

GI Bacterial Infections

(part-1)

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Acute diarrhea and vomiting

- Acute diarrhea , sometimes with vomiting, is the predominant symptom in infective gastroenteritis.
- Acute diarrhea (loose frequent stools) is extremely common and is usually due to feco-oral transmission of bacteria or their toxins, viruses or parasites.
- Infective diarrhea is usually short-lived and diarrhea lasting >10 days is rarely infective in origin.
- Diarrhea can be caused by a variety of drugs, including antibiotics, cytotoxic drugs, PPIs and NSAIDs.



13.12 Differential diagnosis of acute diarrhoea and vomiting

Infectious causes

- Gastroenteritis
- *C. difficile* infection (p. 343)
- Acute diverticulitis (p. 916)
- Sepsis (p. 304)
- Pelvic inflammatory disease (p. 418)
- Meningococcaemia (p. 1201)
- Pneumonia (especially 'atypical disease', p. 682)
- Malaria (p. 353)

Non-infectious causes

Gastrointestinal

- Inflammatory bowel disease (p. 897)
- Bowel malignancy (p. 910)
- Overflow from constipation (p. 917)
- Enteral tube feeding

Metabolic

- Diabetic ketoacidosis (p. 811)
- Thyrotoxicosis (p. 740)
- Uraemia (p. 483)
- Neuroendocrine tumours releasing (e.g.) VIP or 5-HT

Drugs and toxins

- NSAIDs
- Cytotoxic agents
- Antibiotics
- Proton pump inhibitors
- Dinoflagellates (p. 308)
- Plant toxins (p. 308)
- Heavy metals (p. 308)
- Ciguatera fish poisoning (p. 308)
- Scombrototoxic fish poisoning (p. 308)

(5-HT = 5-hydroxytryptamine, serotonin; NSAID = non-steroidal anti-inflammatory drugs; VIP = vasoactive intestinal peptide)



13.11 Causes of infectious gastroenteritis

Toxin in food: < 6 hrs incubation

- *Bacillus cereus* (p. 341)
- *Staph. aureus* (p. 341)
- *Clostridium* spp. enterotoxin (p. 342)

Bacterial: 12–72 hrs incubation

- Enterotoxigenic *E. coli* (ETEC, p. 342)
- Shiga toxin-producing *E. coli* (EHEC, p. 343)*
- Enteroinvasive *E. coli* (EIEC, p. 342)*
- *Vibrio cholerae* (p. 344)
- *Salmonella* (p. 342)
- *Shigella** (p. 345)
- *Campylobacter** (p. 342)
- *C. difficile** (p. 343)

Viral: short incubation

- Rotavirus (p. 327)
- Norovirus (p. 327)

Protozoal: long incubation

- Giardiasis (p. 368)
- *Cryptosporidium* (pp. 369 and 399)
- Microsporidiosis (p. 399)
- Amoebic dysentery (p. 367)*
- Isosporiasis (p. 399)

*Associated with bloody diarrhoea.

Staphylococcal food poisoning

- Transmission is via the hands of food handlers to foodstuffs such as dairy products, and cooked meats.
- Inappropriate storage of foods allows growth of staphylococci and production of heat-stable enterotoxins which can cause symptoms of food poisoning.
- Nausea and profuse vomiting develop within 1–6 hours. Diarrhea may or may not occur.
- The toxins may act as ‘superantigens’, inducing a neutrophil leucocytosis that can be confused with invasive bacterial infection.
- Most cases settle rapidly but severe dehydration can be life-threatening especially in the elderly.

- Antiemetics and appropriate fluid replacement (oral or if not tolerated, iv) are the mainstays of treatment.
- Suspect food should be cultured for staphylococci and demonstration of toxin production.
- The public health authorities should be notified if food vending is involved.
- Rapid and judicious fluid replacement and notification of the public health authorities are required.

Bacillus cereus food poisoning

- Ingestion of the pre-formed heat-stable exotoxins of *B. cereus* causes rapid onset of vomiting and some diarrhea within hours of food consumption, which resolves within 24 hours.
- Fried rice and freshly made sauces are frequent sources; the organism grows and produces enterotoxin during storage.
- If viable bacteria are ingested and toxin produced within the gut lumen, then the incubation period is longer (12–24 hours) and watery diarrhea and cramps are the predominant symptoms.

Clostridium perfringens food poisoning

- Spores of *C. perfringens* are widespread in the guts of large animals and in soil. If contaminated meat products are undercooked and stored in anaerobic conditions, *C. perfringens* spores germinate and viable organisms multiply. Subsequent reheating of the food causes heat-shock sporulation of the organisms, during which they release an enterotoxin.
- Symptoms (diarrhea and cramps) occur some 6–12 hours following ingestion. The illness is usually self-limiting.

Campylobacter jejuni infection

- The most common sources of the infection are chicken, beef and contaminated milk products.
- Contaminated water may also be implicated, as the organism can survive for many weeks in fresh water.
- After an incubation of 2–5 days, colicky abdominal pain, nausea, vomiting and diarrhea, frequently bloody, develop. Symptoms usually resolve spontaneously within 5-7 days.

- About 10-20% have prolonged symptoms requiring antibiotics such as erythromycin, as resistant to ciprofloxacin is increasing. About 1% of cases develop bacteremia and possible distant foci of infection.
- *Campylobacter* spp. have been linked to Guillain–Barré syndrome and postinfectious reactive arthritis.

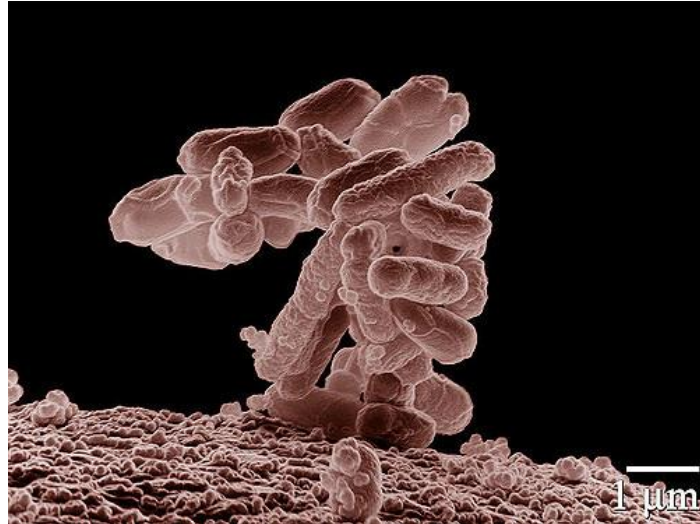
Salmonella spp. Infection

- Many *Salmonella* serotypes other than *S. typhi* and *S. paratyphi*, may cause gastroenteritis and they are widely distributed throughout the animal kingdom.
- Two serotypes are most important worldwide:
 - *S. enteritidis* phage type 4
 - *S. typhimurium* dt.104 (can be resistant to ciprofloxacin).
- Transmission is by contaminated water or food, notably poultry, egg products and related fast foods, direct person-to-person spread.
- After an incubation of 12-72 hours diarrhea begins, sometimes bloody with initial vomiting. About 5% of cases are bacteremic. Reactive (post-infective) arthritis occurs in ~ 2%.
- Antibiotics are not indicated for uncomplicated *Salmonella* gastroenteritis.
- However, evidence of bacteremia is a clear indication for antibiotic therapy, as salmonellae are notorious for persistent infection and often colonize endothelial surfaces such as an atherosclerotic aorta or a major blood vessel.
- Mortality, as with other forms of gastroenteritis, is higher in the elderly.

Escherichia coli infection

- Many serotypes of *E. coli* are present in the human gut. Production of disease depends on either colonization with a new or previously unrecognized strain, or the acquisition by current colonizing bacteria of a particular pathogenicity factor for mucosal attachment or toxin production.
- Travel to unfamiliar areas of the world allows contact with different strains of endemic *E. coli* and the development of travelers' diarrhea.
- Enteropathogenic strains may be found in the gut of healthy individuals and, if these people move to a new environment, their close contacts may develop symptoms.
- At least 5 different clinico-pathological patterns of diarrhea are associated with specific strains of *E. coli* with characteristic virulence factors.
- *Enterotoxigenic E. coli* (ETEC):

- ETEC cause the majority of cases of travelers' diarrhea in developing countries, although there are other causes.
- The organisms produce either a heat-labile or a heat-stable enterotoxin, causing marked secretory diarrhea and vomiting after 1–2 days' incubation. The illness is usually mild and self-limiting after 3–4 days.
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- **Enteroinvasive *E. coli* (EIEC):**
 - Illness caused by EIEC is very similar to *Shigella* dysentery and is caused by invasion and destruction of colonic mucosal cells. No enterotoxin is produced.
 - Acute watery diarrhea, abdominal cramps and some scanty blood-staining of the stool are common. The symptoms are rarely severe and are usually self-limiting.
- **Enteropathogenic *E. coli* (EPEC):**
 - EPEC organisms are very important in infant diarrhea. They are able to attach to the gut mucosa, inducing a specific 'attachment and effacement' lesion, and causing destruction of microvilli and disruption of normal absorptive capacity.
 - The symptoms vary from mild non-bloody diarrhea to quite severe illness, but without bacteremia.
- **Enteraggregative *E. coli* (EAEC):**
 - EAEC strains adhere to the mucosa but also produce a locally active enterotoxin and demonstrate a particular 'stacked brick' aggregation to tissue culture cells when viewed by microscopy.
 - They have been associated with prolonged diarrhea in children.



- **Enterohaemorrhagic E. coli (EHEC):**

- *E. coli* O157:H7 is perhaps the best-known type of EHEC for its implications in hemolytic uremic syndrome.
- Although the incidence of EHEC is considerably lower than that of *Campylobacter* and *Salmonella* infection, it is increasing in the developing world.
- The organism has an extremely low infecting dose (10-100 organisms).
- contaminated milk, meat products (especially incompletely cooked hamburgers), lettuce, and apple juice, have all been implicated as sources of infection.
- After 1-7 days, diarrhea develops, initially watery then frankly bloody in 70% of cases, associated with severe and often constant abdominal pain. There is little systemic upset, vomiting or fever.
- Enterotoxins have both a local effect on the bowel and a distant effect on particular body tissues, such as renal glomeruli, heart and brain.
- The potentially life-threatening hemolytic uremic syndrome (HUS) may appear in 10-15% of cases 5-7 days after the onset of symptoms. It is most likely at the extremes of age, is heralded by a high WBC count, and may be induced, especially in children, by antibiotic therapy.
- HUS is treated by dialysis if necessary and may be averted by plasma exchange. Antibiotics should be avoided since they can stimulate toxin release.