

**THE**



**SYSTEM**

# Microbiology

Sheet

Slide

Handout

Number: 3

Subject: H.pylori - Cl.difficile

Done By: Sally Al.sa'di

Corrected By:

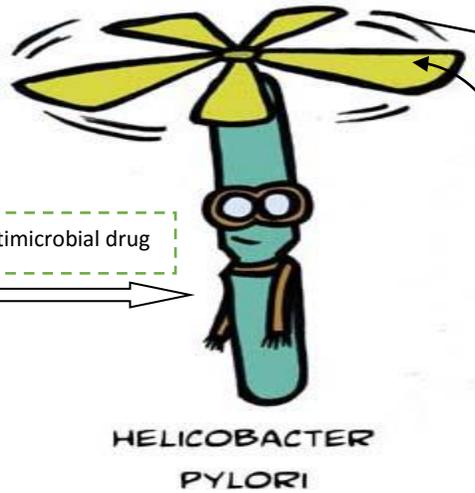
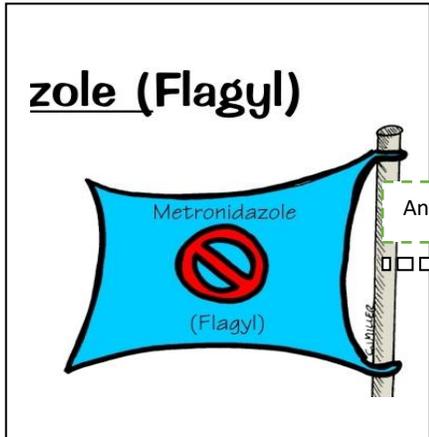
Doctor: Asem Shehabi

Date: 10/4/2016

Price: .....

\*Study this sheet online to be interested with mnemonics.

# 1- Helicobacter pylori



Motile + polar bacteria

\*Multiple flagella (4-6 flagella)

\*Spiral-shaped.



- Release **urease** which convert urea into **CO2/bicarbonate "acid"** & ammonia → neutralize stomach acidity and protects its colonies.



- **H. pylori** can be successfully eradicated **BY** using a combination of certain antibiotics and medicines that **suppress stomach acid production.**
- Re-infection by this bacteria is common.

Hello there.  
 You can call me H. pylori. "HI pylori ☺ you are in helicopter like pilot" - Only pathogenic in human "

I am a helical/spiral **Gram Negative rod.**" - Spiral shaped bacterium with multiple flagella."  
 I live in the mucous layer of the stomach.

I am famous for causing **duodenal and gastric ulcers by making the stomach secrete lots of acid.**  
 I am also a risk factor to some gastric cancers. • Persistence of ulcers → increased risk of stomach cancer and Lymphoma.

More **than half the people** in the world have me. **30%-90%** of world's **population**

- **No vaccine**

**Helicobacter pylori**, is a special type of organism and the only type of organism which can reside in the stomach where it colonize in the mucus {OTHER TYPES IN THE INTESTINE}, and might reside in the **duodenum**, this is due to the fact that this organism produce an important enzyme called **urease**, this enzyme can manage to produce an **alkaline medium** {ammonium chloride} surrounded this organism within the mucosa of the stomach {acidic environment}>>which allow the organism to survive.  **Causing ulceration** in the lining mucosa of the stomach and produce a form of gastritis or a form of ulceration which result in **duodenal ulcer** and might be associated with **developing of malignancy**{persistence of ulceration}.

#Campylobacter + pylori : both of them are flagellated  
But Pylori>>only one that can invade the stomach and survive in high acidity.

**In some cases**  this bacteria can slowly invade the mucosa of stomach without causing any ulceration or any damage. Comparing with other cases in which H.pylori might produce cytotoxins "agents being damaged to cells" >>results with ulceration "peptic ulcer, duodenal ulcer.." gastroenteritis.  
>>>This pathogenesis related to the cell wall of H.pylori.

helicobacter pylori might colonize between 50-90% of the total human population whether they are young, adult ,men and women...etc only 2% of them develop infection from the total percentage of colonization which as you see in billions of the population of the world and might produce under certain conditions

- **Clinical features** mainly pain in the stomach ,vomiting, a problem in the habits of eating ..etc
- **Easily recognized** :  
-Clinically: looking for the production of urease : **Urea breath test** , using urea capsule labeled with active carbon detects urease activity in stomach by splitting urea into **Co2 & Ammonia**>>and this can be done by direct endoscopy when you take gastric biopsy from the infected area of stomach & duodenum. "According to slide" **Culture & Giemsa /silver stain** by histological examination can also be used.

-Culture cannot easily be done and it is not necessary , it can be done for research to look for not only the organism but also to look for the susceptibility for antibiotics.Also, Serological antibodies test is less significant.

- **Treatment**:Should only be done if there was a proven that there is a continuous inflammation/ulceration by this bacteria.

## Drugs:

**flagyl** : Metronidazole + Clarithromycin **or**

sulfate or Metronidazole + Amoxicillin + H2 Blockers..: to reduce stomach acidity

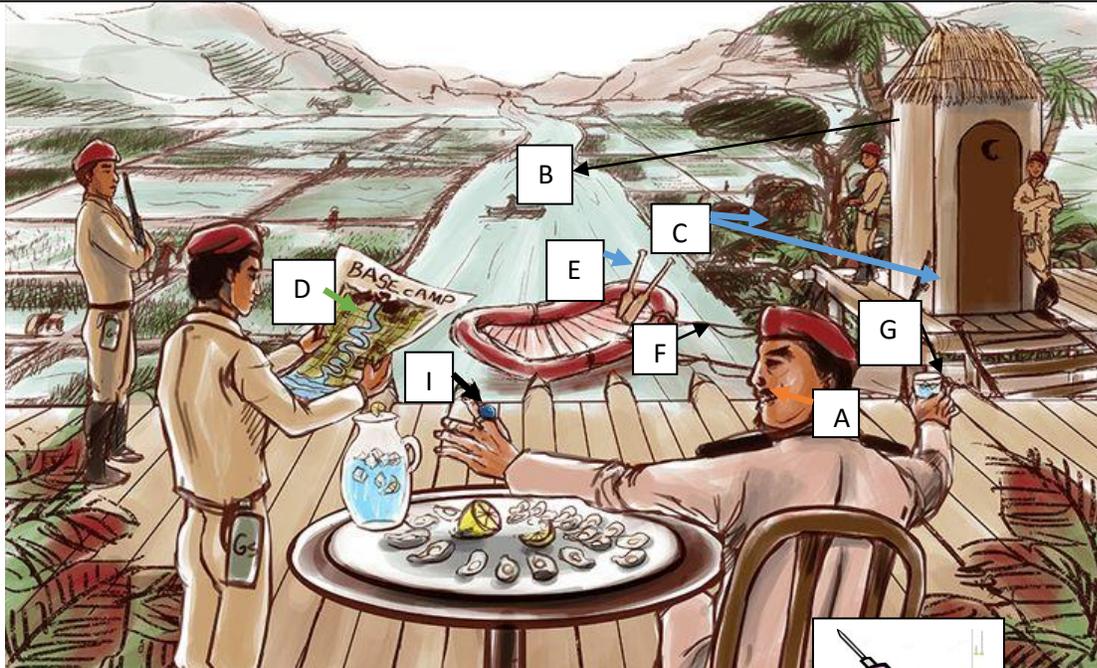
>>Infection by pylori cannot easily be eradicated.

- **Source of infection**: is most likely acquired by ingesting food, water, personal/family contact{ Close contact among family member "e.g.by saliva of infected persons"}.

**2-** If you have a time ,watch this animation " The story of **cholera** " :

<https://www.youtube.com/watch?v=jG1VNSCsP5Q>

- Endemic In India/Africa , causing human Outbreaks{there are no animal reservoirs}. "not endemic in our countries.



**A:** comma-shaped mustaches "comma/curved-shaped cholera"(it might be also straight rods)

**B:** Severe water diarrhea.

**C:** Transmitted through contaminated Water, Fresh Food and Reservoir contaminated water. {common in sea water/fresh water}

**D:** .NOTE THE INTESTINE-SHAPED OF THE RIVER IN THE map

- This bacteria **infect the Small Intestine** .

Only Human is infected through Fecal-oral infection

**E :** red-color COMMA-shaped raft AEROBICALLY>>vibrio-cholera G-ve "red color" , **AEROBIC GROWTH AND MOTILE BY flagellum**.

**F:** Fimbriae attachment BY {single polar flagellum} " No invasion" but- Produce Cholera toxin- enterotoxin , Heat labile toxin

**G:** Treatment: Rapid replacement fluids & electrolytes +with Antibiotic – doxycycline, cotrimoxazole (children), ciprofloxacin>> reduce the Vibrios excretion.

- This bacteria result in Severe water diarrhea (1-3 liters), Severe dehydration, Blood acidosis ,which can lead –if the patient is not rehydrated- to Shock, Death within hours.

• Control through :Public Health sanitation measurements and **Human Vaccine**.

This bacteria may also produce vomiting+ abdominal cramps+ renal failure ❖

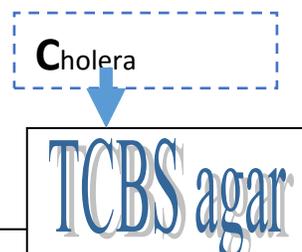
**H:** Base camp :

Increasing cAMP>>causing outpouring large amount of water/NA<sup>+</sup> /K<sup>+</sup>/Cl<sup>-</sup> /HCO<sub>3</sub><sup>-</sup>. ■  
" **alkaline medium** (pH >8-9)".>>infect intestine through stomach>>acid labile. ■

**I:** Oxidase+ve /catalase -ve.

- Incubation period 8-48 h

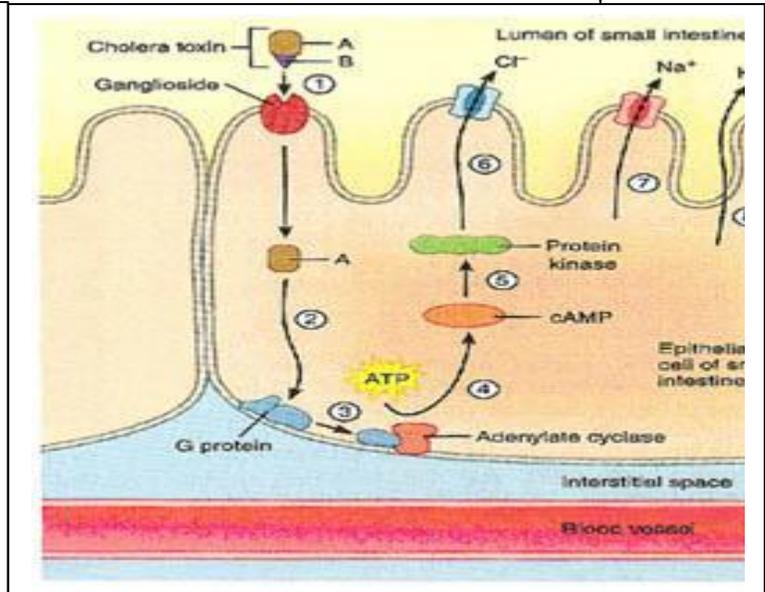
• Lab Diagnosis: Feces Culture and Selective TCBS agar +V.cholera antisera.



**Classical cholera 101:** it is associated with excretion of specific type of toxin, known as cholera toxin.

-It is composed of two specific units one called **A** and the second **B** unit , this toxin is only elaborated inside the intestinal tract(large and small intestine) during the multiplication of the organism , it is not elaborated outside the intestinal tract!!!

- The B subunit attach to specific ganglioside within the intestinal mucosa and the release of the A subunit which induces the production of cAMP which (as in E.coli) is responsible for outpouring of fluids water ,chloride, sodium ,potassium ions and this result in sever outpouring of fluids outside the body.



The toxin can cause the infected person to loss 3 liters of his body fluid in short period , which means that he will suffer from **severe dehydration ,blood acidosis , shocks as kidney failures, cardiac failure and death .**

>>Treatment :-is by replacing the lost of fluids ,this can be done in association with hospitalization, giving saline as well as glucose to replace the lost fluid .

During the infection with vibrio cholerae the intestine respond by production of specific Abs directed against the toxins NOT against the cell body of the bacteria >the classical one 101 or the second one which is called 10329 "mutated type of vibrio chlerae"

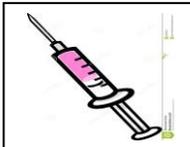
>Antibodies against the toxins{not target the bacteria">partial immunity **Partial intestinal immunity.. antitoxin antibodies** last for 1year, Oral vaccine is effective for short period.{then infected person may be infected again}

**Mutated type of vibrio chlerae 10329 vibrio cholera ,**

- produce cholera toxins but not in the same amount of classical ones.{less virulent }
- also results with severe watery diarrhea {dehydration is required}.

#Both types:

- Watery diarrhea >>due to the release of cytotoxins.
- Noninvasive.. affecting small intestine through **Heat-labile Cholera Toxin** (A and B subunits).



#No need to use vaccine in the non-endemic areas>>but in army or travelers to endemic areas ,vaccine could be used.

The importance to v.cholerae the following :

Usually there is no sporadic cases , If you have found 1 case of v.cholerae you have to expect 100 other cases in the community which means that the outbreak of disease is related to the community and not for single person (unlike salmonellosis and typhoidal fever which are present as single cases )

### Other types of vibrio-cholera that could be invasive resulting with GI infection:

the classical v.cholera very rarely penetrate the mucosa and reach blood vessels causing sepsis whereas:

**V. parahaemolyticus**; it produces a form of hemolytic activity associated with specific gene responsible for invasiveness:" cause Gastroenteritis, blood sepsis , Wound infection" and produce cytotoxin "which may Contaminate raw fish: CAUSES FOOD POISONING".

**V. parahaemolyticus** is Halophilic Vibrio". "salt-loving organisms". It is present in water with increased amount of saline/salts .

It is more found in sea water and might if you swim in sea water and suffer from injury during swimming or some damage in the skin or the mucosa of the oral cavity the organism might produce localized infection in form of wound infection and this might later result in developing of blood sepsis.

**V. parahaemolyticus** is associated with GI symptoms means here watery diarrhea>> later becomes bloody diarrhea >>vomiting and >>it is associated with developing of blood sepsis .this organism is rarely found in our country, found mostly in costal countries where they have more activity with sea water etc.

#### #V. parahaemolyticus

- Affect only small intestine.
- Cause localized wound infection.

#### \* Prevention of cholera

: Safe water & Food.. Early detection of positive infected cases prevent outbreak of cholera in community..

-No Healthy carriers{free from toxin of organism through using antibodies as mentioned before}.

-No animal reservoir for this type of bacteria.

### 3- Staph. Aureus:

#### Foodborne Toxigenic Bacteria:

"Eating Contaminated Stuff Causes Big Smelly C ":

-*E. coli*

-*Clostridium botulinum* [canned foods]

-*Salmonella* [meat, eggs]

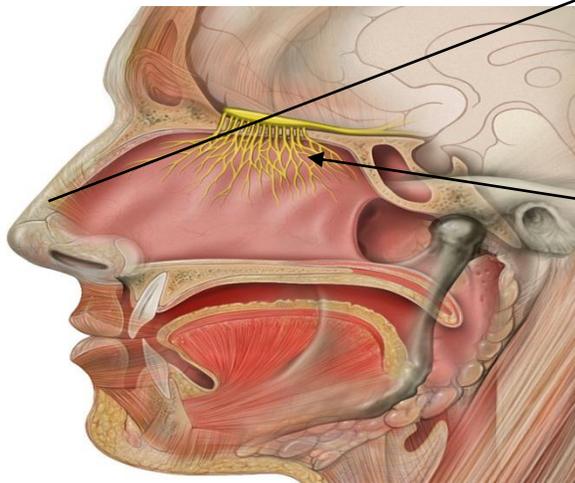
-*Bacillus cereus*

-*Staphylococcus aureus* [salty foods, cream cakes, grounded meat.. Fresh dairy products. White chesses.]

-*Clostridium perfringens* .

#Once this heat stable exotoxins are produced in sufficient amounts (1 microgram) is enough to produce a case of intoxication

#### Intoxication in relation to staph A.



-Strains are found in Nose & Skin humans (25%)



Produce several Heat-stable exotoxins (20 minutes 100C) in food at temperature (20-40C)

Fast absorbed from small Intestine to Blood stream & affects CNS.

#Main symptoms:

-Vomiting –Abdominal pain –rarely Watery diarrhea{oral dehydration to replace loss of fluids as treatment} – Nausea

–**No fever**

>>Normally in healthy people , the symptoms will be subsided in 7 hours{self limited ..recovery within 1-2 days}

- Incub. Period, 30 minutes-6 hours following the consumption of the contaminated food..

Highlighted numbers mentioned in the slide .

**Lab. Diagnoses:** Detection toxins in food/blood.

{Not to identify the presence of staph., but identify the presence of interotoxins >>to identify the source of infection.}

The presence of diarrhea is not necessary and there is no fever

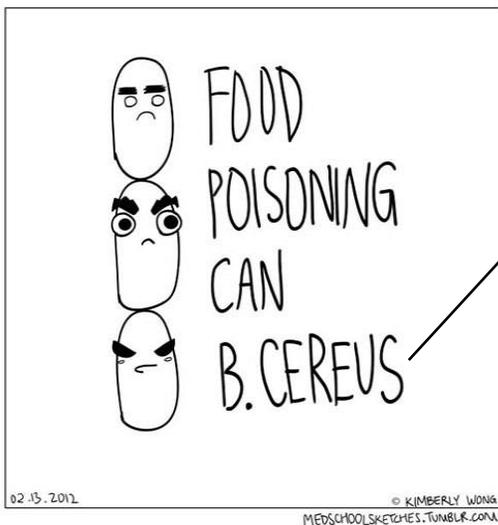
**\*\*Mainly intoxication means mainly vomiting less diarrhea and NO FEVER.**

>>>So it is easy to differentiate between salmonella gastroenteritis and staphylococcus intoxication simply by asking the patient few questions like when was the time that you have developed the feature of vomiting?? especially if there was no fever or diarrhea then mostly it is related to staph toxins

The lab diagnosis can be done but it is not necessary, when it is done you have to ask them about the type of food which has been consumed as well as you might take a blood sample to look for the presence of toxins, but generally it is not done.

**#Giving antibodies is not necessary because you are not dealing with any type of microorganism you are dealing with the toxin.**

#### 4- Bacillus Cereus: "Be Serious!!"



#Associated with two main gastrointestinal Symptoms {Gastroenteritis+Diarrhea"2-"} .  
#Mostly outbreaks in family, schools & commonly associated with Chinese food.. Fried rice

In this case, restoring the fluid by dehydration.

\*G+ve

\*Aerobic

\*Spore forming bacilli

- ☑ Two types of toxins can be produced: { sporulation either in food"1-"or intestine"2-"}

**1-Emetic enterotoxin:{Heat-acid stable}** Outside the body, responsible for foods intoxication and poisoning, without multiplication of the organism inside the intestine, *clinical features is similar to S.aureus* , can't be distinguished clinically between staph and bacillus cereus.

**2-Diarrhegeric/Diarrheal toxin{Heat labile "HL" toxins}**if ingested in huge no. , might produce toxin known as diarrhegeric toxin , inside the Intestine, and this might be associated with watery Diarrhea more than vomiting.

**#According to slide:**

1-Emetic Enterotoxins ..

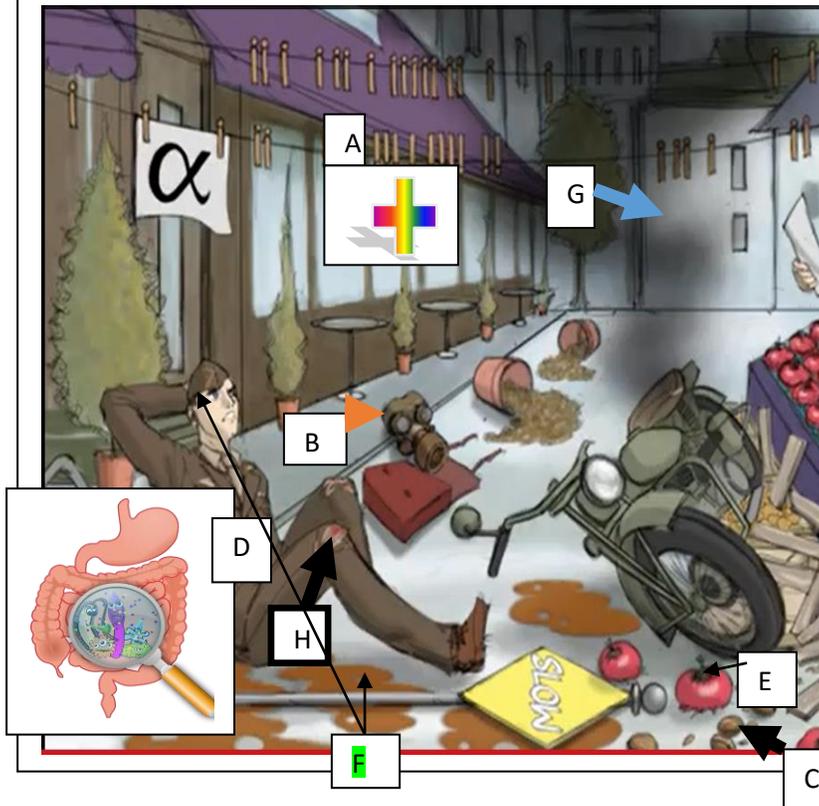
Typically developed within 1-24 hours of eating contaminated fried rice, meat..result with: Vomiting, nausea, stomach cramps>> last for few hours, **No diarrhea or fever.**

2- Diarrheal Toxins/ HL.. **Mild watery diarrhea**, No Fever or Vomiting..self-limiting within 1-3 days.

#All clostridium are :  
Anaerobic ,G+ve, Spore-forming

## 5- Clostridium perfringens: {Gas-Gangrene}

- Widely distributed in the environment.



**A:** G+ve bacteria

**B:** Anaerobic bacteria

**C:** Spore-forming bacteria

**D:** Common in intestine of humans+animals.

**E:** Responsible for food poisoning by specific toxins.

Not easily be killed by boiling temperature.

"Outside the body" you have **1** intoxication of food and "inside the body" you have **2** diarrhea | toxins {diarrhea will follow the production of the toxins in the intestine}:

The toxins of this bacteria might be produced outside the body again a type of toxin **similar to the exotoxins of Bacillus cereus** which means it is associated mainly with vomiting and might at the same time produce the **other toxin which is responsible for diarrhea** but the toxin that is responsible for diarrhea is secreted during the presence of *Clostridium perfringens* in the intestine which means if you eat a type of food with large number of Clostridium perfringens you might later develop diarrhea once the organism produce **the diarrheal toxins** in the intestines and Not outside the body ..

**3** other types of toxins together with the enterotoxins: {many types but you don't have to memorize them}

**G:** Gas-gangrene organism? Associated with damage of subcutaneous tissue >> producing gas under tissue " remember the gas coming from the motorcycle"

**H:** Detection toxin in blood or Food specimens.

**F:**

• *C. perfringens* toxin-type A ..released in Food at room temperature ..intoxication after 8-24 Hrs.. watery Diarrhea more than vomiting..

Nausea.. Abdominal Pain.... **No Fever..**

**Mostly Self-limited.. 1-2 Days.. No Antibiotic**

• *C. perfringens* toxin-Type C.. Released following multiplication in intestine >> ulceration" might be associated with inflammatory reaction and **necrosis** : Producing a feature known as **necrotizing enteritis** and this might give the impression that the patient is suffering from **pseudomembranous colitis** which is caused by clostridium difficile "

**Necrotizing Enteritis..** No vomiting {severe bloody-diarrhea instead}.. Rarely blood sepsis..

can be fatal in certain patients. **Antibiotic treatment is recommended.**

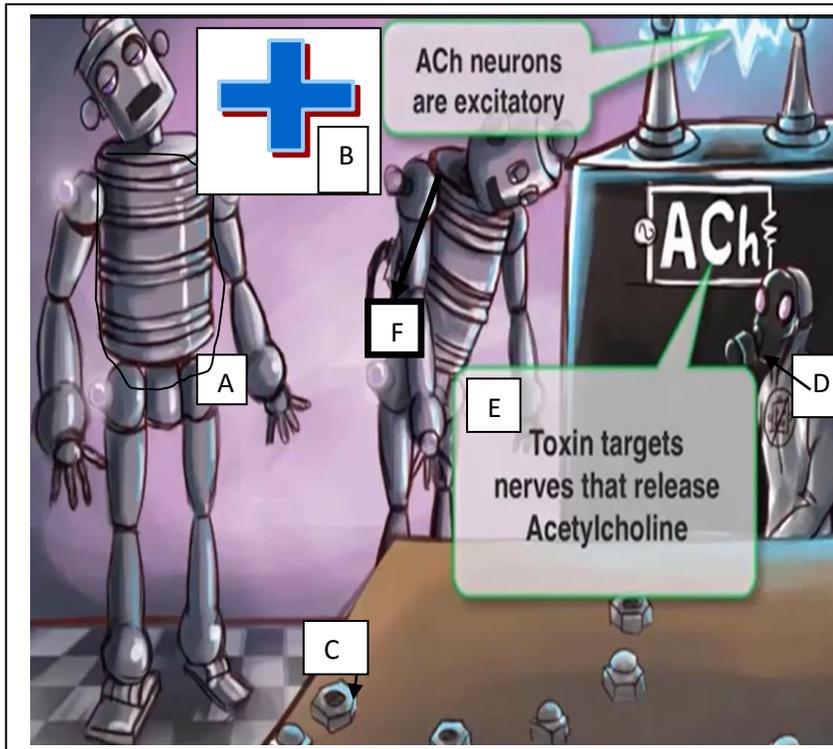
**Necrotizing enteritis can be so severe and fatal in immunocompromised patients or elderly patients.**

**Note :**

\***Enterotoxin:** a toxin that is active in the gastrointestinal tract.

\***Cytotoxin :** toxic agents being toxic to cells .

## 5- Clostridium botulinum : {remember ROBOTulinum}



**A:** Transmitted by improper canning of food, meat, and fish "food intoxication" >> outside the body.

**B:** G+ve bacteria

**C:** Spore forming bacteria {remember mechanical nuts}

**D:** Anaerobic

**E:** toxin will be absorbed in the nerve endings of CNS >> inhibiting ACh release and **produce paralysis** >>

**Botulinum extotoxin** binds to presynaptic nerve ending of peripheral & cranial nerves.. Interfere with neural transmission by blocking the release of **acetylcholine**  
..RESULTING with:

**F:** Flaccid paralysis, Respiratory- Cardiac failure & Death..

Early specific antitoxin may help but can't help in any delay.

Diagnosis: clinical features

>>It's a Heat -stable **neurotoxin** { **Botulinum extotoxin** } requiring 30 min boiling to be inactivated >> can't be easily to treat patient. <Few hours enough to kill any person consuming the toxins>

In relation to amount of toxin; less than one microgram can be enough to kill the person within 3 hs ,  
Most potent toxin !

## 6- Clostridium Difficile : {Pseudomembranous colitis}

- \*G+ve
- \*Anaerobic
- \*Spore-forming

**Difficile** : difficile /difficult to be treated with anti-microbial drugs>>  
**clindamycin** and any other **wide spectrum antibiotic** like the **amoxicillin**  
**ampicillin** and **second generation cephalosporins** and the **third generation** all  
these antibiotics can affect large number of the clostridium difficile  
,decreasing it and allowing the organism to increase in number and to  
produce a toxin known as **difficile toxin** .

The difficile toxin can be **type A or type B**

- Enterotoxin A : damage of large intestine.
- Cytotoxin B: damage of small intestine.

Newly recognized toxin known as **binary enterotoxin** "more potent "

The presence of any of these toxins will result in :

>>**severe inflammatory reaction** in the " large intestine">> resulting in  
**pseudomembranous colitis** "damage of colon " >>which means that the patient  
will suffer from severe bloody diarrhea and may death ,treated by stopping the  
use of the offending drug and replace it by other drugs which inhibits the growth  
of clostridium difficile like:

**Metronidazole** >>>>>>>>>preferring ,why? To Not develop resistance of this  
bacteria as in the case of vancomycin.

and

**Vancomycin**.

### Note :

-*Clostridium difficile*

It is a part of the intestinal flora in 20-30% of the population especially in hospital.

-*Often causes nosocomial infection ( 5-15%) among elderly, surgery & compromised patients .*

# #Other Bacteria species:

2 other organisms {G-ve bacilli}:

## 1) Yersinia enterocolitica

- Y. enterocolitica--> causes enterocolitis due to cytotoxins {inflammation of digestive tract}>>may results with invasion of this bacteria>>leading to blood sepsis . Complication especially in immunocompromised patient (ICP) :Gastric infection ,bloody diarrhea}
- Enterocolitis should be treated with antimicrobial drugs>>to prevent blood sepsis and meningitis if invasion of this bacteria occurred.
- Overall, likes **\*\*cold growth-->more in colder states (0-25c)**not like shigella{not common in our countries}
- \*\*more common in west countries** , in intestines of domestic animals especially pigs and dogs >>may leads to contaminated food (diary products) .

Enterocolitis may :

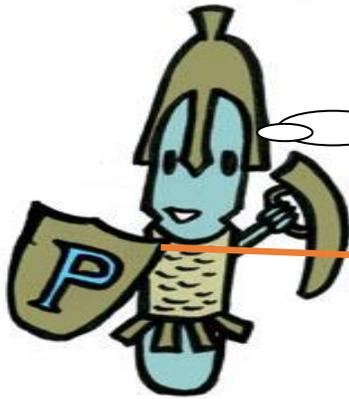
- Results with; watery/ bloody diarrhea ,and fever>>like in cases of infection with shigella or staph.A >>>**No treatment is required in this case.**
- Enterocolitis, sometimes with abdominal pain{DUE TO COLITIS}, complications such as skin rash, joint pains{ARITHRITIS} or blood sepsis >>especially in compromised patients>>>**Treatment must be given.**

**Treatment:**

YERsenia    TRI    SUL    FLU

-Trimethoprim    -Sulfamethoxazole    -Fluoroquinolones

## 2) Aeromonas and pseudomembranous



PSEUDOMONAS  
AERUGINOSA

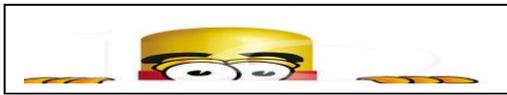
Hello, I'm P. aeruginosa.

I'm a gram negative bacilli. ....



You can mostly find me in hospitals >> Life threatening diseases.

- Innate resistance to many antibiotics "**multi-drug resistant**". Resistant to almost every antibiotic.



• P. aeruginosa : is an opportunistic pathogen –it won't infect a healthy person, only sick and immunocompromised patients.

, might produce some **cytotoxin** and diarrhea in young children and ICP , >>>resulting with watery diarrhea {treated with dehydration} , less fever, and vomiting.

, rarely associated with complications.

**Multi-drug resistant bacteria**



Oral probiotic and prevention of Pseudomonas aeruginosa infections.



Probiotic prophylaxis may prevent colonization and delay onset of Pseudomonas infection in an ICU.

#According to slide:

This type of bacteria is common in natural water sources.. a significant cause of bacterial **Gastroenteritis** in association with fish food ..

Lastly:

#Remember that:

-The symptoms of food poisoning vary which can be useful in diagnosis:

\* Major presenting symptoms of *S.aureus*, *B cereus*

- Abdominal pain • Vomiting • Diarrhea • Nausea • Fever "no fever in staph.aureus"

\*In Salmonella, shigella:

- Also Diarrhea, abdominal pain and fever are symptoms in both diseases.
- **Bloody and mucoid diarrhea** also can be present.

Deep gratitude to Esra'a Abdo 😊