Viral Gastroenteritis

Lecture objectives:

- Definition of viral gastroenteritis.
- Viral etiology of GE (Structures)
- Epidemiology.
- Clinical Features.
- Lab diagnosis.
- Treatment & Prevention (Vaccine).

Color index:

- Important
- Doctors' note
- Extra
- Found in Girls' slides
- Found in Boys' slides

EDITING FILE

Gastroenteritis

Definition

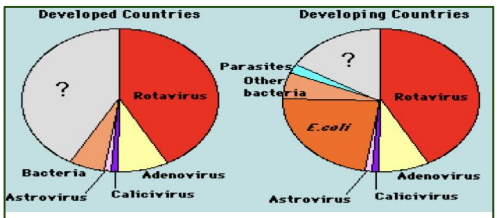
It is an inflammation of the gastrointestinal tract which involves both stomach and small intestine leading to acute diarrhea and vomiting.

Causes:

- Infectious
- Non-infectious: chemicals, toxins, allergy, & side effects of antibiotics.

Epidemiology

- Worldwide; in **poor hygiene, overcrowding, and poverty**.
- Mainly infants & young children > older children.
- Transmit by **faecal-oral route.**
- Peaks in **winter months.**
- Endemic[2] infection: group A Rotavirus & Adenovirus 40 & 41 in children.
- Epidemic[2] infection: Norovirus (from Caliciviruses) in Adults.
  The most common cause of non-bacterial outbreak of GE.



Etiologic agents in severe diarrheal illnesses requiring hygiene and rehydration of infants & young children. (we can see that rotavirus is the most common in both developing and developed countries.)

Etiology

- **Rotavirus.** (Most common & can cause severe infection in children)
- **Adenovirus** serotype 40 & 41.[1]
- **Caliciviruses** (Norovirus/ norwalk virus)
- **Astrovirus.**
- Others: Coronavirus, Torovirus, and Enterovirus.

Clinical Features

- Incubation period: short (1-2 days in Rotavirus)
- Symptoms: **NON BLOODY diarrhea (watery)**, vomiting, fever, and abdominal cramps.
- Winter vomiting disease[3]: **Vomiting more than diarrhea (caused by calicivirus)**
- **Dehydration** with decreased Na+ is a **Life threatening** condition caused by diarrhea and vomiting.

1- Adenovirus has 51 serotypes but **only serotype 40 and 41** can cause gastroenteritis (also called group F).
2- Endemic: A disease that exists **permanently** in a particular region or population. e.g. Malaria is a constant worry in parts of Africa.
Epidemic: An **outbreak** of disease that attacks many peoples at about the same time and may spread through one or several communities.
3- A type of GE caused by calicivirus.

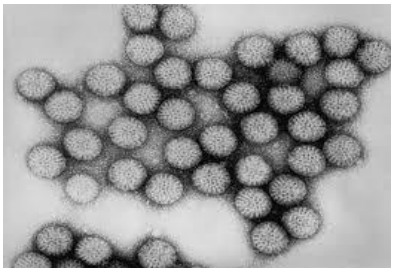
Viral Gastroenteritis

Virus	Rotavirus	Enteric Adenoviruses
Family	Reoviridae (Respiratory Enteric Orphan)	Adenoviridae.
Description[1]	- **Non-enveloped.** - **11 segments ds-RNA.** - Double-layered icosahedral capsid. - 70 nm. - **RNA-dependent RNA polymerase[4].**	- **Non-enveloped.** - **ds-DNA.** - Icosahedral capsid.
Morphological Features	Double-shelled with wheel-like structure.	Classical icosahedral capsid with fibers.
Epidemiology	- **Most common cause of gastroenteritis** - Affect all age groups but **mainly infants 6-24 months**.(Symptomatic infection) - Endemic	The 2nd most common cause of gastroenteritis
Classification	Has 7 groups (A-G). Most common: **group A.**	Adenovirus has 6 subgenera (A-F) (7 subgenera (A-g))which is composed of 51 (>50) serotypes, but only enteric adenoviruses causes gastroenteritis. - Grow in cell culture. **Enteric Adenoviruses:** - **Subgenus F, 40 & 41 serotype.** - Fastidious
Special informations	Outcomes vary: - ½ of all GE cases requires admission. - Developed countries have low mortality. - Developing countries have significant mortality. - Deaths are reported	- **The only virus with fiber protruding from each of the vertices of the capsid.** **- Fibers for:** **1- Attachment,** **2- Hemagglutinin[2]** **3- Type-specific Ag.**
Clinical Features	- Most common cause of gastroenteritis in infants (Infantile GE) & young children (GE) - IP= 1-2 days. - **Watery, non-bloody diarrhea with vomiting & fever.** - **Dehydration[5].** **Intestinal infection:** - GE in infants & young children. - Asymptomatic in older children & adults[6]. - Chronic diarrhea in low immune hosts. **Extra-intestinal infection:** - Encephalitis in small number of cases.	In comparison to Rotavirus: - Longer IP. - Less severe. - Prolonged illness.
Diagnosis:	Immunoassay: (Most used) Viral Ag in stool[7] samples by ELISA & Immunochromatography & latex agglutination. Others: EM, Gel electrophoresis, RT-PCR & Cell culture	Viral Ag in stool samples by ELISA & Immunochromatography

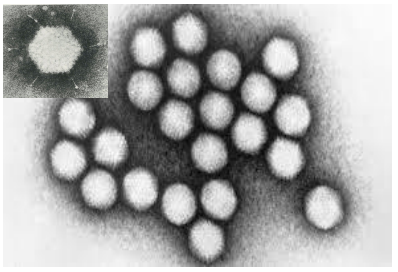
1- ALL viruses are non-enveloped, thus they are more stable in the harsh environment, and stomach acidity.
2- Glycoproteins which cause red blood cells to agglutinate(clump together forming aggregates). This process is called hemagglutination.
4- transcribe mRNA from the 11 segmented dsRNA (it's own genome) 5- Major complication & the cause of death.
6- However, they are source of infection to other susceptible patients (neonates & childrens) 7- Sample collected in the first few days of illness → higher number of viruses.

Viral Gastroenteritis

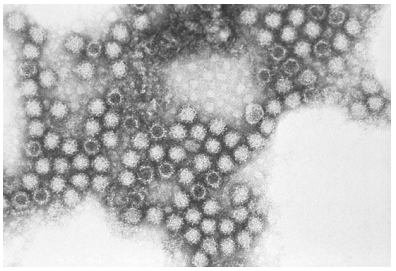
Virus	Caliciviruses (Norovirus)	Astroviruses
Family	Caliciviridae (Calyx=cup).	Astroviridae (astro=a star).
Description	- **Non-enveloped.** - **ss-RNA** with +ve polarity[1] - Icosahedral capsid.	- **Non-enveloped.** - **ss-RNA** with +ve polarity. - Icosahedral capsid
Morphological Features[1]	Cup-like depression on its surface.	5 or 6-pointed star on its surface.
Epidemiology	- **Faecal-oral (water, shellfish).** - All age groups. - **Outbreaks** of GE in schools, camps & cruises. - All age group	-
Classification	**Two morphologic types:** 1- Typical Caliciviruses (**Sapovirus**). 2- Small round structured viruses (**Norovirus**).	8 serotypes.
Clinical Features	Children: vomiting (projectile) Adults: diarrhea.	- Mild GE - Outbreak of diarrhea in children <5 yr.
Diagnosis	Viral Ag in stool samples by ELISA & Immunochromatography	Viral Ag in stool samples by ELISA & Immunochromatography



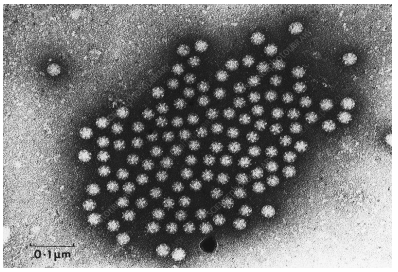
Rotavirus



Enteric Adenoviruses



Caliciviruses (Norovirus)



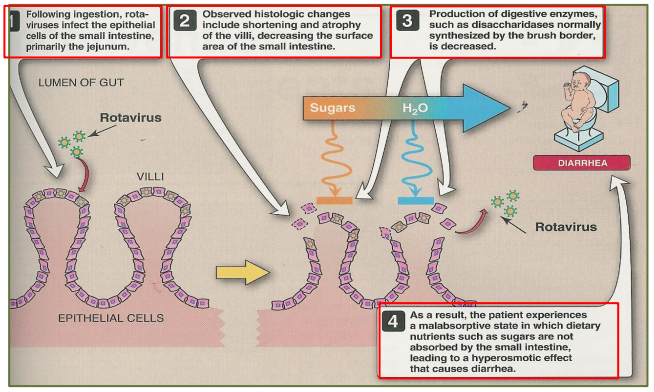
Astroviruses

1- acts directly as a viral mRNA, because it has a base sequence similar to mRNA.

Viral Gastroenteritis

Pathogenesis:[1]

Rotavirus infects villus cells of the proximal small intestine. The virus replicates intracellularly and eventually causes lysis in host cell. Cell destruction results in a significant decrease in intestinal surface area and consequently absorption from the intestinal lumen, thus causing watery diarrhea.



Lab Diagnosis

Cell culture:	Electron microscopy[2]:	Latex agglutination,gel electrophoresis, and RT-PCR[2];	Immunochromatography:	ELISA[3]:
Fastidious → Growing poorly → not used	-Catch all tech -not used (expensive).	Secondary tests for Rotavirus.	for detection of viral Ag in stool samples.	for detection of viral Ag in stool samples.

Complications:

Dehydration with decreased Na^+(life threatening)

Prevention:

Sanitation & hygiene measures.

No vaccines **except for Rotavirus**: **live attenuated vaccine, oral**; Rotarix, **RotaTeq** & Rotashield (withdrawn)[4]

Treatment:

- Self-limiting, treated by **rehydration**[5], and supportive treatment.

1- It's for Rotavirus, but Dr. Abdulkarim says it applies for all 4 viruses.
2- The ability of EM to catch all viruses from a single examination.
3- The major method to diagnose, due to the high sensitivity and specificity.
4- Not used anymore due to its adverse effects, now a days Rotarix and RotaTeq are used.
5- Oral or IV rehydration.

Quiz:

MCQ:

Q1:A, Q2:C, Q3:A, Q4:B, Q5:C Q6:C

Q1:Which of the following describes rotavirus?
A- Non-enveloped, ds-RNA
B- Non-enveloped, ds-DNA
C- Non-enveloped, ss-RNA
D- None of the above.

Q2:Which of the following is true regarding Gastroenteritis caused by Calicivirus(Norovirus)?
A- Can be prevented by vaccines.
B- Children usually experience diarrhea more than vomiting
C- Children usually experience vomiting more than diarrhea
D- Affects children only

Q3:Which of the following viruses can be prevented by vaccines?
A- Rotavirus.
B- Adenovirus
C- Caliciviruses
D- Astrovirus

Q4:A 14 month old child is brought to the pediatrician with a case of diarrhea which his mother describes as "explosive", loose, and watery. She hasn't noticed any blood in the stools. Prior to yesterday's onset of diarrhea, the baby had been vomiting for 2 or 3 days. Some tests showed that the causative agent is non-enveloped, dsDNA. Which of the following is most likely the causative agent?
A- Rotavirus.
B- Adenovirus
C- Caliciviruses
D- Astrovirus

Q5:What type of vaccine is used for Rotavirus?
A- Live attenuated vaccine, IV
B- Inactivated killed antigen, oral
C- Live attenuated vaccine, oral
D- Purified antigen, IV

Q6: When suspecting viral gastroenteritis in children, what type of sample is used for immunoassay, and for the detection of what?
A- Stool sample, viral antibodies
B- Blood sample, viral antibodies
C- Stool sample, viral antigen
D- Blood sample, viral antigen

SAQ:

CASE: In the month of january, a 2-year-old girl is brought to her pediatrician by her parents because of a 3-day history of watery, nonbloody diarrhea, nausea, vomiting, and abdominal pain. Physical examination reveals the child is slightly tachycardic, with sunken eyes and poor skin turgor.

Q1:What's the most likely diagnosis?
A: Viral gastroenteritis

Q2:What are the most likely causative organisms?
A: – Rotavirus. – Adenovirus serotype 40, & 41. – Caliciviruses (Norovirus). – Astrovirus.

Q3: Describe each organism you mentioned above?
A:
Rotavirus: dsRNA, non-enveloped
Adenovirus serotype 40, & 41: dsDNA, non-enveloped
Caliciviruses: ssRNA, non-enveloped
Astrovirus: ssRNA, non-enveloped

Q4: How are they transmitted(Route of transmission)?
A: Faecal-oral route

Q5: How do we diagnose these organisms?
A: ELISA / Immunochromatography for detection of viral Ag in stool samples.

Q6: How can we prevent this disease?
A: We can only prevent rotavirus by vaccines like Rotarix, RotaTeq.

Members board:

- **Team Leaders:**

Abdulaziz Alshomar

Ghada Alsadhan

- **Team sub-leader:**

Mohammed Alhumud

- **This lecture was done by:**

★ Alwaleed Alzunaidi

★ Naif Alhoseini

Note takers:

- Mashal Abaalkhail
- Badr Alqarni
- Razan AlRabah