L:10 Virology

By

Prof.Dr . Nada Khazal K. Hindi

Rotaviruses

Epidemiology Rotaviruses are divided into seven serogroups (A through G) of which group A is the most important cause of outbreaks of disease in humans. Transmission of rotaviruses is via the fecal oral route. Rotavirus infections account for about fifty percent of **cases of severe diarrhea in infants and young children** (up to two years of age)

Clinical significance

Following ingestion, rotaviruses infect the epithelial cells of the small intestine, primarily the jejunum. [Note: Rotaviruses are able to reach the small intestine because they are resistant to the acid pH of the stomach.] The incubation period is usually 48 hours or less. Infection can be subclinical or may result in symptoms ranging from mild diarrhea and vomiting to severe, nonbloody, watery diarrhea with dehydration and loss of electrolytes. The patients who are severely ill are generally hospitalized, with fluid and electrolyte losses rapidly corrected.

- **Structure of Rotavirus:-**
- The genome of rotaviruses (***__**dsRNA**__). in the __**family *Reoviridae***__. The RNA is surrounded by a three-layered ***__**icosahedral protein capsid**__. Viral particles are ***__**not enveloped**__

****__**Rotaviruses are the most common cause of diarrhoeal disease among infants and young children**__. **Nearly every child in the world is infected with a rotavirus at least once by the age of five.

**Immunity develops with each infection, so subsequent infections are less severe; **adults are rarely affected.

There are nine species of the genus, referred to as A, B, C, D, F, G, H, I and J.

****Rotavirus A**, the most common species, causes more than 90% of rotavirus infections in humans.

Rotavirus E, which is seen in pigs, has not been confirmed as a distinct species.

It infects and damages the cells that line the small intestine and causes gastroenteritis (which is often called ****"__**stomach flu**__" despite having no relation to influenza).

- **Transmsion:-**
- **Rotaviruses are transmitted by the ***faecal-oral route**, via contact with contaminated hands, surfaces and objects, and **possibly by the respiratory route**. Viral diarrhoea is highly contagious.
- Rotaviruses are stable in the environment. The viruses survive between 9 and 19 days.
- the incidence of rotavirus infection in countries with high and low health standards is similar.

- **Prevention:-**
- ***Centers for Disease Control and Prevention (CDC) recommends** **routine vaccination** of **infants** with either of the available oral vaccines, **RotaTeq** or **Rotarix**. The vaccines help prevent severe diarrhea and vomiting caused by rotavirus.
- **-Good hygiene** is important in keeping your child safe from rotavirus.

- **Sign and Symptom:-**
- ***<u>**Rotaviral enteritis**</u> Once a child is infected by the virus, there is an incubation period of about 2 days. The period of illness is acute,which is a mild to severe disease .Symptoms often start with **vomiting** followed by 4-8 days of **watery profuse diarrhoea**, **nausea**, **low-grade fever**, and **Dehydration** is the most common cause of death related to rotavirus infection.
- -*Rotavirus A* infections are typically mild or asymptomatic, as the immune system provides some protection. Consequently, ***symptomatic infection rates are highest in children under <u>two years</u> of age and decrease progressively towards 45 years of age**.
- **The most severe symptoms tend to occur **in children six months to two years of age**, the **elderly**, and those with **immunodeficiency**.
- -Due to immunity acquired in childhood, most adults are not susceptible to rotavirus; gastroenteritis in adults usually has a cause other than rotavirus, but **asymptomatic infections in adults may maintain the transmission of infection in the community**.
- -There is some evidence to suggest blood group secretor status and the predominant bacteria in the gut can impact on the susceptibility to infection by rotaviruses**.**
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**Poliovirus is RNA non-enveloped viruses

The causative agent of **polio (also known as **poliomyelitis**), is a **Poliovirus** of serotype of the species **Enterovirus C**, in the family of **Picornaviridae.**

Poliovirus is composed of an RNA genome : **single-stranded positive-sense RNA (+ssRNA) and a protein capsid (**icosahedral symmetry)**.

Transmission:

Poliovirus is very contagious and spreads through person-to-person contact.

It lives in an infected person's throat and intestines.

Poliovirus is an **enterovirus. **Infection occurs via the fecal–oral route**, meaning that the virus can be ingested through the mouth and viral replication occurs in the alimentary tract. **Spreads through contact with the feces of an infected person.**

Droplets from a sneeze or cough of an infected person (less common).

Clinical significance of Poliomyelitis (flaccid paralysis)

- **Poliomyelitis** is an acute illness in which the poliovirus selectively **destroys the lower motor neurons of the spinal cord and brainstem, resulting in flaccid, asymmetric weakness or paralysis**. The few cases of polio that occur (less than ten per year) are all caused by the reversion to virulence of the virus in **the live-attenuated Sabin polio vaccine.**
- **pathogenesis**:
- Poliovirus infections may follow one of several courses:
- 1) asymptomatic infection, which occurs in 90 to 95 percent of cases and causes no disease and no sequelae;
- 2) abortive infection;
- 3) nonparalytic infection
- 4) paralytic Poliomyelitis.

The classic presentation of paralytic Poliomyelitis is flaccid paralysis, most often affecting the lower limbs. This is a result of viral replication in, and destruction of the lower motor neurons in the anterior of the spinal cord. Respiratory paralysis may also occur, following infection of the brain stem. Poliomyelitis should be considered in any unimmunized person with the combination of fever, headache, neck and back pain, asymmetric flaccid paralysis without sensory loss, and pleocytosis (an increase in the number of lymphocytes in the spinal fluid).

In 95% of cases only a primary, transient presence of viremia (virus in the bloodstream) occurs, and the poliovirus infection is asymptomatic. In about 5% of cases, the virus spreads and replicates in other sites such as brown fat, reticuloendothelial tissue, and muscle. The sustained viral replication causes secondary viremia and leads to the development of minor symptoms such as fever, headache, and sore throat. Paralytic poliomyelitis occurs in less than 1% of poliovirus infections. Paralytic disease occurs when the virus enters the central nervous system (CNS) and replicates in motor neurons within the spinal cord, brain stem, or motor cortex, resulting in the selective destruction of motor neurons leading to temporary or permanent paralysis. This is a very rare event in babies, who still have anti-poliovirus antibodies acquired from their mothers. In rare cases, paralytic poliomyelitis leads to respiratory arrest and death. In cases of paralytic disease, muscle pain and spasms are frequently observed prior to onset of weakness and paralysis. Paralysis typically persists from days to weeks prior to recovery.

Symptoms:-

Most people who get infected with poliovirus (72%) **will not have any visible symptoms.**

About **1 out of 4 people** with poliovirus infection **will have flu-like symptoms** that may include:

Sore throat, Fever, Tiredness, Nausea, Headache, Stomach pain

These symptoms usually last 2 to 5 days, then go away on their own.

A smaller proportion of people with poliovirus infection **will develop other, more serious symptoms** that affect the brain and spinal cord:

Paresthesia (feeling of pins and needles in the legs)

Meningitis (infection of the covering of the spinal cord and/or brain) occurs in about 1 out of 25 people with poliovirus infection

Paralysis (can't move parts of the body) or weakness in the arms, legs, or both, occurs in about 1 out of 200 people with poliovirus infection

Paralysis is the most severe symptom associated with polio, because it can lead to permanent disability and death. About 2 - 10 % of people who have paralysis from poliovirus infection die, because the virus affects the muscles.

Even children who seem to fully recover can develop new muscle pain, weakness, or paralysis as adults, 15 to 40 years later. This is called post-polio syndrome.

Prevention :

***There are two types of vaccine that can prevent polio:

***__Inactivated poliovirus vaccine__ (IPV) given as an injection in the leg or arm, depending on the patient's age.

***__Oral poliovirus vaccine__ (OPV) is still used throughout much of the world.

Polio vaccine protects children by preparing their bodies to fight the poliovirus. **Almost all children (99% of children who get all the recommended doses of the inactivated polio vaccine will be protected from polio.**

- **Human Immunodeficiency Virus (HIV)**
- **Acquired immune deficiency syndrome (AIDS)** was first reported in the United States in 1981.
- family of **Retroviruses**, ssRNA, has **lipid envelope**
- The virus infects **CD4+** helper T cells, lymphocytes, monocytes, and dendritic cells,
- **Transmission of HIV**: can transmission by saliva, urine, an insect bite, Sexual contact, blood Transfusions, Contaminated needles, and **Perinatal transmission** (during passage of the baby through the birth canal, or via breast-feeding)

Clinical feature

- **Initial infection:** Lymph nodes also become infected during this time;
- **Latent period:** The acute phase viremia is eventually reduced significantly with the appearance of a HIV-specific cytotoxic **CD8** T-lymphocyte response,
- **complications of HIV infection during the latent period**: lymphadenopathy (swollen lymph nodes), diarrhea, chronic fevers, night sweats, and weight loss. The more common opportunistic infections & coinfection such as herpes zoster and candidiasis may occur repeatedly during this period,

- **Human Immunodeficiency Virus (HIV)**
- **Acquired immune deficiency syndrome (AIDS)**

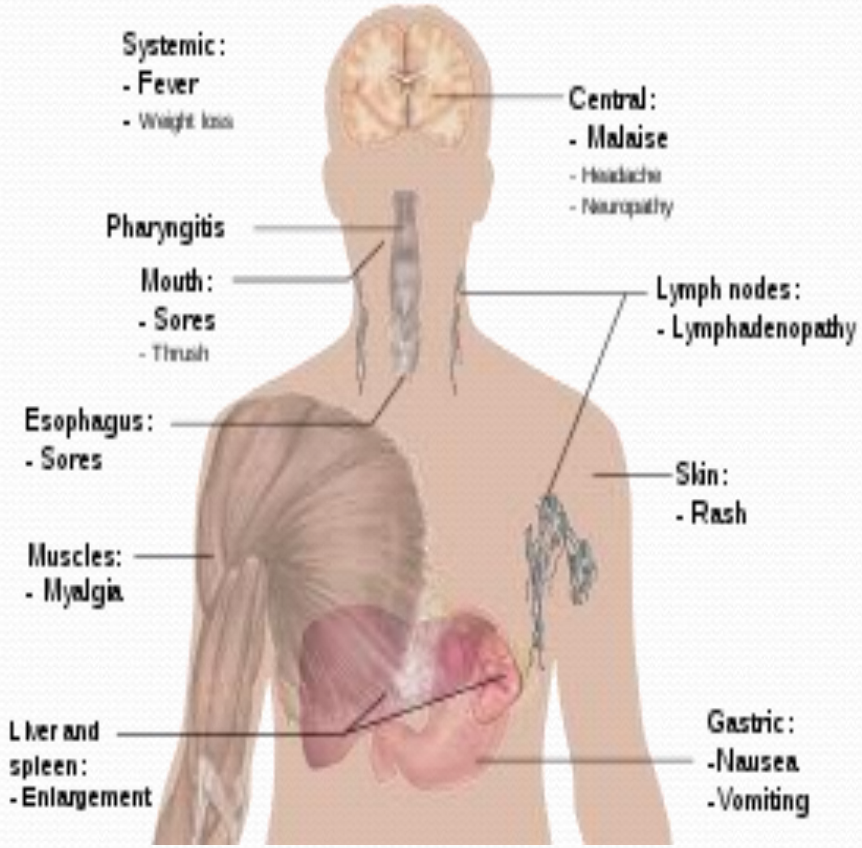
- **Latent Progression to AIDS: A number of virologic and immunologic changes**

Any stimulation of an immune response causing activation of resting T cells also activates HIV replication. The eventual result is an increasingly rapid **decline in CD4+ count**, accompanied by loss of immune capacity.

End-stage AIDS: Nearly all systems of the body can be affected as a result of HIV infection, either by HIV itself or by opportunistic organisms. The weakening immune system leads to many complications including malignancies

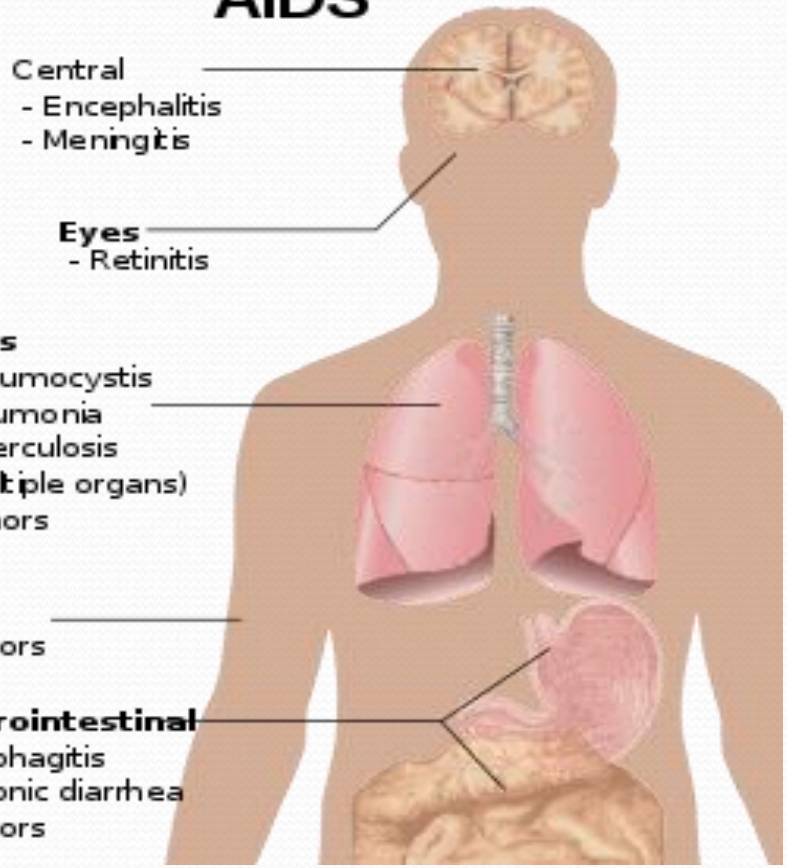
Main symptoms of

Acute HIV infection



Main symptoms of

AIDS



**** **Disease:** Acquired Immuno-Deficiency Syndrome (AIDS)

***Causative agent:** human immunodeficiency viruses (HIV)

The human immunodeficiency viruses 1 and 2 (HIV-1, HIV-2) originated from the simian immunodeficiency viruses (SIVs) of primates. Thus, HIV-1 and HIV-2 each had a zoonotic origin but now spread directly from human to human.

***HIV-1 and HIV-2, are members of the family of **Retroviruses,**

Retroviruses have been found in various vertebrate species, associated with a wide variety of diseases, in both animals and humans

HIV-1 was first isolated in 1983 and HIV-2 in 1986 and they represent two different epidemics.

**The SIV of chimpanzees (SIV_{cpz}) gave rise to HIV-1 in humans,

*The SIV of the sooty mangabey monkey (SIV_{sm}) gave rise to HIV-2 in humans.

HIV structure:

The HIV are approximately **100 nm in diameter.

*Has a **lipid envelope**, with **glycoprotein gp41** to which the **surface glycoprotein gp120** is attached

The human immunodeficiency viruses (HIV):

Structure: -

Is positive-sense, viral RNA genome (+sense ssRNA The viral RNA genome is converted (reverse transcribed) into double-stranded DNA by a virally encoded reverse transcriptase that is transported along with the viral genome in the virus particle. The resulting viral DNA is then imported into the cell nucleus and integrated into the cellular DNA by a virally encoded integrase and host co-factors. Once integrated, the virus may become latent, allowing the virus and its host cell to avoid detection by the immune system.

The HIV strains in **Group M** are the ones mainly responsible for the **HIV/AIDS pandemic**

They have been sub classified into subtypes (or clades) A-K.

- **HIV symptoms:**
- There are three main stages of HIV infection: acute infection, clinical latency, and AIDS.
- ***Stage 1: Acute stage, primary HIV infection:**
- The early symptoms of HIV is **flu-like symptoms** or an **Infectious mononucleosis-like illness** (2 to 4) weeks after getting HIV infection and lasted 1to 2 weeks. some people don't have any symptoms
- large tender lymph nodes, throat inflammation, headache, tiredness, and/or sores of the mouth and genitals. The rash, presents itself on the trunk and is maculopapular, opportunistic infections .vomiting or diarrhea may occur. Neurological symptoms of peripheral neuropathy or Guillain–Barré syndrome also occurs.
- These symptoms happen because human body is reacting to the HIV virus. Cells that are infected with HIV are circulating throughout blood. In response, immune system tries to attack the virus by producing HIV antibodies, this process is called **seroconversion**.
- The only way to know if person have HIV is by taking a test (HIV will not always show up in a test at this early stage, and you may need to test again later to confirm your result
- In the early stages of infection, the amount of HIV in blood is high and can to pass the virus onto others.

****Stage 2: The asymptomatic stage (dormant or latent stage), latency:**

The infected patient if not treated have no symptom in this stage of about 10 (depending on age, background and general health).

the virus will still be active, infecting new cells and making copies of itself. HIV can still be passed on during this stage. If left untreated, over time, HIV infection will cause severe damage to the immune system.

*****Stage 3: Symptomatic HIV infection (AIDS stage):**

*In the third stage of HIV infection a person's immune system is **severely damaged**.

They get serious infections or diseases 'opportunistic infections'.

Symptoms can include: weight loss, chronic diarrhea, night sweats, fever, persistent cough, mouth and skin problems

- ***Acquired immunodeficiency syndrome (AIDS stage) :is defined as an HIV infection with **either a $CD4^+$ T cell count below 200 cells per µL** or **the occurrence of specific diseases associated with HIV infection**.
- The most common sign and symptoms of AIDS are:
- pneumocystis pneumonia
- cachexia in the form of HIV wasting syndrome
- esophageal candidiasis.
- recurrent respiratory tract infections.
- Opportunistic infections may be caused by bacteria, viruses, fungi, and parasites
- People with AIDS have an increased risk of developing viral-induced cancers, including
- ** Kaposi's sarcoma
- Burkitt's lymphoma,
- primary central nervous system lymphoma
- cervical cancer.
- Kaposi's sarcoma is the most common cancer, occurring in people with HIV.

Mode of Transmission:

can be transmitted through body fluids such as **blood, plasma , serum,**

sexual contact **(Genital secretions**): unprotected sexual intercourse

Blood transfusion or Transplantation: organs transplantation as kidney, bone and cornea

Vertical transmission (Congenital or Transplacental transmission) from mother to fetus through placenta during **pregnancy, delivery,** or **breastfeeding**

needle stick injury and open lesions: can be points of entry for HIV.

**There is no risk of acquiring HIV if exposed to feces, nasal secretions, saliva, sputum, sweat, tears, urine, or vomit unless these are contaminated with blood.

Prevention of HIV/AIDS:

Use condoms (using Male latex condoms during sexual contact

Prevent anal or oral sex, and prevent multiple partners

Don't share needles

If you are at risk for HIV, ask your health care provider if pre-exposure prophylaxis (PrEP) is right for you.

If you think you've been exposed to HIV within 3 days, ask a health care provider about post-exposure prophylaxis (PEP) right away. PEP can prevent HIV, but it must be started within 72 hours.

use of a combination of antiviral medications during pregnancy and after birth in the infant, and potentially includes bottle feeding rather than breastfeeding