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Virology

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PicornaViruses(enteroviruses)

Picornaviruses are small, naked, and icosahedral viruses which contain a single-stranded, non-segmented RNA genome.

The genera *Enterovirus*, *Rhinovirus*, and *Hepatovirus* cause a wide variety of clinical syndromes in humans. These viruses are all considered types of the PicornaViruses.

General Features:

1) Infection is done by ingestion of contaminated food and water, or via respiratory droplets
2) They all are acid stable, **<u>except</u>** rhinoviruses. This allows them to replicate in the GI, and then get excreted in the stool (fecal-oral spread).
3) After replicating in the oropharynx and intestinal tract lymphoid tissue, enteroviruses can leave the intestine by entering the bloodstream, and thus spread to various target organs. E.g. poliovirus spreads to the central nervous system (CNS).
4) The majority of their infections are asymptomatic. Their infection, either clinical or subclinical, will end up with acquiring immunity.
5) All Enteroviruses could cause CNS dieses(meningitis),they are the major cause of acute aspetic meningitis .

Most common kinds of Picornaviruses:

- Poliovirus (3 serotypes).
- Coxsackieviruses A and B (25 serotypes).
- Echovirus (28 serotypes).
- Human enterovirus (43 serotypes).
- Human rhinoviruses A, B and C (more than 150 serotypes).
- Hepatovirus (Hepatitis A virus, a single serotype).

Coxsackieviruses, echovirus, and Human enterovirus are the most common cause of **aseptic meningitis.**

Let's differentiate between 2 things: Septic and Aseptic Meningitis :

Aseptic meningitis is a case of virus particles reaching the protective membranes covering the brain and spinal cord, causing an inflammation.
-The most common viruses that cause such cases are as mentioned:
Coxsackieviruses, echovirus, and human enteroviruses.
- Aseptic meningitis is characterized by:

- **Lymphocytes** (T Cells) infiltration into the CSF.
- Aseptic meningitis is **much less severe** than septic meningitis, as it has **low mortality rates.**
- Patients with **aseptic meningitis** often present with classic meningeal symptoms, including fever, neck pain or stiffness, photophobia, headache, nausea or vomiting
- Most often than not, **doesn't** lead to severe neurological damage.
- Treatment is through supportive therapy

Septic meningitis is a case of bacteria reaching the protective membranes of the brain, causing an inflammation.
-The most common Bacteria to cause septic meningitis is Streptococcus Pneumonia.
- Septic meningitis is characterized by:

- **Neutrophils** infiltration into the CSF.
- **Much more severe** than aseptic meningitis, as it has **high mortality rate**.
- Causes severe neurological damage
- Treatment is through Penicillin G and Ceftriaxone
- A characteristic of septic meningitis is: low glucose levels, due to bacteria being glucose hungry.

POLIOVIRUS

Polio virus binds to a specific receptor on the cell, called PVR(CD155).

- The mouth is the portal of entry of the virus, and primary multiplication takes place in the oropharynx or intestine.
- The virus is regularly present in the throat and in stool, even before the onset of illness.

- One week after infection, there is little virus in the throat, but virus continues to be excreted in the stools for several weeks, even though high antibody levels are present in the blood.

- It is believed that the virus first multiplies in the tonsils, the lymph nodes of the neck, Peyer patches, and the small intestine. The CNS may then be invaded by the way of the circulating blood.

- Poliovirus can also spread along axons of peripheral nerves to the CNS, where it continues to progress along the fibers of the **lower motor neurons** to increasingly involve the spinal cord or the brain.

Something important to understand:

Poliovirus **doesn't** actually replicate in the muscles. What the virus does is that it replicates inside the lower motor neurons, which will damage these neurons. This will cause a loss of nerve enervation inside the muscles, leading to **flaccid paralysis.** This flaccid paralysis will lead to muscle **atrophy**, thus muscles become very small.

CLINICAL FEATURES:

When an individual susceptible to infection, gets exposed to the virus, the response ranges from in-apparent infection, without symptoms, to a mild febrile illness, to severe and permanent paralysis. Most infections are subclinical; only about 1% of infections result in clinical illness.

The incubation period is usually 1-2 weeks, but it may range from 3 to 35 days.

Degrees of disease(How Bad):

(1) Mild disease is the most common form. The patient has only a minor illness, characterized by fever, malaise, drowsiness, headache, nausea, vomiting, constipation, and sore throat in various combinations. Full recovery occurs in a few days.

(2) Nonparalytic poliomyelitis (aseptic meningitis) patients have the symptoms of the mild disease plus stiffness and pain in the back and neck.

The disease lasts 2–10 days, and recovery is rapid and complete. Poliovirus is only one of many viruses that produce **aseptic meningitis.**

(3) Paralytic poliomyelitis and progressive postpoliomyelitis muscle atrophy. The predominating complaint is flaccid paralysis resulting from lower motor neuron damage. Respiratory paralysis may occur as well.

TREATMENT AND PREVENTION:

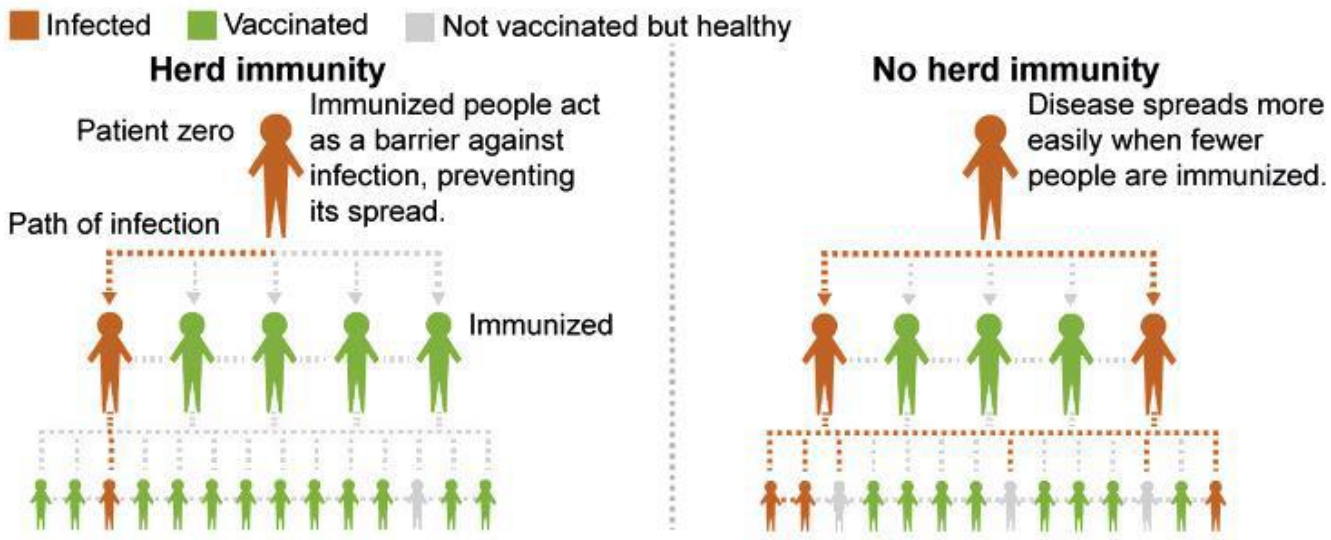
There is no specific treatment for POLIO

There are 2 kinds of vaccines:

(1) Live attenuated vaccine: very effective vaccine, given **orally**, and provides **Herd immunity.** Could cause vaccine associated poliomyelitis(Polio virus could revert back to wild form , causing postpoliomyelitis muscle) with a ratio of 1 reactivation for every 2.4 million vaccinated individuals

(2) Killed Vaccines: not as effective as live attenuated

Vaccines are ***NEVER*** given to pregnant and immunocompromised individuals due to the complications that would accompany vaccination.



COXSAKIEVIRUS

They are divided into two groups: A and B.

They produce a variety of illnesses in humans, including aseptic meningitis and respiratory and acute febrile illnesses.

Herpangina (**vesicular pharyngitis**), hand-foot-and-mouth disease, and acute hemorrhagic conjunctivitis are caused by certain **coxsackievirus group A serotypes.(self-limited disease)**

Pleurodynia(epidemic myalgia; Bornholm disease that presents with fever and stabbing chest pain), myocarditis and pericarditis are caused by some **group B coxsackieviruses.**

***HERPANGINA*(A)**

Herpangina is a febrile illness of relatively sudden onset with complaints of fever and sore throat.

Characteristic lesions are found on the anterior tonsillar pillars, soft palate, uvula, and tonsils, and on the posterior pharynx.

The illness, which has a predilection for the young, is usually self-limited and disappears within a few days.

HAND FOOT AND MOUTH DISEASE(A)

Hand-foot-and-mouth disease is an illness associated with vesicular lesions of the hands, feet, mouth, and, at times, buttocks.

The main causes of hand-foot-and-mouth disease are A10, A16 and EV71(Enterovirus 71).

(NOTE) the Dr. said not to memorize the kinds(A10 and A16). Just know that it is caused by Coxsackievirus (A) and Enterovirus (E) .

EchoViruses

- Echoviruses (enteric cytopathogenic human orphan viruses) are associated with the following human infections: **Aseptic meningitis**, encephalitis, febrile illnesses with or without rash, common colds, and ocular disease.

- Similar clinical syndromes are caused by human enteroviruses. However, **certain enteroviruses are associated with specific syndromes**. E.g. EV 70 is a main cause of acute hemorrhagic conjunctivitis. EV70(conjunctivitis) and 71 are

associated with severe CNS disease(Hand foot and mouth disease). EV71 is associated with HFM disease.

RhinoViruses

- Rhinoviruses are the common cold viruses. They are the most commonly recovered agents from people with mild upper respiratory illnesses. They are usually isolated from nasal secretions, but they may also be found in throat and oral secretions.

- More than 150 types are known that belongs to three species (A, B and C), that's why making a vaccine is difficult.

- Rhinoviruses use intercellular adhesion molecule-1 (**ICAM-1**) members of the low-density lipoprotein receptor (**LDLR**) family as their cellular receptors.
- The incubation period is brief (from 2 to 4 days) and the acute illness usually lasts for 7 days although a non-productive cough may persist for 2–3 weeks.
- The average adult has one or two attacks each year.

- Usual symptoms in adults include sneezing, nasal obstruction, nasal discharge, and sore throat; other symptoms may include headache, mild cough, malaise, and a chilly sensation. There is little or **no fever**. The nasal and nasopharyngeal mucosa become red and swollen.

- No epidemiological findings are associated with Rhinoviruses

- Secondary bacterial infection may produce acute otitis media, sinusitis, bronchitis, or pneumonitis, especially in children. No specific prevention method or treatment is available.

TREATMENT:

Symptomatic treatment.

Common Cold VS Flu:

-Common Cold: Most commonly caused by Rhinoviruses. Common cold is usually associated with local manifestations, such as sneezing, rhinorrhea (nasal cavity is filled with a significant amount of mucus fluid), and nasal discharge.

The second most common cause of common cold is CoronaViruses(also cause lower respiratory tract infection). Other causes of Common cold are Influenza C virus, adenoviruses, enteroviruses, and metapneumoviruses.(other kinds of viruses are still being discovered to cause)

-Flu: associated with Influenza A and B. Flu symptoms are usually systemic. Symptoms include fever and systemic manifestations.

The End