DISEASES OF THE DIGESTIVE SYSTEM

Digestive System

**GROUP 1:** GI tract (alimentary canal) including mouth, pharynx, esophagus, stomach, small intestine, and large intestine

**GROUP 2:** Accessory structures: Teeth, tongue, salivary (parotid) glands, liver, gallbladder, and pancreas

**Mechanism of the digestive system:**
1) Breaking down food – polymers – monomers
2) Absorption
3) Discharge – feces (through peristalsis)

**Breaking down process:**
Mechanical; Chemical – pH; Physiological (Biochemical) – enzymes

**A. Bacterial diseases of the mouth:**

1. **Tooth decay (Dental caries)**
   Gradual softening of the enamel and dentin of a tooth:
   - Enamel → dentin → pulp cavity → root → bone
   - Bacterial invasion, necrosis → abscess ligaments, started with gingivitis (in gingival crevice) or plaque formation – progressed to abscesses, bone destruction.
   **Pathogen:** *Streptococcus mutans, Actinomyces, Norcardia, Corynebacterium.*
   - Sucrose → Glucosyl transferase → glucose + fructose
   - Polymer → lactobacilli → lactic acid → dental caries

2. **Periodontal disease:**
   Inflammation/degeneration of the gum (gingivitis), supporting bone, periodontal areas (periodontitis)
   **Pathogens:** many bacteria from the oral cavity including *Porphyromonas* spp.

**B. Bacterial diseases of stomach (Gastritis) – peptic ulcer**

**Pathogen:** *Helicobacter pylori,* helical shape, gram-negative
   - Due to urease activity (hydrolysis of urea to ammonia and CO₂) → pH increase,
   - *H. pylori* survives (ulcer-causing microbe) strong acid of the stomach
   **Symptom:** in association with stomach ulcers, it can be a predisposing factor of stomach cancer

**C. Bacterial diseases of the lower digestive system:**

**General symptom:**
- Diarrhea, dysentery (blood & mucus stool)
- Diarrhea – dehydration – loss of electrolyte – cardiac arrest
- Inflammation of the stomach and intestinal mucosa

**Treatment:** Refurnish of the electrolytes & antibiotics treatment
1. Staphylococcal food poisoning:  
Pathogen: *S. aureus* – G+ cocci, enterotoxin (exotoxin) a common food poisoning, gastroenteritis  
Symptom: Nausea vomiting, diarrhea (1 – 6) hrs after ingestion  
Identification: Phage typing, coagulase test  
Treatment: Penicillin is not effective antitoxin treatment first. Then antibiotics treatment

2. Salmonella infections: Typhoid, gastroenteritis  
Major species causing disease: *S. choleraesuis, S. typhi, S. enteritidis*  
Serotyped by Kauffmann – White scheme or *Salmonella* antigenic scheme

a) Typhoid fever:  
Pathogen: *S. typhi* (used to be called *S. typhosa*)  
Epithelial lining of the small intestine  
From feces & urine \[ \rightarrow \] Macrophage  
\[ \downarrow \] if not killed by macrophage  
Blood (septicemia) \[ \downarrow \]  
RES (Reticulo Endothelial System) present in the intestine, liver, spleen, kidney, and gallbladder  
Symptom:  
First week: fever, malaise, aches & pain  
When Peyer’s patches (lymphatic tissues in the intestinal wall) are infected, high fever  
(104°F) diarrhea & vomiting follow  
Second week: extended bacterimia, several organs are targeted  
e.g. gallbladder – intestinal lumen  
Some 3% of the patients become chronic carriers  
Transmission: Contaminated food & water (sometimes after the earthquake)  
Diagnosis:  
In early stages: not easily found in stool, but in blood  
In later stages: in stool  
Not easily detected, confused with other diseases.  
Samples from blood & feces: identify cells  
Treatment: Ampicillin, chloramphenicol  
If antibiotic treatment is not enough, removal of gallbladder may be necessary  
Prevention & Control:  
Proper care of water treatment & sewage disposal, pasteurization of milk, killed vaccine  
– some value

b) Salmonellosis (Gastroenteritis):  
Salmonella \[ \rightarrow \] intestinal tract \[ \rightarrow \] proliferate  
Symptom: Fever, abdominal pain, diarrhea, Extensive dehydration \[ \rightarrow \] imbalance of electrolytes  
Transmission:  
Most frequent incident, commonly by contaminated food (especially meat) e.g. poultry & fish; also transmitted by domestic pets  
Diagnosis: Isolation of bacteria from the infected intestinal tract  
Treatment: Supportive therapy – recommended  
Prevention & control: Proper cooking & food processing
3. Bacillary Dysentery (Shigellosis)
   **Pathogen:** *Shigella dysenteriae, S. sonnei, S. flexneri*
   **Pathogens & clinical diseases:**
   - *Shigella* is not able to penetrate into the deeper body tissue or into the blood
   - Bacteria → Small intestine → large intestine → epithelial tissue inflammation
   **Symptom:** fever, abdominal cramps
   - Diarrhea (Bloody & mucous stool) → dehydration → electrolyte imbalance
   - Shiga toxin produces ulcer in the large intestine
   **Transmission:** From body to body via the fecal – oral route or flies
   **Diagnosis:** Isolation of *Shigella* from the patient’s feces & fluid
   **Treatment:** Supportive therapy to maintain fluid balance; Ampicillin & other broad spectrum antibiotics

4. Cholera:
   **Pathogen:** *Vibrio cholerae*, Comma shaped cells, *V. cholerae* biotypes classical & Eltor – most severe
   **Pathogenesis & clinical disease:**
   - Contaminated food & water – proliferate in small
   - Not cause bacteremia (not penetrate into tissue); stays in intestine
   - Enterotoxin production stimulates enzymatic reaction that increases the cell permeability and cause the loss of fluid & electrolytes (*Na^+*, Cl^−*, K^+*, HCO_3^−) into the lumen of the intestines
   **Symptom:** Vomiting & diarrhea (very severe) dehydration & electrolyte imbalance
   **Transmission:** Typically fecal – oral routes
   - Common outbreak in India & Bangladesh also other parts of Asia & Africa, very rare in USA
   **Treatment:** Simple if it is initiated soon enough, death resulted from loss of fluid not tissue damage
   1) Fluid therapy with electrolytes, fatality is high if not proper treatment
   2) Neutralize the enterotoxin
   3) Tetracycline – effective to remove flora from intestinal tract
   **Control & prevention:**
   - Proper water & sewage treatment; Rapid detection, isolation of patients – important
   - Traveler to other country – avoid vegetables, sea food, non – sterilized beverages; killed vaccine – available

**Other Vibrio’s:**
- *V. parahaemolyticus, V. mimicus, V. fluvialis,* – found in marine estuaries, moderately severe cholera

5. *Campylobacter* infection:
   Used to belong to the genus *Vibrio*: curved rod, G-, motile, microaerophilic
   - Normal microflora of intestines of mammals & birds
   - Cause 1) Abortion in domestic animals, gastroenteritis in human (by *C. jejuni*)
   **Symptom:** Fever, diarrhea & abdominal pains
   - Can be spread to the blood & other tissue – also fetus can be infected, fatal
   - Isolation – from the feces of the patient
   **Treatment:** Supportive treatment for diarrhea; Erythromycin, gentamycin, chloramphenicol
   **Prevention:** Proper treatment in hygienic conditions, water & food
D. Viral Diseases

1. **Mumps (Parotitis):** Inflammation parotid (salivary) glands
   **Pathogen:**
   
   

   Prevention and Treatment: MMR vaccination

2. **Gastroenteritis:** Common called “stomach flu”
   **Pathogens:** Rotavirus, Norovirus (Norwalk virus)
   **Treatment:** supportive treatments – rehydration

3. **Hepatitis:** Inflammation of the liver
   **Pathogens:** Hepatitis viruses (5 – known), Epstein-Barr virus, cytomegalovirus
   **Symptom:** Jaundice, severe case – cirrhosis

<table>
<thead>
<tr>
<th>Hepatitis virus</th>
<th>Nucleic acid</th>
<th>Transmission</th>
<th>Epidemiology</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAV</td>
<td>RNA</td>
<td>Fecal-oral</td>
<td>Acute</td>
<td>Highly epidemic, virus in feces, pooled gamma-Ig treatment</td>
</tr>
<tr>
<td>HBV</td>
<td>DNA</td>
<td>Parenteral</td>
<td>Chronic</td>
<td>Dane particle (complete) Au/SH Ag, (HBsAg)</td>
</tr>
<tr>
<td>HCV</td>
<td>RNA</td>
<td>Parenteral+</td>
<td>Chronic</td>
<td>Non-A non-B (NANB),</td>
</tr>
<tr>
<td>HDV</td>
<td>RNA</td>
<td>Parenteral+</td>
<td>Chronic</td>
<td>Defective, needs a helper virus</td>
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</tbody>
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E. Protozoan diseases

1. **Giardiasis:** Flagellate diarrhea
   **Pathogen:** *Giardia lamblia*, flagellated protozoa
   **Symptom & Characteristics:** typical fecal-oral routes
   **Treatment:** metronidazole

2. **Cryptosporidiosis:**
   **Pathogen:** *Cryptosporidium hominis (parvum)*
   **Symptom & Characteristics:** fecal-oral, detrimental effects on AIDS patients
   **Treatment:** Supportive therapy – rehydration

3. **Amoebic dysentery (Amoebiasis):**
   **Pathogen:** *Entamoeba histolytica*, cysts are infective
   **Symptom & Characteristics:** dysentery, some become chronic
   **Treatment:** tetracycline, metronidazole