

Lecture – 3

Cholera



Microbiology Team 430

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Cholera

Cholera is an infection of the **small intestine** caused by ***Vibrio cholerae***. Transmission occurs primarily by **contaminated water/sea food**. It's highly **pandemic** and caused many outbreaks through history (**especially serotype O-1**). *V. Cholerae* produces an **enterotoxin** that causes **watery diarrhea** which lead to **severe dehydration** and electrolyte imbalance. Goal of treatment is **FLUIDS rehydration** and then antibiotics as adjacent therapy.

❖ Etiology

Bacterium *Vibrio Cholerae*

- **Gram (-) comma shaped, with single polar flagellum (motile).**
- It has 2 main serotypes:
 - **O-1 serotype** most common (**2 types classical and El tor**).
 - **O-139 serotype** has a polysaccharide capsule (it caused epidemics in Bangladesh).
- It grows in water, and found in shellfish and planktons – **cholera is water borne disease**.
- Transmitted by **fecal-oral route**.
- Usually in summer seasons.

❖ Epidemiology

- Epidemic in developing countries due to **poor sanitation and low hygiene**.
E.g. **India, Bangladesh**, Africa and South America.

Epidemics (by fecal-oral transmission):

Feces of infected individuals → contaminates water supply (because of Poor sewage and water treatment)
→ This will spread cholera infections causing epidemics in developing countries.

❖ Risk factors

- **Children and elderly.**
- Immune-compromised patients.
- **Low acidity in GIT (using anti-acids or PPIs).**
- **O blood type individuals** are more susceptible.

❖ Pathophysiology

Toxins will bind to G-protein coupled receptor → Inactivation of GTPase → 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 lumen → lead to watery diarrhea → **Dehydration**.

❖ Incubation & Communicability

- Average **incubation period** is from **1-3 days**.
- Communicability is high during Acute stage, and **remain after recovery**
After 1 week from recovery 70% of patients are non-infectious.
By the end of 3rd week 98% are non-infectious.

Incubation period: the time between exposure to the organism and the appearance of symptoms and signs.

Communicability: The ability of an organism to get transmitted.

❖ Infectious Dose (the lowest number of bacteria that causes the disease)

- 10^6 - 10^{11} colony-forming units (this is considered to be a high infectious dose).
- It's high because GIT acidity & bile salts inhibit the bacterial growth (anti-acids and PPIs are risk factors).

❖ Symptoms

- Occur in 2-3 days after consumption of contaminated food/water.
- 75% asymptomatic, 20% mild disease, 2-5% severe.

Symptoms are:

- Watery diarrhea (no blood because it is a non – invasive disease)
- Vomiting
- Cramps

*The symptoms of cholera are caused by the **enterotoxins**.

*Usually there is no fever because the bacteria do not go to blood (no bacteremia).

- These symptoms will lead to **dehydration**, and severe dehydration might cause:

- Hypovolemic Shock
- Metabolic acidosis
- Hypokalemia
- Cardiac and Renal failure
- Sunken eyes and decreased skin turgor
- Almost no urine production

Cholera Gravis (cholera with very severe symptoms)

*usually occurs in patients with risk factors

(Low gastric acidity, elderly)

*Rapid lose of fluids (6L/h) causes dehydration and shock, and this might lead to death in 12 hours or less.

❖ Diagnosis

- It's based on **clinical presentation** and **confirmed by isolation of v.cholerae from stool**.
- **physical examination might show signs of:**

- Decreased skin turgor
- Sunken eyes and cheeks
- Dry mucous membranes

- **Lab workup include:**

- **Visualization by microscopy**

Looks like **shooting stars** (single flagellum and highly motile)

- **Gram staining**

Gram (-) comma shaped bacteria.

- **Isolation from stool**

Cultured on special media **TCBS** agar (Thiosulphate-citrate bile salt sucrose agar)

And appear as **yellow colonies**.

Differential diagnosis of diarrhea includes:

(Viral gastroenteritis, Enterotoxigenic E.coli and bacterial food poisoning).

But cholera produces watery diarrhea that **consist of fluids and electrolytes without RBCs and proteins**.

Also **enormous numbers of v.cholera** (10^7 vibrios/mL) are found in stool.

❖ Treatment

- Most important is **Rehydration**: (it reduces mortality rate to less than 1%)
 - **Oral rehydration**: in mild dehydration (less than 10% loss of body weight)
 - **I.V. rehydration** (e.g. Ringers lactate): in severe dehydration (more than 10% loss of body weight)
- Antibiotics as Adjacent therapy: (it reduces duration and Communicability of the disease)
 - Tetracycline and Doxycycline

Without fluids rehydration mortality rates are 50-60% in several days.

❖ Prevention

- Water sanitation and treatment.
- Vaccines (live-attenuated and killed whole-cell) but they are not recommended.

Summary

1. **Cholera is an infection of the small intestine caused by *Vibrio cholera*.**
2. ***Vibrio Cholerae* is a Gram (-) comma shaped bacteria with single flagellum (motile).**
3. **O-1 is the most common serotype.**
4. **It's transmitted by fecal-oral route** (drinking contaminated water or eating sea food).
5. **It's common in developing countries due to poor sanitation and low hygiene.**
6. **Low acidity in GIT** as in using drugs such as anti-acids and PPIs **is a risk factor.**
7. ***V.Cholerae* produces an enterotoxin** that ↑ cAMP and this will lead to ↑ osmolarity of the intestinal lumen and will drag more water with it until it causes **dehydration.**
8. Communicability is high during Acute stage, and remain after recovery for 3 weeks.
9. **Symptoms** (watery diarrhea, Vomiting and Cramps) **appear in 1-3 days.**
10. **Symptoms will lead to dehydration** and it will cause many complications.
11. Patients will show (**Sunken eyes and cheeks, decreased skin turgor and dry mucous membranes**)
12. Diarrhea consist of **fluids and electrolytes with enormous numbers of v.cholera**, but there is no RBCs.
13. Confirmation is by isolation of v.cholerae from stool by **culturing it on TCBS agar** and it will appear as **yellow colonies.**
14. **Goal of treatment is fluid rehydration and it will decrease mortality rates to < 1%.**
15. **Antibiotics** such as tetracycline are used as **adjacent therapy** to decrease duration and Communicability of the disease.