My Tummy Feels Bummy!
Microbial Diseases of the Digestive System

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- Transmitted in food and water
- Fecal-oral cycle can be broken by:
  - Proper sewage disposal
  - Disinfection of drinking water
  - Proper food preparation and storage

Normal Microbiota

- >300 species in mouth
- Large numbers in large intestine, including:
  - Bacteroides
  - E. coli
  - Enterobacter
  - Klebsiella
  - Lactobacillus
  - Proteus

Bacterial Diseases of the Lower Digestive System

- Symptoms usually include diarrhea, gastroenteritis, dysentery
- Treated with fluid and electrolyte replacement
- Infection caused by growth of pathogen
  - Incubation from 12 hr to 2 wk
- Intoxication caused by ingestion of toxin
  - Symptoms appear 1-48 hr after ingestion

Shigellosis

- Shigella spp. producing Shiga toxin
- Shiga toxin causes inflammation and bleeding

Salmonellosis

- Salmonella enterica serovars such as S. enterica Typhimurium
- Mortality (<1%) due to septic shock caused by endotoxin

Typhoid Fever

- Salmonella enterica Typhi
- Bacteria spread throughout body in phagocytes
- 1-3% recovered patients become carriers, harboring Salmonella in their gallbladder

Cholera

- Vibrio cholerae serotypes that produce cholera toxin
- Toxin causes host cells to secrete Cl⁻, HCO₃⁻, and water
Noncholera Vibrios

- Usually from contaminated crustaceans or mollusks
  - \textit{V. cholerae} serotypes other than O:1, O:139, and eltor
  - \textit{V. parahaemolyticus}
  - \textit{V. vulnificus}

\textit{Escherichia coli} Gastroenteritis

- Occurs as traveler's diarrhea and epidemic diarrhea in nurseries
- 50% of feedlot cattle may have enterohemorrhagic strains in their intestines
- Enterohemorrhagic strains such as \textit{E. coli} O157:H7 produce Shiga toxin
  - O = cell wall antigen
  - H = flagellar antigen

Campylobacter Gastroenteritis

- \textit{Campylobacter jejuni}
- Usually transmitted in cow's milk

Helicobacter Peptic ulcer disease

- Treated with antibiotics
- \textit{H. pylori} found as a cause of stomach cancer

\textit{Yersinia} Gastroenteritis

- \textit{Y. enterocolitica} and \textit{Y. pseudotuberculosis}
- Can reproduce at 4°C
- Usually transmitted in meat and milk

\textit{Clostridium perfringens} Gastroenteritis

- Grow in intestinal tract producing exotoxin

\textit{Bacillus cereus} Gastroenteritis

- Ingestion of bacterial exotoxin produces mild symptoms

Mumps

- Mumps virus
- Enters through respiratory tract
- Infects parotid glands
- Prevented with MMR vaccine

Hepatitis

- Inflammation of the liver
- Hepatitis may result from drug or chemical toxicity, EB virus, CMV, or the Hepatitis viruses

Viral Gastroenteritis

- Rotavirus
- 3 million cases annually
  - 1-2 day incubation, 1 week illness
- Norovirus
  - 50% of U.S. adults have antibodies
  - 1-2 day incubation. 1-3 day illness
- Treated with rehydration

**Mycotoxins**
- Mycotoxins are produced by some fungi:
  - *Claviceps purpurea*
    - Grows on grains
    - Produces ergot
      - Toxin restricts blood flow to limbs; causes hallucination
  - *Aspergillus flavus*
    - Grows on grains
    - Produces aflatoxin
      - Toxin causes liver damage; liver cancer

**Giardiasis**
- *Giardia lamblia*
  - Transmitted by contaminated water
  - Diagnosed by microscopic examination of stool for ova and trophozoite
  - Treated with metronidazole

**Cryptosporidiosis**
- *Cryptosporidium parvum*
  - Transmitted by oocysts in contaminated water
  - Diagnosed by acid-fast staining of stool or presence of antibodies by FA or ELISA
  - Treated with oral rehydration

**Cyclospora Diarrheal Infection**
- *Cyclospora cayetanensis*
  - Transmitted by oocysts in contaminated water
  - Diagnosed by microscopic examination for oocysts
  - Treated with trimethoprim and sulfamethoxazole

**Amoebic Dysentery**
- *Entamoeba histolytica*
  - Amoeba feeds on RBCs and GI tract tissues
  - Diagnosis by observing trophozoites in feces
  - Treated with metronidazole

**Tapeworms**
- *Taenia* spp.
  - Transmitted as cysticerci in undercooked meat
- Cysticerci may develop in humans
- Diagnosed by observing proglottids and eggs in feces
- Treatment with praziquantel
- Neurocysticercosis may require surgery

**Hydatid Disease**
- *Echinococcus granulosus*
- Definitive host: Dogs, wolves
- Intermediate host: Sheep and other herbivores; Humans
- Transmitted by ingesting *E. granulosus* eggs
- Treatment is surgical

**Pinworms**
- *Enterobius vermicularis*
- Definitive host: Humans
- Transmitted by ingesting *Enterobius* eggs
- Treatment with pyrantel pamoate or mebendazole

**Hookworms**
- Larvae in soil hatched from eggs shed in feces
- Larvae bore through skin; migrate to intestine
- Treated with mebendazole

**Ascariasis**
- *Ascaris lumbricoides*
- Lives in human intestines
- Transmitted by ingesting *Ascaris* eggs
- Treated with mebendazole

**Trichinosis**
- *Trichinella spiralis*
- Larvae encyst in muscles of humans and other mammals
- Transmitted by ingesting larvae in undercooked meat
- Treated with mebendazole to kill adults worms