GASTROENTERITIS AND FOOD POISONING
• Case 1

A healthy 4-years old boy fell ill with fever, nausea and vomiting, abdominal cramps, and loose stools. On the third day, bloody diarrhea developed, and he was given an oral antibiotic. On the fifth day, he became lethargic and was admitted to the hospital.

He lives in a suburb and attends a child-care facility, but no other children there, and no family members, are ill. Meals are consumed at home and occasionally at restaurants. There are no sick pets in the home and no other animal exposures. On admission, the boy`s vital signs are as follows: temperature, 38°C, pulse rate 130 beats/min; and blood pressure 80/40 mm Hg. The boy is awake but lethargic. Head and neck examination reveals pale mucosae. Skin turgor is reduced. Rectal exam shows maroon, liquid feces. There is minimal urine output, as measured by an indwelling catheter.
• Case 1

- What is the meaning of bloody diarrhea?
- Is the infection localized to the gastrointestinal tract or disseminated?
- What is the causative agent?
- What was the most likely source of infection?
- Should this patient be treated with antibiotics?
• Case 2

A previously healthy 55-year-old businessman is admitted to the emergency service at 2:00 a.m. with nausea, vomiting, and profuse watery diarrhea.

His vital signs showed tachycardia (120 beats/min), blood pressure of 120/60 mm Hg, and a temperature of 39°C. He is given intravenous fluid replacement and shows progressive improvement. He is discharged by noon the next day.

At 3:00 a.m. on the same morning, another patient is brought to the hospital. Both had attended the same wedding. A quick check of area emergency rooms reveals that ten other wedding guests have also sought medical care for similar symptoms.
• Case 2

- What is the most likely cause of this outbreak of diarrheal disease?
- How could the diagnosis be confirmed?
- How could the source of the outbreak be traced?
- How should the patients be treated?
• Diarrhea is excretion of more than 200g of stool/day. Diarrhea can be caused by bacteria, viruses, or parasites. There are two basic types of diarrhea:

a) profuse secretory diarrhea (usually caused by secretion of exotoxins or by viral infections of the intestinal mucosa)

b) dysentery is characterized by the frequent passage of stools with low volume that contain mucus, pus and blood (usually caused by secretion of cytotoxins or by invasion of the mucose by bacteria or protozoa.)
• **Gastroenteritis** is an infection (acute or chronic) of gastrointestinal tract that includes diarrhea and symptoms of gastric irritation (e.g. nausea, vomiting, epigastric pain). Bacteria and viruses are the most common etiologic agents.

• **Enterocolitis** is an infection of the lower gastrointestinal tract.

• **Food poisoning** is a type of acute gastroenteritis in which the ingestion of a single meal can be identified as the vehicle of infection. Bacteria and bacterial toxins are most commonly implicated in classic cases of food poisoning.
Prevalence

• one of the most common form of infections diseases
• the prevalence of particular causative agents depends on:
  - age of the patient
  - the season of the year
  - socioeconomic factors
Clinical presentation

- diarrhea
- vomiting
- abdominal pain
- fever (usually mean that microorganism is invasive; invasion can be limited to the intestinal mucosa, or spread systemically through the circulation)
Infectious diarrhea and gastroenteritis

• Epidemiology
  - fecal-oral transmission
    direct person-to-person transmission
    contamination of meat, poultry products or seafood
during processing transmission
  contamination of food during or after cooking

-food-borne transmission (meat, poultry products or seafood that have been contaminated before processing)
Infectious diarrhea and gastroenteritis

• Pathogenesis
  1. colonization and proliferation

  2. a) noninvasive bacteria - release enterotoxins
     b) invasive bacteria
     c) penetrative bacteria
### Features of specific types of noninvasive bacterial diarrhoea

<table>
<thead>
<tr>
<th></th>
<th>V. cholerae</th>
<th>E. coli</th>
<th>C. perfringens</th>
<th>B. cereus</th>
<th>S. aureus</th>
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<tbody>
<tr>
<td>Incubation (hours)</td>
<td>12-72</td>
<td>24-72</td>
<td>6-12</td>
<td>3-8</td>
<td>1-6</td>
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<tr>
<td>Duration (hours)</td>
<td>48-120</td>
<td>24-48</td>
<td>12-24</td>
<td>12-24</td>
<td>6-12</td>
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<tr>
<td>Abdominal cramps</td>
<td>0</td>
<td>+</td>
<td>++++</td>
<td>++</td>
<td>++</td>
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<tr>
<td>Vomiting</td>
<td>+</td>
<td>±</td>
<td>+</td>
<td>++</td>
<td>++++</td>
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</table>
- Features of specific types of invasive bacterial diarrhoea

<table>
<thead>
<tr>
<th></th>
<th>Shigella</th>
<th>E. coli</th>
<th>Salmonella</th>
<th>Y. enterococolitica</th>
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<tbody>
<tr>
<td>Incubation (hours)</td>
<td>24-72</td>
<td>24-72</td>
<td>8-48</td>
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<td>Vomiting</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Fever</td>
<td>++</td>
<td>++</td>
<td>++++</td>
<td>++</td>
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</tbody>
</table>
Infectious diarrhea and gastroenteritis

- Laboratory diagnosis
  - feces
  - rectal swab
  - intestinal biopsy samples
  - blood cultures
Infectious diarrhea and gastroenteritis

- Treatment
  - cases of noninvasive diarrhea are usually self-limited and do not require specific therapy
  - cases of invasive diarrhea are usually more severe and require more aggressive therapy.
Food poisoning

- similar symptoms in several members of a group sharing a meal
- acute onset a few hours after food ingestion
Food poisoning may be caused by:
- intoxication (ingestion of food containing performed bacterial toxins)
- infectious food poisoning (ingestion of viable infectious agents)
<table>
<thead>
<tr>
<th>Pathogen</th>
<th>% of reported outbreaks</th>
<th>Incubation period (hours)</th>
<th>Clinical presentation</th>
<th>Characteristic foods</th>
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</thead>
<tbody>
<tr>
<td>B. cereus</td>
<td>1-2</td>
<td>1-6</td>
<td>vomiting</td>
<td>re-warmed fried rice</td>
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<tr>
<td>C. botulinum</td>
<td>5-15</td>
<td>12-72</td>
<td>neuromuscular paralysis</td>
<td>canned food of all types</td>
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<tr>
<td>S. aureus</td>
<td>15-25</td>
<td>2-4</td>
<td>vomiting, diarrhea</td>
<td>meats, custards, salads</td>
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<tr>
<td>V. parahemolyticus</td>
<td>1-2</td>
<td>10-24</td>
<td>watery diarrhea</td>
<td>shellfish</td>
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</table>
Viral diarrhea

- 2 major viral causes of diarrhea in humans:
  - Norwalk virus and related viruses
  - Rotavirus
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<thead>
<tr>
<th></th>
<th>Norwalk-like viruses</th>
<th>Rotavirus</th>
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<tbody>
<tr>
<td><strong>Epidemiology</strong></td>
<td>epidemics</td>
<td>usually sporadic</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>older children, adults</td>
<td>infants, young children</td>
</tr>
<tr>
<td><strong>Transmission</strong></td>
<td>fecal-oral</td>
<td>fecal-oral</td>
</tr>
<tr>
<td><strong>Incubation</strong></td>
<td>1-2 days</td>
<td>1-3 days</td>
</tr>
<tr>
<td><strong>Illness</strong></td>
<td>explosive vomiting or diarrhea; self-limited</td>
<td>severe diarrhea (5-8 days)</td>
</tr>
<tr>
<td><strong>Prevalence</strong></td>
<td>1/3 of epidemics in USA</td>
<td>1/2 of severe infantile diarrhea in world</td>
</tr>
<tr>
<td><strong>Diagnosis</strong></td>
<td>ELISA</td>
<td>ELISA, gene probes</td>
</tr>
</tbody>
</table>
Parasitic diarrhea

- Protozoans

3 protozoans account for most cases of infectious parasitic diarrhea:
- Entamoeba hystolytica
- Gardia lamblia
- Cryptosporidium
<table>
<thead>
<tr>
<th></th>
<th>E. histolytica</th>
<th>G. lambia</th>
<th>Cryptosporidium</th>
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<tbody>
<tr>
<td>Distribution</td>
<td>worldwide</td>
<td>worldwide</td>
<td>worldwide</td>
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<tr>
<td>Disease</td>
<td>amebic dysenteria</td>
<td>chronic diarrhea</td>
<td>diarrhea in immunocompromised patients</td>
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<tr>
<td>Complications</td>
<td>abscesses</td>
<td>malabsorption</td>
<td>malabsorption</td>
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<tr>
<td>Transmission</td>
<td>fecal-oral route</td>
<td>fecal-oral route</td>
<td>contaminated animal food</td>
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<tr>
<td>Diagnosis</td>
<td>microscopic examination</td>
<td>microscopic examination</td>
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</tr>
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</table>
Parasitic diarrhea

- Helminthology
  - Nematodes (Ascaris lumbricoides, Enterobius vermicularis, Trichinella spiralis)
  - Cestodes (Taenia solium, Taenia saginata, Echinococcus granulosus)
• Case 1 revisited

The bloody diarrhea strongly suggests that the patient has an intestinal infection caused by invasive or cytotoxin-producing bacteria.

The constitutional symptoms (fever, lethargy, etc.) suggest that the infection may be disseminated. Anemia and reduced urinary output (acute renal failure) suggest the hemolytic-uremic syndrome.

The precise cause of the disease can be determined only by culturing fecal material and blood. However, it could be *E. coli* O157:H7 (EHEC).

Major means of *E. coli* transmission in recent years has been via the ingestion of undercooked hamburgers at restaurants.

For a severely ill child with symptoms of septicemia and hemolytic-uremic syndrome, emergency admission and antibiotics are indicated.
• Case 2 revisited

The wedding guests most likely are experiencing gastroenteritis secondary to the ingestion of food contaminated with a performed toxin, as suggested by short incubation time (less than 12h). *S. aureus* or *B. cereus* enterotoxins are the most likely causes.

To confirm diagnosis it would be essential to recover an enteropathogenic bacterium or toxin from patient. The source of the outbreaks is most likely a food handler. The treatment for toxin-induced gastroenteritis is suppurative. Administration of antibiotics is usually unnecessary because the infection is usually self-limiting.