

## Lecture 5

### Viral Gastroenteritis



*Microbiology team 430*

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## Viral Gastroenteritis (viral GE)

**Def:** It is an inflammation involving stomach & small intestine.

### ❖ Etiologic agents:

Virus	Genome	Important Morphological features	Type of infection
Rotavirus	ds RNA (11 segments)	<u>Double-Shelled With Wheel-Like Structure.</u>	Endemic & epidemic
Adenovirus (40,41 types)	ds DNA	Classical Icosahedron with <u>fibers</u> .	Endemic
Calicivirus	ss RNA(+)	<u>Cup-Like depression</u> on its surface.	Epidemic
Astrovirus	ss RNA(+)	5 or 6-Pointed <u>Star</u> on its surface.	Epidemic

- **Other viruses:** Coronaviruses ,Toroviruses , Adenoviruses & Enteroviruses

### ❖ Epidemiology:

- **Distribution:** Worldwide ( ↑in poor hygiene, overcrowding, and poverty)
- **Age group:** **infants & young children** more than older children
- **Transmission:** **fecal-oral route.**
- **Season:** **Winter** months.
- **Endemic** infections are caused by **Group A Rota & Adeno 40, 41.**
- **Epidemic** infections are caused by **Norovirus** “Calicivirus”.

### ❖ Clinical Features:

- **Incubation period (IP):** Short.
- **Symptoms:** Diarrhea, Vomiting, Fever & abdominal cramps.
- **Dehydration** with low Na → Life threatening
- Most commonly in **winter**.
- If Vomiting > Diarrhea → that's usually caused by Calicivirus

### ❖ Lab diagnosis:

- **Cell culture:**
  - Fastidious → growing poorly → not used routinely.
- **Electron microscopy (EM):**
  - Catch all technique (Many disadvantages) → not used.
- **Specific test:**
  - **ELISA** for detection of viral antigen in stool [Rota, Adeno, Astro & Caliciviruses].

Disadvantage of EM:

- Expensive
- Require high concentration of organisms in the stool.
- Specific but not sensitive

Immunochromatography → for Rota & Adeno viruses

ELISA → for Astroviruse & Caliciviruses

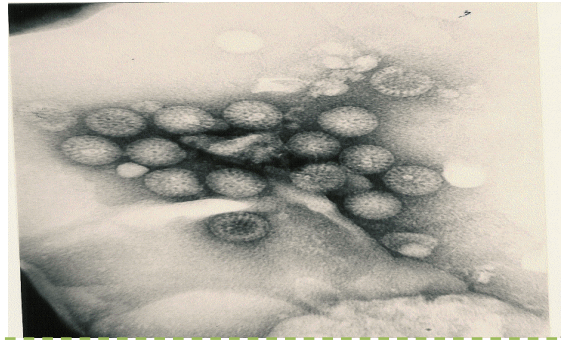
### ❖ Management:

- **Treatment:** Rehydration
- **Prevention:**
  - Sanitation & hygiene measures.
  - No vaccines **except** for **rotavirus**.
- In severe diarrhea illnesses requiring **Hospitalization of infants & young children.**



## ROTA VIRUS (most common)

- **Family:** Reoviridae [Respiratory& Enteric Orphan]
- **Description:**
  - 11 segments dsRNA.
  - Double-layered icosahedral.
  - Nonenveloped.
  - ~ 70 nm
  - RNA – dependent RNA polymerase.
- 7 groups [from A-G] → **Group A is the most common.**



Double layered Icosahedral, **wheel like structure**, non-enveloped & d.s RNA genome

### ❖ Epidemiology:

- **Spread:** Faecal-oral route
- **Age:** all age groups
- **Causes:** Symptomatic infection in children from 6 -24 months.
- **Peak:** Winter months
- **Infection:** Endemic

In infants less than 6 months, asymptomatic infection could happen by acquired maternal antibodies through placenta, so every neonate born having at least one antibody.

### ❖ Pathogenesis: "may apply to all viruses"

Ingested rotavirus → affect **epithelial cell** at the tip of the villi → by replication of the virus, new particles could be produced & affect other cells → causing atrophy of the villi & decreasing the surface area of the small intestine → decreases digestion → hyperosmotic → leads to **malabsorption & diarrhea**.

### ❖ Clinical features:

- **Causes:** Intestinal infection
- **Group age:** **Infants & young children** (it is also called infantile GE)
- **Incubation period (IP)** = 1-2 days
- **Clinical presentation:** Watery & nonbloody diarrhea, Vomiting & Fever → that could result in dehydration
- **Outcomes:** (Vary)
  - In developed count → Mortality is low
  - In developing count → Mortality is significant also deaths have been reported
- 1/2 of all GE cases that require hospital Admission are caused by Rotavirus.
- **Causes:**
  - Intestinal inf:
    - Infants & young children → Gastroenteritis
    - Older children+ adults → asymptomatic infection
    - Immunocompromised hosts → chronic diarrhea
  - Extra-intestinal inf:
    - Encephalitis (in small numbers, usually in immunocompromised patients).

### ❖ Diagnosis:

- **Sample:** from **stool** (should be taken in the first few days because of the high concentration of viruses)
- **Tests :**
  - **Immunoassay (Most used)**
    - ELISA , immunochromatography (ICT) & latex agglutination.
  - Electromicroscope (EM). (is used for non group A rotavirus).
  - Gel electrophoresis.
  - RT-PCR
  - Cell culture

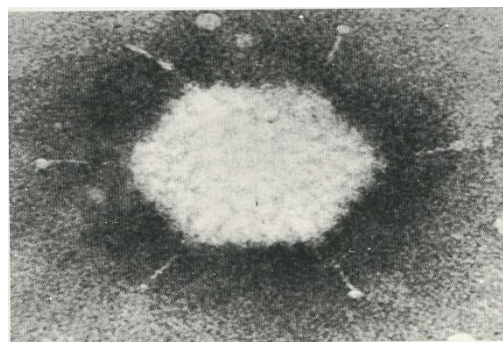
Tests other than immunoassay are usually used for study purposes.

### ❖ Management:

- **Treatment:** Rehydration (by giving electrolytes and fluids) “supportive therapy”
- **Prevention:**
  - Sanitation & hygiene measures
  - **Vaccine: life attenuated vaccine** (LAV) given orally.
    - Rotashield vaccine (has been withdrawn because of its side effects).
    - Rotarix vaccine.
    - RotaTeq vaccine.

## ENTERIC ADENOVIRUSES

- **Family:** Adenoviridae.
- **Description:** Nonenveloped, icosahedral, **dsDNA**, with **fibers**.



- Adenovirus is the only virus with a fiber, protruding from each of the vertices of the capsid
- Fiber can help the virus in:
  - Attachment.
  - Hemagglutinin.
  - Type-specific antigen.

### ❖ Classification:

Adenoviruses:	Enteric adenoviruses:
<ul style="list-style-type: none"> <li>- 6 subgenera [A-F].</li> <li>- 51 serotypes.</li> <li>- Grow in Cell Culture.</li> </ul>	<ul style="list-style-type: none"> <li>- Subgenus F.</li> <li>- <b>40 &amp; 41 serotypes.</b></li> <li>- Fastidious.</li> </ul>

### ❖ Clinical feature:

As compared to Rotavirus it has :

- **Longer** incubation period (IP).
- Less severe.
- Prolonged illness.
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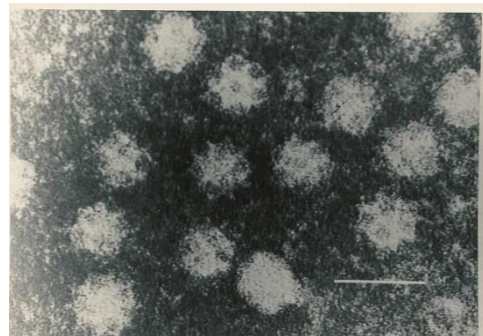
### ❖ Diagnosis:

- Antigen detection in stool by:
  - **ELISA**
  - **Immunochromatography Tech.**

Management & prevention:  
No specific treatment or vaccine

## Caliciviruses

- **Family:** Caliciviridae [Calyx = **cup**]
- **Description:** Nonenveloped, ssRNA, +ve polarity, Icosahedral capsid
- **Two morphologic types:**
  - Typical caliciviruses (Sapoviruses)
  - Small Rounded Structured Viruses. (Noroviruses)



Positive polarity (+ve polarity) means that the RNA of the virus is directly cultured, while -ve polarity, the RNA should be transcribed.

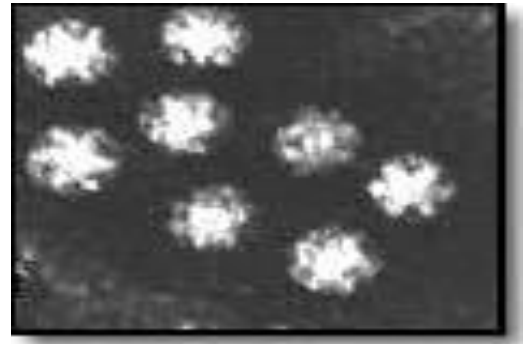
Nonenveloped, ssRNA, +ve polarity, Icosahedral capsid, **cup like depression**.

## NOROVIRUS (*Norwalk virus*)

- **Epidemiology:** Faecal-oral route [water, shellfish]
- **Outbreaks of GE:** often occurs in closed or semi-closed communities such as [Schools, camps, cruise, hospitals and prisons]
- **Group age:** All age groups.
- **Clinical features:**
  - Children → vomiting [projectile].
  - Adults → diarrhea.
- **Diagnosis:** Viral Antigen in stool is detected by ELISA.

## Astroviruses

- **Family:** Astroviridae [astro= a Star]
- **Description:** Nonenveloped, ssRNA, +ve polarity, Icosahedral capsid
- 8 serotypes.
- **Clinical features:**
  - Mild gastroenteritis than Rotavirus.
  - Outbreak of diarrhea <5 yrs
- **Lab. Diagnosis:**
  - Antigen detection in stool by ELISA.
- No specific management.



Nonenveloped, ssRNA, +ve polarity,  
Icosahedral capsid, star shaped

## Summary

- **Viral Gastroenteritis** has **no antiviral therapy**, just a **supportive therapy**.
- **Clinical presentations** -for all viruses- are similar (watery **diarrhea**, **vomiting** and **fever**).
- **Most common** virus causing GE is **Rotavirus** especially **group A**.
- **No vaccine** is available against viruses causing GE **except** for **Rotavirus**.
- Rotavirus vaccine is a **life attenuated vaccine** and it's given **orally**.
- **All viruses** (rotavirus, adenovirus, calicivirus, astrovirus) have a **RNA** genome **except Adenovirus** which has **DNA** genome.
- **Adenovirus type 40 & 41** causes GE.
- **All viruses** (rotavirus, adenovirus, calicivirus, astrovirus) causing GE are **nonenveloped**.
- **All viruses** that cause GE are transmitted by **fecal oral route**.
- **Dehydration** could happen as a **complication** of GE due to loss of Na by vomiting & diarrhea.
- **Best sample** is **stool sample**.
- For lab diagnosis, **ELISA** test is used to detect antigen in **all viruses** (rotavirus, adenovirus, calicivirus, astrovirus).
- **Immunochromatography** is a test that can be used for **Rotavirus & Adenovirus**.
- **Noroviruses** (calicivirus) infections affect all age groups and occur in **closed communities**.

Virus	Genome	Important Morphological features	Type of infection
<b>Rotavirus</b>	ds RNA (11 segments)	<u>Double-Shelled With Wheel-Like Structure.</u>	Endemic & epidemic
<b>Adenovirus (40,41 types)</b>	ds <u>DNA</u>	Classical Icosahedron with <u>fibers</u> .	Endemic
<b>Calicivirus (Noroviruses)</b>	ss RNA(+)	<u>Cup-Like depression</u> on its surface.	Epidemic <b>outbreak in school</b> .
<b>Astrovirus</b>	ss RNA(+)	5 or 6-Pointed <u>Star</u> on its surface.	Epidemic → in children