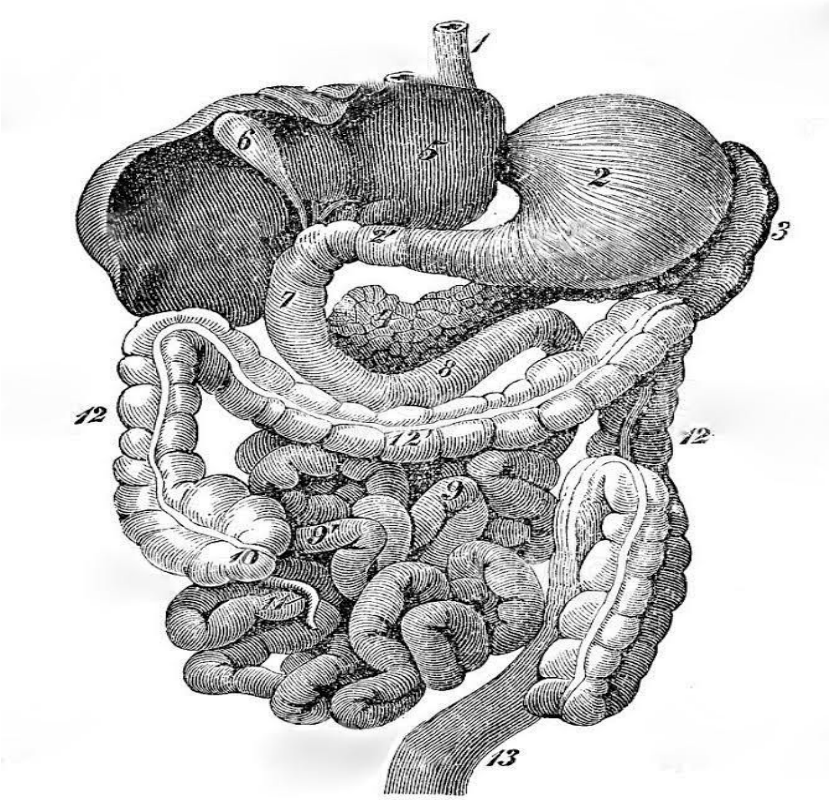
Microbiology

435's Teamwork
GastroIntestinal & Nutrition Block



- Kindly check our Editing File before studying the document.
- Please contact the team leaders for any suggestion, question or correction.
- Pay attention to the statements highlighted in red.
- Extra explanations are added for your understanding in grey.
- **Footnotes color code:** General | Females | Males.
- **color code:** Female's notes | Male's notes.

Revised by
خولة العماري & هشام الغفيلي

Cholerae

Resources: Lippincott's Microcards, Lippincott's Microbiology, team 434,...

Learning Objectives:

By the end of this lecture, you should know epidemiology -history -microbiological characteristic- pathogenesis -clinical features - laboratory diagnosis- **management of cholera and control of outbreak very imp**

Overview	Cholera is a life-threatening intestinal infection that causes severe secretory diarrhea.Caused by *vibrio cholera* which is a comma- shaped gram-negative rods. Produce a non-invasive enterotoxin.**(a non-invasive diarrheal disease)**leads to **outbreak and epidemic**. It is a Water-borne illness caused by ingesting of water/food. 
Epidemiology	• **V. cholera O1 and O139 serogroup organisms are the causes of epidemic cholera.** لوقالو لي اكتبي سؤال بكتب عن هذي • Seven major outbreaks. • Each year 3-5 millions cases result in 100,000 deaths. • A major **epidemic** disease. Common in India, Sub-Saharan Africa & Southern Asia but Very rare in industrialized countries. It is a leading cause of death in Africa. • **Endemic** in areas of poor sanitation (India and Bangladesh)(Endemic in > 50 countries). • In 2016 in Haiti after Hurricane Matthew, in South Soudan and Yemen and many other African countries
Discovery	في عام 1854 حادثة حدثت في لندن اختلطت فيها مياه المجاري مع مياه الشرب أدت إلى انتشار الكوليرا في منطقة معينة ومجرد ما أزالوا مصدر المياه الملوثة انتهت
V. Cholerae	*V.cholera* is highly motile, gram-negative, curved or comma-shaped rods with a single polar flagellum.

O1 serotypes	O139 Serogroup	Others
Have 2 categories: • *Classical*: 1 case per 30-100 less highly infectious infections • *El Tor*: 1 case per **2-4** infection highly infectious	• appeared in Bangladesh 1992 • Has polysaccharide capsule but does not have O1 antigen	Most are cholera toxin negative (CT -ve) and are not associated with epidemic disease.

Transmission	• Transmitted by **fecal-oral route** (Strictly Human transmitted) → Resulting diarrhea makes it easy for bacteria to spread in unsanitary conditions **causing epidemics.** • Common in summer grows in brackish estuaries and coastal seawaters, often in close association with copepods or other zooplankton[1] • مجاري الصرف الصحيSewage or infected person contaminate water supply. • **Under-cooked shellfish.** كررها الدكتور كثير وهو يشرح

[1] تنمو كثيرا في الصيف عند مصبات الأنهار المالحة ومياه البحر الساحلية، في كثير من الأحيان ترتبط ارتباط وثيق مع الجَوادِف (رتبة من الحيوانات البحرية القشرية) أو غيرها من العوالق الحيوانية

<table>
<tr><td>Risk factors</td><td colspan="3">

People with low gastric acid are more susceptible. (Children and Elderly)
O blood type (O>> B > A > AB)

</td></tr>
<tr><td>Infectivity</td><td colspan="3">
The period of infectivity occur when pt is symptomatic >produce large amount(up to 20 L of 10^9 CFU/ml /day) of watery diarrhea (contains V.cholerae)

Period of infectivity during acute stage till recovery (end one to three wks)فتبعد عن المصاب بعد ماتطلع عليه الاعراض من اسبوع الى 3اسابيع
high infectious dose NOT like Shigella:

Infectious dose 10^6-10^{11} colony-forming units,Due to harsh environment of the intestine ie temperature and stomach acidity and Bile salts, organic acids in the intestine
</td></tr>
<tr><td>Pathogenesis

(Cholera Toxin mechanism)</td><td colspan="3">

Vibrio cholerae uses toxin-coregulated pili (TCP) to colonize the human intestine. Produce Enterotoxin THEN THIS WILL ACTIVATES cAMP then it will affects chloride channels and then this chloride goes to lumen then sodium follow chloride creating an osmotic gradient so water goes and secretes a large amount of watery diarrhea

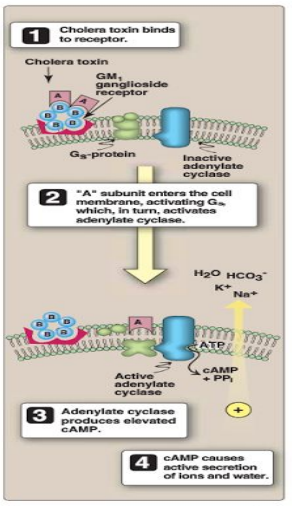


Figure 12.13
Action of cholera toxin. cAMP = cyclic adenosine monophosphate, PP_i = pyrophosphate.
</td></tr>
<tr><td rowspan="3">Symptoms

IP:Ranges from a few hours to 5 days(range 1-3 days).
Depending on gastric acidity and initial infectious dose
(75% are asymptomatic)</td><td colspan="2">Mild disease (20%)</td><td>Severe symptoms (2-5%)
Cholera Gravis  </td></tr>
<tr><td colspan="2">

Vomiting
Cramps
Watery diarrhea (1 L/hour), consisting of:

➔ flecks of white mucus (rice water stool) with a fishy odor
</td><td>
Rapid loss of body fluids(6L/H) → hypovolemic shock(Severe metabolic acidosis due to inadequate O) and electrolytes imbalance(↓ Ca^{++} and K can lead to ileus, muscle pain and spasm,and even tetany) → multi organ failure (Cardiac and renal)

Sunken eyes[2], and ↓skin turgor (tenting)[3], cold and clammy[4].
Anuric and lactic acidosis (Kussmual breathing[5]).
Hypoglycemia leads to seizure or comma.
Cardiac and Renal failure.
Aspiration pneumonia(from vomiting)

</td></tr>
<tr><td>prognosis</td><td>Without treatment, death in 18 hours-several days.</td><td>

Mortality 50-60% without treatment within 12 hours or less
Mortality <1% with redehydration

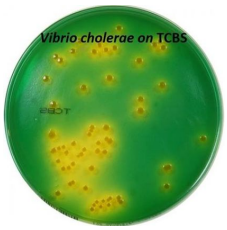
</td></tr>
</table>

[2] جحوض العينين لان السوائل تثبت العين بمكانها
[3] يقل انتفاخ الجلد بيصير جاف يابس (بسبب فقد السوائل)

[4] moist
[5] **Kussmaul breathing** is a deep and labored **breathing** pattern often associated with severe metabolic acidosis

<table>
<tr><td>Laboratory Diagnosis</td><td colspan="3">

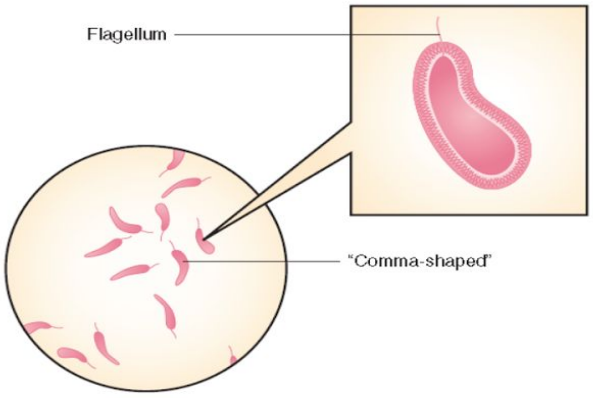
Suspect in sever diarrhea with dehydration.
Other non-invasive bacterial, ETEC and viral gastroenteritis might have similar presentation.
Complete history and physical examination.
Insert central line for IV fluid, collect blood for basic routine tests (chemistry and hematology).
Send stool for smear and culture on special media.
Culture not routinely performed, you have to request it.
Dark field microscopy (shooting stars)
Recovery of organisms can be enhanced by enrichment of stool in alkaline peptone water. (60-100%)
Gram Stain: Red, curved rods of bacteria.
Isolate V. cholerae from patient’s stool: TCBS agar بسألكم عن الميديا shows Yellow colonies indicating V. cholerae fermentation of sucrose.

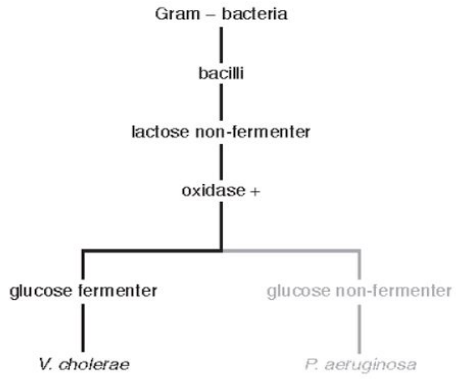


</td></tr>
<tr><td rowspan="2">Treatment:
*Rehydration therapy must begin immediately!
*Basically rehydration and antimicrobial therapy.</td><td>Oral Rehydration Salts (ORS)</td><td colspan="2">Intravenous rehydration</td></tr>
<tr><td>Use when less than 10% of bodyweight lost in dehydration.</td><td colspan="2">Either oral rehydration if the patient can tolerate it (not vomiting or start IV rehydration.</td></tr>
<tr><td colspan="4">Antimicrobial therapy:Reduce the recovery time to 2-3 days & Decrease infectivity.
Azithromycin single-dose is often the preferred therapy especially in children & pregnant ladies.
OR (Tetracycline, Doxycycline) OR Ciprofloxacin</td></tr>
<tr><td>Prevention</td><td colspan="3">1. Disrupt fecal-oral transmission. Traveling precautions:
No ice. Cook everything.Wash hands frequently.
2. Water Sanitation and treatment:</td></tr>
<tr><td rowspan="5">Oral vaccines
Don't provide good protection مالها فايدة فعليه</td><td></td><td>1. Killed Whole-cell Vaccines: not strong & not widely used</td><td>2. Live Attenuated Vaccines: ابغاكم تعرفون انها الافضل</td></tr>
<tr><td>adult</td><td>50% protection for 6 months</td><td>60% protection for 2 years</td></tr>
<tr><td>children aged 2-5</td><td>< 25% protection</td><td>protection rapidly declines after 6 months</td></tr>
<tr><td>Doses</td><td>Multiple doses</td><td>_____</td></tr>
<tr><td>Side effects</td><td>_____</td><td>Mild diarrhea, abdominal cramping</td></tr>
</table>

Summary: Lippincott's Microcards Microbiology Flash Cards Third Edition

Vibrio cholerae — *Cholera*





CLINICAL CASE

A man visiting India arrives in the emergency room with signs of severe dehydration: He is thirsty, has decreased skin turgor, tachycardia, and somnolence. He abruptly began to suffer from diarrhea this morning and complains about the magnanimous watery volumes he is excreting. He has no fever, and the doctor treats with fluid and electrolytes.

CLINICAL PRESENTATION

"rice-water" diarrhea
dehydration

PATHOBIOLOGY

carried in water, food, and shellfish → large inoculums necessary to overcome gastric acid defense → produces mucinase to digest protective mucous coat around intestinal cells → attaches to proximal small intestine (little competition from other bacteria here)

secretes cholera toxin (AB_5 toxin) → toxin ribosylates Gs, keeping adenylate cyclase active and increasing [cAMP] → crypt cells secrete more Cl^-, villous cells absorb less Na^+ → osmotic loss of water to lumen → watery diarrhea and dehydration → if no care, hypovolemic shock and death

DIAGNOSIS

comma-shaped Gram – rods with single flagella in stool cultures
flat yellow colonies on TCBS agar

TREATMENT

oral/IV rehydration therapy
tetracycline
killed-cell vaccines available (not very effective)

QUICK FACTS

Oral rehydration therapy (glucose + Na) capitalizes on Na-glucose cotransporters in the small intestine.
Cholera toxin is carried on bacteriophage.
Blood group O patients are more vulnerable.
Vibrio parahaemolyticus presents similarly but is associated with raw seafood consumption, most often in Japan. Differences: grows in 8% NaCl unlike *V. cholera* (remember, it is from the sea); more invasive than *V. cholera* and thus can cause fever.

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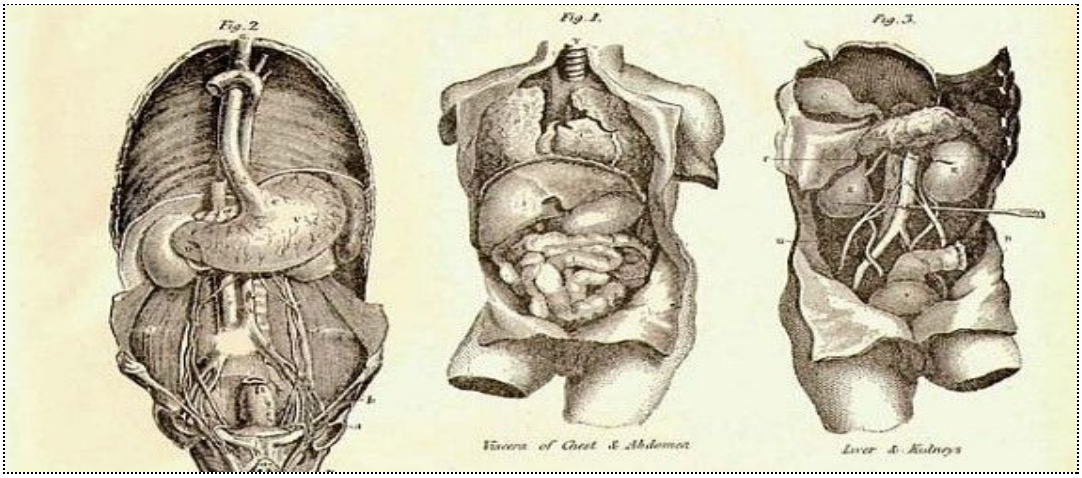

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Heartful thanks to our phenomenal team members

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