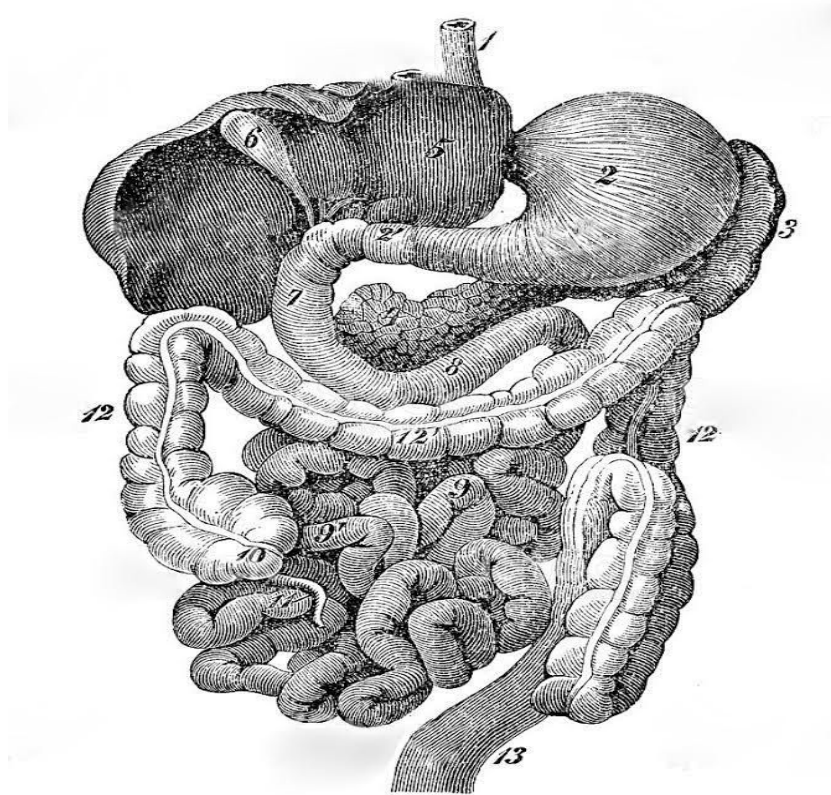


# Microbiology

435's Teamwork  
GastroIntestinal & Nutrition Block



- Kindly check our [Editing File](#) before studying the document.
- Please contact the team leaders for any suggestion, question or correction.
- Pay attention to the statements highlighted in **red**.
- Extra explanations are added for your understanding in **grey**.
- **Footnotes color code:** General | **Females** | **Males**.
- **color code:** **Female's notes** | **Male's notes**.

Revised by

خولة العماري & هشام الغفيلي



# Viral gastroenteritis

Resources: Sherris Medical Microbiology, LIR Microbiology,...

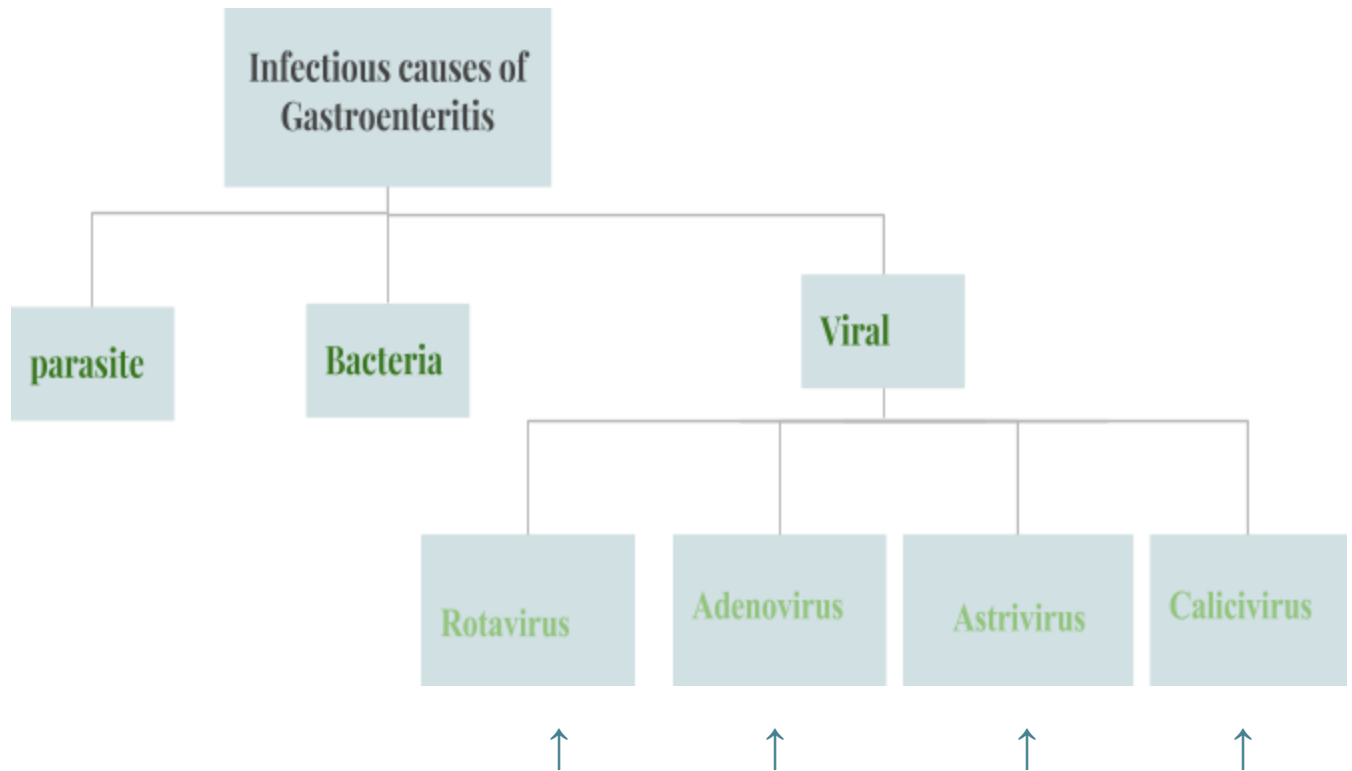
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## Learning Objectives:

**By the end of this lecture, you should know the...**

1. Identify and compare between the main viral etiology of gastroenteritis (rotavirus, adenovirus, calicivirus, astrovirus)
  2. Describe the essential characteristics of these viruses.
  3. Explain the epidemiology and the mode of transmission of these viruses.
  4. Explain the clinical manifestations of gastroenteritis.
  5. Describe and interpret the laboratory methods used to diagnose these viral infections.
  6. Describe the treatments and the prevention measures available for these viral infections
- 

## Lecture Outline:



**ALL are Non-enveloped**

# Gastroenteritis

التهاب المعدة والأمعاء -vedio-

<b>Definition</b>	It is <b>inflammation</b> of the <b>gastrointestinal tract</b> which involves both <b>stomach</b> and <b>small intestine</b> and leading to acute <b>diarrhea</b> and <b>vomiting</b> .	
<b>Causes</b>	<b>Infectious<sup>1</sup>:</b>	<ol style="list-style-type: none"> <li>1) <b>Rotavirus</b> →(Most common cause of gastroenteritis in devolving and developed countries)</li> <li>2) <b>Adenovirus</b> serotype 40, &amp; 41</li> <li>3) <b>Calicivirus (Norovirus)</b>.</li> <li>4) <b>Astrovirus</b>.</li> <li>5) Other viruses: Coronaviruses, and Enteroviruses</li> </ol>
	<b>Noninfectious:</b>	chemical –allergy to food – drugs.
<b>Epidemiology</b>	<ul style="list-style-type: none"> <li>Worldwide distribution but common in poor hygiene, overcrowding and poverty.</li> <li>Affected infants and children less than 5 years more than older children and adults.</li> <li>Transmission: <b>Fecal-oral route</b>.</li> <li>Season: Winter months.</li> <li><b>Endemic</b> infection: group A <b>Rotavirus</b> and <b>Adenovirus</b> 40,41 in children</li> <li><b>Epidemic</b> infection: <b>Norovirus</b> in adult</li> </ul>	
<b>Clinical Features</b>	<ul style="list-style-type: none"> <li><b>Short</b> incubation period.</li> <li>Symptoms: non bloody <b>diarrhea</b>, <b>vomiting</b>, fever and <b>abdominal cramps</b>.</li> <li>Life-threatening complication: <b>dehydration</b>.</li> <li>Winter vomiting disease: main symptom is <b>vomiting cause is calicivirus</b>.</li> </ul>	
<b>Lab diagnosis</b>	<b>Used</b>	- <b>ELISA</b> for detection of viral antigens <b>in stool</b> .
	<b>Not used</b>	<ul style="list-style-type: none"> <li>Cell culture: growing poorly.</li> <li>Electron microscopy: many disadvantages<sup>2</sup>.</li> </ul>
<b>Management</b>	<b>Treatment<sup>3</sup></b>	<ul style="list-style-type: none"> <li>Self limiting لأنها فيروسات</li> <li>Rehydration and supportive</li> </ul> <p>المريض عنده نقص في السوائل -Dehydration- بسبب الإسهال، فنسوي له إعادة سوائل عن طريق شرب الكثير من الماء+ بعض المركبات المساعدة.</p>
	<b>Prevention</b>	<ul style="list-style-type: none"> <li>Sanitation &amp; hygiene measures.</li> <li>No vaccines <b>except for Rotavirus</b>.</li> </ul>

هذا الجدول كنظرة عامة وشاملة للفيروسات المسببة لالتهاب المعدة والأمعاء، فهكم له ببسمل عليك باقي المحاضرة، يتبقى لك الخصائص لكل فيروس ونحوها..

1 parasite – **viruses**- bacteria.

2 expensive – specific not sensitive ( require high concentration of viruses in the sample to get positive result)..

3 no specific treatment.

## ROTAVIRUS

<p><b>Description</b></p>	<ul style="list-style-type: none"> <li>- Family: <b>R</b>eoviridae [<b>R</b>espiratory &amp; <b>E</b>nteric <b>O</b>rpha]</li> <li>- 11 segments - <b>DsRNA</b></li> <li>- Double-layered icosahedral</li> <li>- <b>Double-Shelled</b> with Wheel<sup>4</sup>-Like Structure</li> <li>- <b>Nonenveloped</b><sup>5</sup> ~ 70 nm</li> <li>- RNA – <b>dependent RNA polymerase</b></li> <li>- It has 7 groups [A-G]: group A most common</li> </ul> <div data-bbox="1177 205 1523 569" style="float: right;"> </div>
<p><b>Epidemiology</b></p>	<ul style="list-style-type: none"> <li>- <b>Fecal-oral</b> route transition.</li> <li>- Affect all age groups.</li> <li>- Symptomatic infection → 6 -24 months. <b>Neonate mostly</b></li> <li>- Peak in <b>Winter</b> months</li> <li>- Infection : <b>Endemic</b> in children.</li> </ul>
<p><b>Pathogenesis</b></p>	<p>Ingestion of Rotavirus → affect the epithelial cells of small intestine (jejunum) → atrophy of villi and decreased production of digestive enzyme (disaccharidases) → sugars are not absorbed and accumulated in the lumen ( leads to increase water level ) → diarrhea</p> <div data-bbox="345 982 1576 1732" style="border: 1px solid black; padding: 10px;"> <ol style="list-style-type: none"> <li><b>1</b> Following ingestion, rotaviruses infect the epithelial cells of the small intestine, primarily the jejunum.</li> <li><b>2</b> Observed histologic changes include shortening and atrophy of the villi, decreasing the surface area of the small intestine.</li> <li><b>3</b> Production of digestive enzymes, such as disaccharidases normally synthesized by the brush border, is decreased.</li> <li><b>4</b> As a result, the patient experiences a malabsorptive state in which dietary nutrients such as sugars are not absorbed by the small intestine, leading to a hyperosmotic effect that causes diarrhea.</li> </ol> </div>

<sup>4</sup> Rotavirus : rota means wheel.

<sup>5</sup> more resistant to acidic PH than enveloped. So every organism cause gastroenteritis is nonenveloped.

Clinical features	Intestinal infection	<p><b>1-Infants &amp; young children (gastroenteritis):</b></p> <ul style="list-style-type: none"> <li>- Incubation period is 2 days.</li> <li>- Watery, <b>non-bloody diarrhea, vomiting</b> &amp; fever.</li> <li>- Complication: <b>Dehydration</b>.</li> <li>- Half of all admission cases of gastroenteritis is caused by rotavirus.</li> <li>- Death have been reported.</li> <li>- Outcomes:vary <ul style="list-style-type: none"> <li>- <b>Half</b> of all cases require <b>admission</b></li> <li>- In developed countries: <b>Mortality is low</b><sup>6</sup>.</li> <li>- In developing count: <b>Mortality is significant</b>.</li> </ul> </li> </ul> <p><b>2-Older children + adults (asymptomatic).</b></p> <p><b>3-Immunocompromised hosts (chronic diarrhea).</b></p>
	Extra intestinal infection	<ul style="list-style-type: none"> <li>- Encephalitis (small numbers)</li> </ul>
Diagnosis	<ul style="list-style-type: none"> <li>• <b>Sample stool</b> <ul style="list-style-type: none"> <li>- Most used Immunoassay (<b>ELISA</b><sup>7</sup>, <b>ICT</b><sup>8</sup> &amp; latex agglutination<sup>9</sup>)</li> <li>- Electron microscope</li> <li>- Gel electrophoresis<sup>10</sup></li> <li>- RT-PCR<sup>11</sup></li> <li>- Cell culture</li> </ul> </li> </ul>	
Management	Treatment	<ul style="list-style-type: none"> <li>- Self limiting</li> <li>- Rehydration</li> </ul>
	Prevention	<ul style="list-style-type: none"> <li>- Sanitation &amp; hygiene measures</li> <li>- <b>live attenuated vaccine oral :</b> <ul style="list-style-type: none"> <li>- Rotashield (withdrawn) سحب من الأسواق</li> <li>- Rotarix</li> <li>- RotaTeq</li> </ul> </li> </ul>

6 They have good treatment.

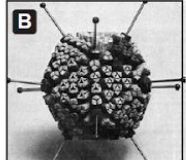
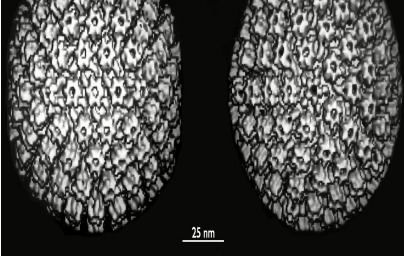
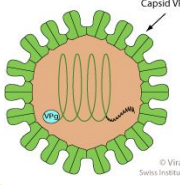
7 enzyme linked immunosorbent assay ( ELISA ): test that uses antibodies and color change to identify a substance.

8 Immunochromatographic Test (ICT)picture

9 this tests use the patient antigen- antibody immune response.

10 method for separation and analysis of macromolecules ( DNA, RNA and proteins ).

11 reverse transcription polymerase chain reaction

Virus	ADENOVIRUSES	ASTROVIRUSES	CALICIVIRUSES
<b>Description</b>	 <ul style="list-style-type: none"> <li>- <b>Family:</b> Adenoviridae</li> <li>- <b>Nonenveloped</b></li> <li>- <b>dsDNA</b></li> <li>- icosahedral</li> <li>- Only virus with a <b>fiber protruding from each of the vertices</b> (apex) of the capsid</li> <li>- Fiber is important for Attachment, <b>Hemagglutinin</b> and Type-specific antigen<sup>14</sup></li> <li>- <b>Classification:</b> <ul style="list-style-type: none"> <li>- <b>Adenoviruses:</b> (6 subgenera[A-G] _ 51 serotypes_ Grow in cell culture)</li> <li>- <b>Enteric adenoviruses:</b><sup>15</sup> (Subgenus F _ 40&amp;41 serotypes_ Fastidious<sup>16</sup>)</li> </ul> </li> </ul>	 <ul style="list-style-type: none"> <li>- <b>Family:</b> Astroviridae (astro= a star)</li> <li>- Nonenveloped</li> <li>- <b>ssRNA, +ve polarity</b></li> <li>- Icosahedral capsid</li> <li>- 5 or 6 Pointed Star on its surface.</li> <li>- 8 serotypes</li> </ul>	 <ul style="list-style-type: none"> <li>- <b>Family:</b> Caliciviridae (Calyx=cup)</li> <li>- Nonenveloped.</li> <li>- <b>ssRNA, +ve polarity.</b></li> <li>- Icosahedral capsid.</li> <li>- <b>Two morphologic types:</b> <ul style="list-style-type: none"> <li>- Typical caliciviruses (<u>Sapovirus<sup>12</sup></u>)</li> <li>- <b>small rounded structured</b> (<u>Norovirus</u>"norrwalk virus<sup>13</sup>").</li> </ul> </li> </ul>
<b>Clinical feature</b>	<p><b>Longer</b> incubation period, <b>less severe</b> and <b>prolonged</b> period than rotavirus</p>	<p>Mild gastroenteritis. Outbreak of diarrhea affect children less than 5 year</p>	<p><b>Of Norovirus:</b> Common symptom in children is <b>vomiting</b> Common symptom in adult is <b>diarrhea</b></p>
<b>Diagnosis</b>	<p>Antigen detection in stool by( <b>ELISA</b> Or Immunochromatography Technology)</p>		
<b>Epidemiology</b>	<p><b>Of Norovirus:</b> - <b>Faecal-oral</b> route Outbreaks in school, cruises and camp - Affect all age groups</p>		

12 Sapporo like virus is named after Sapporo, Japan where the virus was first discovered following an outbreak of mild gastroenteritis, Unlike Noroviruses Sapoviruses generally only causes mild gastroenteritis in young children

13 **Norwalk virus**, also known as winter vomiting **virus**, is a **virus** named after **Norwalk**, Ohio, in the United States, where an outbreak of acute **viral** gastroenteritis occurred among children in 1968

14 fibers make the virus able to attach to surface and help in classification of the virus

15 part of adenoviruses

16 شديدة الحساسية enteric adenoviruses don not grow in cell culture like other adenovirus

## Summary:)

### Gastroenteritis

**definition:** It is inflammation of the gastrointestinal tract which involves both stomach and small intestine and leading to acute diarrhea and vomiting

**Transmission:** Fecal-oral route. **Season:** Winter months

**Endemic infection:** Rotavirus and Adenovirus in children

**Epidemic infection:** Norovirus in adult

**Symptoms:** non bloody diarrhea, vomiting, fever and abdominal cramps

**Diagnosis:** ELISA for detection of viral antigens in stool

**complication:** dehydration

**Prevention:** Sanitation & hygiene measures- No vaccines except for rotavirus

**Treatment:** Rehydration

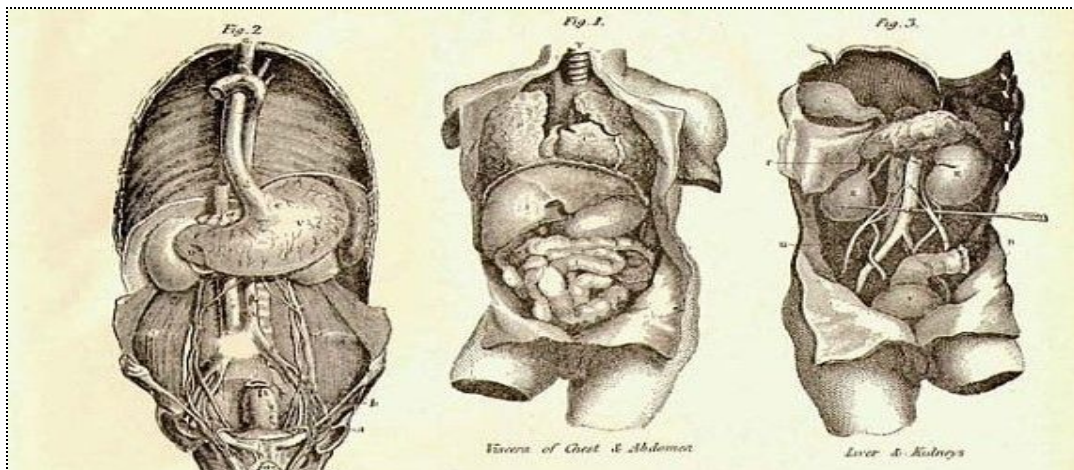
### Viral causes of infectious gastroenteritis

ROTA VIRUS	ADENOVIRUSES	Caliciviruses
<p><b>morphology:</b> 11 segments - dsRNA – Nonenveloped - group A most common</p> <p><b>transition:</b> Fecal-oral route affect all age groups Symptomatic infection: 6 -24 months</p> <p><b>Clinical feature:</b> 1-Infants &amp; young children (<i>gastroenteritis</i>). 2-Older children + adults(<i>asymptomatic</i>). 3-immunocompromised pt (chronic diarrhea)</p> <p><b>diagnosis:</b> stool sample <b>Most used</b> Immunoassay (ELISA, ICT &amp; latex agglutination)</p> <p><b>Treatment:</b> Rehydration <b>Prevention:</b> Sanitation &amp; hygiene measures</p> <p><b>live attenuated vaccine oral :</b> (Rotashield (withdrawn), Rotarix or RotaTeq)</p>	<p><b>morphology:</b> dsDNA Nonenveloped - – icosahedral</p> <p><b>*Enteric adenoviruses</b> (Subgenus F-Fastidious -40 &amp; 41 serotypes). Longer incubation period, less severe and prolonged period than rotavirus</p> <p><b>diagnosis:</b> Antigen detection in stool by <b>ELISA.</b></p>	<p><b>morphology:</b> ssRNA Nonenveloped - Icosahedral capsid</p> <p><b>:Two morphologic types</b> <u>Sapovirus</u> <u>Norovirus</u></p> <p>.Faecal-oral route .Outbreaks in schools and camps Affect all age groups Common symptom in children is vomiting Common symptom in adult is diarrhea</p> <p><b>Diagnosis :</b> Viral antigen in stool by <b>ELISA</b></p>

## Astroviruses

Astroviridae- ssRNA – Nonenveloped- Icosahedral capsid  
Mild gastroenteritis Outbreak of diarrhea affect children less than 5 years.  
Antigen detection in stool by **ELISA**

<u>Virus</u>	<u>Genome</u>	<u>Important Morphological features</u>
• Rotavirus	dsRNA 11 Segments	Double-Shelled With Wheel-Like Structure.
▪ Adenovirus 40,41 types	dsDNA	Classical Icosahedral capsid with fibers.
▪ Calicivirus	ssRNA(+)	Cup-Like depression on its surface .
▪ Astrovirus	ssRNA(+)	5 or 6-Pointed Star on its surface .





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## **Team Leaders**

**Rawan Aldhuwayhi & Ali Alzahrani**

### **Heartful thanks to our phenomenal team members**

**Afnan Almalki**  
**Alanoud Alomair**  
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**Reem Albahlal**  
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