Lecture (7)

Viral Gastroenteritis

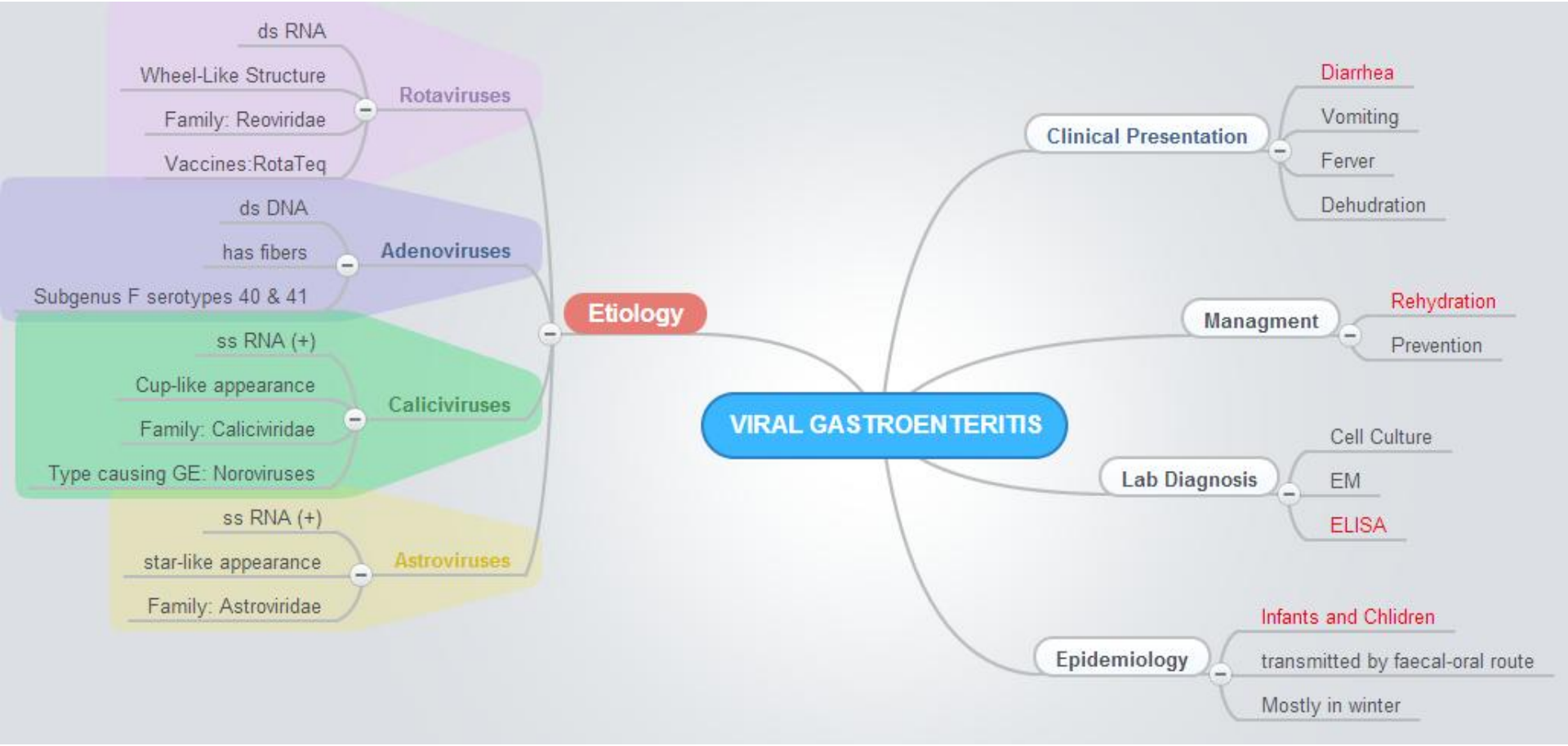
Objectives:

- Definition of Gastroenteritis.
- Viral etiology of Gastroenteritis (and Structures). Including: Rotavirus , Adenovirus , caliciviruses & Astrovirus.
- Epidemiology.
- Clinical Features.
- Lab diagnosis.
- Treatment & Prevention (Vaccines).

Done by: Latifah Al-fahad

REVIEWED BY: fahed alotaibi

MIND MAP
(Viral Gastroenteritis)



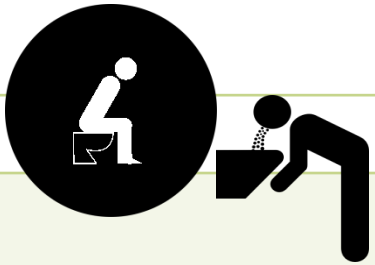
GE: Gastroenteritis.

Viral Gastroenteritis

Epidemiology:

Distribution	Worldwide. Incidence increase with poor hygiene, overcrowding, and poverty	
Age	Infants and children (younger more than older children)	
Transmission	Faecal-oral route	
Season	Winter	
Infection	Endemic	Rotavirus group A and Adenvirus serotype 40 and 41
	Epidemic	Norovirus (type of Caliciviruses)

Clinical Features:



Incubation period	Short
Symptoms	1. Diarrhea, vomiting and fever. 2. Dehydration with loss of Na+ (life threatening) 3. Winter vomiting disease: presents with vomiting more than diarrhea and is caused by Calicivirus.

Viral Gastroenteritis

Lab Diagnosis:

Cell culture	No longer used because these viruses are fastidious and grow poorly.
Electron microscopy	It's a catch all technique. (detects all sorts of viruses) But not used due to its many disadvantages. (the sample is stool).
Specific tests	ELISA for detection of viral antigens in stool. (detects all viruses in this lecture)

Most common way to diagnose viral GE

Management:

Treatment	**Rehydration.**
Prevention	1. Sanitation & hygiene measures 2. No vaccines except for rotavirus

Viral Causes of Gastroenteritis

Virus	Genome	Important Morphological features
Rotavirus	ds RNA 11 Segments	Double-Shelled With Wheel-Like Structure
Adenovirus 40,41 types	ds DNA	Classical Icosahedron with fibers
Calicivirus	ss RNA(+)	Cup-Like depression on its surface
Astrovirus	ss RNA(+)	5 or 6-Pointed Star on its surface

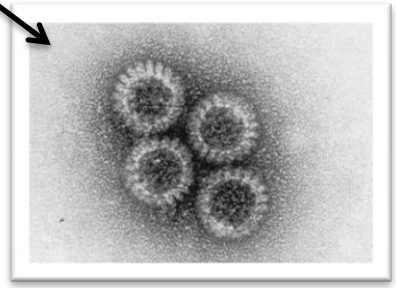
All these viruses are not enveloped. This makes them stronger and helps them resist the acidity of the stomach and hence, reach and infect the intestine.

ROTAVIRUS

Family: Reoviridae [Respiratory& Enteric Orphan]

Description:

- 11 segments ds RNA
- Double-layered icosahedral (wheel-like structure)
- Nonenveloped
- ~ 70 nm
- RNA – dependent RNA polymerase*
- 7 groups [from A to G] (Group A is most common. (More than 95% of rotavirus infections)



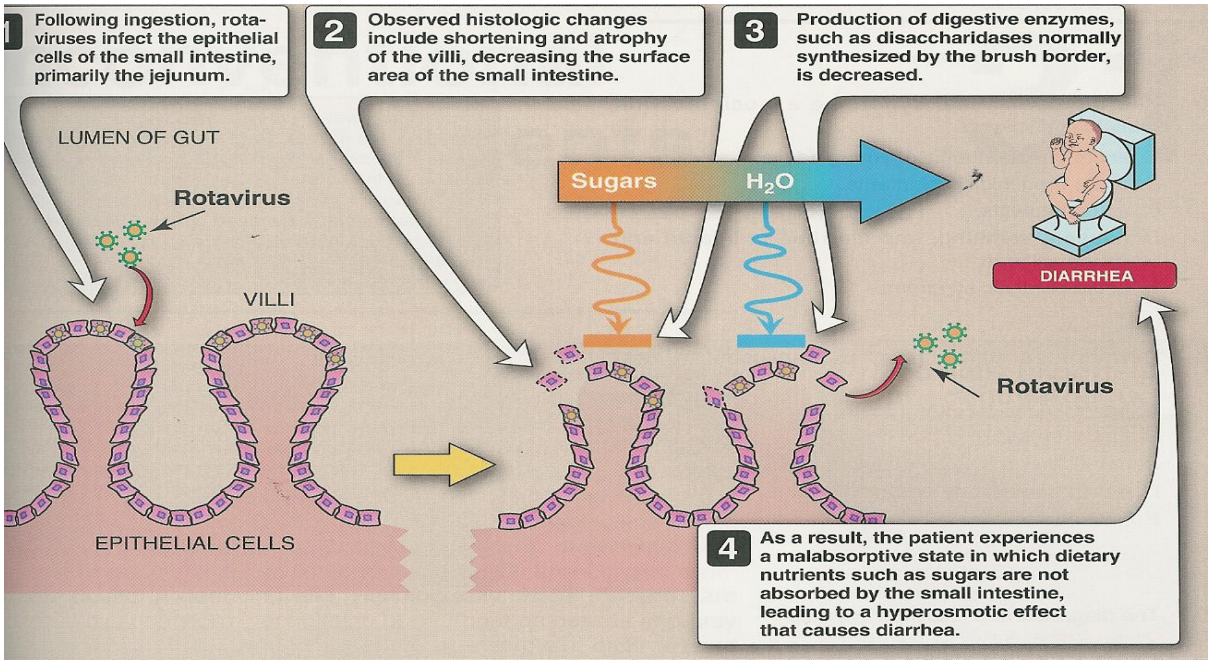
*RNA – dependent RNA polymerase is an enzyme that catalyses synthesis of the RNA strand complementary to a given RNA template.

ROTAVIRUS

Epidemiology:

Age	All age groups. Symptomatic in infants between 6 – 24 months.
Transmission	Faecal-oral route
Peak	Winter
Infection	Endemic

Pathophysiology:



ROTAVIRUS

Clinical Features:

1. **Extra-intestinal infections:** As Encephalitis (small numbers)
2. **Intestinal infections:**
   - Infants and young children ➔ GE
   - Older children and adults ➔ asymptomatic disease
   - Immunocompramised hosts ➔ chronic disease

the intestinal infection is common in Infants & young children (infantile GE):

Incubation period	1-2 days
Symptoms	1. Watery non-bloody diarrhea, vomiting and fever. 2. Dehydration

- Outcomes varies:
  - In developed countries ➔ Mortality is low
  - In developing countries ➔ Mortality is significant
  - ~1/2 of all GE cases need Admission
- Deaths have been reported

ROTAVIRUS

Lab Diagnosis:

Cell culture	
EM	Detects all groups (from A to G)
Immunoassay*	ELISA, ICT** and latex agglutination — Most used
Gel electrophoresis	Detects the migration pattern of the 11 segments.
RT.PCR	

The Sample is stool

Management:

Treatment	**Rehydration.** 
Prevention	1. Sanitation & hygiene measures 2. Vaccination by oral live attenuated viruses (LAV): A. Rotashield (withdrawn from the market) B. Rotarix C. RotaTeq

* Detects group A only.

** Immunochromatography.

ADENOVIRUSES

(ENTERIC ADENOVIRUSES)

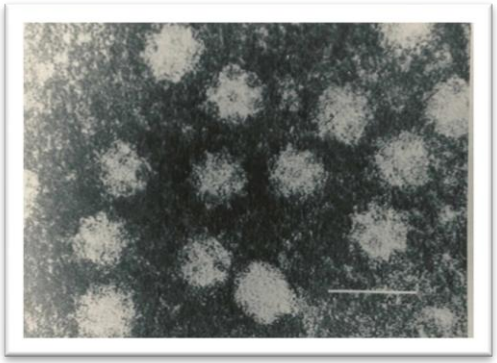
Family: Adenoviridae

Description:

- Nonenveloped, icosahedral , dsDNA
- The only virus with fibers protruding from each of the vertices of the capsid

  Fiber are:

  - For attachment
  - Contain Hemagglutinin
  - and Type-specific antigens



- Classification:

Adenoviruses →

Subgenera	6 From A to F
Serotypes	51 serotypes
They grow in cell culture.	

Enteric adenoviruses are:
- Subgenus F
- Serotypes 40 and 41
- Are fastidious

ADENOVIRUSES

(ENTERIC ADENOVIRUSES)

Clinical Features:

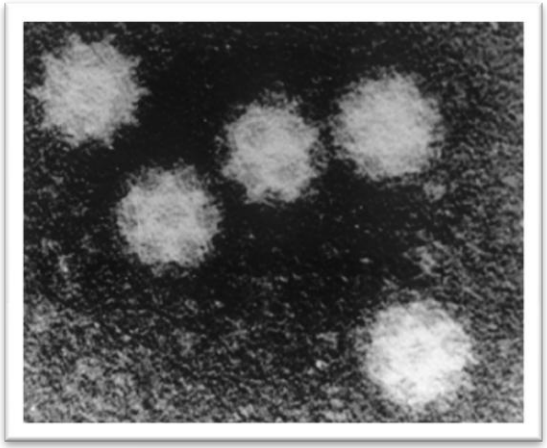
- Longer IP
- Less severe
- Prolonged illness

} Compared to Rotaviruses

Lab Diagnosis:

Immunoassay	1. ELISA: Antigene detection in stool. 2. ICT

Caliciviruses



Family: Caliciviridae [Calyx =cup]

Description:

- Nonenveloped
- ssRNA,+ve polarity*
- Icosahedral capsid

Two morphologic types:

1. Typical caliciviruses (Sapoviruses)
2. Small rounded structured viruses (Noroviruses)

*means that the base sequence of the viral ss RNA is the same as mRNA (viral RNA acts directly on the host to produce protein)

Caliciviruses

(NOROVIRUS - Norwalk virus)

Epidemiology:

Age	All age groups. Causes Outbreaks of GE in schools, camps & cruises.
Transmission	Faecal-oral route (water, shellfish)

Clinical Features:

Children	vomiting [projectile]
Adults	Diarrhea

Lab Diagnosis:

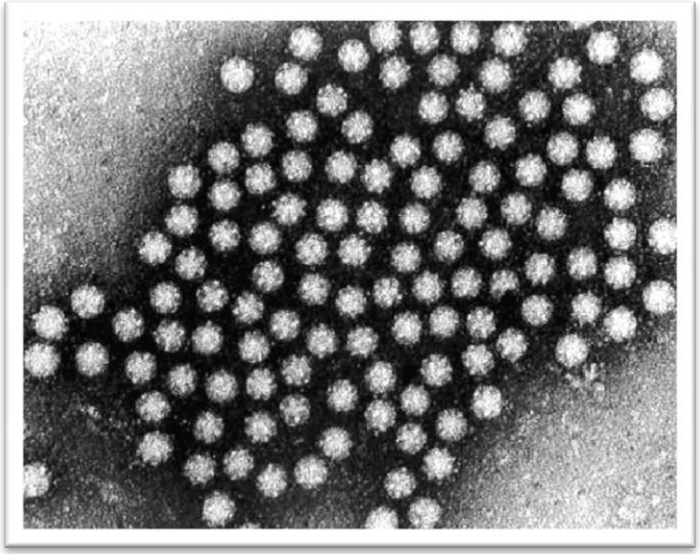
Immunoassay	ELISA: Antigene detection in stool.

Astroviruses

Family: Astroviridae [astro= a star]

Description:

- Nonenveloped
- ssRNA,+ve polarity
- Icosahedral capsid
- 8 serotypes



Clinical Features:

1. Mild GE
2. Outbreak of diarrhea <5 ys

Lab Diagnosis:

Immunoassay	ELISA: Antigene detection in stool.

	ROTAVIRUSESS	ADENOVIRUSES (Norovirus)	Caliciviruses	Astroviruses
Description	*ds-RNA	*ds-DNA	*ss-RNA	*ss-RNA
Clinical features	Intestinal infections: *Watery diarrhea -vomiting- fever *dehaydration *INFANTS= GE *ADULTS= asymptomatic *Low immune host= chronic diarrhea	*Longer IP than rotavirus *Less severe than rotavirus *Pronlonged illness	Children=vomiting Adults diarrhea	*Mild GE *Outbreak of diarrhea
Lab diagnosis	Ag detection in stool sample by ELISA or immunochromatography(ICT) -EM -Gel electrophories -RT-PCR -Cell culture	Ag detection in stool sample by ELISA or immunochromatography	Ag detection in stool sample by ELISA	Ag detection in stool sample by ELISA
Treatment	Self limiting rehydration	--	--	--
Vaccine	Live attenuated vaccine	--	--	--
Notes	* Faecal oral route *IP= 1-2 days *Endemic * Most common In developed and developing country	Enteric adenovirus: *40-41 serotype	*:Faecal-oral *Outbreak of GE in school camps cruises *All age of group	

	ROTAVIRUSESS	ADENOVIRUSES (Norovirus)	Caliciviruses	Astroviruses
Description	*ds-RNA	*ds-DNA	*ss-RNA	*ss-RNA
Clinical features	Intestinal infections: *Watery diarrhea -vomiting- fever *dehaydration *INFANTS= GE *ADULTS= asymptomatic *Low immune host= chronic diarrhea	*Longer IP than rotavirus *Less severe than rotavirus *Pronlonged illness	Children=vomiting Adults diarrhea	*Mild GE *Outbreak of diarrhea
Lab diagnosis	Ag detection in stool sample by ELISA or immunochromatography(ICT) -EM -Gel electrophories -RT-PCR -Cell culture	Ag detection in stool sample by ELISA or immunochromatography	Ag detection in stool sample by ELISA	Ag detection in stool sample by ELISA
Treatment	- Self limiting -rehydration	--	--	--
Vaccine	Live attenuated vaccine	--	--	--
Notes	* Faecal oral route *IP= 1-2 days *Endemic * Most common In developed and developing country	Enteric adenovirus: *40-41 serotype	*:Faecal-oral *Outbreak of GE in school camps cruises *All age of group	

Summary

Dr. Malak's notes.

• Viral GE is most commonly seen in infants and younger children.
•The most common cause of endemic viral GE is Rotaviruses group A. Followed by Adenoviruses subgeneus F, serotypes 40 and 41. Other causes include Caliciviruses and Astroviruses.
• The most common cause of non-bacterial epidemic GE is Caliciviruses, specifcally Noroviruses.
• The most important presentation is watery non-bloody diarrhea. A stool sample helps in the diagnosis.
•the most commonly used technique in diagnosing viral GE is immunological assays, particularly ELISA.
• These viruses can be diagnosed by electron microscopic examination because they have characteristic morphological appearances. But it's not the most commonly used technique.
• Viral GE is managed by rehydration.
•No vaccines available except for Rotaviruses (Live attenuated vaccine)

QUESTIONS

1) 7-month old infant presented with fever and watery diarrhea for the past 2 days. The doctor suspects viral GE, so a stool sample was taken for examination. The best way to examine this sample is by:

a. Cell culture.
b. EM.
c. ELISA.
d. RT-PCR.

2) For question 1, the detected virus is probably a:

a. Rotavirus type E.
b. Rotavirus type A.
c. Adenovirus subgenus B.
d. Adenovirus subgenus F.

QUESTIONS

3) A mother presented with diarrhea just after her 4-year old son started vomiting in a projectile manner the night before. The mother mentions that her son's classmates at the daycare center have the same symptoms. The most likely cause is:

a. Astrovirus.
b. Norwalk virus.
c. Adenovirus.
d. Rotavirus.

4) The most proper way to manage viral GE is:

a. Vaccination.
b. Antiviral agents.
c. Antipyretics.
d. Rehydration.

1. c
2. b
3. b
4. d

FOR ANY SUGGESTIONS AND PROBLEMS PLEASE CONTACT:
MICROBIOLOGY TEAM LEADERS
KHALED ALOSAIMI AND JOHARAH ALMUBRAD
MICROBIOLOGY432@GMAIL.COM