

Enteric viruses (Polio, Rota)

rum of viral genera that invade and replicate in the represent a wide spectrum **Enteric virus** are the commonest causes of gastroenteritis Enteric viruses. tract mucosa of the intestinal worldwide, they are most often transmitted via the fecal-oral route, with transmission by direct human contact and via fomites being common. Enteric viruses may also be can be grouped as follows: Enteric viruses. Present in contaminated water supplies **1)** Viruses causing localized inflammation at any level of the intestinal tract, predominantly in small intestinal mucosa, resulting in acute gastroenteritis, for example, rotaviruses, caliciviruses, adenoviruses, astroviruses. **2)** Viruses that multiply at any level of the intestinal tract, causing few enteric symptoms prior to producing clinical disease at a distant site, for example, measles virus, reoviruses, enteroviruses (including polioviruses, coxsackieviruses, enteroviruses, hepatitis A and E). 3) Viruses that spread to the intestinal tract during the later stages of systemic disease, generally in an immunocompromised host, for example, human immunodeficiency virus (HIV), cytomegalovirus.

Polio Virus

Polio virus is the causative agent of polio (also known as poliomyelitis) which is a highly contagious disease caused by a virus that attacks the central nervous system. Children younger than 5 years old are more likely to contract the virus than any other group.

Structure and properties of polio Virus 1- Virus classification: Picornaviridae, Genus Enteroviruses. 2- Virion: Viral particle is spherical in shape about 30 nm in diameter with icosahedral symmetry. 3- Genome: is a single-stranded positive-sense RNA (+ssRNA), linear with 7500 nucleotides long.

4- The particles are simple in that they are composed of **a protein shell** surrounding the **naked RNA genome**.

5- The virus particles **lack a lipid envelope**, and their infectivity is insensitive to organic solvents. **5-** Humans are the only susceptible hosts. **6-** Three serotypes of

poliovirus, PV-1, PV-2, and PV-3. **7- Capsid** contains 60 copies each of the four viral polypeptides VP1, VP2, VP3, and VP4.

8- Replication of Polio Virus occur in the **cytoplasm**. viral particles are release from the host cell through **lysis** of the cell.

Pathogenesis of Polio Virus

The mouth is the portal of entry for the virus, transmitted by fecal oral route on ingestion of contaminated water. **The incubation period is 9-12 days.**

Following ingestion, the virus multiplies in the oropharyngeal and intestinal mucosa. The lymphatic system, in particular the tonsils and the Peyer's patches of the ileum are invaded and the virus enters the blood resulting in primary viraemia. Antibodies to the virus appear early in the disease, usually before paralysis occurs. The antibodies are produced to prevent infection from spreading. In a minority of cases, on continued infection and multiplication of virus in the Reticuloendothelial System (**RES**), it invades the blood stream causing secondary viremia. During this period of viremia, the poliovirus crosses the blood brain barrier and gain access to the brain. The virus shows tissue tropism by specifically combining with neural cells. The virus recognizes the receptor present on the anterior horn of spinal cord, dorsal root ganglia and motor neurons. The destruction of motor neurons leads to paralysis. **Clinical Manifestations of Polio Virus**

There are 3 possible outcomes of infection:

1- Subclinical infection (90 - 95%): in apparent subclinical infection account for the vast majority of poliovirus infections.

2- Abortive infection (4 - 8%): a minor influenza-like illness occurs characterized by fever, headache, sore throat, loss of appetite, vomiting, and abdominal pain. **Neurological symptoms are typically absent.**

3- Major illness (1-2%): the major illness may present 2-3 days following the minor illness or without any preceding minor illness. Signs of aseptic meningitis are common. Involvement of the anterior horn cells of spinal cord led to flaccid paralysis. Involvement of the medulla may lead to respiratory paralysis and death.

Laboratory Diagnosis of Polio Virus

Specimen: Stool, rectal swab, throat swab, CSF (rare)

1- Microscopy: Virus can be detected in stool specimens by direct electron microscopy or also by immune electron microscopy.

2- Virus isolation: Virus may be recovered from pharyngeal aspirations and feces. Virus isolation from feces and throat swab is carried out by cultivation on monkey kidney, human amnion, 6 days. –Cytopathogenic effects appear in 3 2 and other cell cultures. -HeLa cells, HepAn isolated virus is identified and typed by neutralization with specific antiserum.

3-Serodiagnosis: Demonstration of antibody titer in the serum sample collected at the time of acute illness and time of convalescence. **Neutralization test** and **complement fixation** test is carried out to demonstrate antibodies presence.

Treatment of Polio Virus: No antiviral treatments are available for the treatment of poliomyelitis.

Prevention: The disease may be prevented through Vaccination. There are two vaccines available: -

1- Intramuscular Poliovirus Vaccine (IPV): consists of formalin inactivated virus of all 3 poliovirus serotypes. Produces serum antibodies only: does not induce local immunity and thus will not prevent local infection of the gut.

2- Oral Poliovirus Vaccine (OPV) Consists of live attenuated virus of all 3 serotypes. Produces local immunity through the induction of an IgA response as well as systemic immunity.

Rotavirus ► Classification of Rotavirus:

- Family: **Reoviridae**
- Genus: **Rotavirus**
- Classified into seven distinct groups (A to G) based on structural antigen VP6. Group A, B, and C Rotaviruses are found in Human infection as well as animal infection. Group A Rotaviruses are most frequent Human pathogen.

► Structure, composition and properties of Rotavirus

- Characteristics” wheel” like appearance (Rota-means wheel).
- **Size:** 65nm-100nm in diameter.
- **Shape:** Spherical shape.
- **Symmetry:** Icosahedral.
- **Genome:** 11 segments of **double stranded RNA (ds RNA)**.
- **Protein:** 6 structural protein (VP) and 6 Non-structural protein (NSP).
- **Envelope:** Absent

Nucleic acid is surrounded by two layer of capsid- **inner capsid (VP6)** and **outer capsid (VP7)**.

VP4 is the spike protein, it is a cell surface receptor.

Replication: Occurs in cytoplasm of infected cell.

Rota virus contain an **RNA-dependent RNA polymerase** and other enzymes capable of producing capped RNA transcripts.

Rota virus do not **grow in cell line culture**. ► **Mode of Transmission:** □ Ingestion of contaminated food and water. □ Directly from feces contaminated fingers. □ Occasionally by droplet infection. □ Children below 5 years are mostly affected. □ Adults are infected by contact with pediatric cases. ► **Pathogenesis:**

Incubation period: 2-3 days

- Rota virus replicates in enterocyte near the tip of villi destroying enterocytes.
- Viral encoded toxin: early profuse, secretory diarrhea is caused by enterotoxin, NSP4.
- Disruption of intestinal epithelium due to virus replication
- Histologic changes of enterocytes that triggers enteric nervous system, intestinal secretion and immune response.
- The acute infection and diarrhea normally resolve within 7 days in immunocompetent hosts. **Clinical symptoms:**

1- Local infection:

- Acute Gastroenteritis, severe in case of infants aged 6-24 months.

- Infected Infants are unable to digest milk due to lactase deficiency caused by destruction of enterocytes
- Diarrhea, nausea and vomiting
- Malabsorption of Na^+ , water and disaccharides.
- Symptoms of Dehydration: decrease in urination, dry mouth and throat and feeling dizzy when standing up.

2. Systemic infection:

High grade Fever

Lymphocytosis and transient neutropenia.

Laboratory diagnosis: Specimen: feces in early infection,

1- Viral antigen detection: by solid phase agglutination, ELISA (it is sensitive for detected virus in stool sample, Electron microscopy.

2-PCR: For genotyping of Rotavirus.

3-Virus culture: No cell line culture.

Treatment:

Oral rehydration

- Other supportive rehydration therapy to control loss of water and electrolytes.

Vaccine: Two Oral rotavirus vaccines are currently licensed for use in infants: -

1- RotaTeq (RV5) is given in 3 doses at ages 2 months, 4 months, and 6 months.

2- Rotarix (RV1) is given in 2 doses at ages 2 months and 4 months