Gastrointestinal Tract Infections

Gastrointestinal tract
Protection
Normal flora
Diseases

Protection (Barriers)
- Intestinal surfaces - layer of mucus
- Muscular walls (peristalsis)
- Saliva
- Secretory IgA
- Stomach acid
- Bile
- Gut-associated lymphoid tissue (GALT)
- Commensal or normal flora
- Peptide Antibiotics - Defensins

Normal Flora
Numerous species present
- Bacteria
- Fungi
- Protozoa
- Oral cavity
  - more than 550 species of bacteria
- Stomach and small intestine
  - Relatively sparsely populated
- Large intestine
  - more than $10^{11}$ cells per gram of contents

Diseases
- Tooth and gum infections
- Mumps
- Gastritis and ulcers
- Acute Infectious Diarrhea
- Acute diarrhea with vomiting
- Chronic diarrhea
- Helminthic intestinal infections
- Liver and intestinal disease
  - Hepatitis
Tooth and gum infections

- Dental caries
- Periodontal diseases

Dental caries

- Bacterial infection
- Most common infection
- Dissolution of solid tooth surface
  - Carbohydrates are fermented by bacteria and produce acids

Features of dental caries.

<table>
<thead>
<tr>
<th>Causative Organism(s)</th>
<th>Streptococcus mutans, Streptococcus sobrinus, others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most Common Modes of Transmission</td>
<td>Direct contact</td>
</tr>
<tr>
<td>Virulence Factors</td>
<td>Adhesion, acid production</td>
</tr>
<tr>
<td>Culture/Diagnosis</td>
<td>–</td>
</tr>
<tr>
<td>Prevention</td>
<td>Oral hygiene, fluoride supplementation</td>
</tr>
<tr>
<td>Treatment</td>
<td>Removal of diseased tooth material</td>
</tr>
</tbody>
</table>

Periodontitis

- Communities of different bacterial species
- Periodontitis – late or more serious infection, following Gingivitis
- Plaque
- Calculus

Features of periodontal diseases.

<table>
<thead>
<tr>
<th>Necrotizing ulcerative gingivitis and periodontitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synergistic effects caused by community of different bacterial species</td>
</tr>
<tr>
<td>Severe condition</td>
</tr>
<tr>
<td>At risk</td>
</tr>
<tr>
<td>– poor hygiene</td>
</tr>
<tr>
<td>– AIDS patients</td>
</tr>
<tr>
<td>– Diabetes patients</td>
</tr>
<tr>
<td>– Smoking patients</td>
</tr>
</tbody>
</table>

Features of periodontal diseases.
Endoscopic appearance of esophageal candidiasis (left), showing typical white plaques and nodules, in a patient with multiple myeloma. Herpes simplex esophagitis (right), characterized by numerous small ulcerations, in an immunocompetent adult with fever and odynophagia.

**Etiology of Esophagitis**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidiasis</td>
<td>HSV, Varicella-zoster virus, HIV, human immunodeficiency virus</td>
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</tr>
<tr>
<td>Esophageal candidiasis</td>
<td>HSV, Varicella-zoster virus, HIV, human immunodeficiency virus</td>
</tr>
<tr>
<td>Herpes simplex esophagitis</td>
<td>HSV, Varicella-zoster virus, HIV, human immunodeficiency virus</td>
</tr>
</tbody>
</table>

**Treatment of Esophagitis**

<table>
<thead>
<tr>
<th>Stage</th>
<th>usual treatment</th>
<th>alternative therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>early</td>
<td>PPI or H2RA</td>
<td>alternative antibiotic therapy for HSV infection (Acyclovir, Famciclovir)</td>
</tr>
<tr>
<td>severe</td>
<td>PPI or H2RA</td>
<td>alternative antibiotic therapy for HSV infection (Acyclovir, Famciclovir)</td>
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</tbody>
</table>

**Gastritis and gastric ulcers**

- Bacterial infections
- Pain & lesions (peptic ulcers) in the abdomen
- More common for blood type O individuals
- Bacteria neutralize stomach acid environment
- Immune response may damage epithelium
- Possibly zoonotic

**Helicobacter pylori**: The gastric niche

**Acute infectious diarrhea**

- Bacterial infections
- Non-bacterial infections

- Common, particular day care centers
- Developing countries – serious health effects, fatal
- In the U.S., 1/3 due to contaminated food
Nausea, Vomiting, and Noninflammatory Diarrhea
EPEC, EHEC, ETEC …..

Enteropathogenic (EP) & enterohemorrhagic (EH) Escherichia coli serotypes classically recognized in infantile diarrhea outbreaks.*

Serotypes of Escherichia coli that appear with increased frequency among enterotoxigenic (ET) isolates

HKO antigens

- H = flagellar antigen
- K = capsular antigen
- O = cell wall antigen

Example: E. coli O157:H7

Etiology of Traveler’s Diarrhea

Viral Pathogens Causing Gastroenteritis

Rotavirus has a unique “spoked-wheel” appearance.

Comparison of the Three Types of Enteric Infection
Possible Enteric Pathogens in Patients with Acquired Immunodeficiency Syndrome (AIDS)

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Cases in AIDS (n = 260)</th>
<th>Cases in non-AIDS (n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter</td>
<td>14.4%</td>
<td>0%</td>
</tr>
<tr>
<td>Escherichia coli O157</td>
<td>8.6%</td>
<td>0%</td>
</tr>
<tr>
<td>Listeria</td>
<td>2.6%</td>
<td>0%</td>
</tr>
<tr>
<td>Salmonella</td>
<td>1.2%</td>
<td>0%</td>
</tr>
<tr>
<td>Shigella</td>
<td>1.1%</td>
<td>0%</td>
</tr>
<tr>
<td>Vibrio</td>
<td>0.4%</td>
<td>0%</td>
</tr>
<tr>
<td>Yersinia</td>
<td>0.2%</td>
<td>0%</td>
</tr>
<tr>
<td>Lactobacillus</td>
<td>2.4%</td>
<td>0%</td>
</tr>
<tr>
<td>Escherichia coli KI</td>
<td>0.8%</td>
<td>0%</td>
</tr>
<tr>
<td>Escherichia coli 045</td>
<td>0.2%</td>
<td>0%</td>
</tr>
<tr>
<td>S. aureus</td>
<td>0.2%</td>
<td>0%</td>
</tr>
<tr>
<td>Staphylococci aureus</td>
<td>0.2%</td>
<td>0%</td>
</tr>
<tr>
<td>Other enteric pathogens</td>
<td>3.4%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Foodborne Disease


Foodborne Disease

Annual Incidence of Diagnosed Infections Identified through Active Surveillance in the Foodborne Disease Active Surveillance Network—United States, 2002

Foodborne Disease

Pathogenic Mechanisms in Bacterial Foodborne Disease

Foodborne Disease

Outbreak cases of Known Cause Reported to the CDC, 1973-2000

Foodborne Disease

Estimated Frequency of Hospitalizations and Deaths for Known Foodborne Pathogens, United States, 1997
Types of water related diseases

- Waterborne: Disease transmitted by ingestion of contaminated drinking water. Examples: cholera, typhoid fever, dysentery.
- Water-carried: Disease acquired by accidental ingestion of, or exposure to contaminated water by contact with water. Examples: typhoid, shigellosis, hepatitis A.
- Water-borne: Disease caused by exposure to contaminated water. Examples: typhoid, cholera, dysentery.
- Water-borne: Disease caused by a parasite in the water supply. Examples: typhoid, cholera, dysentery.

Access to clean (drinking) water is crucial to prevent waterborne diseases.

Cryptosporidium infection

- Protozoan infection
- Zoonotic
- Oocysts
- Intracellular
- AIDS patients are at risk
- Associated with fresh water outbreaks

Hepatitis (Inflammation of the liver)

- Viral infection
  - Hepatitis A
  - Hepatitis B
  - Hepatitis C
- Jaundice
- Noninfectious conditions may cause hepatitis

Features of Hepatitis.

Checkpoint 22.8 Hepatitis

Approach to diagnosis and management of infectious diarrhea.