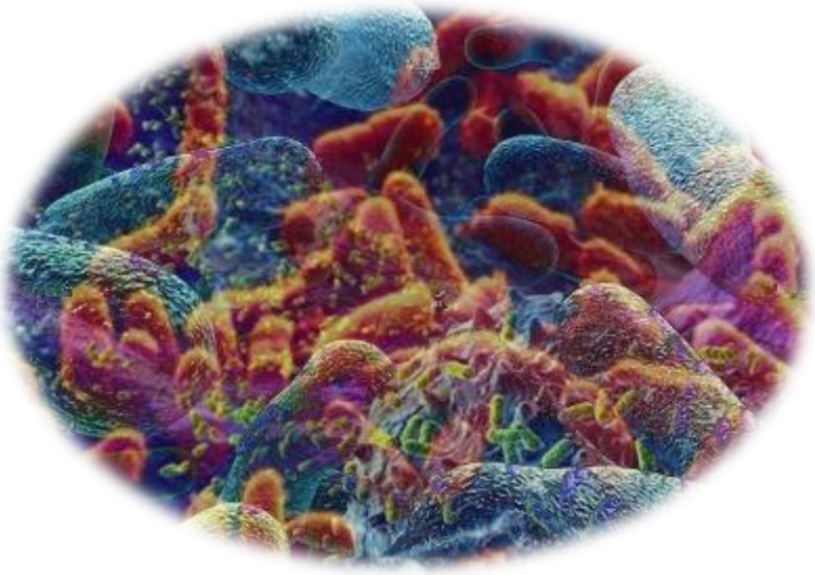
431 Microbiology Team

Cholera

GIT & HAEMATOLOGY BLOCK



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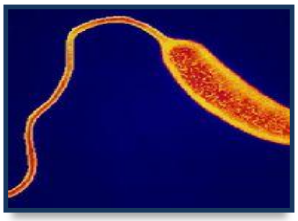
Etiology



- **Bacterium Vibrio Cholerae**
- **Gram negative(-)** comma shaped rods with single polar flagellum (are **highly motile**)
- Occurs in the **small intestine**
- Pathogenicity is due to **cholera enterotoxins** produced by the organism
- **It is a water-borne disease:** Found in salty or fresh water and may persist in shellfish or plankton
- Two main serotypes that cause the disease (that are toxigenic):
    1) **O1** serotype is more common. Has two types:
        - ❖ **Classical** → more common
        - ❖ **El Tor** → more aggressive
    2) **O139** serotype causes endemics in areas of poor sanitation such as India, Bangladesh
- Proliferate in the summer

El Tor = الطُّور (طور سيناء بمصر)
The name of the area where it was first identified

Pathophysiology

Toxins will bind to G-protein coupled receptor → Inactivation of GTPase (GTP will not be hydrolyzed to GDP) → G- protein stuck in "on" position → Increase cAMP → Activation of ion channels → NaCl influx into intestinal lumen → Increased intestinal lumen osmolarity will drag water into the lumen → Watery diarrhea → **Dehydration**

Transmission

- **Fecal-oral route***

* Feces of affected individual contaminate water supply → Infected water supply due to **poor sanitation and poor treatment of water** → Endemic

- Contaminated water or food due to:
  - ❖ Inadequate sewage treatment
  - ❖ **Improper cooking** of contaminated food

- Communicability: It is the ability of the organism to spread disease
  - ❖ During acute stage and a few days after recovery (**high communicability**)
  - ❖ By end of **1st** week, 70% of patients are non-infectious
  - ❖ By end of **3rd** week, 98% of patients are non-infectious

- Incubation period:
  - ❖ **Average** is **1-3 days**
  - ❖ **Low gastric acidity** (i.e: high gastric pH) and **high doses of cholera** reduce incubation period

Risk Factors

- **Low gastric acidity** (patients **using anti-acids** or **protein-pump inhibitors**)
- Immune-compromised patients
- Children and elderly
- **Blood type O** (unknown reasons)

Infectious Dose

It is the amount of pathogen (measured in number of microorganisms) required to cause an infection in the host.

- **10^6 - 10^{11}** colony-forming units (considered a high dose)
- A high dose is needed because the **high gastric acidity** and **bile salts in intestine** inhibit the organism's growth

Symptoms

- Occur 2-3 days after consumption of contaminated food/water
- Usually there is no fever and no destruction cells (doesn't enter blood stream)
- Usually mild, or no symptoms at all
  - ❖ **75% asymptomatic**
  - ❖ **20% mild disease**
  - ❖ **2-5% severe**
- **Watery diarrhea** (1L/hour) ⟶ **Dehydration**
- **Vomiting** ⟶ **Dehydration**
- Cramps

- Complications of **severe dehydration:**
  - ❖ **Sunken eyes, decreased skin turgor**
  - ❖ **Almost no urine production** (to conserve fluids)
  - ❖ Intravascular volume depletion **(hypovolemia)**
  - ❖ Severe metabolic acidosis
  - ❖ Hypokalemia

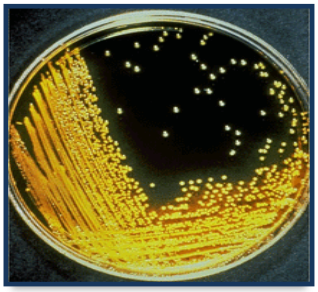
- **Cholera Gravis:**
  Cholera with more severe symptoms such as: excessive watery diarrhea (6L/Hour) and a large number of vibrio in stool (10^7 vibrios/mL).
  Patients rapidly lose more than 10% of body weight and death occurs in 12 hours or less.

Diagnosis

- Based on **clinical presentation** and confirmed by isolation of **vibrio cholera from stool**, and **history of patient** (if the patient visited any endemic areas)
- Cholera should be suspected when patients present with watery diarrhea, severe dehydration

- Clinical signs:
  - **Sunken eyes and cheeks**
  - **Decreased skin turgor**
  - Little to no urine production
  - Dry mucous membranes
  - **Watery diarrhea** consists of electrolytes and fluid **without RBCs or proteins**
  - enormous numbers of vibrio cholera (10^7 vibrios/mL)

- Lab diagnosis:
  - **Gram negative(-)** comma shaped (curved) rods with single polar flagellum (are highly motile)
  - Visualization by dark field or phase microscopy: **shooting star/dart appearance** (because of high motility)
  - Isolate V. cholerae from patient's stool → Culture on **TCBS** agar →formation of **yellow colonies**
  - Adding Antibody sera to the stool sample will stop motility in organism (visible on microscope)



TCBS: (Thiosulphate-citrate bile salt sucrose agar)

- Differential diagnoses of severe diarrhea:
  - Enterotoxigenic e. coli
  - Viral gastroenteritis
  - Bacterial food poisoning

Treatment

- Main goal is **rehydration**
- Oral rehydration: used when there is **less than 10%** body weight loss (**mild**) by ORS (oral rehydration salts), contains NaCl, KCl, NaHCO3, glucose
- Intravenous rehydration: **Ringer's solution (also called Ringer's Lactate)**, used if patient is vomiting, or there is **more than 10%** body weight loss (**severe**)
- Antibiotics: **Tetracycline**, Doxycycline
  - Reduce fluid loss
  - Shorten recovery time
  - **Decrease communicability**

Proper treatment reduces chance of mortality from 50% to less than 1%

Prevention

- Water sanitation and treatment, e.g. treating water with chlorine
- Cooking food thoroughly
- Washing hands frequently
- Vaccination:
  - ❖ Not recommended (brief and incomplete immunity, not effective in endemics)
  - ❖ Two types:
    Killed whole-cell (has weak protection)
    and
    Live-attenuated (induces mild cholera symptoms)

Summary

- Cholera is a water-Borne disease
- Pathogen is: Bacterium Vibrio Cholerae, **gram negative(-) comma shaped (curved) rod** with single polar flagellum (highly motile)
- Pathogenicity is due to **cholera enterotoxins** produced by the organism
- Infectious dose is **10^6 - 10^{11}**
- Major serotypes causing disease: O1 (more common) and O139
- Route of transmission: Fecal-oral
- Major symptoms are **watery diarrhea** (without blood nor proteins) and **vomiting** which cause **dehydration**; thus, there is a danger of hypovolemic shock. For this reason the major treatment is **rehydration** (orally by ORS if mild, IV by Ringer's Lactate if severe), and second to that comes antibiotics (**tetracycline**, doxycycline)
- Signs of severe dehydration: **Sunken eyes, decreased skin turgor, almost no urine production**
- Risk factors are: low gastric acidity (stomach), low bile salts (in intestine)
- For diagnosis: Clinical symptoms (diarrhea and vomiting...etc) + lab investigations (Gram stain, **shooting star/dart appearance** under visualization by dark field or phase microscopy, **yellow colonies** on **TCBS** agar)
- Vaccines are not recommended.

Questions:

1- A patient in the emergency department presents with vomiting, watery diarrhea and sunken eyes. The most initial treatment needed to save the life of this patient is:
A) IV doxycycline
B) Rehydration
C) Blood transfusion
D) Respiratory resuscitation

2- A young child was brought by his parents to the emergency department after coming back from a trip to a village and was complaining of severe diarrhea and vomiting after drinking from the main water pump in that village. A sample of his stool was sent to the lab and shooting star appearance was visible under dark field microscopy. Which of the following is the most likely diagnosis?
A) Enterotoxigenic e.coli
B) Viral gastroenteritis
C) Cholera
D) None of the above

3- Which of the following sites in the GIT is affected by vibrio cholerae in cholera infections?
A) Stomach
B) Small intestine
C) Large intestine
D) All of the above

4- Which of the following is found in the stool of a cholera patient?
A) Red blood cells
B) Proteins
C) Electrolytes
D) All of the above

Question no.	1	2	3	4
Answer	B	C	B	C