

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 on its surface.</u>	Epidemic
Astrovirus	ss RNA(+)	<u>5 or 6-Pointed Star on its surface.</u>	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

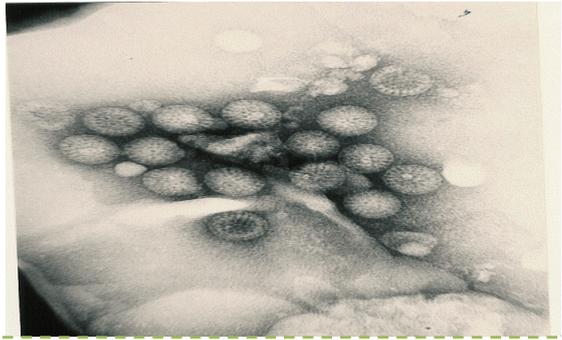
ELISA → for **Astroviruse & Caliciviruses**

❖ 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

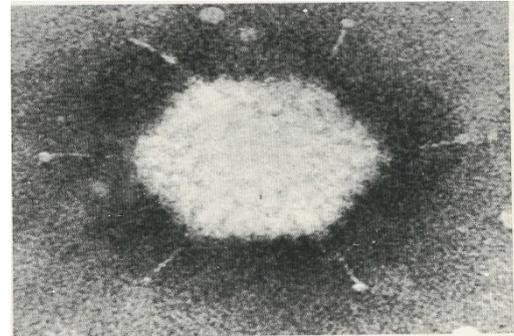
Tests other than immunoassay are usually used for study purposes.

❖ **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 it's 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"> - 6 subgenera [A-F]. - 51 serotypes. - Grow in Cell Culture. 	<ul style="list-style-type: none"> - Subgenus F. - 40 & 41 serotypes. - Fastidious.

❖ Clinical feature:

As comparative to Rotavirus it has :

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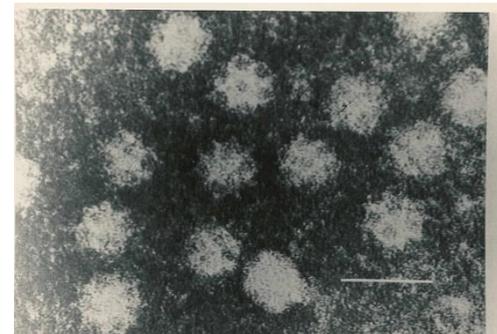
❖ Diagnosis:

- 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 transcript.

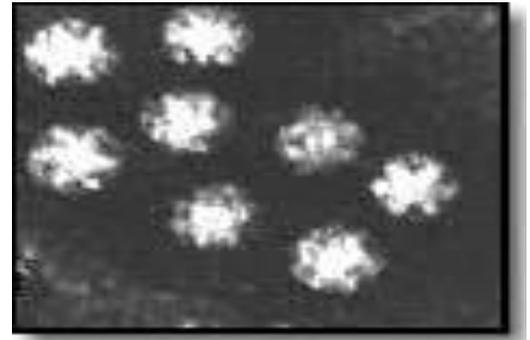
Nonenveloped, ssRNA, +ve polarity, Icosahedral capsid, **cup like depression.**

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** (caliciviruses) infections affect all age groups and occur in **closed communities**.

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Calicivirus (Noroviruses)	ss RNA(+)	<u>Cup-Like depression</u> on its surface.	Epidemic outbreak in school .
Astrovirus	ss RNA(+)	5 or 6-Pointed <u>Star</u> on its surface.	Epidemic →in children