



Chapter 84 (9th Ed.)

- 1) Describe a general approach or investigation and management for suspected infectious diarrhea in the following groups:
 - a. Non-bloody diarrhea
 - b. Bloody Diarrhea
- 2) What are the 4 most common causes of infectious diarrhea? List 4 pathogens that a special test needs to be requested to diagnose in addition to stool C+S, O+P.
- 3) Describe common infectious patterns and risk factors for each of the following
 - a. Campylobacter
 - b. Salmonella
 - c. Shigella
 - d. Yersinia
 - e. Vibrio parahaemolyticus
 - f. Enterohemorrhagic E. coli
 - g. Plesiomonas
 - h. Bacillus anthracis
- 4) List 6 causes of bloody diarrhea and 5 features of illness that suggest invasive E.coli
- 5) List causes of toxin-induced bacterial enteritis: 4 performed toxins, 4 in-which toxins are produced after colonization. For each, describe typical source and pattern of illness
- 6) List 5 RFs for C. diff. What are 2 therapy options?
- 7) List the 2 most common causes of viral gastroenteritis. Differentiate the two based on patient population and course of illness
- 8) List 4 protozoal causes of gastroenteritis. For each, describe the clinical presentation
- 9) List 6 causes of diarrhea in AIDS. Describe an appropriate initial work-up. What additional steps may be required?
- 10) What is food poisoning?
- 11) Describe an approach to the management of travelers' diarrhea. What are 5 common causes. Which if the most common?

Rosen's in Perspective

Here are some definitions!

Diarrhea = three or more unformed liquid stools a day, stools of more than 250 g/day, or stool that takes the form of the container into which it is placed.

Dysentery = inflammation of the intestine, particularly the colon, causing diarrheas associated with blood and mucus; it is generally associated with fever, abdominal pain, and rectal tenesmus (sense of incomplete defecation).

- Acute gastro = symptoms < 2 weeks
 - think viral and bacterial
- Chronic gastro = symptoms > 2 weeks (most like parasites / non-infectious causes)
 - Giardia, IBD



So what actually causes gastro? Well, think about 4 things:

1. You ingest preformed toxins that make you barf (food poisoning)
2. Ingestion of infectious pathogens that stick to your intestinal cellular walls
3. Your mucosal walls get invaded by something
4. Some bug is in your intestines polluting you with enterotoxins/cytotoxins

(Toxins, sticky bacteria, invasive bugs, toxin factory)

Here are some key epidemiologic factors to ask patients about:

- Foreign travel
 - Traveler's diarrhea—enterotoxigenic Escherichia coli
 - Southeast Asia—Vibrio species
 - Rotavirus—South America, Asia, Africa
- Recent camping Giardia, Aeromonas, Cryptosporidium
- Recent antibiotics: Increase in C. difficile infection
- Daycare exposure: Rotavirus
- Exposure to raw seafood: Non Cholera Vibrio
- Anal-receptive sex—men who have sex with men:
 - Shigella, Campylobacter, Salmonella
- HIV-positive status: Mycobacterium avium-intracellulare complex, microsporidia, Cytomegalovirus, Giardia
- Outbreaks: Cruise ships—norovirus

Contaminated local water, food, products, restaurants; organism usually identified by local health department (eg. Campylobacter, Salmonella, E. coli). Important to ask every patient with the chief complaint of diarrhea these things, because it helps you and I narrow down what we're dealing with!

In addition, think about the onset of their symptoms and whether they fit a pattern:

- Sudden onset severe vomiting, with moderate diarrhea (Norovirus)
- Large volume = small bowel
- Small volume but bloody, mucousy = large bowel
- Vomiting WITHOUT diarrhea is NOT gastro!!

“Viruses account for up to 70% of cases of infectious gastroenteritis, bacteria, 15% to 20%, and parasites, about 10% to 15%. It is difficult to identify the exact organism causing the GI illness on initial presentation. The predominance of vomiting along with upper respiratory symptoms is more likely associated with a viral cause. A rapid onset of vomiting as the predominant symptom may suggest the presence of preformed bacterial toxins. The presence of high fever, fecal blood, abdominal pain, or colitis likely indicates an invasive bacterial organism.”

Bacteria organisms are broadly categorized as invasive or non-invasive. Invasive gastroenteritis is a clinical diagnosis made in the presence of signs or symptoms of intestinal mucosal invasion, such as



fever, gross or occult blood in the stool, tenesmus (feeling of constantly needing to pass stool), or severe abdominal pain (Table 84.5). Patients with noninvasive gastroenteritis generally do not exhibit fever, produce bloody stools, or experience significant abdominal pain. Noninvasive gastroenteritis likely suggests the presence of a viral pathogen or toxin-producing bacteria. This illness typically is brief and self-limited, and diagnostic testing is not likely to be of benefit (Table 84.6).”

[1] Describe a general approach or investigation and management for suspected infectious diarrhea in the following groups:

Investigation guidelines:

- Routine blood tests for the unwell patient groups.
- Good hx and full physical examination for all patients (to look for signs of focal abdominal findings/rashes/other clinical findings)

Stool cultures should be sent for patients with:

1. **Severe illness,**
2. **Fever of 38.5° C (101°F) or higher,**
3. **Dysentery (mucous, bloody, tenesmotic),**
4. **Persistent diarrhea for 14 days or longer** (send for O+P)
5. **Patients who are immunocompromised**
6. **Recently hospitalized / recent antibiotics.**

Management:

- Anti-emetics (serotonin, dopamine, histamine and muscarinics all great choices) and oral rehydration (solution with glucose AND electrolytes) - for all!
 - Encourage food intake - fasting will worsen the bowels capacity to absorb food!
- Antimotility drugs prn (loperamide 4 mg PO prn)
- Antibiotics (see below)
- Volume resuscitation prn, electrolyte replacement prn
 - a. **Non-bloody diarrhea (possible non-invasive infection ie viral or toxin producing bacteria)**
 - generally supportive
 - consider stool for culture and O&P if immunocompromised, recent hospitalisation / antibiotic use, or send for O&P if persisting beyond 14 days
 - No antibiotics
 - b. **Bloody Diarrhea (possible invasive infection ie badness: mucosal invasion)**
 - Possibly invasive bacterial infection here: send stool for culture.
 - Ova & parasites if persistent diarrhea.
 - Stool for fecal leukocytes, lactoferrin or hemoccult can help with the diagnosis of invasive bacterial infection causing intestinal inflammation.
 - Antibiotics ONLY WHEN PATHOGEN IS IDENTIFIED



“Empirical antibiotic treatment for bloody diarrhea should be approached with caution. It is not recommended in children because of the risk of HUS. In adults, empirical treatment is recommended only for patients with a temperature over 38.5°C (101°F) because the presence of significant fever suggests a pathogen other than E. coli O157:H7.” - Rosen/s 9th Edition

[2] What are the 4 most common causes of infectious diarrhea? List 4 pathogens that a special test needs to be requested to diagnose in addition to stool C+S, O+P.

- Campylobacter (Stool PCR)
- Non-typhoid Salmonella (Stool PCR)
- Shiga toxin–producing Escherichia coli (STEC - Sorbitol MacConkey and serotyping for O157)
- Shigella

See Table 84.2 in Rosens 9th Edition

[3] Describe common infectious patterns and risk factors for each of the following

Pathogen	RF	Infectious Pattern	Incubation	Duration
Campylobacter (Most common bacteria)	-backpacker's diarrhea / backcountry water sources -raw / undercooked poultry meat	-acute watery diarrhea -fevers, dysenteric characteristics	2–5 days	5–14 days
Salmonella (Usually foodborne)	-age <5 -Sickle Cell -Immunocompromised -eggs, poultry, unpasteurized milk, pets	-acute watery diarrhea -often with fever	12–24h	2–7 days
Shigella (Toxigenic)	-Jails, nursing homes, daycares -MSM -HIV/AIDS -Swimming pools, water parks, fountains	-acute watery diarrhea -fever, dysenteric	1–2 days	2–7 days
Yersinia	-Children -Contaminated pork / milk / dogs / Cats -rare in United States -common with travel to Asia	-Acute diarrhea, -dehydrating -can mimic appendicitis	12–48 h	5–14 days
Vibrio parahaemolyticus	Associated with seafood / shellfish	-watery diarrhea -dysentery	8–24 h	5–14 days
STEC (Toxigenic)	-Children <10 Foodborne:	-Watery / bloody diarrhea	3–8 days	5–10 days



	-contaminated beef and produce -associated with HUS and TTP			
ETEC	Common cause of traveler’s diarrhea, but in US increasing cause of foodborne disease	-Acute watery diarrhea	1–3 days	1–7 days

Shigellosis is a nationally notifiable disease. Complications are rare and include bacteremia, Reiter’s syndrome, HUS, toxic mega- colon, colonic perforation, seizures, and toxic encephalopathy.

[4] List 6 causes of bloody diarrhea and 5 features of illness that suggest invasive E.coli

Features:

- Watery diarrhea to bloody w/ incubation 3-4 days
- Severe abdominal cramps
- Low grade fever
- Thrombocytopenia
- MAHA
- Neurologic sequelae

Spaced repetition...

- Bacterial causes: “Clotty salty excrement screws your vitals” (episode 31)
- Campylobacter, Salmonella, EPEC, Shigella, Yersinia, Vibrio

Other differential LGIB (Episode 30):

Adult	Peds
Diverticular disease Angiodysplasia Colitis (inflammatory, infectious, ischemic) Anorectal sources Neoplasm Upper GI bleeding	Anorectal fissure Infectious colitis Inflammatory bowel disease Juvenile polyps Intussusception Meckel’s diverticulum

[5] List causes of toxin-induced bacterial enteritis: 4 preformed toxins, 4 in-which toxins are produced after colonization. For each, describe typical source and pattern of illness

Pre-formed

- Stapholoccocus spp



- Most protein-rich foods support the growth of staphylococci, especially ham, eggs (even hard boiled), custard filled pastries, mayonnaise, milk, and salads such as egg, tuna, chicken, potato, and macaroni
- Onset: 1 to 6 hours after ingestion
- Presents w/ Cramping and abdominal pain
- Hallmark: violent retching and vomiting
- Short-lived, usually subsiding in 6 to 8 hours and rarely lasting as long as 24 hours.
- Clostridium perfringens
 - One of most common outbreaks in US per year
 - Think about if >100 person outbreak
 - Common in meat or poultry cooked >24hrs from consumption
 - Pre formed toxin released as spores germinate
 - Onset 6 to 12 hours but can occur up to 24 hours
 - Watery diarrhea and abdo cramping
- Bacillus cereus
 - IT'S EVERYWHERE! Sources: milk products/pasta/rice/spices/dried foods/meat/chicken/vegetables/seafood/fruits and grains.
 - 2 toxins with separate clinical presentations
 - Cereulide: Staphylococcus-like enterotoxin causing emetic form
 - HBL - a hemolysin similar to E.coli causing diarrheal form
 - Emetic form indistinguishable from staphylococcal enterotoxin: presents the same way
 - Diarrheal form incubation 6 to 14 hours and looks essentially like C. perfringens

Post Colonization

- Cholera and Noncholera Vibrio Species
 - Similar to V. parahaemolyticus: think seafood
 - Unlike parahaemolyticus, these strains produce a toxin in vivo post infection that doesn't destroy mucosa, but stimulates enterocyte adenylate cyclase which disrupts fluid reabsorption and thus lots of secretory diarrhea!
 - Non cholera toxin similar function, less severe outcome
 - V. vulnificus - leading cause of food related death!!! Can cause profound shock (also associated with marine water wounds)
 - REMEMBER: need TCBS media cultures!
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- Enterotoxigenic Escherichia coli (ETEC)
 - Most common cause of traveler's diarrhea
 - Common in travelers returning from: South Asia, sub-Saharan Africa, and Latin America
 - Unpeeled fruits, leafy vegetables, unsanitary drinking water, and ice are all known sources
 - incubation period of 24 to 72 hours
 - Acute onset secretory diarrhea (cholera like) from toxin induced fluid disturbance in small intestine
- C. Difficile
 - Hospital acquired / recent antibiotic use
 - secrete toxins A and B that cause mucosal injury, and secretory diarrhea
 - Complications include pseudomembranous colitis, toxic megacolon, or even colonic perforation
 - watery diarrhea up to 10 to 15 times daily, with lower abdominal pain, cramping, low-grade fever, and leukocytosis



[6] List 5 RFs for C. diff. What are 2 therapy options?

*****First off: REMEMBER TO WASH YOUR HANDS!!! Spores are not killed by hand sanitizers.*****

Risk factors:

- Recent (within 2-4 weeks) / concurrent antibiotic use
- recent hospitalization
- living in a long-term care facility
- use of antacids
- Recent person to person contact with known infected person

Treatment:

- A) Mild to Moderate: 1st line = Metronidazole, 500 mg PO tid for 10 to 14 days
- B) Severe infections: Vancomycin 125 mg PO qid for 10 to 14 day

[7] List the 2 most common causes of viral gastroenteritis. Differentiate the two based on patient population and course of illness

- o See tables 84.3 and 84.7

Here we're talking about:

1. **Norovirus**
2. **Rotavirus ** (the only one with a vaccine)**
3. Sapovirus
4. Adenovirus
 - a. Rarely can cause serious illness (bronchitis, pna, conjunctivitis)
5. Astrovirus

These usually follow the 60 hour rule - i.e. they take < 60 hrs to incubate and last < 60 hrs. All can have N/V/D, belly cramping, fevers, myalgias, headaches.

Virus	Pt. population	Course of illness	Notes
<p>Norovirus</p> <p>Dx: with stool RT-PCR studies</p> <p>Quick on quick off!</p>	<p>Children and adults in the winter months</p>	<p>Fecal-oral transmission. *air borne droplets of vomitus/fomites*</p> <p><60 hr incubation periods and < 60 hr duration.</p> <p>Highly infectious</p> <p>Abrupt onset - severe vomiting. Mild-moderate diarrhea - watery.</p>	<p>#1 cause of foodborne disease in the USA Children < 5 and adults > 65 are at greatest risk of complications</p> <p><u>Virus can be shed in stool for 2-3 weeks post infection!</u></p> <p>Can have associated:</p> <ul style="list-style-type: none"> ● Malaise, myalgias, h/a, fever <p>Rare complications can occur post-infection:</p> <ul style="list-style-type: none"> ● Reflux, seizures, encephalopathy



<p>Rotavirus</p> <p>Dx: stool antigen testing for rotavirus</p>	<p>Predominantly children (mild disease in adults)</p>	<p>Fecal-oral</p> <p><u>2 day incubation, 3-8 day duration</u></p> <p>N/V, fever, non-bloody diarrhea</p>	<p>Self-limited.</p> <p>Can be prevented with two oral vaccines</p> <p>Rare complications:</p> <ul style="list-style-type: none"> • Resp symptoms, seizures, encephalitis
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Treatment:

- Supportive fluids, antiemetics, etc.
- Contact and isolation precautions
- Good hand hygiene!

Diagnostic criteria for norovirus outbreak:

A norovirus outbreak in the community is suspected when these criteria are met:

- Mean incubation period of 24 to 48 hours
- Mean duration of illness of 12 to 60 hours
- Presence of vomiting in more than 50% of cases
- Absence of bacterial pathogens on stool cultures

These criteria have a 99% specificity and 68% sensitivity for the diagnosis.

[8] List 4 protozoal causes of gastroenteritis. For each, describe the clinical presentation

These are all transmitted via contaminated food/water sources. Usually all have varying degrees of n/v, abdominal cramps, and flatulence/bloating.

1. *Giardia lamblia*
 - a. Sudden onset diarrhea, malaise, weight loss, N/V, cramps, **++ flatulence and foul, floaty stool (greasy)**
 - b. Risk groups: children who aren't toilet trained in close living conditions, anal sex, hikers drinking contaminated water.
 - c. Stool immunoassays are most accurate, stool microscopy for O+P can be variably accurate.
 - d. Symptomatic cases treatment:
 - i. Metronidazole 500 mg PO BID 5/7
2. *Entamoeba histolytica*
 - a. Aka: **AMBEIASIS**
 - b. Most infections are asymptomatic
3. *Cryptosporidium*
4. *Cyclospora cayentanensis*



[9] List 6 causes of diarrhea in AIDS. Describe an appropriate initial work-up. What additional steps may be required?

Usual bacterial suspects plus (don't forget primary HIV induced diarrhea, HAART induced, and salmonella / vibrio!):

- Cytomegalovirus
- Cyclospora
- Cryptosporidium
- Isospora
- Mycobacterium avium-intracellulare complex
- Giardia

Workup:

- A) stool examination & cultures
- B) C Diff toxins and salmonella PCR
- C) CMV and MAI if CD4+ count <200
- D) Acid fast smear for Cryptosporidium, Cystoisospora, Isospora, and Cyclospora
- E) sigmoidoscopy

If above workup negative consider small bowel biopsy and duodenal aspiration

[10] What is food poisoning?

“Classic food poisoning manifests usually 1 to 6 hours after the ingestion of preformed toxins from bacterial organisms such Staphylococcus, B. cereus, or C. perfringens...Food poisoning is generally short-lived (24 hours), and its treatment is generally supportive care only.” - Rosen’s 9th edition

Pearl: Scombroid poisoning IS NOT AN ALLERGIC reaction. It results from eating spoiled dark meat from fish with toxin complexes that work via histidine decarboxylase activity; your patient just consumed straight histamine!

[11] Describe an approach to the management of travelers’ diarrhea. What are 5 common causes. Which if the most common?

- See table 84.9 and 84.10 in Rosens 9th Edition



Let's quickly bring this podcast to a wrap up: it's been a tough episode and it's tough to determine the key salient points:

Here are four questions to wrap up the content, so if you were zoning out, pay attention!

1. When do I order stool studies (C+S, O+P)

Stool cultures should be sent for patients with:

1. **Severe illness,**
2. **Fever of 38.5° C (101°F) or higher,**
3. **Dysentery (mucous, bloody, tenesmotic),**
4. **Persistent diarrhea for 14 days or longer** (send for O+P)
5. **Patients who are immunocompromised or who have been**
6. **Recently hospitalized or placed on antibiotics.**

2. When do I Rx antibiotics??

1. Toxic appearing patient
2. Fever or dysentery
3. Severe travelers' diarrhea
4. Suspected C. diff infection
5. Immunocompromised patients with diarrhea
6. KNOWN organism isolated in the stool

Remember that 70% of the time, GASTRO is caused by a virus. As with other invasive GI pathogens, antiperistaltic drugs are not recommended unless the patient is simultaneously treated with antibiotics.

Campylobacter = most common cause of bacterial enteritis

Norovirus = most common cause of acute gastroenteritis in children and adults and usually occurs in the winter months.

ETEC = most common cause of traveler's diarrhea

3. Which food-borne illnesses are associated with neurological symptoms?

- Campylobacter: associated with Guillain Barre syndrome
- TTP from STEC

4. What are gastro mimics?

- SBO
- Bowel ischemia
- Appendicitis
- Colitis (IBD)
- Malabsorption / celiac disease / IBS