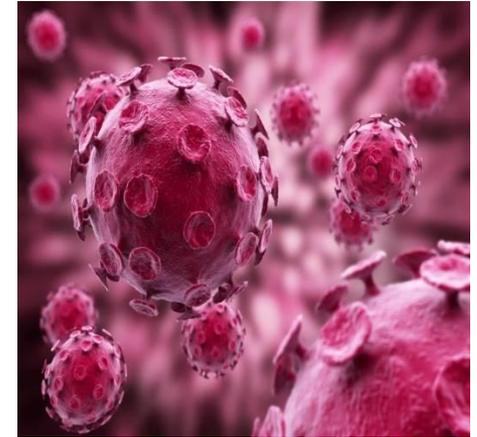


ENTEROVIRUSES

PNS Module 2022-2023

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PNS Module



Family: *Picornaviridae*

Characteristics:

- ▶ Small, 20-30 nm, icosahedral particles.
- ▶ Non-enveloped ss-RNA.
- ▶ They replicate in the cytoplasm .

Classification:

- nine genera.
- only five cause human diseases:

1 Genus *Enterovirus* Polio, Coxsackie, Echo, & Enteroviruses

2 Genus *Rhinovirus* Rhinoviruses

3 Genus *Hepatovirus* Hepatitis A virus

4 Genus *Parechovirus* Human Parechoviruses 1 & 2

5 Genus *Kobuvirus* Aichi virus Human Pathogens

Genus *Erbovirus* Equine Rhinitis B viruses 1 & 2

Genus *Cardiovirus* EMCV, Theiler's viruses

Genus *Aphthovirus* FMDV

Genus *Teschovirus* Porcine teschoviruses 1-10

Enteroviruses

They are divided into five groups:

Polioviruses (3 serotypes).

Coxsackie A viruses (> 20 serotypes).

Coxsackie B viruses (6 serotypes).

Echoviruses (31 serotypes).

Others , Enteroviruses types 68 – 71.

General characteristics of Enteroviruses:

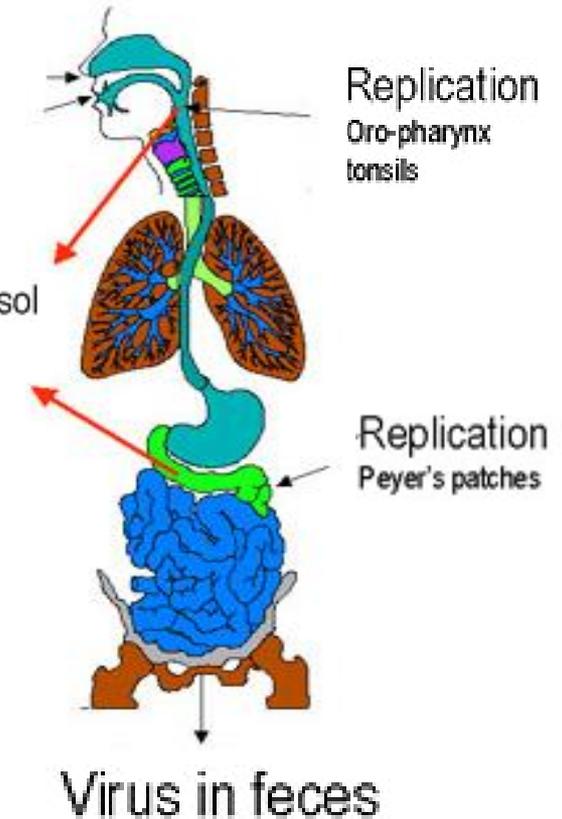
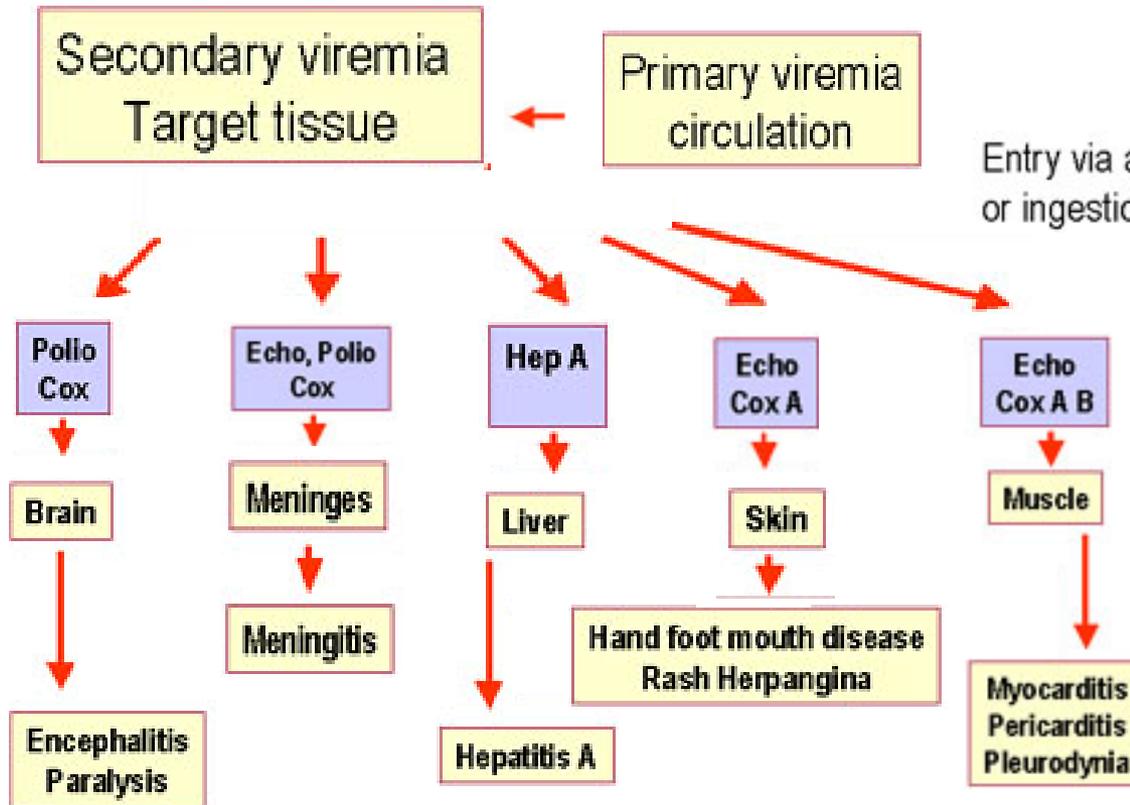
1. Replicate mainly in the gut.
2. They shed in stool.
3. Stable in acid pH.
4. ssRNA virus with icosahedral symmetry.
5. They cause neurological and non-neurological diseases.

Transmission

By the fecal oral route:

- ▶ Fruits and vegetables, water contaminated with infectious fecal material.
- ▶ Contamination of fruits and salads by food handlers.

ENTEROVIRUS PATHOGENESIS



CATAGORIES OF ENTEROVIRUSES

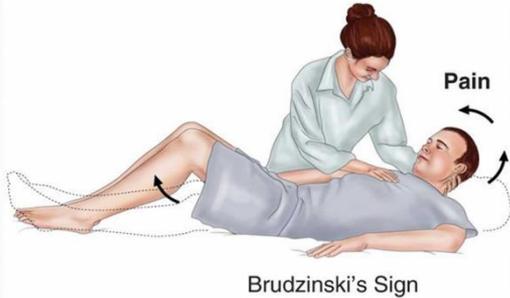
VIRUS	SEROTYPES	CLINICAL DISEASES
Polioviruses	3 types	Asymptomatic infection, <u>viral meningitis</u> , <u>paralytic disease</u> , <u>poliomyelitis</u>
Coxsackie A viruses	23 types (A1-A22, A24)	<u>Viral meningitis</u> plus, rash, ARD, myocarditis, orchitis
Coxsackie B viruses	6 types (B1-B6)	<u>Viral meningitis</u> , but no orchitis
Echoviruses	32 types	<u>Viral meningitis</u> , with orchitis
Other Enteroviruses	4 types(68-71)	<u>Viral meningitis</u>

Nuchal rigidity ——— Fever
 Headache ——— Emesis

Clinically ←



Meningitis



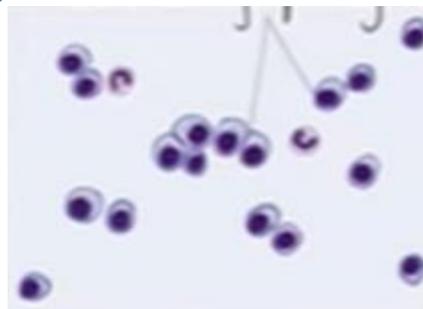
- 30 y male.
- 3 days history of sore throat

- Working as a preschool teacher
- Winter time.

CSF analysis

- Cell count
- Gran stain: bacteriologically sterile.
- Glucose: N
- Protein: Modest increase
- Later: molecular diagnosis

Elevated lymphocytes



Possible causes

1. Viral meningitis
2. TB
3. Autoimmune

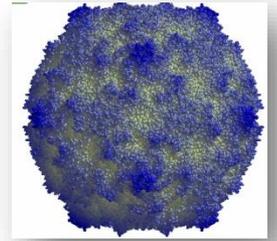
Enteroviral infection

→ Aseptic Meningitis

Types of meningitis

	Cells	Glucose	Proteins	Pressure
Normal	< 5 cells	2/3 rd BG	15-45 mg/dl	70-180 mm H2O
Bacterial	Neutrophil >1000	↓↓	↑	↑↑↑
Aseptic (Viral)	Lymphocytes 100-1000	N	N/↑	N/↑
Granulomatous (TB/Fungal)	Lymphocytes 100-1000	↓↓	↑	↑↑↑

Coxsackie viruses:



Characteristics:

- Naked nucleocapsid with single stranded, positive polarity RNA.
- Group A (24 serotypes)
- Group B (6 serotypes) viruses are defined by their different pathogenicity in mice.
- Group A causes wide spread myositis and flaccid paralysis and rapidly fatal.

Coxsackie viruses:

Diseases associated with Coxsackie A viruses

- Febrile rash.
- URT infection.
- Aseptic Meningitis.
- Herpangina.
- Hand, foot & mouth disease.

Disease associated with Coxsackie B viruses.

- ▶ Febrile rash.
- ▶ URT infection.
- ▶ Aseptic Meningitis.
- ▶ Peri & myocarditis.
- ▶ Juvenile diabetes/ pancreatitis .
- ▶ Pleurodynia (Bornholm disease): viral myalgia

Coxsackie viruses:

Transmission and Pathogenesis:

- Feal-oral route, respiratory aerosols
- Replicate in the oropharynx and intestinal tract.
- ---- through blood stream.
- A → skin and mucous membranes
- B → diseases in various organs (heart, liver, pancreas).
- A and B----- meninges and motor neurons (anterior horn cell).
- **Imm. Type specific IgG.**

Coxsackie A viruses specific diseases:

Herpangina:

- Fever, sore throat.
- Tender vesicles appear in the oropharynx.
- Recovery is usual .



Hand, foot and mouth disease:

- ▶ Vesicular rash on hands and feet and ulceration in the mouth
- ▶ Mainly children.
- ▶ Recovery is usual .



Coxsackie A viruses specific diseases:

Epidemic myalgia, pleuritic type chest pain.

Peri & myocarditis.

Fever, chest pain , congestive heart failure .

Juvenile diabetes/ pancreatitis .

Pleuritic chest pain is characterized by being well localized, sharp in nature and exacerbated by inspiration. Chest pain that does not have these characteristics is described as non-pleuritic. The main focus of investigation should be on diagnosing or excluding an acute coronary syndrome

Laboratory diagnosis:

- **By observing a rise in titer of neutralizing antibodies.**
- **PCR-based test → diagnosis of viral meningitis .**

Treatment & Prevention:

Neither antiviral drug therapy nor a vaccine.

Echoviruses:

- ECHO is: enteric cytopathic human orphan.

The term "orphans" is used to designate those viruses which cannot definitely be associated with any recognized disease syndrome.

- More than 30 serotypes.
- Transmitted by the **fecal–oral** route.
- Aseptic meningitis, URT inf., febrile illness, maculopapular rash, infantile diarrhea, hemorrhagic conjunctivitis.
- **Diagnosis:** Isolation of the virus in cell culture.
- **Treatment and Prevention:** no antiviral or vaccine.

Other Enteroviruses

Enterovirus 70:

- The main cause of **acute hemorrhagic conjunctivitis**, characterized by petechial hemorrhages on the bulbar conjunctiva.
- Complete recovery.
- No therapy.



Enterovirus 71:

- Is one of the leading causes of meningitis, encephalitis, and paralysis.
- Causes diarrhea, pulmonary hemorrhages.
- A major cause of hand-foot-and-mouth disease and herpangina.
- Two new **vaccines** appear to offer protection against it.



Enterovirus 68:

- Causes **respiratory illness**, varies from mild to severe--- pneumonia, respiratory failure.
- Causes **acute flaccid polio-like paralysis in children**. Recovery of motor function was poor.
- Diagnosis, by real-time PCR.
- No specific treatment and no vaccine, treatment is directed against symptoms.



Poliovirus:



Important Properties:

- **Host range:** human and non human primates.
- **Characteristics:** Naked nucleocapsid with single-stranded, +ssRNA.
- There are 3 serotypes, little cross reactivity.
- Type 1 is the most virulent and common.
- vaccines are “trivalent”.
- After infection: immunity → type specific.

Poliovirus:

Transmission and Pathogenesis:

Fecal-oral route.

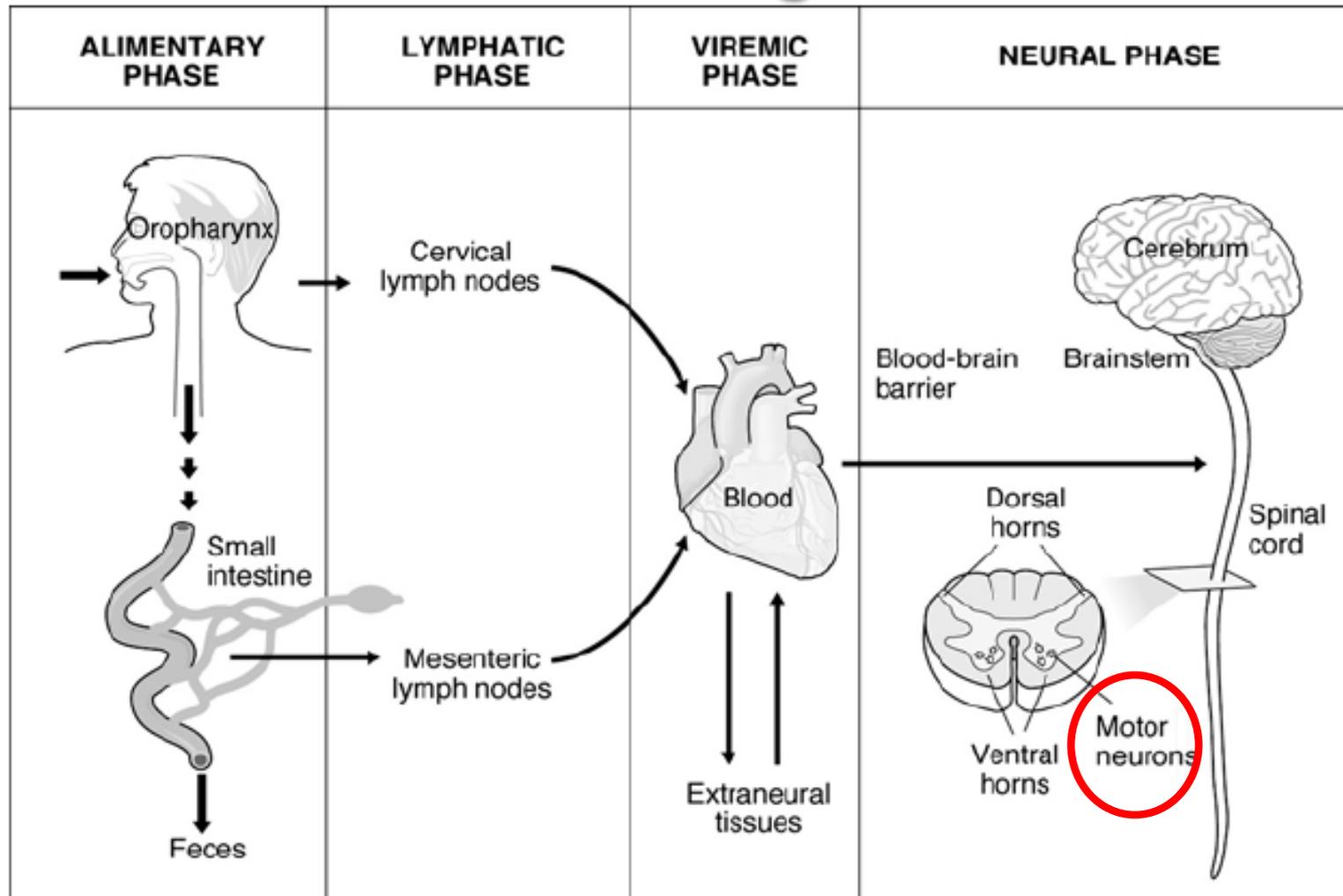
- The virus **replicates** in the **pharynx** and **GIT** (lymphoid tissue).
- In **throat** and **stools** before the onset of illness.
- Excreted in the feces for several months, **no permanent carrier**.

Does polio require isolation?

If poliovirus infection is confirmed, patients will remain in medical isolation for 6 weeks from time of symptom onset or if they have no symptoms, from time of diagnosis.

Poliovirus:

Transmission and Pathogenesis:



Poliovirus:

Transmission and Pathogenesis:

- It can spread → blood → CNS.
- Most infections are asymptomatic or very mild aseptic meningitis than paralytic polio.
- Paralysis is the result of death of the motor neurons, especially anterior horn cells in the spinal cord.
- **Immunity:** Poliovirus infection can provide lifelong immunity against the disease,

Poliovirus:

Clinical features:

- IP 10-14 days.
- **Clinically, four forms:**
 - **Asymptomatic infection (95%)**.
 - **Minor illness (abortive polio)** : fever, nausea, vomiting, malaise, headache and recover completely.
 - **Non paralytic (Aseptic meningitis)**, recovery is usual.
 - **Paralytic polio**: flaccid paralysis , **irreversible**. Involvement of **the brain stem** may lead to **respiratory paralysis and death**.
 - **Postpolio syndrome**: **Marked deterioration** of the **residual function** of the affected muscles many **years after the acute stage**.



Poliovirus:

Laboratory diagnosis:

- Isolated from **throat**, **stool**, and **CSF** in cell culture (CPE, **neutralization** with type-specific antiserum).
- Isolation of the virus from stools indicates infection but not necessarily disease.

Treatment:

No antiviral therapy is available

Poliovirus:

Prevention:

1. live attenuated vaccine(Sabin vaccine) or Oral vaccine (OPV).
 - **Three polioviruses** as attenuated strains.

Advantages:

- ▶ long lasting immunity.
- ▶ IgA production (gut immunity).
- ▶ Administered orally



Poliovirus:

Prevention:

2. Inactivated (killed) vaccine (Salk vaccine): (IPV)

- ▶ Three polioviruses.
- ▶ Given by injections.
- ▶ Enhanced polio vaccine eIPV → higher seroconversion rate --- High Ab titer, IgA.



ENTEROVIRUS CONTROL

- Polio vaccination
- Hygiene

ENTEROVIRUS DIAGNOSIS

Specimens

- Rectal swab
- Throat swab
- Nasal wash
- CSF
- Blood
- Urine
- Vesicle fluid

Diagnosis

- Culture
- NAAT

