Gastrointestinal Microbiology

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H pylori

General Characteristics:-it is gram(-),spiral with blunted/curved end, highly motile organism with 2-6 flagella at one end(lophotrichous), urease(+),catalase(+), mucinase(+) and it's growth requires a microaerophilic atmosphere at 37°

Virulence Factors of Hpylori :-

1-gram(-)----->means it has endotoxin lipopolysaccharide(LPS/lipid A) on it's cell wall

2-Urease enzyme--->which play a major role in the neutralization of the stomach acidity to protect the Hpylori from HCL

3-Mucinase enzyme----->which degraded mucus membrane in stomach and cause peptic ulcer(because Hpylori is the main cause of peptic ulcer)

4-Microaerophilic--->which means the becteria which growth at low proportion of O2 with CO2

5-Catalase and superoxide dismutase enzyme--->it is enzyme which convert H2O2 to H2O +O2 and inhibit phagocytosis

6-Vaculating cytotoxin(VacA)---->which generating multiple large cytoplasmic vacuoles that mediates epithelial cell erosion and invasion

7-cytotoxin associated proteins(Cag)---->it is cytoxin which contribute to the inflammatory process in stomach cells and it can cause destruction to the tissue

Reservoir:-humans, generally in the stomach near the pylorus (because of that we called it Hpylori because it live in the stomach near to the pylorus)

Route of Transmission:-by fecal-oral route or by contact with gastric secreation in some other ways

Epidemiology of the disease:-

1-Barry J Marshall & J Robin Warren is the first scientists which prove that the Hpylori it is the main cause of peptic ulcer in humen by exposed him self to the bacteria after they make sure that he didn't have peptic ulcer and he was subjected to the endoscopy procedur and within 2-3 days after exposure to the bacteria , all the classical manifestations of peptic ulcer appear to him , and they made a culture by taking a sample from the ulcer , and they saw the H.pylori bacteria .

2-The organism(Hpylori) is found in the stomachs of 30-50% of adults in developed countries and it is almost universal "90% -about to be 100%-" in developing countries

3-Colonization increases progressively with age. (assume that at age 5 years there is 5% of people which are H.pylori positive then at age 10years they would be 10% then at age 20years they would be 30% and so on)

***4-H. pylori* is the most common cause of gastritis, gastric ulcer, and duodenal ulcer. It is also linked to gastric adenocarcinoma, and gastric mucosa-associated lymphoid tissue lymphoma (MALToma)**

H.pylori Associated Diseases:-

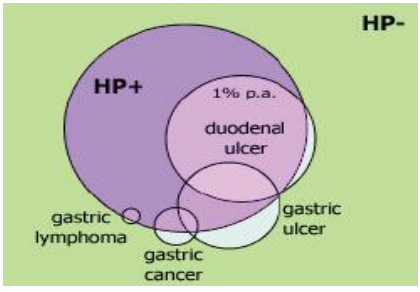
1-80% asymptomatic which is most common presentation of H.pylori colonization is positive without symptoms

2-5-15% peptic ulcer disease

3-10% non-ulcer dyspepsia

4-1-3% gastric adenocarcinoma

5-0.5% gastric MALToma



Pathogenesis of the disease:-Firstly Hpylori will reach the stomach by ingestion(fecal-oral route)---->then it will swim by it's flagella to the less acidic pH location beneath the gastric mucus----->then the Hpylori will attenuate the acidity of stomach at site of binding of Hpylori with gastric mucosa by urease enzyme ($Urea+HCL+2H_2O \xrightarrow{Urease}$ bicarbonate + ammonia)------->then

the Hpylori will adhere at the mucosa, which is mediated by surface proteins(Lewis blood group antigens)----->then Hpylori will start to breakdown the gastric epithelium and mucosa by VacA,Cag& mucinase enzyme----->peptic ulcer and risk of perforation

Clinical Presentation:-

1-Primary infection with *H. pylori* is either silent or causes an illness with nausea and upper abdominal pain lasting up to 2 weeks

2-After many years of primary infection:-

A-Many patients may remain asymptomatic for decades

B-Acute complication like perforation that can lead to extensive bleeding and peritonitis

C-Chronic "after long time" complication including gastritis and peptic ulcer disease presented with nausea, anorexia, vomiting, epigastric pain, and less specific symptoms such as indigestion

D-Might end with stomach cancer

Laboratory Diagnosis:-

1-Direct examination: gram-negative spiral bacteria

2-Histological examination: inflammatory cells and mucosal cell damage

3-Culture of the gastric mucosa (1 week in humidified, microphilc, 35-37 °C on selective or non-selective agar)

4-Biochemical test:-Urease detection by pH change in coloured media ,Oxidase positive & Catalase positive

5-Urea breath test: the patient ingests 13C- or 14C labeled urea, from which the urease in the stomach produces products that appear as labeled CO2 in the breath

6-Stereological test:-a number of methods for detection of antibody directed against *H. pylori* are now available (IgG or IgA)

7-H. pylori stool antigen test

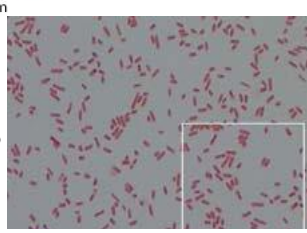
Treatment:-(cure rate is 95%)

1-treatment with triple therapy (PPI+2 antibiotics) of PPI(Omeprazole),amoxicillin, and clarithromycin which is prolonged for 10-14 days, up to 3 weeks.

2-Quadruple therapy when clarithromycin resistance is >15% (PPI + bismuth + 2 antibiotics–eg.metronidazole and tetracycline)

Prevention:-there is no vaccine

Salmonella



General characteristic:-It is encapsulated,motile,enteric gram negetive rods,facultative anaerobe,Non lactose fermenting, Resistant to bile salts,acid-liable & produces H2S which produces black colonies on Hektoin agar

Reservoir:-Gall bladder of Humans only(not animals)

Transmission:-fecal-oral route from human carriers, then enters the gall bladder and sleep there.

-Note:-"The decrease in stomach acidity or impairment of mononuclear cells such as in sickle cell disease it will increase risk of *Salmonella* infections"

لانه السالمونيلا ما بتتحمل الmedia acidic فلهيك حمض المعدة بحميني منها فلو قل الحمض تبع المعدة راح تزيد احتمالية الاصابة بالسالمونيلا والاهم انه السالمونيلا بتقدر تعيش بوسط من الBile لهيك بنلاقيها عايشة بالgall bladder ونايمة فيها لهيك ممكن شخص يحمل السالمونيلا بالgall bladder تبعته ولكن لا تظهر عليها الاعراض ولكنه قادر يعدي غيره لهيك بنسمي هذا الشخص Asymptomatic carrier

Salmonella species:-

There are many species of Salmonella such as S. choleraesuis, S. typhi, and S.paratyphi ,but the most common form which cause the disease for humen is S.typhi

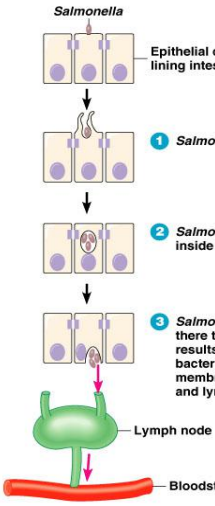
Virulence Factors of *Salmonella* :-

1-Invasiveness(which means it can invade the stomach cells until reach the blood vessels and invade it into bloodstream)

2-Intracellular survival & multiplication inside the vesicle

3-Endotoxin(such as lipid A)

4-Exotoxins:such as enterotoxins, cytotoxin



Pathogenesis of the disease:-

Firstly the organism will reach the stomach cells then it will attach to the surface of cell------>then it will invade the cell membrane and enter the stomach epithelial cells inside the vesicles-------->then salmonella will multiply within the vesicles inside the the cells----->then it will release the exotoxins(cytotoxins,enterotoxin) which breakdown and lysis of stomach epithelial cells----->after that the salmonella it may reach the lymph node of stomach cells ---->then reach the blood vessels and invade it------>finally,the salmonella will reach the blood stream----->cause septicemia and death

Diseases and clinical presentation:-

1-Asymptomatic carriage(chronic carriage):-it is the patient which have the salmonella sleep in it's gall bladder and don't have the symptoms ,but we should treat it because it can transmit the disease to another people.

-Chronic carriage it is represent of 1-5 % of cases which following S. typhi or S. paratyphi infection

واكثر فئة ممكن تكون chronic carriage هم عمال المطاعم لهيك كل 6 اشهر لازم يعملوا شهادة خلو امراض

2-Enteritis(acute gastroenteritis):-It is the most common form of salmonellosis with major foodborne outbreaks and sporadic disease which appear after 6-48h of eat contaminated Poultry, eggs,meat…etc.

-Symptoms of enteritis:-Nausea, vomiting,bloody diarrhea(dysentery), fever, abdominal cramps, myalgia and headache common

3-Enteric fever:-it is mainly caused by S. typhi &also S.paratyphi A, B and C can cause milder form of enteric fever

-The symptoms of enteric fever it will apear after 10-14 days of eat or drink contaminated food or water

-Symptoms of enteric fever:-fever(it may reach 40-41C°),slight increase in pulse,N/V/D,abdominal pain

مهمة جدا شغلة الpulse لأنها بتميز السالمونيلا لأنه بالوضع الطبيعي اي بكتيريا مثلا بترفع درجة حرارة الجسم لحد 40° بتوقع لما اقيس الpulse يطلع بحدود 140-150 بينما بحالة السالمونيلا بتوصل درجة الحرارة 40° بس بلاقي الpulse طبيعي تقريبا او فوق الطبيعي بشوي مثلا بلاقيه 90-105

4-Septicemia:-it is the emergant case with high fever and it may lead to multi-organ failure(such as liver and kidney failure and osteomylitis of bone

Laboratory test:-

1-CBC(full blood count):-salmonella it is the only becteria which cause neutropenia(↓neutrophils) but other becteria cause leukocytosis(↑WBC)

2-Stool analysis

3-Microscopic examination:-see gram negetive bacilli under microscope

4-Culture:we can use 2 type of cultures which are:-

A-MacConkey agar---->no change in color because salmonella it is non-lactose fermenting

B-S-S agar(salmonella-shigella specific agar)--->only salmonella or shigella can growth on that agar and then we differentiate between them by motality test(salmonella is motile but shigella not-motile)

5-Biochemical test(H2S production)

6-Ag-Ab detection in the blood

Treatment:-

1-Enteritis----->self-limiting doesn't need antibiotic

2-Enteric fever---->we use 3rd generation cephalosporin antibiotics such as ciprofloxacin and ceftriaxone

3-Septicemia----->it is need ICU,IV fluid and IV antibiotic

Prevention:-

1-boil and cock the food and water very good

2-Give vaccine for people which need to travel for endemic area(but the effect of vaccine still only 2 years)

3-treat the Asymptomatic carriage by antibiotic

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Shigella

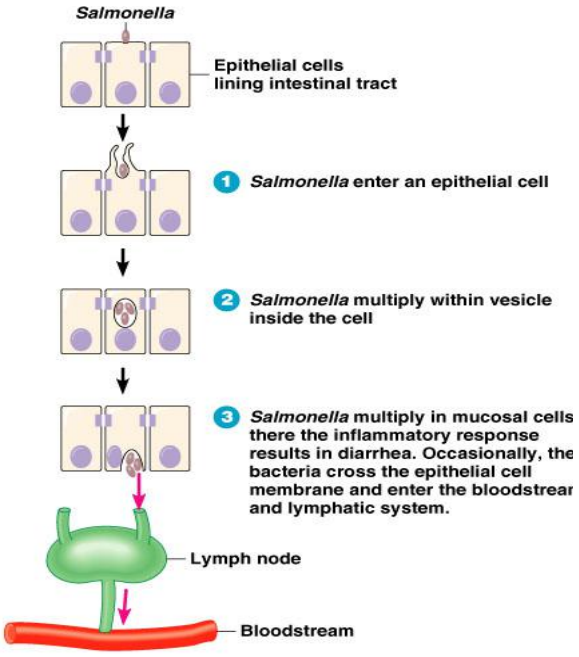
General characteristic:-It is gram negetive enteric rods, non-motile ,facultative anaerobe,Non lactose fermenting,Resistant to bile salts,acid-liable & not produces H2S which produces green colonies on Hektoin agar

Reservoir:-human colon only (no animal carriers)

Mode of Transmission:-fecal-oral spread, persons to person(common in day cares amongst children!)

Shigella species:-(imp)
1-Shigella sonnei (most common in industrial world-US-)
2-Shigella flexneri (cause severe disease and most common in developing countries)
3-Shigella boydii & Shigella dysenteriae

Virulence factors:-
1-Invasiveness(salmonella is usually invade the bloodstream,but shigella mainly invade laterally in gastrointestinal epithelium and not



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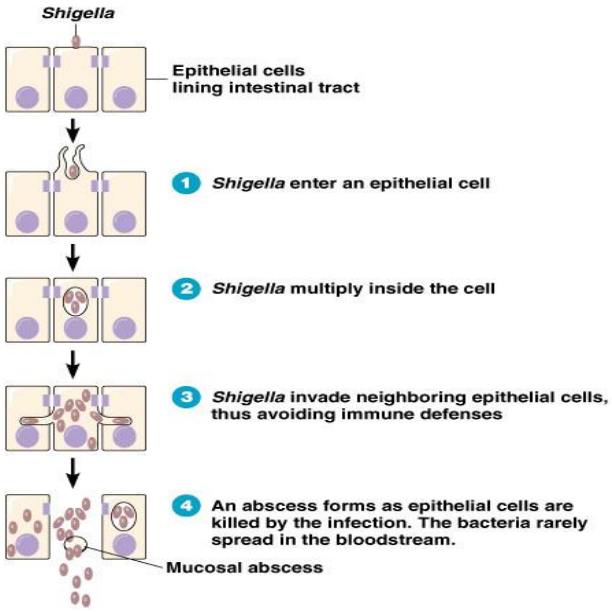


2-Attachment and internalization

3-Large virulence plasmid

4-Exotoxin(Shiga toxin)

5-Intracellular survival & multiplication

Pathogenesis of the disease:-

Early stage:-Watery diarrhea attributed to the enterotoxic activity of Shiga toxin, fever attributed to neurotoxic activity of toxin after 1-3 days of infection

Second stage:-Adherence and tissue invasion of large intestine with typical symptoms of dysentery

اذا باول من stage الshigella infection بصير عندي watery diarrhea بسبب
الshigella toxin من ثم لما يصير invasion of shigella بتتحول الحالة الى
Bloody diarrhea

Epidemiology of the disease:-

1-Major cause of bacillary dysentery (severe 2nd stage) in pediatric age group (1-10 yrs) via fecal-oral route
2-Outbreaks in daycare centers, nurseries, institutions
3-Estimated 15% of pediatric diarrhea in U.S.
4-Leading cause of infant diarrhea and mortality(death)in developing countries

Laboratory test:-

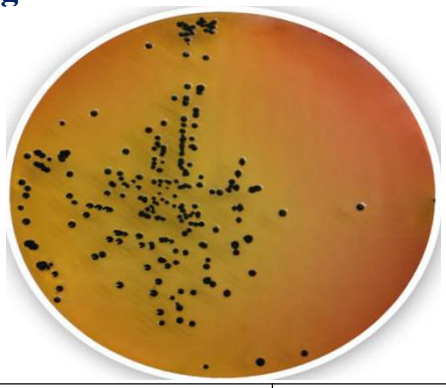
1-CBC(Full blood count):-leukocytosis in shigella infection(but neutropenia in salmonella infection)
2-Stool analysis:-See WBC,blood or becteria in the stool
3-Microscopic examination
4-Culture - selective media:-we can use 2 type of cultures which are:-
A-MacConkey agar---->no change in color because shigella it is non-lactose fermenting
B-S-S agar(salmonella-shigella specific agar)---->only salmonella or shigella can growth on that agar and then we differentiate between them by motality test(salmonella is motile but shigella not-motile)
5-Biochemical tests(not produce H2S)

Treatment:-

1-Symptomatic treatment and fluid replacement:-by use antipyritic for fever and use IV fluid or ORS(oral rehydration salts) for children
2-Use balcatrim antibiotic (trimethoprim-sulfonamide) help in shortening the period of illness
3-ciprofloxacin can be used

Prevention:-

1-Prevention by proper food cooking and handling, hand washing and sanitary measures
2-No vaccine for shigella

Difference between salmonella & shigella		
	salmonella	shigella
motility	Motile(test by motality test)	Non-motile
H_2S production	Black Hektoin agar(due to H2S production)	Green Hektoin agar (don't produce H2S)
Lactose fermentation	Both are non lactose fermenter(no color change) MacConkey Agar 	
invasiveness	Mostly invade the blood vessels	Mostly not invade the blood vessels
CBC	Neutropenia(↓neutrophils)	Leukocytosis
Culture	Both growth as black cocci on S-S agar 	
Vaccination	Has vaccine	Don't have vaccine

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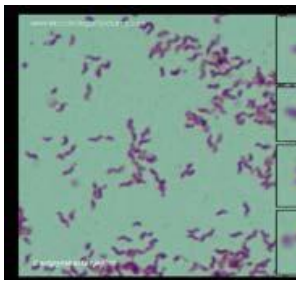
CAMPYLOBACTER JEJUNI



General characteristic:-helical (spiral or curved), gram-negative, rapid motile with Long sheathed polar flagellum at one (polar) or both (bipolar) ends of the cell,microaerophilic (likes less O2 and more CO2),capnophilic(high CO2 culture) and grows well at 42°C (thermophilic),oxidase (+)

-Note:-"It is tendency to form coccoid & elongated forms on prolonged culture or when exposed to O2"

Campylobacter species:-
The most important and common infective species is C. jejini

Reservoir:-intestinal tracts of humans, cattle, sheep, dogs, cats, especially poultry

Transmission:-fecal oral,humans acquire via ingestion of contaminated food (primarily from poultry),unpasteurized milk, or improperly treated water.

Pathogenesis:-low infectious dose (as few as 500) as all that is needed; bacteria is acid resistant so can pass through the stomach easily; it invades the mucosa of the colon ,and destroys the mucosal surfaces, causing an inflammatory diarrhea; it rarely causes septicemia

Incubation period:-Illness begun 1-7 days after ingestion

Disease:-Starts with fever and sever abdominal pain followed by dysentery with pus and blood

Complications of the disease:-
1-reactive arthritis
2-Guillain-Barre syndrome

Epidemiology:-
1-Most common form of acute infectious diarrhea in developed countries;Higher incidence than Salmonella & Shigella combined
2-Zoonotic infections in many animals particularly avian (bird) reservoirs

كلمةzoonotic تعني انه المرض ينتقل من الحيوان للانسان

Diagnosis:-by culture and growth on selective media under microphilic conditions

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Treatment:-
1-Self-limiting within 3-5 days but we can use erythromycin for severe or complicated enteritis & bacteremia, & fluroquinolones are also highly active
2-Replace fluids and electrolytes

Prevention:-Control should be directed at domestic animal reservoirs and interrupting transmission to humans.

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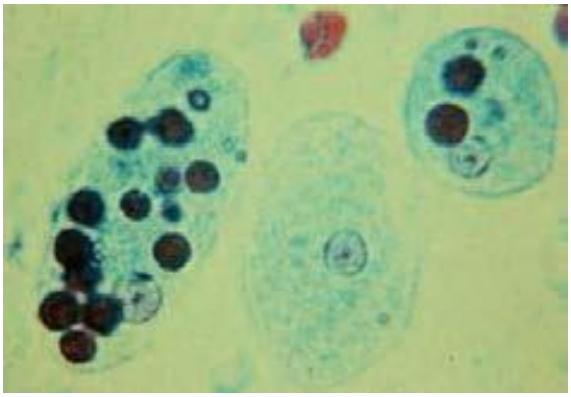
ENTAMOEBA HISTOLYTICA-Protozoan Amebae-

General characteristics:-Multiply by simple binary fission&move by pseudopods

Several genera of amebas:-Entamoeba, Endolimax, and Iodamoeba

Two subtypes:-(IMP)
1-E.histolytica:-is the invasive pathogen
2-E.dispar:-is the commensal organism

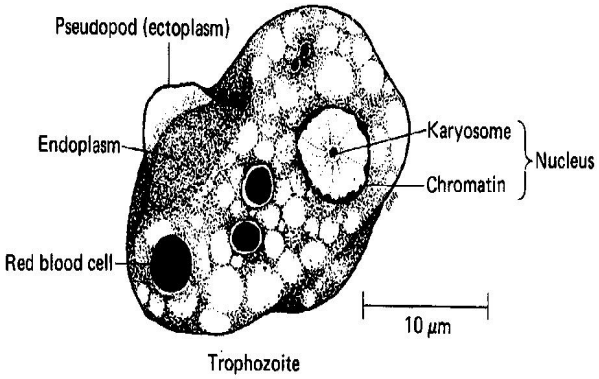


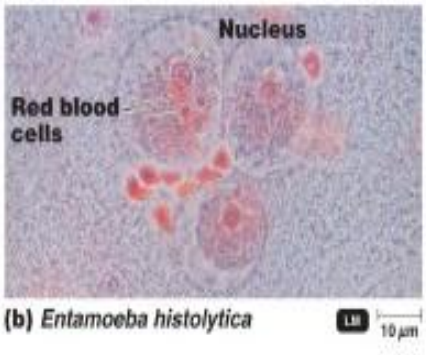
We have two pathogen forms:-

A-Trophozoites:-

1. **Microerophiles**
2. **habitate in the wall or lumen of the colon**
3. **feed on bacteria and tissue cells**
4. **Morphology of trophozoites:-4.12-20 Mm in size, directional motility, granular, vacuolated endoplasm and sharply demarcated, clear ectoplasm with finger-like pseudopods.**

TROPHOZOTES released in small intestine and encyst again in large intestine.



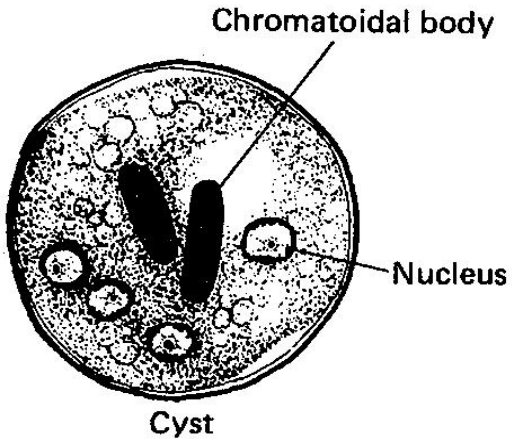


B-Cysts:-the infectious form

Initially, a cyst contains a single nucleus, a glycogen vacuole, and one or more, cigar shaped ribosomal clusters known as chromatid bodies.

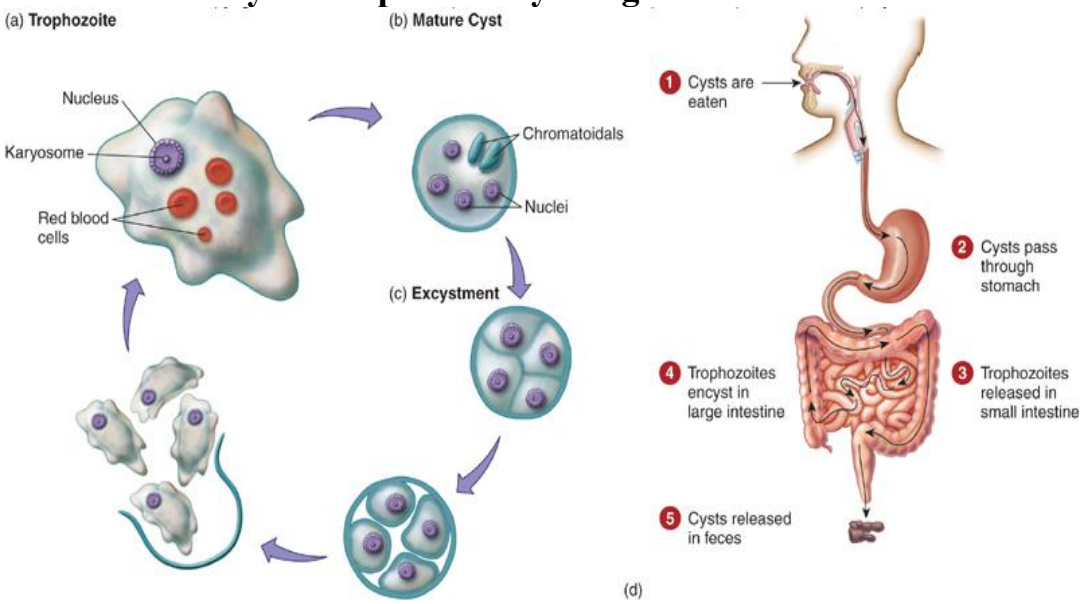
With maturation, the cyst becomes quadrinucleate, and the cytoplasmic inclusions are absorbed.

Mature cysts---->can survive environmental temperatures up to 55°C water supplies, and normal levels of gastric acid.



Mode of Transmission:-are obligate parasites of the human alimentary tract and are passed as cysts from host to host by the fecal–oral route from fresh fruits and vegetables.

Life Cycle:-mature cyst are ingested by mouth then reach the stomach and can servive in the stomach acidity----->then cyst are hatch to trophozoites and release in smal intestine----->then trophozoites cause damage to the small intestine and GI---->after that the trophozoites will re-encyst again in large intestine to prepare self to go outside the body by stool----->then cyst will release in stool outside the body and repeat the cycle again



Sites of infection:-intestine (mostly) the cecum,ascending colon, rectum, sigmoid, appendix, and terminal ileum.Or extra intestinal (hepatic abscess).

Pathology of the disease:-

Amebas contact and lyse colonic epithelial cells, producing small mucosal ulcerations ----->then cause little inflammatory response with edema and hyperemia, and the mucosa between ulcers appears normal---->then Trophozoites invade in large numbers at the junction between necrotic and viable tissue---->then once the invasion of organism reach below the superficial epithelium, it will spreads laterally in the submucosa, and producing a flask-like lesion with a narrow mucosal neck and a large submucosal body

Disease:-it is cause the disease which called amebiasis and can be either:-

1.Asymptomatic
2.Acute infection accompanied with diarrhoea and abdominal pain
3.Chronic infection

The Clinical symptoms:-

1-Diarrhea which is Intermittent, watery and Foul smelling contain mucus and blood

2-Flatulence

3-cramping abdominal pain

Complications:-hemorrhage, perforation, appendicitis, and tumor-like growths, amebomas, liver abscess in 5% of Cases

Epidemiology:-

1-E. histolytica infection rates are higher in warm climates, particularly in areas where the level of sanitation is low.

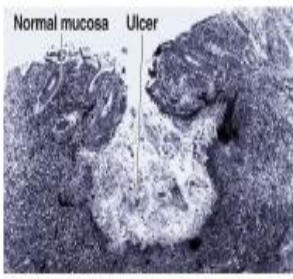
2-1-5% of the population represent harbors Entamoeba especially nonpathogenic E. dispar which survive in stool survey

3-Food- and water-borne spread occur, occasionally in epidemic area under conditions of poor personal hygiene

Diagnosis:-

1-The microscopic diagnosis:-the trophozoites or cysts are seen in the stool on fecal antigen test or sigmoidoscopic aspirates

-IMP note about microscopic diagnosis:-"E. dispar can be differentiated from E. histolytica by the presence of ingested erythrocytes inside E.dispar,but E.histolytica doesn't have RBC inside it"



2-Indirect hemagglutination test and EIA are the most sensitive.

3-we can also see specific histological feature of the disease in GIT epithilium by microscope which show specific feature which we called it a flask-like(water-bottel) lesion

اذا بنشوف الصورة الموجودة على الجنب هي التي تمثل ما نسميه flask-like lesion حيث تحفر الاميبا داخل الGIT epithilium وتعمل شكل كقربة الماء او بريق الشاي بحيث انه المنطقة المحفورة هي مكان تواجد الاميبا اما الجانبين تبقى خلايا طبيعية غير مصابة

Treatment:-

1-is Drug of choice is METRONIDAZOL and we can use paromomycin, and chloroquine

2-Blood and fluid replacement

Prevention:-Proper sanitary disposal of human feces and improvement in personal hygienic practices.

Vibrio Cholera

General characteristics:-Gram-negative,curved comma shaped bacilli,Motile by single polar flagella,Non spore forming and Non capsulated,grow well in alkaline pH,Facultative anaerobes& Oxidase and catalase positive.

Classification of cholera:-

1-According to pathogenicity:

A-Group A – Vibrio cholerae:-which includes classical, El-Tor, INABA, Hikojima

B-Group B – non cholera Vibrios (Non pathogenic to man)

2-According to surfacr antigen (serogrouping):-by presence of specific O antigen, serogroups O1 to O139

Virulence Factors of cholera:-

1-Cholera toxin (enterotoxin) very important in inducing watery diarrhea

2-Somatic O antigens

3-Motility(by single polar flagella)

4-Mucinase:-which breakdown GIT mucus

5-Hemolysin:-which cause lysis of RBCs

6-Cytotoxin

Epidemiology:-

1-The organism cause epidemics and pandemics severe watery diarrhea

2-It is endemic in southern Asia (India, Pakistan, and Bangladesh)

Mode of Transmission:-Transmission in countries with poor sanitation by:
1-Ingestion of contaminated water or seafood
2-Exposure of ruptured skin or mucous membrane to contaminated water

Incubation period of the disease:-1-4 days after exposure to organism

Clinical symptoms:-
Sudden onset of intense vomiting and severe rice-water diarrhea with rapid dehydration and may lead to shock in 4-12h

Laboratory Diagnosis:-
1-Specimen:-rice watery stool
2-Gram stain:-gram (-) rods bacilli
3-Culture:-by show yallow colonies on specific TCBS selective media

4-Biochemical tests:Oxidase-positive,&Only sucrose fermentation is positive
5-Serology:-O1, O139 antisera

Treatment:-
1-fluid and electrolyte replacement by IV
2-antibiotics such as macrolides,doxycycline or ciprofloxacin

Prevention:-proper sanitation; new vaccine

بهذا الرابط بتلاقوا فيديوهات سكتشي:-
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