vaccine is available to prevent HIV infection, and thus the best strategies to control the spread of HIV infection are the following:

- Religious education (teaching the risk of making prohibited relations).
- Public health education (teaching the risk of using shared materials).
- Practice safer sex by having one sexual partner.
- Advise of using condoms when is necessary.

Treatment

- Is a combined therapy known as high active antiretroviral therapy (HAART).
- **NOTE:** HAART does not clear (**eradicate**) the virus from the body, and should be taken all life.
- **NOTE:** HAART treated patients are still contagious even if their blood viral load below detection level (< 50 copies/mL).
- HAART is usually composed of two reverse transcriptase inhibitors and one protease inhibitor.

Goals of HIV treatment

To inhibit viral replication.

To control chronic immune activation and keep the immune system as close as possible to the normal state.

To prevent the development of opportunistic infections.

To minimize the chance of viral transmission especially from mother to neonate.

Thank you for your
attention !

