Infectious Diarrhea

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📜 DIARRHEA (GASTROENTERITIS, ENTEROCOLITIS)

🔷 Definition

- Diarrhea: >3–5 bowel movements/day or increased frequency/volume relative to the patient's baseline.

- Types by Duration:

  - Acute: <2 weeks
  - Chronic: >4 weeks *(not the focus here)*

- Types by Nature:

  - Non-inflammatory (Watery, Non-bloody):
    - Site: *Usually small intestine*
    - Mechanism: *Secretory or osmotic*

  - Inflammatory (Bloody):
    - Also called: Dysentery
    - Example: *Shigella → Bacillary dysentery*
    - Site: *Usually colon*
    - Mechanism: *Invasion or cytotoxin-mediated mucosal damage*

◈ Epidemiology

- ~179 million cases/year in USA.
- Most common cause (overall): Norovirus
    - *Highly contagious, especially in outbreaks (cruise ships, hospitals)*
- Most common cause of fatal diarrhea:
  → Hospital-associated *Clostridium difficile* infection (CDI)

◈ Pathophysiology

📌 Mechanisms:

Mechanism	Pathogens
Preformed exotoxin ingestion	*S. aureus, B. cereus, C. perfringens*
Enterotoxin production	*ETEC, V. cholerae*
Cytotoxin production	*Shiga-toxin producing E. coli (STEC),*

	C. difficile
Mucosal invasion	*Shigella, Salmonella, Campylobacter, some E. coli strains*

🩹 Additional Notes:

- C. difficile produces cytotoxins → Pseudomembranous colitis
- ETEC = major cause of Traveler's diarrhea
- STEC (e.g., E. coli O157:H7) → HUS risk in children

🔶 Risk Factors

- PPI use: ↓ gastric acid → ↑ risk of infection
- Recent travel: Especially to developing countries
- Antibiotic use: Disturbs flora → predisposes to *C. difficile*
- Immunosuppression: ↑ susceptibility and severity

🔶 Clinical Manifestations

- General symptoms:

    - Diarrhea with urgency, bloating, cramping

- Non-inflammatory:

    - Watery stools
    - Vomiting may be prominent (e.g., *norovirus, S. aureus*)

- Inflammatory:

    - Blood or pus in stool
    - Fever may be present

⏱ Clue from onset time:

Onset <6 hrs after eating	Think Preformed toxins of *S. aureus, B. cereus*
Vomiting predominant	Viral gastroenteritis (e.g., *norovirus*) or food poisoning

⚠ Physical exam findings:

- Dehydration signs: Tachycardia, orthostatic hypotension

🟤 Hemolytic-Uremic Syndrome (HUS)

- Seen in children with STEC infection (esp. E. coli O157:H7)
- Pathogenesis: Shiga toxin → bloodstream → endothelial damage
- Triad of HUS:
  - 💧 Hemolytic anemia (*schistocytes seen*)
  - ↓ Platelets (Thrombocytopenia)
  - 🔁 Renal failure
- Risk increased by: Use of ciprofloxacin
- Sources:
  - Undercooked hamburger
  - Contaminated vegetables
  - Petting zoo animal exposure

📊 Comparison: Watery vs. Bloody Diarrhea

Feature	Watery Diarrhea	Bloody Diarrhea
Inflammation	❌ No	✅ RBCs and WBCs

	RBCs/WBCs in stool	present (inflammatory)
Fever	Usually afebrile	Often febrile
Stool Volume	Large-volume	Small-volume
Site of Infection	Small intestine	Colon

🧠 Mnemonic for Bloody Diarrhea Features:
FIRCS = *Fever, Inflammation, RBCs/WBCs, Colon, Small volume*

 Common Organisms Causing Diarrhea

 Watery Diarrhea (Non-inflammatory)

Affects small intestine via toxins/enterotoxins

- *Enterotoxigenic E. coli (ETEC)*
- *Vibrio cholerae*
- *Staphylococcus aureus*
- *Bacillus cereus*
- *Listeria monocytogenes*

- *Norovirus*
- *Rotavirus*
- *Giardia lamblia*
- *Cryptosporidium hominis*

🧱 Bloody Diarrhea (Inflammatory / Dysentery)

Affects colon via mucosal invasion or cytotoxins

- *Shiga toxin-producing E. coli (STEC)* — e.g., *E. coli O157:H7*
- *Shigella species*
- *Salmonella enterica*
- *Campylobacter jejuni*
- *Clostridium difficile*
- *Yersinia enterocolitica*
- *Entamoeba histolytica*

🧠 Mnemonic for Bloody Pathogens:

"SEE CSYH" = *Shigella, EHEC, Entamoeba, Campylobacter, Salmonella, Yersinia, Histolytica*

🧪 Diagnosis of Diarrhea: Lab Investigations

🧬 General Rule

- Stool culture indicated if:
    - Fever, bloody diarrhea, or
    - Patient is elderly, immunocompromised

🔎 Routine Stool Culture Identifies:

- *Salmonella*
- *Shigella*
- *Campylobacter*

🧪 Special Diagnostic Techniques

Organism	Special Test or Media Used
STEC (e.g., E. coli O157:H7)	❗ MacConkey–Sorbitol Agar (no sorbitol fermentation) ✅ Confirm via PCR or Shiga toxin immunoassay
ETEC	❌ Not cultured routinely in labs
C. difficile	✅ Detect toxin in stool 🔍 Colonoscopy: *Yellow plaques* = Pseudomembranous colitis

Rotavirus	✅ Rotaviral antigen or PCR for RNA
Norovirus	✅ PCR for viral RNA (especially useful in outbreaks)
Parasites (e.g., Giardia, Entamoeba)	✅ Ova & Parasite (O&P) exam 🔁 Send stool samples 3 consecutive days due to intermittent shedding

⚠️ When to Order Stool for O&P Exam

- Immunocompromised
- Recent foreign travel
- Waterborne community outbreak

💊 TREATMENT OF DIARRHEA

🔶 1. First-Line Management (All Types)

- Mainstay treatment: 🥤 Hydration
    - Oral Rehydration Solution (ORS): Water + Salt + Sugar
      Life-saving globally, especially in pediatric or developing world cases

- IV fluids: For severe dehydration or vomiting

2. General Guidelines

- Empiric antibiotics: ❌ *Not usually recommended* for community-acquired diarrhea

- Probiotics: ❌ *Little to no benefit* for established diarrhea

3. Symptomatic Relief

Condition	Medication
Traveler's diarrhea	*Bismuth subsalicylate (Pepto-Bismol)* or *Loperamide (Imodium)*

4. Pathogen-Specific Treatments

Infection / Condition	Drug of Choice (DOC)	Notes
C. difficile (mild-moderate)	Metronidazole	First-line for non-severe cases

C. difficile (severe)	Oral Vancomycin	Life-threatening colitis → oral only
Shigella (severe)	Ciprofloxacin	Treat bacillary dysentery
Campylobacter (severe)	Azithromycin	Especially useful if macrolide-susceptible
Giardia lamblia	Tinidazole	Flagyl (Metronidazole) also used as an alternative
Listeria (immunocompetent)	✕ No antibiotics needed	Unless pregnant, elderly, or immunocompromised
Norovirus /	✕ No	Supportive care only

Rotavirus	antiviral treatment available

🛡️ PREVENTION OF DIARRHEA

🔹 1. General Measures

- Travel precautions:
  - 🚱 Avoid unboiled/untreated water
  - 🍉 Avoid raw fruits & vegetables not washed in boiled or filtered water
- Traveler's Kit:
  - *Self-treatment pack* with ciprofloxacin for emergency use

🔹 2. Prevention of C. difficile Colitis

- Probiotics may be useful when taking antibiotics (esp. broad-spectrum)

🔹 3. Vaccination: Rotavirus

Vaccine	Type	Contents	Notes
Rotarix	Live, attenuated	Single strain (G1 serotype)	Most common US strain
Rotateq	Live, reassortant	Five rotavirus strains	Broader coverage
❗ Risk	Both vaccines linked to ↑ risk of intussusception		
Avoid in	Children with history of intussusception		

🧠 Age-limited use: Rotavirus vaccines are only given during infancy (check national schedule)

📚 CLINICAL PRESENTATION, DIAGNOSIS & TREATMENT OF GI PATHOGENS CAUSING DIARRHEA

◈ 1. Acute Non-Inflammatory Diarrhea

(Watery, non-bloody stools; usually no fever)

Pathogen	Presentation	Diagnosis	Treatment	Comments
Staphylococcus aureus	Vomiting, epigastric pain, mild diarrhea	Clinical; toxin detection	Supportive (fluids/electrolytes)	Onset: <6 hrs after ingesting dairy, mayo, meat; recovery in 1–2 days
Bacillus cereus	Vomiting, epigastric pain, diarrhea	Clinical; toxin detection	Supportive care	Onset: <6 hrs after reheated rice
ETEC	Afebrile, watery diarrhea	DNA probe for LT/ST toxins	Ciprofloxacin	Classic Traveler's diarrhea
Listeria	Febrile,	Suspect if	Supportiv	Found in

monocytogenes	vomiting, diarrhea	culture negative in outbreaks	e care	unpasteurized cheese, deli meats; grows in fridge temperature
Vibrio cholerae	Severe watery diarrhea ("rice-water"), vomiting	Clinical; stool culture	Supportive + ciprofloxacin	Suspect in outbreaks, rapid volume loss
Norovirus	Afebrile, vomiting, headache, diarrhea	Clinical; stool PCR	Supportive care	Common in cruise ship/nursing home outbreaks
Rotavirus	Vomiting + low-grade fever → diarrhea	Stool antigen or PCR	Supportive care	Common in children

Giardia lamblia	Bloating, flatulence, foul-smelling fatty stools (may float)	O&P exam or stool antigen	Metronidazole / Tinidazole	May be chronic; cysts/trophozoites visible
Cryptosporidium hominis	Watery diarrhea, cramps	Acid-fast stool stain	Nitazoxanide (severe); ART in AIDS	Community waterborne outbreaks; AIDS patients at risk

🔥 2. Acute Inflammatory Diarrhea

(Bloody stools; may be febrile)

Pathogen	Presentation	Diagnosis	Treatment	Comments
STEC (E. coli O157:H7)	Bloody diarrhea, abd. pain, afebrile	Sorbitol-negative culture; PCR/imm	✕ No antibiotics	Risk of HUS, esp. with ciprofloxacin; undercooked

		unoassay for Shiga toxin		beef, contaminated veg
Clostridium difficile	Bloody diarrhea, fever	Toxin assay; colonoscopy (yellow plaques)	Metronidazole / Oral vancomycin	Antibiotic-associated or community-acquired; risk in PPI users
Shigella	Bloody or purulent diarrhea, fever, cramps	Stool culture	Ciprofloxacin	Bacillary dysentery; person-to-person spread; no animal reservoir
Salmonella	Watery or bloody diarrhea, low-grade fever	Stool culture	Ciprofloxacin (severe); Supportive (mild)	Source: Eggs, poultry, turtles, raw veg

Campylobacter jejuni	Fever, diarrhea	Culture on selective medium	Azithromycin or Ciprofloxacin	Poultry, unpasteurized dairy; linked to Guillain–Barré syndrome
Yersinia enterocolitica	Fever, diarrhea; mimics appendicitis (mesenteric adenitis)	Stool culture (special medium)	Ciprofloxacin (severe)	Acquired via pork or unpasteurized milk
Entamoeba histolytica	Bloody diarrhea, fever, abdominal pain	O&P exam; serology for extraintestinal disease	Metronidazole + Paromomycin	Amebic dysentery; can form liver abscess

- 6-hour vomiting + diarrhea = Think preformed toxin → *S. aureus, B. cereus*
- Rice-water stools = *Vibrio cholerae*
- Traveler's diarrhea = *ETEC* (watery), *Giardia* (chronic fatty)
- Dairy + poultry = *Listeria, Salmonella, Campylobacter*
- Undercooked beef → HUS = *STEC*
- Antibiotic history + yellow plaques = *C. difficile*
- Appendicitis mimic = *Yersinia*
- Foul, fatty, floating stool = *Giardia*
- Liver abscess + dysentery = *Entamoeba histolytica*