Microbiology of GIS

**H. pylori**

1) Specimens of H. pylori & how we use it:
   - Gastric biopsy --> histologic examination
   - Blood --> serum antibodies
   - Stool samples --> antigen detection

2) Invasive techniques --> endoscopy, biopsy
   - Non-invasive techniques --> urea breath test, urine/blood, stool specimen

3) H. pylori urease splits the urea in --> 1–2 hours

4) acute symptoms of H. pylori infection last for --> 1 to 2 weeks

5) H. pylori is --> Neutrophils (grow between pH 6 – 7)

6) H. pylori could be found in --> deep in the mucous layer

7) ammonia produced by the urease activity damage the cells --> directly

8) Ingestion of H. pylori lead to --> gastritis and hypochlorhydria

9) *H. pylori* also produce:
   - protease --> modify the gastric mucus
   - urease --> yields ammonia --> buffering of acidity of the stomach

**Shigellae**

1) All shigellae does not ferment lactose except --> Shigella sonnei

2) shigella infections are limited to --> gastrointestinal tract

3) shigella infective dose is --> $10^3$ organisms

4) salmonellae and vibrios infective dose is --> $10^5$–$10^8$
5) S. dysenteriae type 1 produces a heat-labile exotoxin

6) S. dysenteriae exotoxin affect gut, small intestine & CNS

7) antitoxin that neutralizes S. dysenteriae exotoxin develop from S. flexneri or S. sonnei

8) shigella incubation period 1–2 days

9) diarrhea by shigella attributed to exotoxin acting in the small intestine

10) shiga toxin subunit that reacts with the rRNA is subunit A

11) shiga toxin subunit that binds with the Gb3 is subunit B

12) shiga toxin effective against small blood vessels

13) shigella selective media is Hektoen enteric agar & SS asagar

14) shigella’s colorless colonies is lactose-negative

15) antibodies in the gut act on limiting reinfection is IgA

**SALMONELLA**

1) salmonella acquired by oral route

2) salmonella produce H2S

3) Infective dose is 10^5–10^8 salmonellae

4) Infective dose for S. typhi organisms 10^3

5) signs and symptoms appear after ingestion of salmonellae in 8-48h

6) episode usually resolves in 2–3 days

7) diarrhea and vomiting symptoms due to enterotoxin

8) release of endogenous pyrogens from the host due to endotoxin

9) disintegration of the cytoplasm due to cytotoxin
after salmonella done their duty it move to --> liver or spleen

**Campylobacters**

1) Campylobacters lead to --> diarrheal & systemic diseases
2) C. jejuni --> gull wing or S shapes & monotrichous
3) C. jejuni is --> Capnophile & Microaerophilic
4) Incubation of C. jejuni should be at --> 42C
5) C. jejuni LPS have --> endotoxic activity
6) C. jejuni acquired by --> oral route
7) how many organisms is necessary for infection --> $10^4$
8) C. jejuni multiply in --> small intestine

**Hepatitis**

1) Viral hepatitis is a --> systemic disease.
2) the common cause of post transfusion hepatitis is --> HCV.
3) Member of the picornavirus family is --> HAV.
4) chose the correct answer related to HAV --> there is only one serotype is known.
5) There is no antigenic cross-reactivity with any hepatitis viruses and .. --> HAV.
6) The only viral genome that is ds circular DNA related to --> HBV.
7) In HBV the inner nucleocapsid core surrounded by --> HBsAG.
8) Parenchymal changes in HBV infection are accompanied by --> Kupffer cell hyperplasia.
9) HBV infection infiltrated by --> mononuclear cells + cell degeneration.
10) Damaged hepatic tissue restored in -- > 8–12 weeks.

11) mild benign disease by HBV characterized by -- > abnormal aminotransferase values and hepatomegaly.

12) None of the hepatitis viruses are -- > typically cytopathogenic.

13) cellular damage seen in hepatitis is -- > immune-mediated.

14) development of hepatocellular carcinoma could be related to -- > HBV & HCV.

15) post-transfusion NANB hepatitis caused by -- > HCV.

16) HCV variation exist in response to -- > antiviral therapy.

17) development of fibrosis in HCV due to effect of -- > Cytokines.

18) one of the major pathogenic mechanisms of HCV is -- > liver cell proliferation.

19) Hepatitis C is combined with -- > minimal to moderate elevation of liver enzymes.

20) circular ss RNA genome -- > HDV.

21) smallest of known human pathogens -- > HDV.

22) for transmission of HDV it acquires -- > HBsAg coat.

23) onset of jaundice related to -- > viral hepatitis.

24) hepatitis in which there is no jaundice -- > icterus.

25) Cirrhosis occur due to -- > chronic HBV or HCV infections.

26) Laboratory diagnosis always made by -- > serum antibodies.

27) HBsAg indicates -- > that the patient is a carrier and potentially infective.

28) anti-HBs appears in serum during -- > recovery phase.

29) anti-HBs presence indicates -- > recovery and immunity.

30) enterically transmitted hepatitis -- > HEV.
ROTAVIRUSES

1) Rotaviruses are a major cause of diarrheal illness in human.

2) Rotaviruses is a dsRNA viruses.

3) Classification of rotaviruses based on antigenic epitopes on internal structural protein VP6.

4) the most frequent human pathogens --> Group A rotaviruses.

5) epitopes important in neutralizing activity are outer capsid proteins VP4 & VP7.

6) Rotaviruses infect cells of villi of the small intestine.

7) NSP4 is a viral enterotoxin.

8) Rotaviruses appear in stool (10^12 particles per gram of feces).

9) Diarrhea by rotaviruses due to impaired sodium & glucose absorption.

10) in rotaviruses infection normal function of small intestine restored within 3-8 weeks.

11) Rotaviruses usually don’t cause diarrheal in adults.

12) type of the diarrheal watery diarrhea.

13) Viral excretion in the stool may persist up to 50 days after onset of diarrhea.

14) Laboratory diagnosis depends on

a) presence of virus in stool
b) rise in antibody titer detected by ELISA

15) most sensitive detection method for the genotype --> PCR

16) Symptomatic infections are m.c in children between 6 months and 2 years.

17) transmission by the fecal–oral route.

18) protection against rotavirus may occur by presence of IgA or interferon.
**Adenoviruses**

1) Adenovirus infections are --> subclinical.

2) Adenoviruses display --> icosahedral symmetry with no envelope.

3) Human adenoviruses replicate in --> intestinal epithelium.

4) Serotypes that are etiologically associated with gastroenteritis --> types 40 & 41.

5) Adenoviruses present in --> stools.

6) Symptoms of adenoviruses last for approximately --> 10 days.

**Norwalk Virus or SRSV**

1) Norwalk Virus present in --> stools.

2) Norwalk Virus infection is a --> Winter Vomiting Disease.

3) Mostly transmission by --> food.

4) Norwalk Virus infection is a --> asymptomatic but the patient is infectious.

5) Incubation period is about --> 24 hours.

6) Persistence of illness for --> less than 3 days.

**Coronaviruses**

1) Coronavirus is a --> linear ssRNA.

2) Club-shaped spikes could be found in --> Coronavirus.

3) Usually coronavirus have --> 2 glycoproteins & 1 phosphoprotein.

4) PCR assays are useful to detect coronavirus --> nucleic acid (not Ag).

5) Coronavirus present in --> stools.

6) Serologic diagnosis is possible using --> passive hemagglutination test.
**ASTROVIRUSES**

1) Astrovirus characterized by --> star-like morphology, nonenvelop, ss RNA.

2) Astroviruses are transmitted by --> fecal-oral route.

3) Astroviruses cause gastroenteritis by:
   a) destruction of the intestinal epithelium.
   b) inhibition of absorption mechanism.
   c) loss of secretory functions.
   d) decrease in epithelial permeability in the intestines.

4) Incubation period is approximately --> 3-4 days.

5) Infection usually is --> not severe & rarely leads to dehydration.

<table>
<thead>
<tr>
<th>Viral</th>
<th>Bacterial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involved site</td>
<td>Small intestine</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>Watery</td>
</tr>
<tr>
<td>Vomiting</td>
<td>+++ or +</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>+ or –</td>
</tr>
<tr>
<td>Tenesmus</td>
<td>–</td>
</tr>
<tr>
<td>Anorexia</td>
<td>+ or –</td>
</tr>
<tr>
<td>Systemic illness symptom</td>
<td>+ or –</td>
</tr>
</tbody>
</table>

**V. cholera**

- oxidase positive, which differentiates them from enteric gram-negative bacteria.
- When the vehicle is water, $10^{10}$ organisms are necessary.
- When the vehicle is food, as few as $10^2-10^4$ organisms are necessary.
- incubation period is 12 hours–3 days.
- not an invasive infection. The organisms do not reach the bloodstream but remain within the intestinal tract.
- halotolerant
- grow at a high pH (8.5–9.5)
- rapidly killed by acid.
**Vibrio parahaemolyticus**
- halophilic.
- acute gastroenteritis after ingestion of contaminated seafood.
- Incubation period of 12–24 hours.
- infection can occur by the fecal-oral route or Wound infections

**Escherichia coli**
- Some strains of ETEC produce, heat-labile **exotoxin** (LT) which activates adenylyl cyclase. (↑ cAMP)
- Some strains of ETEC produce, heat-stable **enterotoxin** STa. which activates guanylyl cyclase. (↑ cGMP)

**STAPHYLOCOCCUS AUREUS**
- coagulase positive, which differentiates it from the other species
- 19 enterotoxins that are superantigens.
- enterotoxins are heat stable.
- Ingestion of 25 µg of enterotoxin B results in vomiting and diarrhea.
- onset start 1-6h after eating, symptoms last less than 12 hours.
- For the detection of food poisoning, a stool culture is needed.
**Bacillus cereus**
- Bacillus are aerobes.
- **Emetic type**: associated with fried rice, Sta toxin, self-limiting within 24h. It begins 1–5 h after ingestion.
- **Diarrheal type**: associated with meat dishes & sauces, LT toxin, incubation period of 1–24 h.
- **diarrhetic syndromes**: related to Hbl, NHE, CytK.
- Cereulide --> potent cytotoxin that destroys mitochondria.

**Clostridium botulinum**
- Clostridium in general are anaerobes.
- Types A, B, E, and F are the principal causes of human illness.
- Botulinum is a neurotoxin, It’s heat-labile.
- acts on the peripheral nervous system.
- inhibiting the release of Ach.
- Honey is a common vehicle for spread of the spores in infants.

**Clostridium perfringens**
- associated with: 1) Gas gangrene 2) Food poisoning.
- Enterotoxin produced and released during sporulation.
- The incubation period for enterotoxin is 8–24 h.
**Entamoeba histolytica**

- nuclear membrane surrounded a small central body --> **karyosome**
- Cyst are the infectious form.
- trophozoites multiply and accumulate above --> **muscularis mucosae**.
- ulcer of primary amebiasis looks like --> **flask-shaped**.
- E. histolytica travel to the **terminal ileum**.
- **favored** sites for later lesions are --> **sigmoid colon & rectum**.
- Symptoms may develop within **4 days** of exposure or after a year or may not develop.
- prefered test when stool is negative for amebiasis, while there are signs & symptoms of amebiasis --> **EIA**.
- E. histolytica transmitted via **fecal-oral route**.
- Flies could consider as a route of transmission too.

**GIARDIA LAMBLIA**

- found in the **duodenum** and **jejunum**.
- trophozoite has **4 pairs** of flagella (8 flagella).
- concave sucking disk to --> **adhere** to intestinal villi.
- **cysts** are passed in the stool.
- **2 nuclei** as **Immature** cysts.
- **4 nuclei** as **mature** cysts.
- Cysts can survive in water for up to **3 months**.
CRYPTOSPORIDIUM
- infect the intestine
- Oocysts passed in feces & are immediately infectious
- multiply asexually & sexually
- self-limited 1–2 weeks in normal persons
- Diagnosis depends on detection of oocysts in fresh stool samples
- incubation period 1 to 12 days
- EIA for detection of fecal antigen

Strongyloides stercoralis
- inhabit the intestine
- produce an autoreinfection
- Diagnosis is based on finding juveniles in freshly passed stools
- Rhabditoid larvae is the feeding stage
- Filariform larvae non feeding stage

Balantidium coli
- trophozoites have 2 visible nuclei (macronucleus & micronucleus)
- Cysts are round and have heavy cyst wall
- trophozoites and cysts are yellowish or greenish in color
- Balantidiasis is a zoonotic disease
- feco-oral route transmission
- *Balantidium coli* lives in the **cecum & colon**.
- Infection occurs in people with 1) **malnutrition** 2) **compromised immune**.
- Trophozoites colonize in **large intestine**.
- Encystation occurs in the **distal large intestine** & also occur in **feces**.
- In **acute disease** --> explosive diarrhea may occur as **every 20 minutes**.

**Ascaris lumbricoides**
- Infection acquired after **eggs** are **ingested**.
- Larvae hatch in the **duodenum**.
- Eggs are infective after **1 month** in the soil.
- High numbers of adult worms cause **mechanical obstruction**.

**Enterobius vermicularis** (**Pinworm**)
- Female have a **slender, pointed** posterior end.
- Males have a **curved** posterior end.
- Causes --> **ground itch**.
- Symptom --> **perianal pruritus**, especially at night.
- **Hand-to-mouth transmission**.
- Scotch Tape technique to recover eggs.
**TRICHURIS TRICHIURA** *(whipworm)*

- **anterior end** of the worms is **slender** & the **posterior end** is **thicker**.
- whipworms inhabit the **colon**.
- eggs become infective after about **3 weeks**.
- **larvae hatch** in the **small intestine**, where they mature and **migrate to the colon**.
- **anterior ends** of the worms lodge within the **mucosa of the intestine**.
- **Severe infection** may lead to profuse **bloody diarrhea**.
- worms may migrate to the **appendix**, causing **appendicitis**.

**Toxocariasis**

- **VLM** --> diseases associated with **major organs**
- **Covert toxocariasis** a milder version of VLM
- **OLM** --> pathological effects restricted to the **eye** and the **optic nerve**
- Eggs hatch as second stage larvae in the **intestines**.
- Eggs are passed in the **feces**.
- infective **after several weeks** outside of a host.
- larvae will also hatch in the **small intestine**.
- Toxocara infection are **asymptomatic** in adults.
- symptoms occur in result of **migration of 2nd stage** Toxocara larvae through the body.
- **Covert toxocariasis is due to chronic exposure**.
- **Covert toxocariasis** **hepatomegaly** & **lymphadenitis**.
- **VLM** is primarily diagnosed in **young children**.
- OLM is rare.

- **Loss of vision** due to OLM occurs **over days or weeks**.

- Transmission through **ingestion of infective eggs**.

- **Defecation habits of dogs** cause **T. canis** transmission to be **more common** than T. cati.

- eggs require a **several week incubation** period outside the host --> **infective**.

- Finding **Toxocara larvae within a patient** is the **only definitive diagnosis**

  - **Serological tests** are **dependent on the number of larvae** & is **not very specific**.

**Schistosoma**

- live in **venous system**.

  - **S mansoni**: **inferior mesenteric veins**.

  - **S japonicum**: **inferior & superior mesenteric veins**.

  - **S haematobium**: **veins of urinary bladder**.

- infection **acquired by** contact with **water infested with the Infectious cercariae**.

- Within **30 minutes**, the **cercariae** have **penetrated the epidermis and transformed into Schistosomules**,

- begin releasing eggs --> **5–8 weeks** after infection.

- **pathology is associated** with the **schistosome eggs**, not the adult worms.

- In chronic cases, blood flow to the liver is impeded, which leads to **portal hypertension**, accumulation of **ascites** in the abdominal cavity, **hepatosplenomegaly**, and **esophageal varices**

  - **S mansoni** (lateral spine) egg in **stool**.

  - **S japonicum** (nubby spine) eggs in **stool**.

  - **S haematobium** (terminal spine) eggs in **urine**.
**Echinococcus granulosus** *(HYDATID CYST)*
- Echinococcus granulosus --> 3 segmented tapeworm.
- larva of Echinococcus develops into **hydatid cyst**.
- Humans are infected only by ingesting *Echinococcus eggs* from **dog feces**.
- Humans are only the intermediate and **never the final host**.
- The **liver** is the most common site of cysts.
- Cyst ruptures lead to **anaphylactic shock** & **metastasize** to form additional hydatid cysts.
- **dogs & wild carnivores** as a definitive host.
- Definitive hosts are where parasites reach maturity and reproduce.
- **sheep & human** serve as an intermediate host.
- Cysts cause clinical symptoms.

**Ancylostoma duodenale**
- Females release more than 10,000 eggs per day into the **feces**.
- Larva hatches from the egg within a day or two.
- **Small intestine** where they mature into adult worms.
- **Hookworm disease** --> severe anemia and iron deficiency.
- **Feet and ankles** are common sites of infection.
**Fasciola hepatica** *(Sheep Liver Fluke)*

- Fasciola hepatica is a flatworm of the class Trematoda.
- It infects the liver of definitive host.
- Fasciolosis is a tropical disease.
- Once eggs in freshwater they become embryonated --> hatch as Miracidia then invade intermediate snail host --> cercariae are released from snail --> Metacercariae form Cysts on surfaces of aquatic vegetation --> Inside the duodenum of the host, the metacercariae are released from within their cysts.
- Inside the bile ducts, they develop into an adult fluke.
- produce up to 25,000 eggs per fluke per day, passed out via stools.
- acute phase --> immature worms.
- chronic phase --> when the worms mature in the bile duct.

**Taenia saginata** *(Beef)* & **Taenia Solium** *(Pork)*

- larvae called cysticerci.
- Adult worms are asymptomatic.
- egg pass out with human feces.
- eggs migrate & encyst as cysticerci in cow muscle (beef) or pig muscle (pork).
- Humans infected by eating raw or undercooked meats that contain cysticerci.
- cysticerci develop into adult worms in the human intestine.
**Hymenolepis nana**

- there are **direct life cycle** & **indirect life cycle** --> human can infected in both ways.
- **scolex** bears a single circle of 20 to 30 hooks and also has **4 suckers**.
- Infection is acquired most commonly by **direct life cycle**
- Eggs hatch in the **duodenum** --> **Oncospheres** penetrate the mucosa & lie in lymph channels of the villi --> develops into a **cysticercoid** --> **5-6days** cysticercoid emerge into **small intestine** where they attach and mature.

“The struggle you are in today is developing the strength you need for tomorrow”

**This summery alone isn’t enough to study on for the exam**

Wish you a Good luck

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