بسم الله الرحمن الرحيم

# MICROBIOLOGY

## Final – Lecture 6

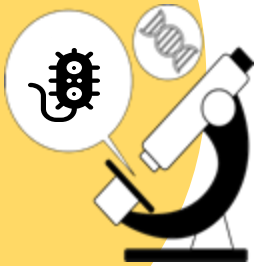
# Rhinoviruses, Coronaviruses, Influenza, Parainfluenza & RSV (Pt.2) and Enteroviruses, Rotaviruses, and caliciviruses.

﴿ وَإِن تَتَوَلَّوْا يَسْتَبْدِلْ قَوْمًا غَيْرَكُمْ ثُمَّ لَا يَكُونُوا أَمْثَالَكُم ﴾

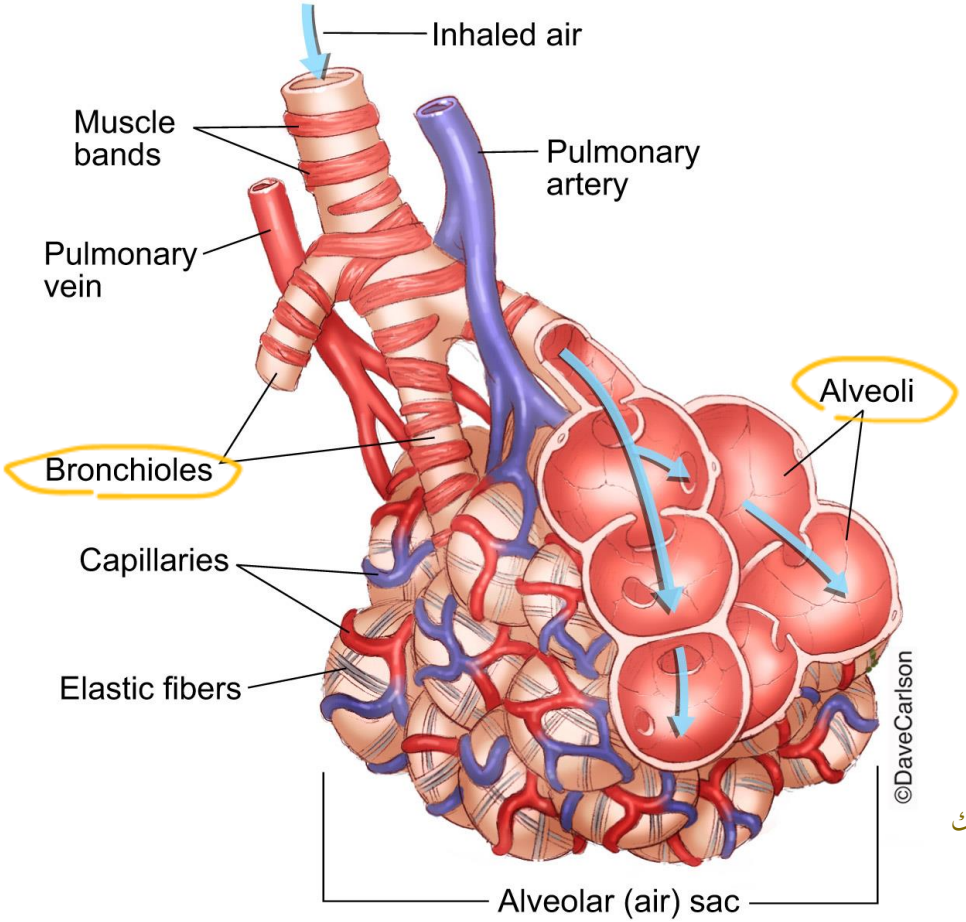
اللهم استعملنا ولا تستبدلنا


Written by:

- Raya Al Weshah
- Layan Fawarseh
- Hala Sweidan

# Before we begin...

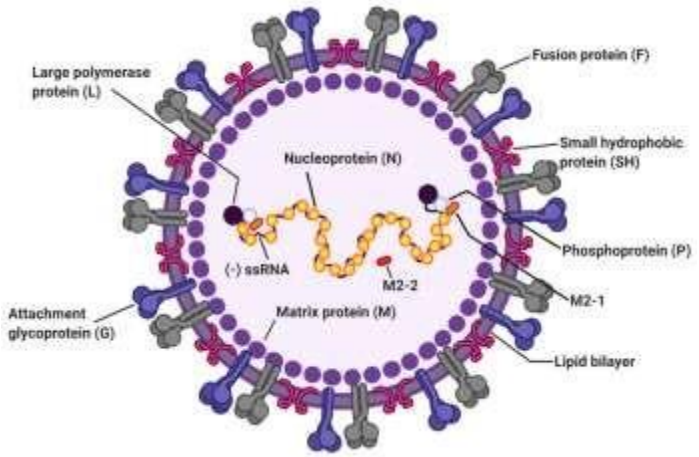



...you are **not** required to know RS anatomy. However, I would like you to look at the **bronchioles** and **alveoli** to give some context to help you better understand where RSVs affect the human body.

المحاضرة طويلة شوي بس سهلة بإذن الله وزي دائما، إذا ما صليت قوم صلي
ولا تنسى إخواننا في غزة من الدعاء
بسم الله نبدأ :)
اللهم إني أسألك الثبات في الأمر والعزيمة على الرشد وأسألك موجبات رحمتك وعزائم مغفرتك
وأسألك الغنيمة من كل بر والسلامة من كل إثم وأسألك حسن عبادتك وشكر نعمتك
وأسألك قلبا سليما ولسانا صادقا وأسألك الفوز بالجنة والنجاة من النار وأسألك من خير ما
تعلم وأعوذ بك من شر ما تعلم واستغفرك لما تعلم أنك أنت علام الغيوب

# 4. Respiratory syncytial virus (RSV)

- Family: Paramyxoviridae
- Large, 150-300 nm
- Pleomorphic, helical nucleocapsid
- Enveloped with two glycoprotein spikes:
  - The G protein, lacks hemagglutinins and
    - neuraminidase activities. Attachment protein
  - The F, Mediates cell entry, by the fusion process
- The viral genome is ss-RNA
- Most common cause of severe lower respiratory tract disease in infants, responsible for 50-90% of Bronchiolitis and 5-40% of Bronchopneumonia. In older children and adults, the symptoms are much milder.

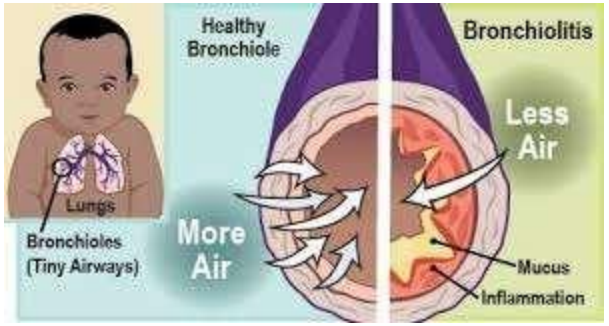


# RSV

RSVs differ from the viruses mentioned in the last lecture in a couple of things. Firstly, RSVs are larger in size (150-300nm), they contain a **helical** capsid, instead of an icosahedral one. Lastly, their glycoprotein spikes include an attachment protein, **G protein,** and another that mediates cell entry via fusion, **F protein.** RSVs, along with other respiratory and GIT viruses, primarily affect infants and toddlers during the first 3 years of age, as it is the period when a child starts interacting with other children/people around. RSV causes **bronchiolitis,** inflammation in the bronchioles, or **bronchopneumonia** in the lungs. The child's symptoms become milder as he/she grows, until they completely fade away and the child's immunity is improved. It's less common for older kids or adults to be infected.

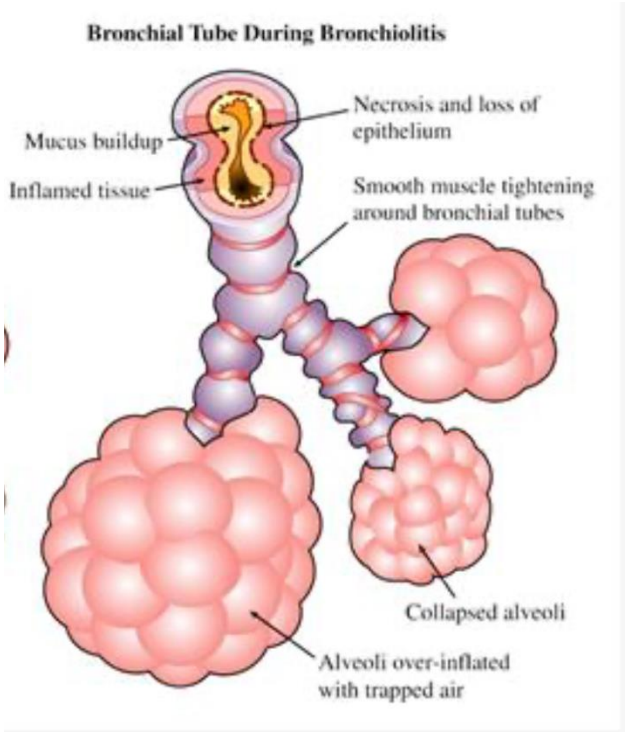
# Bronchiolitis

- Inflammation of the bronchioles in infants and young children. Bronchioles become inflamed, edematous and obstructed by mucous .
- Respiratory syncytial virus ( RSV ) and parainfluenza virus type 3 are the major cause of bronchiolitis in infants.
- Symptoms:
  - Usually preceded by URT symptoms.
  - Expiratory obstruction.
  - Expiratory wheezing.
  - Respiratory distress (difficult & labored breathing).
  - Hypoxia and cyanosis
- Most cases are mild, recover completely & do not require hospitalization. Increasing respiratory distress, cyanosis, fatigue or dehydration are indication for hospitalization.
- Diagnosis is usually clinical, and no specific treatment and no vaccination is available.



# Bronchiolitis

Inflammation of bronchioles in infants and young children leads to edema, which narrows of bronchioles allowing for mucus buildup and obstruction. **Expiratory obstruction and wheezing** are the major manifestations of bronchiolitis. Inspiration (breathing in) requires bronchodilation to accommodate the incoming air volume. During expiration (breathing out), wheezing can be heard due to the narrow caliber of the bronchioles.




Click here to listen to bronchiolitis wheezing

# Cyanosis

If the obstruction is severe, the child may suffer hypoxia and cyanosis, blue or purple discoloration. **Cyanosis** can be central or peripheral. Central cyanosis takes place around the mouth, where the lips and tongue turn blue due to oxygen deprivation, while peripheral cyanosis affects the fingers and can cause them to turn blue. Central cyanosis is more concerning than peripheral cyanosis. The child should be admitted to the hospital if blue lips/tongue should appear for intubation until hypoxia subsides. Most children experience mild, self-limiting bronchiolitis that resolves within a few days.

اللَّهُمَّ إِنِّي أَعُوذُ بِكَ مِنْ قَلْبٍ لَا يَخْشَعُ وَمِنْ دُعَاءٍ لَا يُسْمَعُ وَمِنْ نَفْسٍ لَا تَشْبَعُ وَمِنْ عِلْمٍ لَا يَنْفَعُ

# Bronchiolitis VS Asthma

The whistle-like wheezing in bronchiolitis patients can sometimes be mistaken for asthma. However, unlike bronchiolitis, asthma is primarily an allergic reaction, not inflammation. While wheezing is common to both conditions, the other symptoms, like mucus buildup and obstruction, are specific to bronchiolitis and not observed in asthma. Another key difference is the recurrent nature of asthma, which affects children over a long period of time, whereas bronchiolitis is self-limiting.

(فَبِأَيِّ آلَاءِ رَبِّكُمَا تُكَذِّبَانِ) ٥٥:١٣

# Viral pneumonia

- Inflammation of the lung and alveoli
- RSV and parainfluenza virus type-3 are the major cause of infantile pneumonia
- Symptoms: usually preceded by the URT symptoms
  - Fever
  - Chills
  - Pharyngitis
  - Cough
  - Shortness of breath
  - Muscle aches
  - Fatigue
  - Chest pain

- Prognosis: Most cases are mild and get better without treatment
- Some cases are more serious and require hospitalization
- Complications: Respiratory failure and heart failure

# Viral Pneumonia

RSV and parainfluenza type III are similar in the diseases they cause. Though, distinction between the two is clinically insignificant, because the treatment is almost the same regardless of the causative virus. Viral pneumonia mainly affects **infants**, 1-2 years of age, and rarely affects 10-year-olds, for example. This is because as a child grows, their bronchioles and alveoli grow, as well. Therefore, even if the 10-year-old is infected with the virus, they have a smaller chance obstructed airways.

# Symptoms

The symptoms typically begin in the upper respiratory tract and progressively affects the lower respiratory system. **Fever** is a hallmark symptom that helps distinguish viral pneumonia from other viral infections. **Shortness of breath** indicates that the virus has reached the lungs. **Chest pain** can be classified as **central**, in the case of inflammation of bronchi and bronchioles, or **lateral,** which occurs in pneumonia. The lateral migration of the pain reflects the spread of infection through the lungs of the virus. Taking deep breaths can be agonizing for the patient, so, they typically take short breaths (labored) to reduce the pain as much as possible. Hypoxia and cyanosis can also occur in pneumonia.

# Complications

As a general rule of thumb, most RS viruses are mild and self-limiting; however, extreme cases may require hospitalization but occur rarely. Hospitalization is an adequate preventative measure to ensure limiting of viral spread. In severe cases of viral pneumonia that require hospitalization, it is feared that the patient will suffer respiratory or heart failure. Respiratory failure occurs when the respiratory system essentially “gives out” due to exasperation of smooth muscles needed to get the necessary oxygen. Although rare, but heart failure may be caused by the increased workload on the heart.

(وَمَن يَتَّقِ اللهَ يَجْعَل لَّهُ مَخْرَجًا وَيَرْزُقْهُ مِنْ حَيْثُ لَا يَحْتَسِبُ) ٦٥:٣

# Deterioration of Pneumonia

To assess whether pneumonia is deteriorating or resolving, it is important to closely monitor the shortness of breath, cyanosis/hypoxia, and the duration of pneumonia. Monitoring the patient's respiratory rate (RR) is crucial for precise assessment. If a patient's normal RR is 16, and their current RR is 40-60, that can also indicate worsening of the pneumonia, and the urgency to transfer the patient to the ICU.

اللَّهُمَّ إِنِّي أَسْأَلُكَ عِلْمًا نَافِعًا وَرَحْمَةً وَمُغْفِرَةً وَتُدْنِي مِنَ النَّارِ

# Enteroviruses, Rotaviruses, & Caliciviruses

Mohammad Altamimi, MD, PhD
Faculty of Medicine, Jordan University, 2024

(أَلَيْسَ اللَّهُ بِكَافٍ عَبْدَهُ) ٣٩:٣٦

# Introduction to Enteroviruses

This group of viruses cause gastroenteritis, The respiratory system is the most accessible system for viruses. The majority of ER and clinic cases are respiratory system-related. The second most accessible system of viruses is the GI. The mode of transmission is the fecal-oral route, through ingesting food containing the virus. This group of viruses includes enteroviruses, rotaviruses, and caliciviruses.

# Objectives

- Understand the structure, properties, classification, pathogenesis epidemiology, clinical presentation, laboratory diagnosis and treatment of:
- Enteroviruses
- Polioviruses
- Coxsackie viruses
- Echoviruses

ٱللَّهُ لَطِيفُۢ بِعِبَادِهِۦ ۖ يَرۡزُقُ مَن يَشَآءُۖ وَهُوَ ٱلۡقَوِيُّ ٱلۡعَزِيزُ (19) مَن كَانَ يُرِيدُ حَرۡثَ ٱلۡأٓخِرَةِ نَزِدۡ لَهُۥ فِي حَرۡثِهِۦۖ وَمَن كَانَ يُرِيدُ حَرۡثَ ٱلدُّنۡيَا نُؤۡتِهِۦ مِنۡهَا وَمَا لَهُۥ فِي ٱلۡأٓخِرَةِ مِن نَّصِيبٍ

# Enteroviruses

**Enteroviruses = GI-infecting viruses.**

- Enteroviruses are a genus of the picornavirus family which replicate mainly in the gut.
- Single-stranded naked RNA virus with icosahedral symmetry
- Capsid has 60 copies each of 4 proteins, VP1, VP2, VP3 and VP4 arranged with icosahedral symmetry around a positive sense genome.
- Divided into 5 groups:
  - Polioviruses
  - Coxsackie A viruses
  - Coxsackie B viruses
  - Echoviruses
  - Enteroviruses

The genome protects the surrounding viral proteins

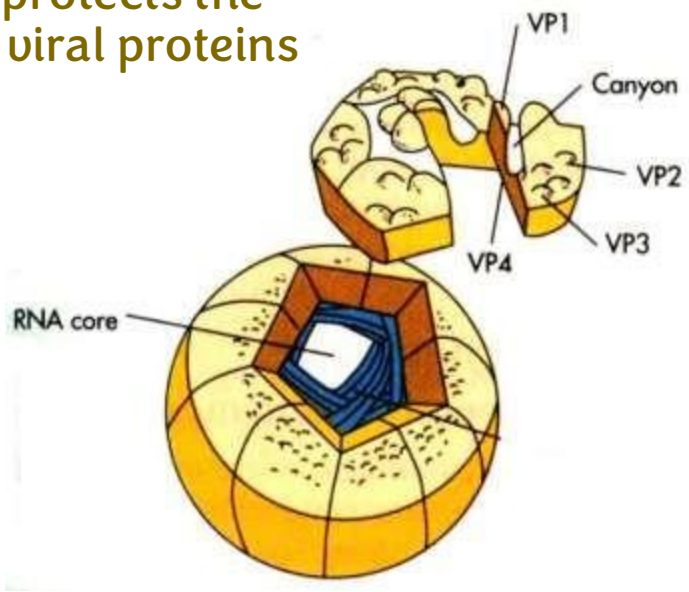


*Figure out further notes & information in next slides*

Each serotype has its own antigen & genes, but they can't be distinguished according to their structure.

# Poliovirus

- 3 serotypes of poliovirus (1, 2, and3) but no common antigen (Each one has its own antigen).
- Have identical physical properties but only share 36- 52% nucleotide homology (they have different genes.).
- Humans are the only susceptible hosts.
- Polioviruses are distributed globally before the availability of immunization (vaccine) which affect (decreases) the incidence of poliovirus).

*Figure out further notes in the next slide*

# Poliovirus – Con.

- The availability of immunization and the poliovirus eradication campaign* has eradicated poliovirus in most regions of the world except in the Indian Subcontinent and Africa.
- * Eradication campaign: encouraging parents to give their children the vaccine according to a specific program.
- Poliovirus vaccine became one of the vaccines program in almost all world countries → a decline was noticed in poliovirus incidens & most countries are eradicated now (= they don't have cases of poliovirus).
- Poliovirus is on course of being eradicated worldwide (it is an aim to eradicate poliovirus worldwide just like smallpox (which in last years its incidence was zero = no new cases are recorded)).

# Poliovirus – Con.

- The vaccine is effective on the three serotypes = wild type (have three of them).
- The virus still exist and transmit but do NOT cause poliomyelitis as a disease.
- Recently, new cases are found in Gaza and Syria (outbreak + near geographic areas) , due to that there were revaccination campaigns in Jordan.
- Like other Enteroviruses, Poliovirus is transmitted through fecal-oral route (via food) ,but it is special and didn't match Enteroviruses in its effect because it will be transmitted to the nervous system (spinal cord) and affect it accordingly it will cause paralysis (figure out the clinical presentation in the next few slides).
- الحمد لله, It is not easy to record new cases in Jordan due to vaccines.

*Figure out further notes in the next slide*

# Pathogenesis

- The incubation period is usually 7 - 14 days (relatively short).
- Following ingestion (fecal-oral route), the virus then multiplies in the oropharyngeal and intestinal mucosa.
- The lymphatic system, in particular the tonsils and the Peyer's patches *1 of the ileum are invaded and the virus enters the blood resulting in a transient viraemia.

# Pathogenesis

- GI → Lymphatic tissues & nodes in GI (tonsils & Peyer's patches) → Dissemination to blood → Transient Viraemia → May reach the nervous tissue.
- 95% of cases will remain in GI.
- Only in few cases, poliovirus will transmit to CNS and cause poliomyelitis.
- *1 Peyer's patches: collection of lymph nodes around the intestine.
- In a minority of cases, the virus may involve the CNS following dissemination.

# Clinical Manifestations

- There are 3 possible outcomes of infection:

1. **Subclinical infection** (90 - 95%) - inapparent subclinical infection account for the vast majority of poliovirus infections.
2. **Abortive infection** (4 - 8%) - a minor influenza-like illness occurs, recovery occurs within a few days and the diagnosis can only be made by the laboratory (simple & self-limiting).
3. **Major illness (1 - 2%)** (classical poliomyelitis) - the major illness may present 2 - 3 days following the minor illness or without any preceding minor illness. Signs of aseptic meningitis are common. Complications may occur such as:
   - Involvement of the anterior horn cells lead to flaccid paralysis.
   - Involvement of the medulla may lead to respiratory paralysis and death.

*Figure out further notes & information in next slides*

# Paralytic poliomyelitis

* meningeal irritation is diagnosed by: raising the child's leg up → the child serve from severe pain → the child try to reduce the pain by tilting the head backward.

- Prodrome: Headache, malaise, meningeal sign (irritation & inflammation in meninges which lead to severe pain when nodding the head forward)*.
- Sever myalgia, Meningismus (meningeal signs), Weakness, Flaccid paralysis (special type of paralysis) مرتخي
- Asymmetric distribution (Very typical symptom ,so if noticed, the disease will be detected easily/Affected limps: left leg + right arm (OR) left arm + right leg)

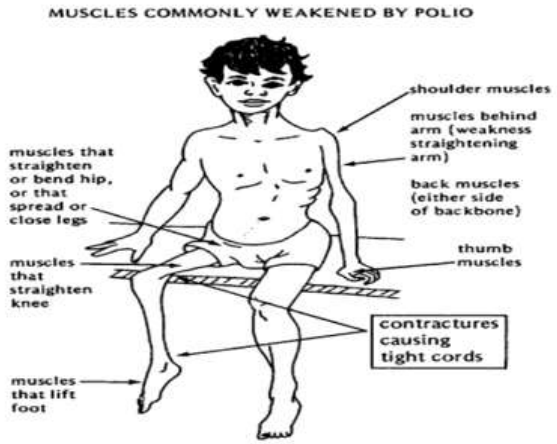



*Figure out further notes in the next slide*

# Paralytic poliomyelitis – Con.

- Proximal muscles involve more than distal muscles, e.g.: thigh muscle is affected more than leg and ankle muscles.
- Sensory function remains intact (pure motor dysfunction)
- Diagnosis: PCR, isolation, and serology.
- Prevention:
  - Intramuscular Poliovirus Vaccine (IPV)
  - Oral Poliovirus Vaccine (OPV) (recently it is preferred, for several reasons: not irritating – induce the production of IgA in digestive system)
  - THERE IS NO TREATMENT and progression of the disease is inevitable, because the damage that occur in CNS is irreversible (so taking the vaccine is the most accurate way to protect children from the virus والأمان بالله )

# Paralytic poliomyelitis – Con.

- To recap how to detect the disease:

1. The child didn't take the vaccine.
2. Examination & typical presentation (classical symptoms = Paralytic poliomyelitis) : meningeal irritation - Asymmetric distribution - Sensory function remains intact.
3. To ensure the diagnose: PCR, isolation, and serology.

# Coxsackieviruses

- They are divided into 2 groups (both are extremely rare) on the basis of the lesions observed in suckling mice.

1. **Group A viruses** produce a diffuse myositis with acute inflammation and necrosis of fibers of voluntary muscles so the patient may lose some muscles.
2. **Group B viruses** produce focal areas of degeneration in the brain, necrosis in the skeletal muscles (voluntary muscles), and inflammatory changes in the dorsal fat pads, the pancreas and occasionally the myocardium.

- Each of the 23 group A and 6 group B coxsackieviruses have a type specific antigen, accordingly there is no vaccine.

# Echoviruses

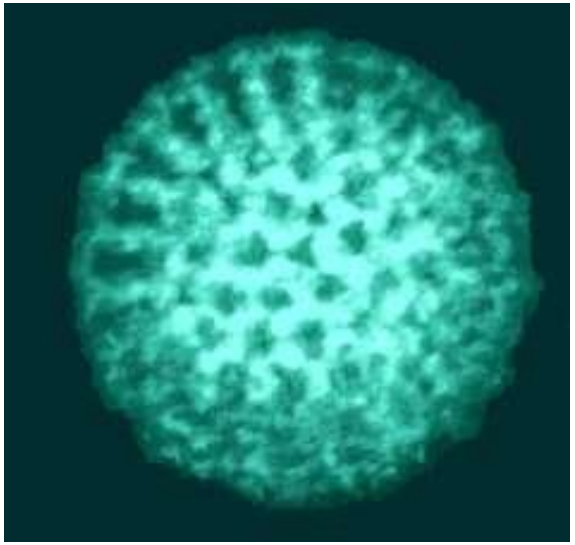
- The first echoviruses were accidentally discovered in human faeces, unassociated with human disease during epidemiological studies of polioviruses.
- These viruses were produced CPE in cell cultures, but did not induce detectable pathological lesions in mice.
- Altogether, There are 32 echoviruses (types 1-34; echovirus 10 and 28 were found to be other viruses and thus the numbers are unused)
- **It is part of Enteroviruses but it has no clear clinical manifistation so it is not very important.**

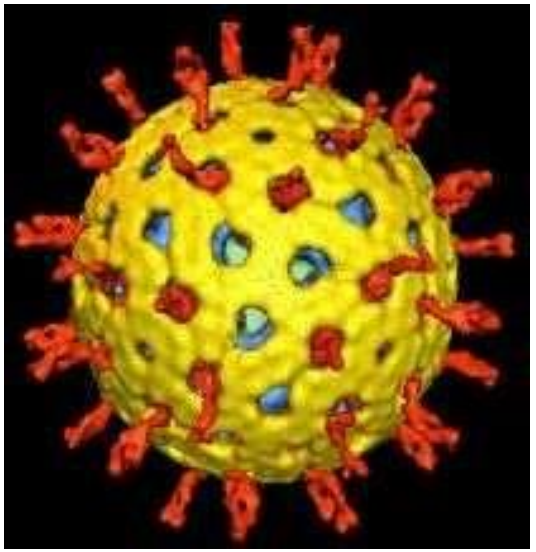
***Until here we have finished the Enteroviruses , take a deep breath then move on to the new virus.***

# Rotavirus

- **It is very common in children, with clear manifestations.**
- **Approximately 50% of diarrhea in children are caused by rotavirus.**
- no **shift** and **drift** in rotavirus, as these processes are specific to certain influenza virus types.

- 70 nm round, double-shelled, enclosing a genome of 11 segments of **double**-stranded RNA.
- Non-enveloped virus
- Icosahedral symmetry
- Double capsid (outer and inner capsid)
- EM appearance of a wheel with radiating spokes



وَعَصَيْتُم مِّنۢ بَعْدِ مَآ أَرَىٰكُم مَّا تُحِبُّونَ ۚ مِنكُم مَّن يُرِيدُ ٱلدُّنْيَا وَمِنكُم مَّن يُرِيدُ ٱلْأٓخِرَةَ

# Classification

Rotavirus is classified into five groups, each consisting of several serotypes. Only Group A infects humans, while the other groups primarily infect animals.

- **Group A subtypes 1, 2, 3, 4**

(main human pathogens- responsible of most human infection )
(Further 7 subtypes) also infect animals (monkey, calf, mouse)

- Group B Infects pigs and rats
  - Found to cause extensive outbreaks in China in past decade
- Group C Infects Pigs (Occasionally Man)
- Group D Infects birds
- Group E Infects pigs

gastroenteritis, which is a simple inflammation of the gastrointestinal tract, can lead to death in children. This is because children have smaller bodies and less fluid volume. For instance, diarrhea can cause significant dehydration, and if left untreated, it can be fatal.
Similarly, respiratory diseases are often self-limiting, but they can become dangerous if hypoxia or cyanosis occurs. The same is true for gastroenteritis: while it is usually self-limiting, it can become life-threatening if the child becomes severely dehydrated.

# Epidemiology

- Millions are affected, with 600,000-850,000 deaths/year
- Outbreaks of rotavirus infection are common, particularly during the cooler months, among infants and children 1 to 24 months of age.
- Older children and adults can also be affected, but attack
  - rates are usually much lower.
- Outbreaks among elderly, institutionalized patients have also been recognized. **These viruses tend to spread more during colder months.**
- By the age of 4 years, more than 90% of individuals have humoral antibodies, suggesting a high rate of virus infection early in life.
- Transmission is mainly by fecal oral rout

# Clinical Manifestations ( see next slide )

- Incubation period of 1 to 3 days ( because of eating or drinking food that contaminated by rota )
- Abrupt onset of vomiting, followed within hours by frequent, copious, **watery**, brown stools.
- In severe cases, the stools may become clear; the Japanese refer to the disease as **hakuri, the "white stool diarrhea"**
- Fever, usually low grade, is often present.
- Vomiting may persist for 1 to 3 days, and diarrhea for 4 to 8 days.
- The major complications result from severe dehydration, occasionally associated with hypernatremia.

# Manifestations

- Nausea, vomiting, diarrhea, and cramps are typical symptoms of gastroenteritis (mostly viral , and large part is rota ) as the body tries to expel the virus - fever may also be present-. Using medications to stop vomiting or cough is generally not recommended because these symptoms are the body's natural way of getting rid of the virus, except in cases where dehydration occurs you may give these drugs.
- Dehydration happens when the body loses too much fluid, leading to an imbalance of electrolytes, especially a rise in sodium (Na) levels inside the body .
- Symptoms of dehydration in children include:

Crying without tears

Dry lips

No saliva

Dry skin

Hypotension (low blood pressure)

- Most cases of gastroenteritis are treated without hospitalization. However, if dehydration occurs, it is important to take the child to the hospital. Mothers should be informed of the symptoms of dehydration and know when to seek medical help to avoid serious complications.

# Diagnosis

- Diagnosis of acute rotavirus infection is usually by detection of virus particles or antigen in the stools during the acute phase of illness.
- This can be accomplished by direct examination of the specimen by electron microscopy or, more conveniently, by immunologic detection of antigen with EIA methods.
- PCR can be used to confirm the diagnosis
- **No RBC or WBC in stool – watery non invasive -**

Usually, an electron microscope is not required for detecting rotavirus. A simpler and more affordable-cheaper- test is commonly used to detect the disease, which involves testing for the rotavirus antigen. This process includes:
1.Taking a stool sample.
2.Performing a rotavirus antigen test on the sample.
3.A positive result indicates the presence of the disease.
Additionally, stool samples are often examined under a microscope to rule out the presence of parasites or bacteria, ensuring the diagnosis is specific to rotavirus.

# Treatment and Prevention

- There is no specific treatment ---> no antiviral. Vigorous replacement of fluids and electrolytes is required in severe cases and can be life-saving.
- The rotaviruses are highly infectious and can spread quickly in family and institutional settings. Fast spread in schools .
- Control consists of rigorous hygienic measures, including careful hand washing and adequate disposal of enteric excretions.
- The virus is present in the stool, so if an infected person goes to the toilet and doesn't wash their hands properly, they can transfer the virus when preparing food for a baby. . Therefore, hand hygiene is absolutely critical in preventing the transmission of the virus.
- Recently rota virus vaccine has been developed and licensed for infants used. Vaccine developed in 1998 an effectiveness of 80% with good safety. Vaccine has been adopted by many developed countries.safe and effective vaccine--> reduce the symptoms .

*common that a child gets infected two or three times in one year until they develop immunity.

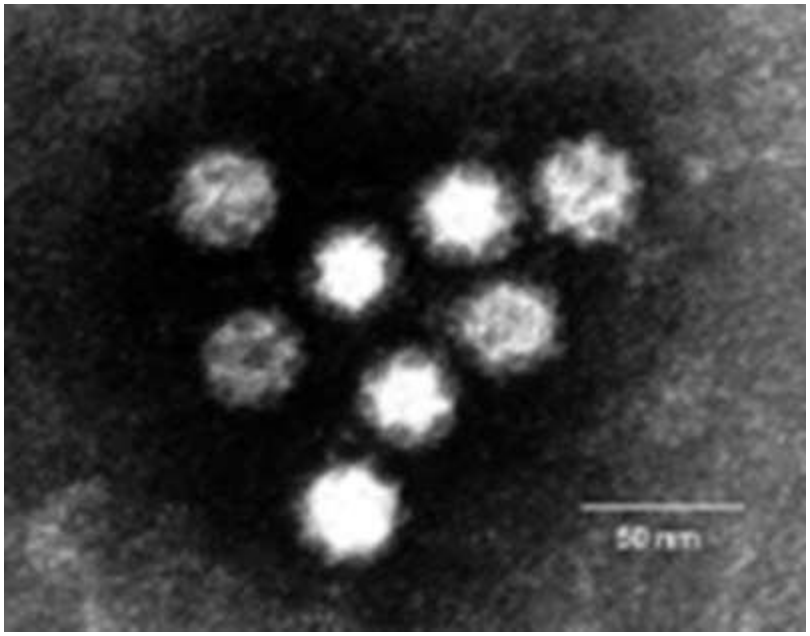
رَبِّ إِنِّي لِمَا أَنزَلْتَ إِلَيَّ مِنْ خَيْرٍ فَقِيرٌ

# Caliciviruses

- Small **ssRNA** viruses
- Naked icosahedral capsid
- Characteristic surface morphology consisting of hollows.

**Stars like-**

- particles 35 nm in diameter.



The first common virus is rotavirus, and the second is **calicivirus**.

# Epidemiology

- Sharp family and community outbreaks are common and can occur in any season. Unlike rotaviruses, caliciviruses are much more common causes of gastrointestinal illness in older children and adults.
- The prevalence of antibodies rises slowly, reaching approximately 50% by the fifth decade of life, a striking contrast to the frequent acquisition of antibodies to rotaviruses early in life. By the age of fifty, 50% of people are infected, compared to rotavirus, where by the age of four, 90% of people have been infected. **-most likely to reach to adults-.**
- Transmission is primarily fecal–oral; outbreaks have also been associated with consumption of contaminated water, uncooked shellfish, and other foods.

# Clinical Manifestations

- The incubation period is 10 to 51 hrs
- Followed by abrupt onset of vomiting and diarrhea, a syndrome clinically indistinguishable from that caused by rotaviruses.
- Respiratory symptoms rarely coexist, and the duration of illness is relatively brief (usually 1–2 days).

All gastroenteritis viruses have similar symptoms, including diarrhea, cramps, vomiting, and mild fever. As a result, they are often indistinguishable based on their manifestations alone.

# Diagnosis and Treatment

- These viruses can be detected by electron microscopy or immunoelectron microscopy in stools during the acute phase of illness.
- In addition, EIA and PCR methods have been developed. EIA stands for **Enzyme Immunoassay** a laboratory technique used to detect the presence of specific antigens or antibodies in a sample.
- As with rotavirus infection, there is **no specific treatment** other than fluid and electrolyte replacement.
- Prevention requires good hygienic measures.**NO VACCINE**

# How do we treat dehydration?
# Fluid Replacement

- The recommended treatment for dehydration is **oral rehydration solution (ORS)**. ORS packets contain a specific, balanced amount of electrolytes and glucose, which are appropriate for children. An example of such a solution is **AquaSal (ORS)**, محلول الاكواسال سهل الاستعمال:)

- Using just **water and sugar**, or drinks like **Seven Up(مقاطعة)**, is **incorrect**, as they do not provide the correct balance of electrolytes and sugars needed for proper hydration. Since you may not know the exact amounts of sugar and salt to administer, it's best to visit a pharmacy, purchase an ORS solution, and mix it with **1 liter of water** as per the instructions on the package.

- If more severe symptoms of dehydration appear, it's essential to go to the hospital for **IV fluid replacement**. IV fluid calculations are complex and should be managed by healthcare professionals.

# Summary for the last 2 viruses

- **Rotavirus**

1. **Structure** Non-enveloped, double-shelled, 70 nm, 11-segment dsRNA, icosahedral symmetry

2. **Classification** - **Group A** Main human pathogens (subtypes 1-4) - **Group B** Infects pigs, rats - **Group C** Infects pigs, occasionally humans - **Group D/E** Infects birds, pigs

3. **Epidemiology** - Primarily affects infants and young children (1-24 months) - Transmission Fecal-oral - Up to 90% of individuals have antibodies by age 4

4. **Clinical** - Incubation 1-3 days - Symptoms Vomiting, watery diarrhea, low-grade fever - Major complication Severe dehydration

5. **Diagnosis** Stool antigen detection (EIA, PCR)

6. **Treatment** No specific antiviral; fluid and electrolyte replacement

7. **Prevention** Vaccine with 80% effectiveness

**Calicivirus**

1. **Structure** Non-enveloped, 35 nm, ssRNA, icosahedral capsid

2. **Epidemiology** - Common in outbreaks, especially in older children/adults - Transmission Fecal-oral, contaminated food/water

3. **Clinical** - Incubation 10-51 hours - Symptoms Vomiting, diarrhea, short duration (1-2 days)

4. **Diagnosis** Clinical, antigen detection

# For any feedback, scan the code or click on it.

Corrections from previous versions:

| Versions | Slide # and Place of Error | Before Correction | After Correction |
|---|---|---|---|
| V0 → V1 | Slide 24 | (Very typical symptom and if noticed, the disease will be detected. easily … | (Very typical symptom ,so if noticed, the disease will be detected easily … (just in order to make it clear) |
| | Slide 25 | (recently it is preferred, for several reasons: not irritable – induce the neutralizing of IG-A in digestive system) | (recently it is preferred, for several reasons: not irritating – induce the production of IgA in digestive system) (just in order to make it clear) |
| | Slide 31 | The last sentence wasn't visible | "Transmission is mainly by fecal oral rout" |

# Additional Resources:

Extra References for the Reader to Use:

1. Sketchy: Picornavirus Overview
2. Dr. Matt & Mike: RSV
3. Physeo: RSV and hPMV (not included)

# رسالة من الفريق العلمي:

اللهم احمِ الأردن آمنه وآمانه، سمائه وأرضه ومائه، قائده وشعبه وجيشه وكل القائمين على أموره، وسدد قائده وأولي الأمر منا لما فيه صلاح أحوالنا وأحوال الأمة الإسلامية والعربية، وأدم علينا الدين والأمن والأمان والصحة والعافية.

اللهم نستودعك أهالي غزّة وفلسطين و المسلمين المستضعفين فانصرهم واحفظهم بعينك التي لا تنام، واربط على قلوبهم وأمدهم بجُندك وأنزل عليهم سكينتك وسخر لهم الأرض ومن عليها، اللهم داوي جرحاهم وشافي مرضاهم وتقبّل شهدائهم واطعم جوعهم وارو ظمأهم واستر عوارتهم وآمن روعاتهم واجعل ما يحدث لهم بردًا وسلامًا عليهم , و قوي ايمانهم , اللهم ثبّت الأرض من تحت أقدام المجاهدين وسدد رميهم وانصرهم على عدوك وعدوهم. "اللهم اكسر بنا شوكتهم ، اللهم نكّس بنا رايتهم ، اللهم أذّل بنا قادتهم ، اللهم حطّم بنا هيبتهم ، اللهم أزل بنا دولتهم ، اللهم أنفذ بنا قدرك فيهم ، بالزوال والتدمير والتتبير يا رب العالمين ".

كان غيرك أفقه وأعلم ثم ضل، وكان غيرك أثبت وأعبد ثم زل .. فلا تتكبر واسأل الله الثبات. اللهم ما مقلب القلوب ثبت قلوبنا على دينك و صرّف قلوبنا على طاعتك.