A Potpurri of Diarrhea, Enteritis, and Related Pathologies

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Goals

- Gain an understanding of the key features of classic and common GI conditions and illnesses causing diarrhea, cramps, and other “abdominal” signs and symptoms, including the pathophysiology, diagnostic approaches, and management considerations

Objectives

Upon completion of this session, you will be able to

1. Describe the key features of classic presentations of GI conditions that are associated with diarrhea, including but not limited to, enteritis
2. Discuss the role of ED diagnostics in differentiating the causes of acute diarrhea and enteritis
3. Propose therapeutics effective for the management of acute diarrhea, including when they should and should not be prescribed
4. Name life-threatening causes of acute enteritis causing diarrhea

Instructions

1. Divide into ten small groups
2. Research the four assigned cases as a group
   - You will have 10-15 minutes to complete your work
3. Your group should be prepared to report out on the cases assigned
   - Suspected etiology, mimics and relevant pathophysiology
   - Diagnostics and therapeutics
   - Bottom line: **Will this condition kill?**

Case 01

- 40-year-old woman presents with abdominal pain and frequent watery diarrhea for 6 hours.
- Reports eating a poultry dish prepared the night before a picnic and re-warmed at picnic
- No nausea or vomiting
- Two friends that ate the same food are also ill
- Vital signs are normal, exam without localizing abdominal pain, guarding, rebound or rigidity

Case 01 Answer

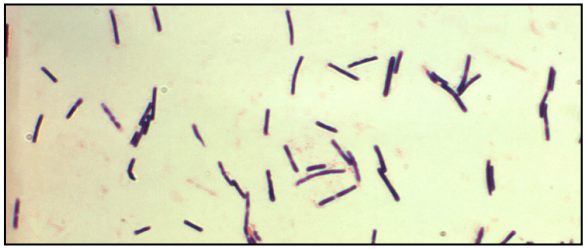
Clostridium perfringens

Clostridium perfringes

Cellulitis/wound infection

Myonecrosis

Diarrheal illness



Key Features

- **Most common cause of food poisoning**
- Food prepared up to 4 hours before consumption, cooled slowly, then served cold or re-warmed
- Spores survive cooking – germinate – grow and form an infectious inoculum – after ingestion, sporulation occurs in the gut producing enterotoxin
- Incubation: 8-16 hours
- Duration: 24 hours

Key Features

- Symptoms:
  - Abdominal cramps
  - Diarrhea (frequent, watery, non-bloody)
- Symptomatic treatment only
- Patient education is important
- **Compare with Staphylococcal food poisioning**
  - Staph food poisoning: more severe vomiting, less diarrhea

Preformed toxins			
Staphylococcus	Food-handler related; potato salad, mayonnaise, confections	I: 1-6 hr D: 6-10 hr	Very high attack rates, large outbreaks
Bacillus cereus emetic toxin	Fried rice	I: 2-4 hr D: 10 hr	High attack rate, almost always fried rice
Bacillus cereus diarrheal toxin	Vegetables, meats, especially gravies	I: 6-14 hr D: 24-36 hr	Food reheated or sitting out for long periods
Scombroid	Mahimahi, tuna, bluefish	I: 5-60 min D: 6 hr	Peppery or bitter taste, histamine intoxication, high attack rates
Ciguatera	Large, predacious, coral reef fish	I: 2-6 hr D: 7-14 days	High attack rates, neurologic symptoms with gastrointestinal symptoms, chronic paresthesias
Toxins produced after colonization			
Clostridium perfringens	Meat, poultry, gravies, "steam table" meats	I: 6-24 hr D: 24 hr	Food reheated or sitting out for long periods
Vibrio	Seafood, especially raw shellfish	I: 24-48 hr D: **8-16 hours**	Summer months, dehydration common
Escherichia coli	Usually unsanitary drinking water	I: 24-72 hr D: 1-7 days	Travelers, dehydration common in children
Clostridium difficile	Overgrowth of normal flora	I: 5-14 days D: Variable	Antibiotic-associated colitis, cytopathic toxin
Aeromonas	Untreated drinking water	I: 1-5 days D: 2-10 wk	Common and severe in children, chronic watery diarrhea in adults, occasionally mimics inflammatory bowel disease

Case 02

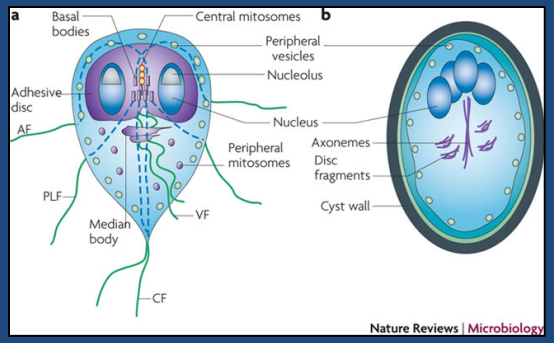
- 45-year-old businessman returning from overseas business trip with abdominal discomfort, distention, colic, and flatulence 2 hours after landing
- Reports passing 4-5 loose, foul-smelling stools over last 1-2 hours
- Reports “chicken on plane tasted funny”
- Exam: vague, mild, generalized abdominal discomfort without localizing tenderness, guarding, rebound or rigidity; rectal exam normal (guaiac negative)

Case 02

- What else do you want to know?
- What are your treatment options and what discharge instructions will you give?

Case 02 Answer

Acute Giardiasis



Foodborne Agents Causing Diarrhea

- **Viruses**
  - Norwalk virus
  - Rotavirus
  - Hepatitis A
- **Parasites**
  - Giardia lamblia
  - Cryptosporidium
  - Entamoeba histolytica
- **Bacterial**
  - Salmonella
  - Staph aureus
  - Bacillus cereus
  - Clostridium perfringens and C. botulinum
  - E. coli 0157-H7
  - Shigella
  - Campylobacter
  - Vibrio cholera and parahemolyticus
  - C. diff

Acute Giardiasis

- Most common etiology of waterborne diarrhea outbreaks in USA.
- Sources
  - Fecal-oral transmission of G. lamblia cysts
  - Contaminates water supply
  - Remote mountain streams, called "**backpackers diarrhea**"
  - Homosexuals, day care centers
- Symptoms
  - Incubation – 1-3 wks (symptoms after travel return)
  - Always ask "Where have you been?"
  - Sudden onset, diffuse abdominal cramps, distention, flatulence, borborygmi, and loose, explosive, foul-smelling stools

Five F's

Fecal-Oral

Flatulence

Foul-smelling stool

Fatty Stool

Flagyl

Table 89-4. Epidemiologic Aspects of Protozoan Gastroenteritis

Pathogen	Sources	Incubation period (I)	Features
Entamoeba histolytica	Fecally contaminated food and water sources	3 wk to 4 mo	Infection may be commensal or intermittently symptomatic or produce severe dysentery
Giardia lamblia	Water-borne, fecal-oral, day care centers, travelers, backpackers, AIDS, male homosexuals	1-3 wk	5%-10% of U.S. population, malabsorption syndromes or commensal
Coccidia			
Cryptosporidium and *Isospora*	Fecal-oral, water-borne, animals, day care centers, AIDS	5-10 days	Profuse watery diarrhea, self-limited in the immunocompetent, persistent in the immunocompromised
Cyclospora cayetanensis	Fresh fruit, berries, lettuce, water supply	1 wk	Explosive, protracted, watery diarrhea; fatigue, weight loss
Strongyloides stercoralis	Occupational exposure to soil, travel to endemic areas in United States (Kentucky, Tennessee, Ohio) or overseas	Weeks to months	Eosinophilia, sepsis, and hyper-infection syndrome in AIDS patients
Enteromonas hominis	Fecal-oral, male homosexuals	?	Chronic watery diarrhea, especially in children

Acute Giardiasis

- Diagnosis
  - **Throphozoites cyst** (stool or duodenal aspirate)
  - Stool antigen: **test of choice**
- Treatment
  - **Metronidazole**
  - **Quinacrine** (Atabrine)
  - **Furazolidone suspension**

Case 03

- 30-year-old woman awoke from sleep with acute nausea, vomiting, watery diarrhea, diaphoresis, and crampy abdominal pain
- Reports “numbness and tingling of mouth and tongue”
- Reports “cold wash cloth on forehead feels hot”
- She and her husband ate a dinner of wild rice, green beans, red snapper, and wine 6 hours ago at a local restaurant (husband with same symptoms)
- Your colleague has seen the patient’s husband in the next room but doesn’t know what to do. Where is Dr. Roit?

Case 03

- Is there any other information you want?
- If this wasn't a presentation on food poisoning, what else would be in your differential diagnosis?

Case 03 Answer

Ciguatera Fish Poisoning

Ciguatera Fish Poisoning

- **Most common form** of fish poisoning
  - (more than 50% of all fish poisoning in USA)

- **Source**
  - **Ciguatoxin (heat and acid stable, lipid soluble)**
  - Marine dinoflagellate: ***Gambierdiscus toxicus***
  - Toxin moves up food chain, concentrated in larger predators (Snapper, Grouper, Barracuda, Sturgeon, Sea Bass, Jack Tuna).
  - **It does not affect the fish in any way (odorless and tasteless)**

Key Features

- Incubation:2-6 hours
- Duration: 12-30 hours
- **Produces GI and neurologic symptoms**
  - N-V, watery diarrhea—weakness, ataxia
  - Abdominal cramps
  - Vertigo
  - Dysesthesias, parathesias
  - Sensory reversal dysesthesia
  - Neuro symptoms increase with alcohol

Treatment

- Treatment is symptomatic—the disease is self-limited, though the neurological symptoms can last days or even weeks
  - IV fluids
  - Symptomatic relief: diphenhydramine, amitriptyline (dysesthesias), gabapentin
  - CNS symptoms: mannitol
  - Avoid alcohol
- **Poisoning is not the fault of the restaurant or supplier** (toxin undetectable)

Table 89-3. Epidemiologic Aspects of Toxin-Induced Bacterial Enteritis

Pathogen	Sources	Incubation period (I) and duration (D) untreated	Features
Preformed toxins			
Staphylococcus	Food-handler related; potato salad, mayonnaise, confections	I: 1-6 hr D: 6-10 hr	Very high attack rates, large outbreaks
Bacillus cereus emetic toxin	Fried rice	I: 2-4 hr D: 10 hr	High attack rate, almost always fried rice
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Toxins produced after colonization			
Clostridium perfringens	Meat, poultry, gravies, "steam table" meats	I: 6-24 hr D: 24 hr	Food reheated or sitting out for long periods
Vibrio	Seafood, especially raw shellfish	I: 24-48 hr D: 6-8 days	Summer months, dehydration common
Escherichia coli	Usually unsanitary drinking water	I: 24-72 hr D: 1-7 days	Travelers, dehydration common in children
Clostridium difficile	Overgrowth of normal flora	I: 5-14 days D: Variable	Antibiotic-associated colitis, cytopathic toxin
Aeromonas	Untreated drinking water	I: 1-5 days D: 2-10 wk	Common and severe in children, chronic watery diarrhea in adults, occasionally mimics inflammatory bowel disease

Case 04

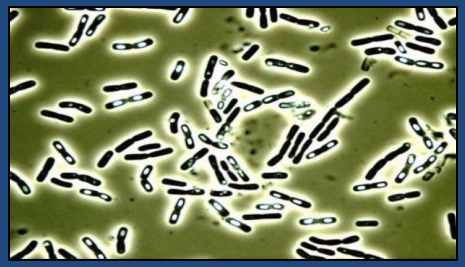
- 22-year-old man presents with nausea, vomiting, and abdominal cramps
- Ate pork fried rice dinner at a local Chinese restaurant three hours earlier
- Exam:
  - Retching
  - Prostrating
- Exam: vague, mild, generalized abdominal discomfort without localizing tenderness, guarding, rebound or rigidity

Case 04

What is causing his illness?

How will you treat the patient?

Case 04 Answer



Bacillus cereus

Bacillus cereus ("Be serious")

- **Source**
  - Gram+ rod ubiquitous in soil and raw, dried, and processed foods, especially in **uncooked fried rice**
- **Pathophysiology**
  - Heat resistant spores (survive boiling)
  - Germinate when rice left unrefrigerated (**common practice to avoid clumping of grain**)
  - Vegetative forms then multiply and produce toxin
  - Flash frying or re-warming are not sufficient to destroy the performed heat-stable toxin

B. Cereus Presentations

Enteric Form

- Almost always from fried rice
- Same symptoms as staphylococcal enterotoxin
- Prominent vomiting and abdominal cramps, diarrhea occasionally
- Similar onset, duration of illness

Diarrheal Form

- Less common, more like *Clostridium pefringens* (rewarmed food)
- Watery diarrhea, little if any vomiting

Case 05

- 41-year-old man presents with severe throbbing headache, palpitations, and abdominal cramps
- Reports vomiting twice within 20 minutes of eating dinner
- Exam:
  - Vital signs: BP, 150/100mmHg; P, 110/min; R, 24/min; T, 37C (98.6F)
  - Face is red (!); marked facial and upper torso flushing, suffused conjunctiva, urticaria on back
  - No abdominal discomfort; no localizing tenderness; no guarding, rebound or rigidity

Case 05

- **And for dinner he consumed…?**
- **What clue might have altered the patient to the grief he was about to experience?**

Case 05 Answer

Scombroid Fish Toxicity (Saurine Poisoning)

Pathophysiology

- Improper refrigeration of fish
- Normal bacterial marine flora decarboxylase histidine content of dark meat dish
- Heat stable histamine-like toxin (saurine)
  - *Scombroidae* family (tuna, mackerel, “mahi-mahi”, blue dolphin, dolphin fish)

Symptoms

- Incubation **20-60 min.**
- High attack rate
- Duration 6-10 hours.
- Often the fish has **a bitter or peppery taste** while being eaten, which may warn the consumer to stop eating the fish
- **Resembles histamine intoxication**
  - Facial flushing, throbbing severe headache, palpitations, abdominal cramps, diarrhea, N-V, occasionally urticaria

Table 89-3. Epidemiologic Aspects of Toxin-Induced Bacterial Enteritis

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Treatment

- Prompt symptom relief with antihistamin
- H1 and H2-receptor antagonists
- **Not an allergic reaction**
  - Improperly refrigeration/handling of fish after capture
- **It is *not* the cook's or the restaurant's fault - you cannot sue them!**

Case 06

- Another 40-year-old man presents with “red face”
- Reports “burning and tingling” and “redness” in his skin with associated “restlessness” and “headache”
- Medications: diuretic (hypertension); recently started “vitamins” and regular exercise
- Exam:
  - Anxious, flushed appearance (face, neck, torso)
  - Vital signs: BP, 160/95mmHg; P, 105/min, R, 20/min, T, 37C (98.6F). Remainder of exam, including neurologic exam, is normal

Case 06 Answer

Niacin toxicity

Niacin Toxicity (B3)

- "Mega vitamin" therapy taken for better "health"
- USDA recommendation: 13-19 mg
- Common practice: 500-1000 mg or more
- Uses: treatment of hyperlipidemias, tuberculosis

Symptoms

- Vasodilator
- Painful flushing, hives, rash
- Excessive sweating
- Blurred vision
- Liver damage
- Impaired glucose tolerance

Treatment

- Reassurance
- Supportive care
- Antihistamines, sedatives are beneficial
- Stop niacin, or diminish dose

Case 07

- 55-year-old taxi cab driver presents with headache, nausea, abdominal pain, lightheadedness, and arm numbness and tingling
- Reports eating a hamburger, fries, and coleslaw at a “local greasy spoon” in his cab approximately 30 minutes ago
- Exam:
  - Awake, alert, anxious, pale, sweaty, exhausted
  - Vital signs: BP, 190/110mmHg; P, 100/min; R, 24/min; T, (99F)
  - Remainder of exam, including neurologic exam, is normal

Case 07

What did he eat?

Case 07 Answer

Carbon monoxide poisoning

Carbon Monoxide Poisoning

- Appearances are deceiving!
- All that appears to be food poisoning may not be so!
- Headache, nausea, vomiting, chest pain: common with CO toxicity
- Many cases of CO poisoning are misdiagnosed as **“flu” or “food poisoning”**

Case 08

- 36-year-old woman - school teacher - presents with “blurred vision” since last evening; overnight, reports dizziness, lightheadedness, mild headache, nausea and vomiting
- Her PCP this morning diagnosed her with the “flu”, provided reassurance, and sent her home
- Now in ED 12 hours later with slurred speech, difficulty swallowing, weakness, and unsteady gait
- Exam:
  - Diffuse muscular weakness; proximal muscle groups (in arms, legs) weaker than distal muscle groups
  - Patient admitted with a diagnosis of “CVA”

Case 08

What is really wrong with this woman?

Case 08 Answer

Botulism
(*Clostridium botulinum* toxin)

Clostridium species

- Responsible for several severe diseases
  - ***C. botulinum***
  - ***C. tetani***
  - ***C. perfringes***
  - ***C. difficile***
- All are associated with significant GI symptoms.
- Botulism and tetanus also have neurologic sequela.

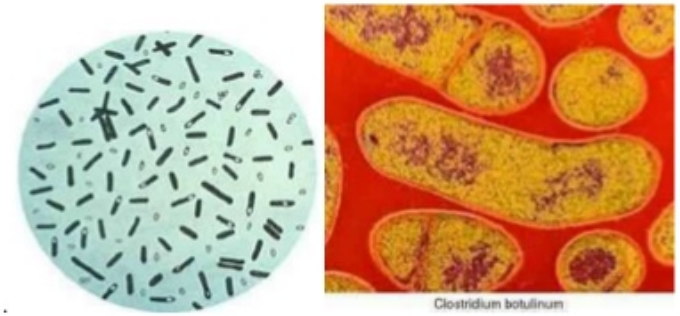
BOTULISM

Definition

Botulism is an acute, progressive condition caused by botulinum toxin, a natural poison produced by the spore-forming bacteria *Clostridium botulinum*. Exposure to the botulinum toxin usually occurs from eating contaminated food although, in infants, it may be caused by specific types of clostridia obtained from soil or inhaled spores, causing growth of the bacteria in the infant's intestine. Botulinum toxin is a neurotoxin that blocks the ability of motor nerves to release acetylcholine, the neurotransmitter that relays nerve signals to muscles, a process that may result in unresponsive muscles, a condition known as flaccid paralysis. Breathing may be severely compromised in progressive botulism because of failure of the muscles that control the airway and breathing.

Cause-Clostridium botulinum --------- Neurotoxin—acts on peripheral nervous system.

It is a gram positive bacillus



Clostridium botulinum

Description

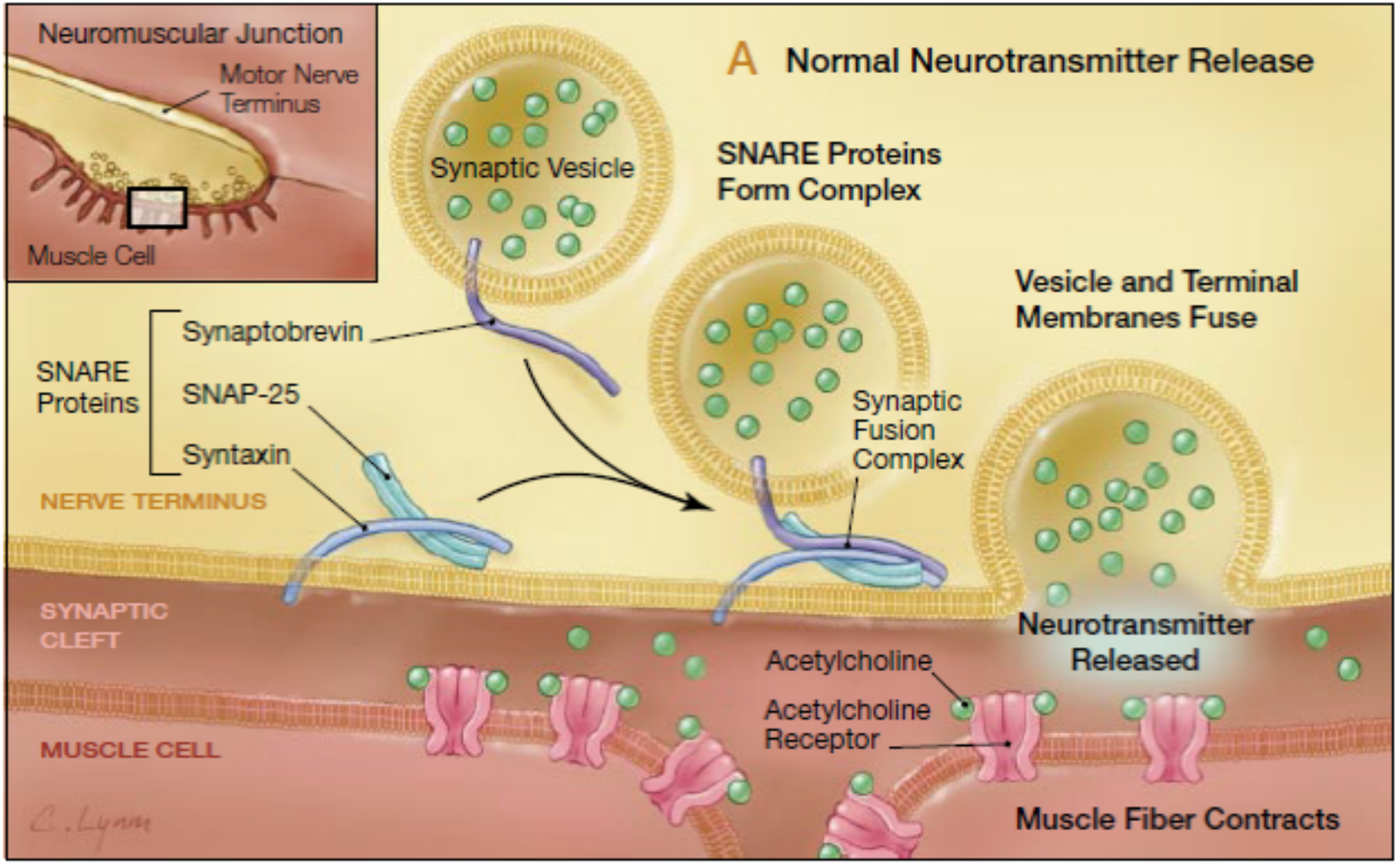
Botulism occurs only rarely, but its high fatality rate makes it a great concern for those in the general public and in the medical community. Clinical descriptions of botulism reach as far back in history as ancient Rome andGreece. However, the relationship between contaminated food and botulism was not defined until the late 1700s. In 1793 the German physician, Justinius Kerner (1786–1862), deduced that a substance in spoiled sausages, which he called *wurstgift* (German for sausage poison), caused botulism. The toxin's origin and identity remained vague until Emile van Ermengem (1851–1932), a Belgian professor, isolated *Clostridium botulinum* in 1895 and identified it as the source of food poisoning .

Three types of botulism have been identified: food-borne, wound, and infant botulism. The main difference between types hinges on the route of exposure to the toxin. Food-borne botulism accounts for 25 percent of all botulism cases and can usually be traced to eating contaminated home-preserved food. Infant botulism accounts for 72 percent of all cases. About 98 percent of infants recover with proper treatment. Although domestic food poisoning is a problem worldwide, concern is growing regarding the use of botulism toxin in biological warfare. At the end of the twentieth century 17 countries were known to be developing biological weapons, including the culture of botulism toxins.

1 DR MAGDI AWAD SASI 2013 INFECTION RARE BUT IF MISSED FATAL

Acute Botulism

- *C. botulinum*: G+ anaerobe spore-former
- Botulinum toxin: most poisonous substance known
- Enters systemic circulation, affects acetylcholine release



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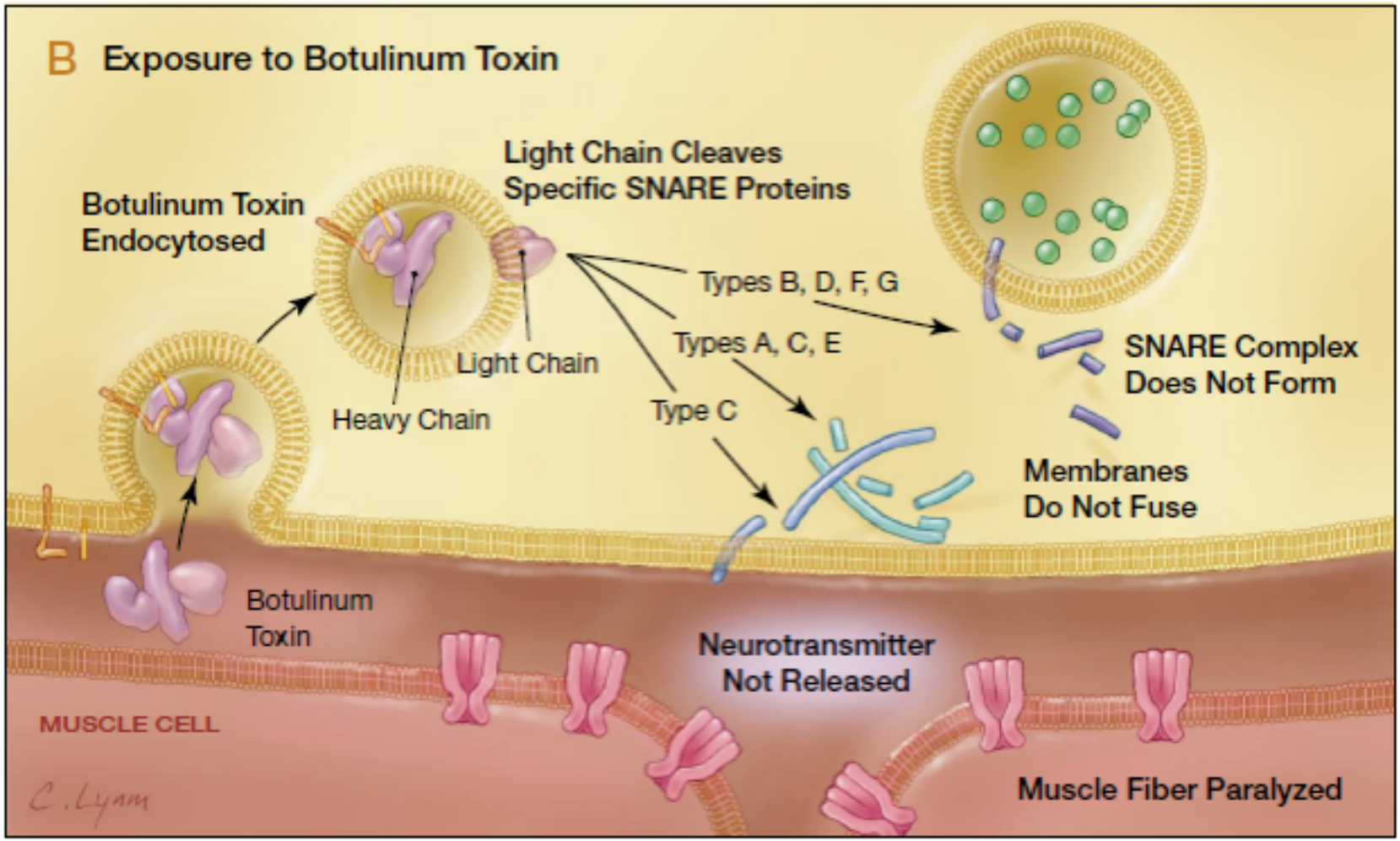

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Presentations

Infant botulism

(floppy baby syndrome)

- Ingestion C. botulinum spores (honey)

Foodborne botulism

- Improperly canned foods ingesting toxin

Wound botulism

- C. botulinum organism in wound (no GI symptoms)
- Soil, IVDU

Iatrogenic

- Botulism toxin (plastics)

Symptoms

- Incubation: 12-36 hours
- Neurologic:
  - Acute bilateral, symmetric cranial nerve impairment (CN3 and CN6)
  - Peripheral nerve impairment (descending flaccid paralysis)
  - No sensory or mental impairment
- DTR usually preserved, symmetrical
- Gastrointestinal: nausea, vomiting (less prominent)

Exam

- No fever
- Awake and alert patient
- Normal BP and pulse
- No meningeal signs
- Normal DTR’s

5 Ds

Diplopia

Dysarthria

Dysphagia

Dilated Pupils

Descending Paralysis

Diagnosis

- Serum for toxin (special lab)
- Stool, vomit, suspected food items (may reveal toxin, up to 12 days following ingestion)
- EMG
- Isolation of C. botulinum from wounds

Differential Diagnosis

- Hypermagnesemia
- Hyperthyroidism
- Guillain-Barre
- Myasthenia Gravis
- Polio
- Tick paralysis

- Drugs
  - aminoglycosides,
  - atropine,
  - scopolamine
  - CO

Treatment

- Supportive
- IVIG (infantile botulism)
- PT/OT
- Penicillin, metronidazole (wound botulism)
- Antitoxin

Botulism: Treatment

CDC
Centers for Disease Control and Prevention

- Supportive (ABCs)
- Surgical debridement of wounds
- HBO
- Close observation, DVT prevention
- IVIG (infant botulism)
- Hyperalimentation, PT/OT
- Local antibiotics (**penicillin G**, **metronidazole)** helpful in wound botulism (***C. botulinum***)

Botulism: Treatment

- Antibiotic use is not recommended for infant botulism (cell death, lysis = more toxin release)
- **Antitoxin** (blocks the action of circulating toxin)
  - Available from California Department of Public Health or CDC
  - If given before complete paralysis, antitoxin can prevent deterioration and shorten recovery time.
- 24-hour CDC hotline:
  - (404) 329-3753 days
  - (404) 329-3644 nights

Case 09

- A 35-year old man presents to the ED for your professional advice
- Reports that he will be traveling to Puerto Rico next week with his new girlfriend
- Last time he was in Puerto Rico, he had “terrible diarrhea”
- He knows he will get it again, and the last thing he wants is to be “embarrassed”
- **What prophylaxis, if any, would you offer?**

Case 09 Answer

Rifaximin,
Bismuth subsalicylate

Prophylaxis

- Rifaximin
  - 200 mg BID for duration of the trip
  - Non-absorbed antibiotic
- Bismuth subsalicylate 2 tablets (262 mg/tablet)
  - Effectively prevents traveler's diarrhea (90%)
- TMP-SMX and/or ciprofloxacin
  - **not recommended**
- The regimen is started the **day before** travel and continues until two days after return
- Bactrim is not recommended as a first line due to significant resistance

Prophylaxis

- Freezing water (e.g., ice, ice cream) does not kill organism
- Alcohol does not sterilize drinks (mixed drinks may still be contaminated)
- Fruit salad, lettuce, chicken salad, guacamole frequently contaminated with high bacterial counts
- Steam-table buffets promote growth of bacteria: avoid these!

What can be done?

Zhanna's Rules for Travel

- **Boil it !**
  - Brush teeth with boiled water
  - Two drops of bleach or three drops of tinture of iodine
- **Cook it !**
- **Peel it !**
- **Or…..Forget it !**

- Bismuth
- Rifaximin

- Diarrhea is defined as the passage of loose stools 3x within 24 hours
  - Acute < 14 days
  - Chronic > 30 days
- Traveler's diarrhea is an infectious illness caused by
  - Bacteria
  - Viruses
  - Parasites

Dysentery

- Inflammatory diarrhea
- Characterized by fever, bloody stools, fecal leukocytes
- Organisms invade intestinal mucosa leading to cell death and impaired absorption
  - **NOT TOXIN mediated**
- Poor sanitation, unsafe water sources

Dysentery: Etiologies

- Bacterial (Bacillus) Diarrhea
  - Shigella dysenteriae,
  - EIEC, EHEC
  - Salmonella,
  - Yersinia
  - Campylobacter
  - Clostridium difficile (nosocomial)
- Parasite
  - Entamoeba histolytica,
  - Trichuris trichura, Strongyloides stercoralis

Causes of Traveler's Diarrhea

Agent	Estimated Incidence (%)
Bacteria	80-85 (approx)
Enterotoxigenic ***Escherichia coli* - *most common traveler's diarrhea***	45-50
Shigella	8-12
Campylobacter	7-9
Enteroinvasive *E. Coli* (hemorrhagic strain 0157:H7)	5-6
Salmonella	3-5
Others, such as *Vibrio, Aeromonas, Plesiomonas,* shigelloides, *Yersinia*, other types of *E. Coli*	1-5
Viruses	5-10 (approx)
Rotavirus	5-10
Norwalk agent and others	0-5
Parasites	5-6 (approx)
Giardia lamblia	4-5
Cryptosporidium	3-4
Entamoeba histolytica	0-1
Strongyloides stercoralis	0-1
Unknown	5-10

E. coli

Responsible for causing:

1. UTI
2. Diarrhea
3. Neonatal meningitis
4. Gram negative sepsis (hospitalized patients)

E. coli diarrhea caused by several strains

- Based on virulence factors

E. Coli – Enterotoxins: Heat labile & Shiga-like

- E. Coli diarrhea (traveler's diarrhea)
  - **ETEC**: Enterotoxigenic E. coli (**most common, severe watery diarrhea**)
  - **EHEC**: Enterhemorrhagic E. coli: strain 0157:H7
    - Bloody diarrhea, HUS
  - **EIEC**: Enteroinvasive E. coli
    - Bloody diarrhea, WBC in stool, fever, Shiga-toxin: same disease as Shigella “dysentery”
  - **EPEC**: Enteropathogenic E. Coli
    - Endemic in developing countries and epidemic infantile diarrhea

Case 10

- 27-year-old man (medical student) presents with abdominal pain and 3 episodes of bloody diarrhea
- Well until five days ago; developed cramps, frequent watery diarrhea
- Two days ago, went to ED; diagnosed with “acute gastroenteritis” and “diarrhea”; received 2 L lactated Ringer’s solution
- Reports no fever or chills; food and sexual histories are non-contributory; denies recent antibiotics, recent medication changes, or new medications

Case 10: Exam

- Alert, pale, diaphoretic, uncomfortable
- Vital signs: BP, 110/75mmHg; P, 110/min; R, 20/min; T, 37.2C (99F), dizziness with standing
- Icteric sclera
- CV: S1, S2 regular
- Lungs: clear
- Abdomen: **diffuse tenderness**, no distention, no guarding, rebound, or rigidity; no masses; bowel sounds normal
- Rectal: frank bloody stool; normal tone; no lesions, no tenderness

Case 10: Diagnostics

Test	Value
CBC	WBC count 13,600/mm^3 Hemoglobin 11 g/dL; Hematocrit 36% Platelets 95,000/mm^3
BUN	37 mg/dL
Creatinine	3.2 mg/dL
Glucose	80 mg/dL
INR	1.2
Lactate (VBG)	2
UA	5 RBC/hpf; 0 WBC/hpf; 4+ protein
ECG	Sinus tachycardia
CXR	Normal

Case 10

What is your initial impression and how would you work up this aspiring young colleague?

Case 10 Answer

Enterohemorrhagic
Escherichia coli 0157:H7

Enterohemorrhagic E. coli 0157:H7 (Infectious Colitis)

- CDC: #1 “Emerging Disease of the 90’s.”
- Invasive enterocolitis
- Produces bloody diarrhea
- Significant mortality rate in infants and elderly

Sources of EHEC 0157:H7

- **Usually ground beef** (lives in intestines of healthy cattle)
- Meat contaminated during slaughtering process
- Ground into center of hamburgers and other foods
- **Hamburgers should be cooked until juices run clear and the center of meat is no longer pink. (Yuck!)**

Symptoms of EHEC 0157:H7

- Watery diarrhea
- Bloody stool
- Toxic appearance
- Special media required (Sorbital-MacConkey agar)
- Differential includes: **ischemic colitis, ulcerative colitis**

Treatment of EHEC 0157:H7

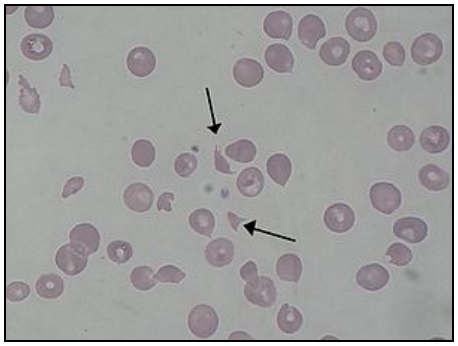
- Mostly supportive, antibiotics? (no proven benefit)
- **Watch closely for Hemolytic-Uremic Syndrome (HUS)**
  - 2-7% of cases (higher in children)
  - Mortality rate in elderly with HUS secondary to EHEC 0157:H7 greater than 50%

Three Components of HUS

Microangiopathic hemolytic anemia

Renal failure

Thrombocytopenia



Schistocytes as seen in a person with hemolytic-uremic syndrome

Key Points: EHEC 0157:H7

- Children and adults
- Bloody diarrhea
- 0157:H7
- Shiga-like toxin
- Vero-cell assay for feces
- Hemolytic anemic syndrome (HUS)

Case 11

- 45-year-old man presents an acute onset of profuse watery diarrhea and abdominal cramps
- He has vomited once and passed 9 or 10 loose watery stools in the last few hours
- The evening before, he had a meal of raw oysters and wine
- His wife is sure the diarrhea is from the raw oysters and she warned him yesterday not to pig out on them.

Case 11

What is wrong with the patient?

What do you tell the man's wife?

Case 11 Answer

Norwalk virus

Foodborne Diarrhea - Agents

- **Viruses**
  - Norwalk virus
  - Rotavirus
  - Hepatitis A
- **Parasites**
  - Giardia
  - Cryptosporidium
  - Entoamoeba histolytica

- **Bacterial**
  - Salmonella
  - Staph aureus
  - Bacillus cereus
  - Clostridium perfringens and C. botulinum
  - E. coli
  - Shigella
  - Campylobacter
  - Vibrio cholera and parahemolyticus

The prototype of norovirus is Norwalk virus

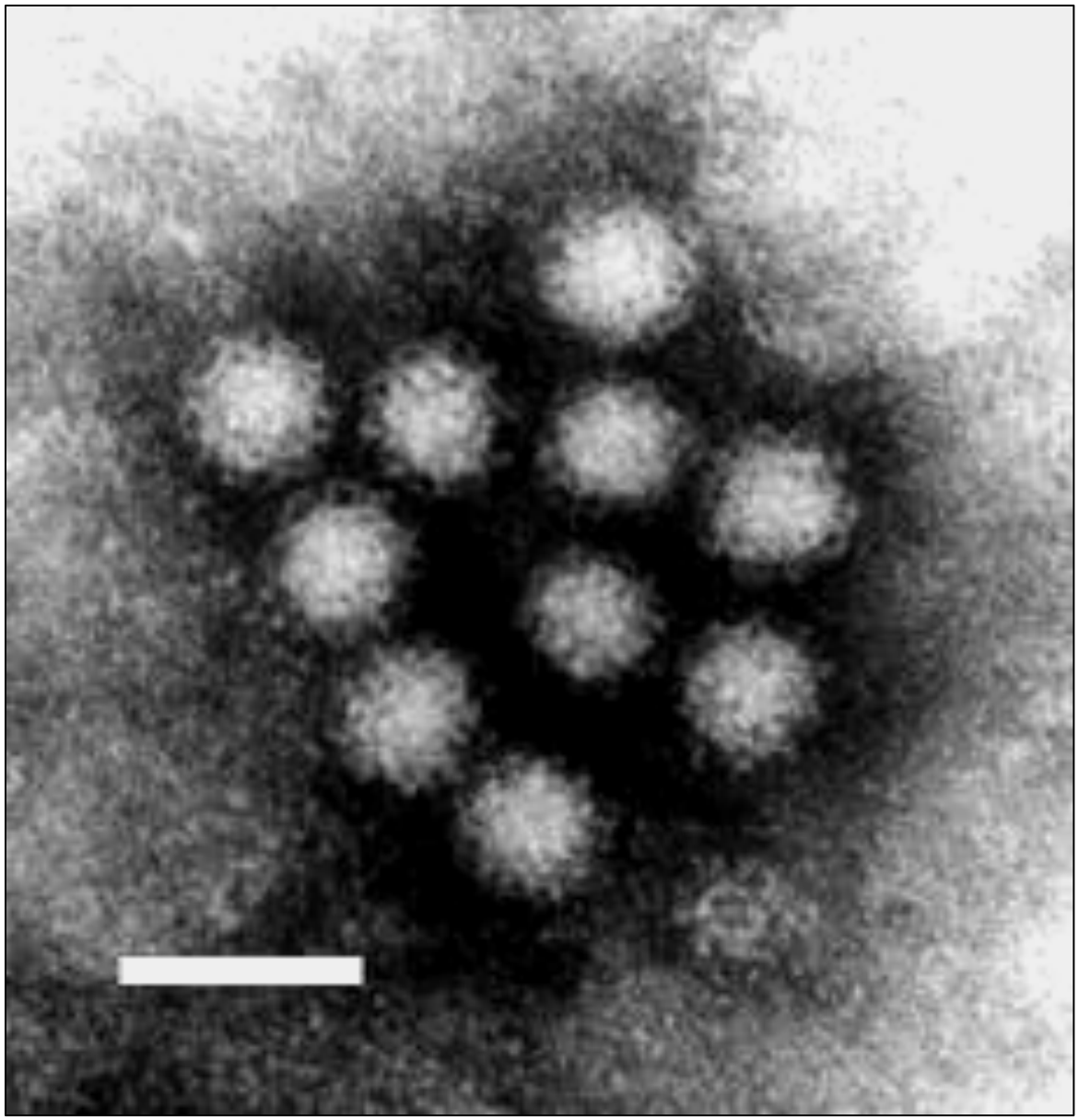
Four groups of viruses have been implicated in diarrhea:

- **Caliciviruses** (including Norwalk virus and noroviruses)
  - Primarily infects young children and infants
  - Indistinguishable from rotavirus
  - Diarrhea, vomiting, fever
  - Norovirus
    - Major cause of acute infectious diarrheal outbreaks on **cruise ships, Katrina hurricane (2005): 50% of population with positive Norovirus**
- **Rotaviruses**
  - One of the leading causes of acute infection in infants
- **Adenoviruses**
- **Astroviruses**
  - Cause periodic outbreaks of diarrhea in infants, children, and elderly

Norwalk / Norwalk-like Virus

Transmitted: *food, fomites or aerosolization* with vomiting

- 50% of all gastroenteritis worldwide
- Self-limiting: Starts 24-48 h after exposure / lasts for 24-60 h
- Cruise ships, raw oyster/sushi bars
- Symptosm: nausea, vomiting, diarrhea, abdominal pain
- Lethargy, weakness, myalgias, headache, low-grade fever
- No antibiotics
- Rule-out Hepatitis A
- **Life-threatening in the young, the elderly, and the immune-compromised if dehydration is ignored or not treated.**



Norwalk virus was named after Norwalk, Ohio, where an outbreak of acute gastroenteritis occurred among children at an elementary school in November 1968

In INFANTS and CHILDREN it is estimated that 70% of diarrhea is due to VIRUSES

Travellers Diarrhea is fundamentally a sanitation failure leading to bacterial contamination of drinking water and food.

Case 12

- 3-month old child returning from Grandma's house with low-grade fever, watery bloodless diarrhea, colic/cramps, and vomiting.
- On arrival, appears dehydrated and pale; demonstrates tachcardia
- Received three 20 mL/kg boluses of crystalloid IV fluid, ondansetron, and acetaminophen
- Demonstrated clinical improvement, discharged home with parents with instructions to follow-up with the pediatrician
- **Propose the type of gastroenteritis the patient most likely has.**

Case 12 Answer

Rotavirus

Foodborne Agents Causing Diarrhea

- **Viruses**
  - Norwalk virus
  - Rotavirus
  - Hepatitis A
- **Parasites**
  - Giardia lamblia
  - Cryptosporidium
  - Entamoeba histolytica
- **Bacterial**
  - Salmonella
  - Staph aureus
  - Bacillus cereus
  - Clostridium perfringens and C. botulinum
  - E. coli 0157-H7
  - Shigella
  - Campylobacter
  - Vibrio cholera and parahemolyticus
  - C. diff

Rotavirus

- **Most common cause:** severe diarrhea in children
  - killing about 600,000 children every year in developing countries
- Seven major groups of Rotavirus have been identified
  - Groups A, B, and C infect humans
  - Group A is the most common
- Self-limiting, mild to severe disease
- No antibiotic treatment, only supportive
- **Diarrhea = death by dehydration**

Rotavirus

- Rotavirus excretes large numbers of viral particles and *spreads via fecal-oral route*:
  - contaminated hands, objects, or utensils
- Incubation period ranges from 1-3 days
  - vomiting followed by 4-8 days of diarrhea
  - *Temporary lactose intolerance may occur*
- Severe diarrhea without fluid and electrolyte replacement may result in death

Rotavirus: Oral Vaccines

- **RotaTeq** (RV5) – effective against rotavirus disease. Prevents 74% of all cases, 98% of severe cases, and 96% of hospitalizations
- **Rotarix** (RV1)

http://www.cdc.gov/vaccines/vpd-vac/rotavirus/

Case 13

- 26-year-old woman presents with acute cramps, LLQ abdominal pain, and bloody diarrhea
- Reports 2 days of headache and myalgia
- Reports that she frequently drinks unpasteurized milk purchased in a health food store
- Exam:
  - Fever
  - Tachycardia
  - Diffuse abdominal tenderness (worse in the LLQ) with associated cramps with palpation
- Diagnostics
  - Stool: positive for WBCs, blood

What is the likely diagnosis?

a. *Bacillus cereus*
b. *Campylobacter jejuni*
c. *Clostridium perfringens*
d. *Giardia lablia*

Case 13 Answer

Campylobacter jejuni

Foodborne Diarrhea - Agents

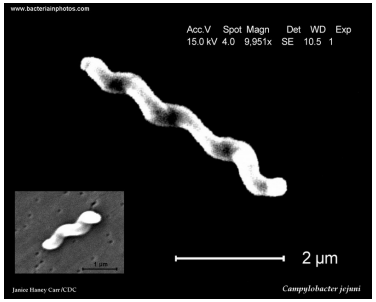
- **Viruses**
  - Norwalk virus
  - Rotavirus
  - Hepatitis A
- **Parasites**
  - Giardia
  - Cryptosporidium
  - Entoamoeba histolytica

- **Bacterial**
  - Salmonella
  - Staph aureus
  - Bacillus cereus
  - Clostridium perfringens and C. botulinum
  - E. coli
  - Shigella
  - **Campylobacter**
  - Vibrio cholera and parahemolyticus

Campylobacter jejuni

"camping bacteria in the jejunum with nothing better to do than cause diarrhea"

- **Campylobacter jejuni, ETEC, and rotavirus** are the **three most common** causes of diarrhea in the world
- **Campylobacter jejuni** causes up to 2 million cases of diarrhea in the US alone
- Curved G-rod with polar flagellum
- Zoonotic, domestic animals and poultry, uncooked meat, pultry, **unpasteurized milk**, Fecal-oral
- **Clinical**: secretory or bloody diarrhea
- **Diagnosis**: stool culture, blood culture



Unique Features: Campylobacter jejuni

- Cholecystitis
- Erythema nodosum
- Pericarditis / Myocarditis
- Reiter's syndrome
- Guillain-Barre syndrome

Treatment

- First line: erythromycin, azithromycin
- Second line options: ciprofloxacin
- Fluoroquinolones: resistance approaching 20%
- If systemic: imipenem, ceftriaxone

Case 14

- 30-year-old man presents with acute abdominal pain, cramps, and diarrhea (watery, contains mucous)
  - Associated with low grade fever, chills, malaise, nausea, vomiting
- Reports eating partially cooked eggs from poultry farm 24 hours ago
- Vital signs: BP, 110/70mmHg; P, 110/min; R, 16/min; T, 38.3C (101F); SpO_2, 100%
- Exam: mild diffuse abdominal tenderness, mild dehydration
- Diagnostics: stool with WBCs

What is the most likely diagnosis?

a. *Campylobacter jejuni*

b. Enterotoxigenic *E. coli*

c. *Salmonella typhi*

d. *Staphylococcus aureus*

e. *Vibrio parahemolyticus*

Case 14 Answer

Salmonella typhi

Case 14 Answer

Salmonella typhi

Foodborne Diarrhea - Agents

- **Viruses**
  - Norwalk virus
  - Rotavirus
  - Hepatitis A
- **Parasites**
  - Giardia
  - Cryptosporidium
  - Entoamoeba histolytica
- **Bacterial**
  - Salmonella
  - Staph aureus
  - Bacillus cereus
  - Clostridium perfringens and C. botulinum
  - E. coli
  - Shigella
  - Campylobacter
  - Vibrio cholera and parahemolyticus

Salmonella

- Lives in GI tract of animals and infects humans through food/water contaminated with animal feces
- never part of normal intestinal flora; **always pathogenic**
- Picnic, uncooked eggs, dairy, poultry, beef and pet turtles
- Onset 16-72 hours
- Disseminated disease in young and old
- Multi-drug resistant DT104 most common

Salmonella

S. typhi: Carried only in humans

Zoonotic: pet turtles, chickens, uncooked eggs

Clinical: **4 disease states in humans**

- The famous typhoid fever (enteric fever); carrier state (recovery from typhoid fever; not actively infected; no symptoms; harbor *Salmonella typhi* in their gallbladders and excrete the bacteria constantly)
- Sepsis
- Gastroenteritis
- Complication: osteomyelitis (sickle-cell p

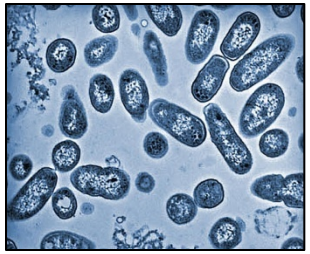
Mary Mallon, Irish immigrant worked as cook and spread disease to dozens in NYC (1906)

Treatment (if indicated): ciprofloxacin, ceftriaxone, TMP-SMX, azithromycin

Salmonella typhi: Symptoms

- Patient is sick
- Headache
- abdominal pain
- Relative bradycardia
- Pea soup stool (brown green color)
- Intractable fever
- Splenomegaly
- Rose spots on the body, second week of the illness

- Blood cultures positive
- Treatment:
  - IV antibiotics
- **Salmonella** typhi bacteria
  - Typhoid fever spreads through **contaminated food** and water or through close contact with someone who's infected.




Salmonella
Food Poisoning
食物環境衞生署
Food and Environmental Hygiene Department
Salmonella
Food Poisoning
食物環境衞生署
Food and Environmental Hygiene Department

WASH YOUR PRODUCE!

http://www.google.com/imgres?imgurl=http://wholefoodusa.files.wordpress.com/2009/01/wheel-of-salmonella_6001.jpg&imgrefurl=http://wholefoodusa.wordpress.com/2009/01/08/raw-milk-alert-ohio-in-on-us-food-poisoning-outbreak/&usg=___um50zPxP3QAm1NUTmctUcEtjfA=&h=673&w=600&sz=581&hl=en&start=12&itbs=1&tbnid=TYAG4L6aXVipoM:&tbnh=138&tbnw=123&prev=/images%3Fq%3Dsalmonella%26hl%3Den%26safe%3Dstrict%26client%3Ddell-usuk%26channel%3Dus%26gbv%3D2%26ad%3Dw5%26tbs%3Disch:1

Case 15

- 30-year-old man presents with swollen right knee
- Reports pain in bilateral ankles two days ago
- Reports new urgency and frequency in urination
- Two weeks earlier, seen in ED with fever, diarrhea, and abdominal cramps; discharged with "gastroenteritis"
- **Propose the etiology of the patient's "gastroenteritis" two weeks ago.**

Case 15

- What do you expect to find in synovial fluid?
- What does this patient have now, what is your diagnosis? What other symptoms might you expect to see?
- What type of gastroenteritis did the patient have two weeks ago?

Case 15 Answer

Yersinia enterocolitica +
Reiter's syndrome

Reiter's syndrome

- **Reactive arthritis** that occurs in genetically susceptible hosts after infection with Chlamydia trachomatis in the genitourinary tract, or Salmonella, Shigella, Yersinia, or Campylobacter organisms in the GI tract
- **Conjunctivitis**, uveitis, or iritis
- **Balanitis circinata** (painful lesions on the glans penis – 20% of the patients)
- **Keratoderma blennorrhagia** (waxy plaques on palms and soles looks like psoriasis – 10% of the patients)

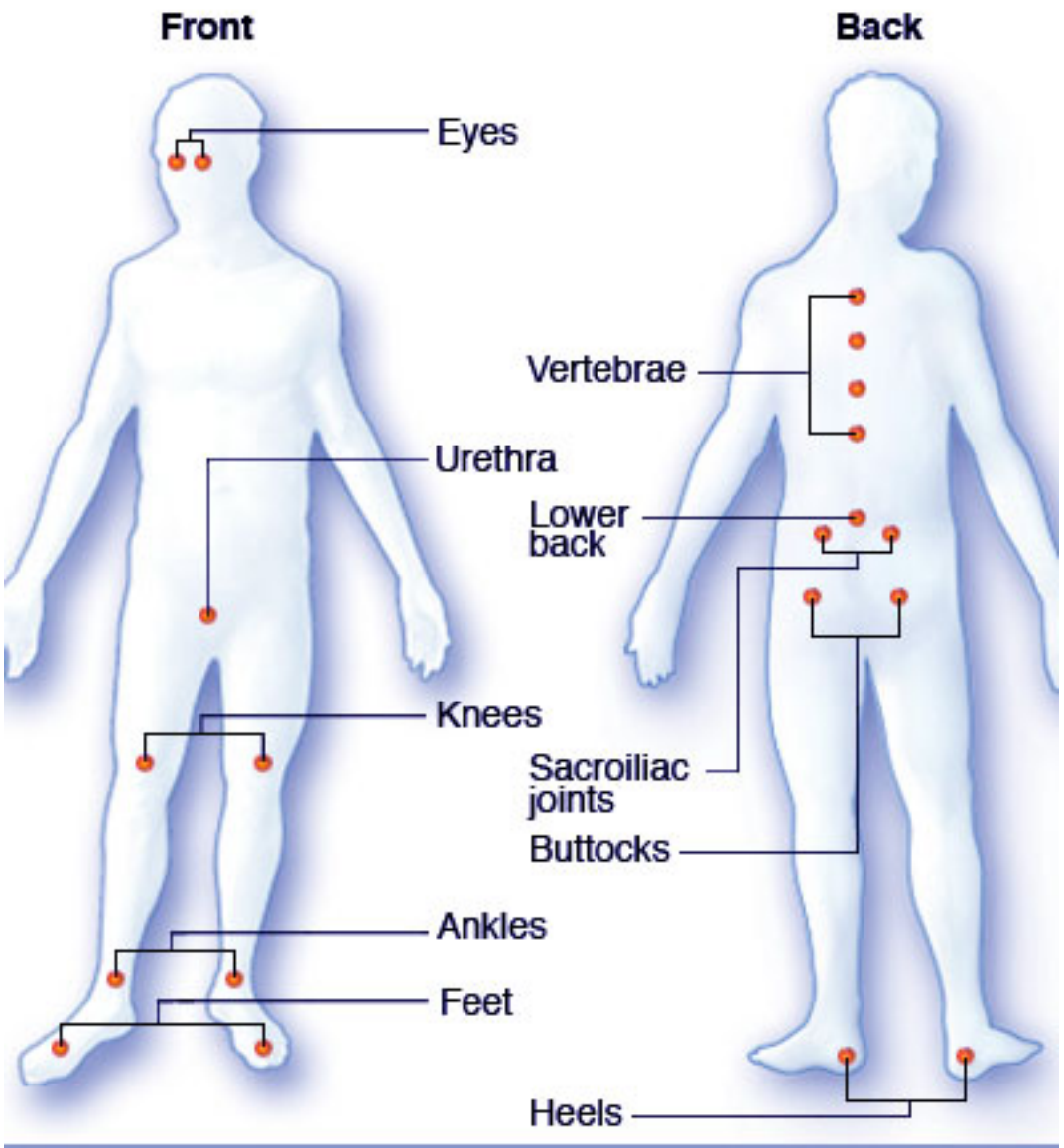
Reiter's Syndrome

Cannot See

Cannot Pee

Cannot Climb the Trees

Reactive Arthritis (Reiter's Syndrome)



Not all patients have symptoms at all locations

Reiter's Syndrome

- Conjunctivitis

- Balanitis circanata

meatitis and early balanitis. The lesion is erythematous, moistened by the urethral discharge, and, like the later stages, painless.

- Keratoderma blennorrhagia

Numerous pustules are present on the feet of a patient with reactive arthritis. They begin as vesicles on erythematous bases and become sterile pustules.

Reiter's Syndrome

- Inflammatory arthritis developing a few weeks after a gut or GU infection.
- It is a sterile arthritis typically affecting the lower limb.
- It may be chronic or relapsing

- Organisms

GU

-Chlamydia

-Neisseria

Gut

-Salmonella

-Shigella

-Yersinia

-Campylobacter

Reiter's Syndrome

- Synovial fluid is inflammatory and predominance of PMN's.
- **Chlamydia, Salmonella, and Yersinia** antigens have been found in synovial membrane and even in the joint fluid, but cultures are sterile.
- RF and ANA are negative but **HLA-B27** antigen occurs in 80% of the patients.

Treatment

- NSAIDs, particularly **indomethacin**
- **Antibiotics**
- **Tetracyclines** for patients with chlamydia arthritis
- **TMP-SMX** the Yersinia organism is usually susceptible to this, which is the treatment of choice if antibiotic therapy is indicated.
- Doxycycline or ciprofloxacin are effective alternatives

Case 16

- 5-year-old boy with parents, referred from PCP's office for "suspected appendicitis"
- Presented with RLQ pain, low-grade fever, diarrhea (twice over 2 days); parent reports loss of appetite and decreased activity
- Vital signs: BP, 110/70mmHg; P, 110/min; R, 14/min; T, 37.8C (100F); SpO_2, 100%
- Exam
  - HEENT, Lungs, CV: negative
  - Abdomen: soft, tender to palpation in RLQ, with rebound and guarding
  - GU: testicles bilaterally normal, guaiac negative stool

Case 16: Diagnostics

- Complete blood count
  - WBC count: 20,000/mm^3
  - Hemoglobin: 10 g/dL
  - Hematocrit: 34%
  - Platelets: 360,000/mm^3
  - Electrolytes:
  - Serum glucose: 100 mg/dL
- Urine
  - no WBC or RBC/hpf; no LE or nitrites
- **Propose findings on CT / POCUS**

Case 16 Answer

Yersinia enterocolitica

Yersinia enterocolitis

- Bacteria localize in lymphoid tissue in Peyer's patches / associated with mesenteric adenitis
- Most common course for Mesenteric Adenitis in children and young adults
- Commonly transmitted from sick household pets (puppies and kittens)
- Symptoms
  - 2 week incubation
  - Fever, vomit, diarrhea, abdominal pain (**RLQ pain, mimics appendicitis**)
  - 10-20% bloody diarrhea
- Treatment
  - Symptomatic
  - Abx only for systemic disease or extra-intestinal infection
  - TMP/SMX for children, doxycycline or ciprofloxaxin in adults

Talking to the mother, child got a new puppy 2 weeks ago.

Complication
Erythema nodusum and Reitier's syndrome (reactive arthritis)

What other Yersinia-associated infections do you know of?

Answer

Yersinia pestis

Bubonic plague

Transmitted by tick bite

Case 17

- 22-year-old woman with history of travel (one month vacation visiting grandmother in rural India) presents with syncope.
- Reports multiple liquid “rice water” stools, nausea, and vomiting.
- Provides picture of her grandmother’s village well
- Exam:
  - Appearance: Extremely dehydrated, orthostatic changes with standing
  - Vitals (supine): BP, 80/40mmHg; P, 120/min; R, 16/min; SpO_2: 100%, T, 37.7C (99.8F)

Case 17 Answer

Vibrio cholera

Foodborne Diarrhea - Agents

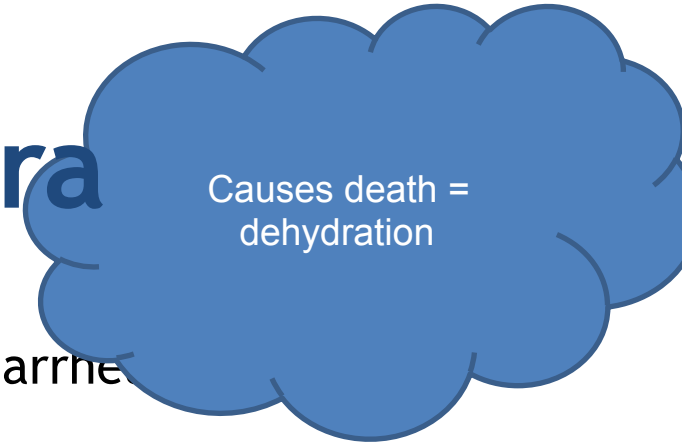
- **Viruses**
  - Norwalk virus
  - Rotavirus
  - Hepatitis A
- **Parasites**
  - Giardia
  - Cryptosporidium
  - Entoamoeba histolytica

- **Bacterial**
  - Salmonella
  - Staph aureus
  - Bacillus cereus
  - Clostridium perfringens and C. botulinum
  - E. coli
  - Shigella
  - Campylobacter
  - **Vibrio cholera and parahemolyticus**

Vibrio spp. Classifications

- **V. cholerae** (the causative agent of cholera) – generally transmitted by contaminated water
- **V. parahaemolyticus** – eating uncooked seafood
- **V. vulnificus** – eating raw shellfish

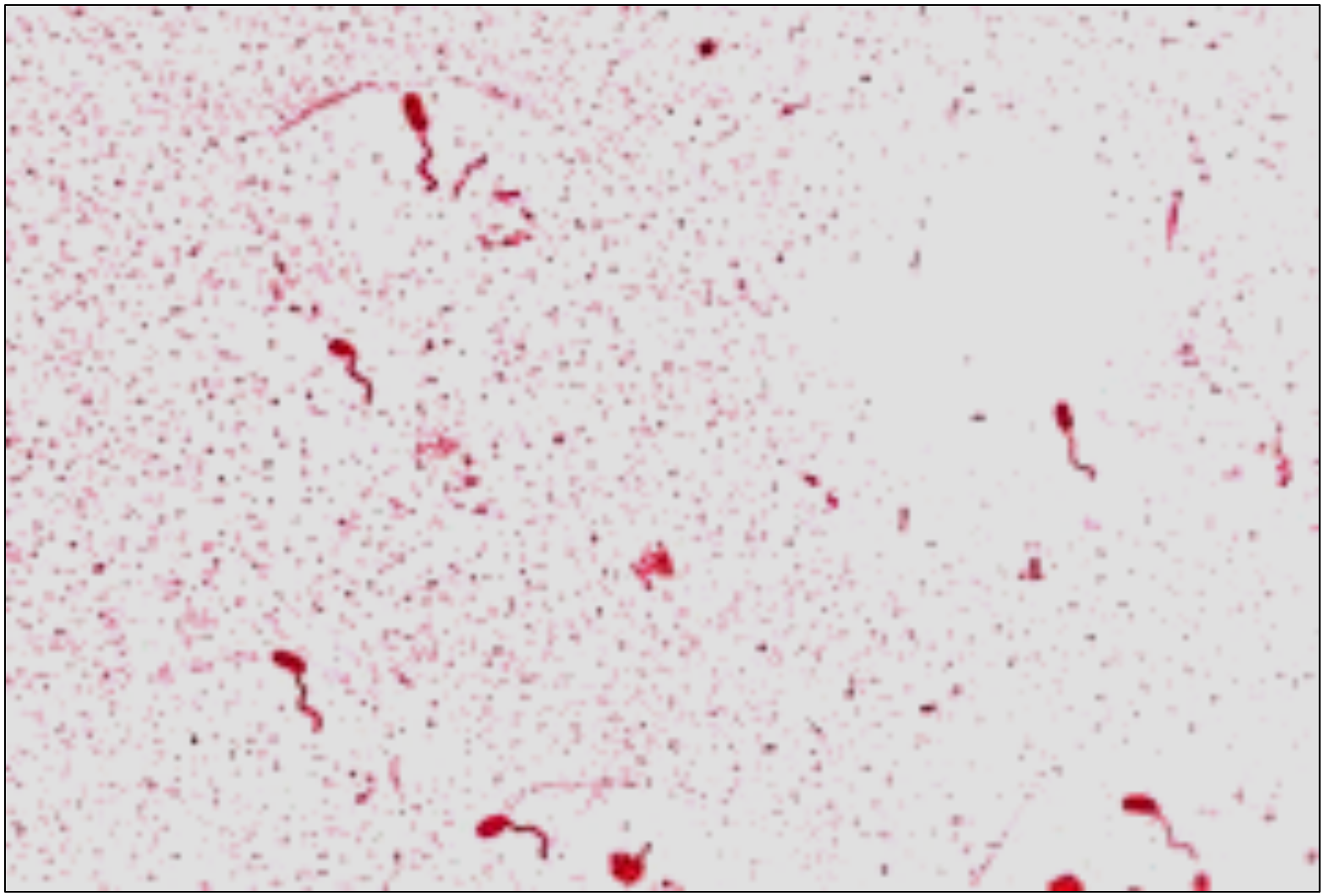
Vibrio cholera



- Short, comma-shaped G- rod
  - Fecal-oral transmission
  - Uncooked fish and sushi, leading cause of diarrhe
- Clinical: Watery diarrhea with rice-watery stools, no WBC"S, severe dehydration and electrolyte abnormalities
- Treatment: fluids, doxycycline, fluroquinolone
- Monovalent vaccine created (2013)
- Prophylaxis for travellers to countries where vibrio endemic
- **Single dose live oral cholera vaccine (Vaxchora® approved by the FDA)**

Vibrio parahaemolyticus

- Curved G- rod with single flagellum
- Fish-raw
- Clinical: 25% food poisoning Japan
- Treatment: Doxycycline, fluoroquinolone



Vibrio cholerae with a Leifson flagella stain

Case 18

- 35-year-old woman presents with cramps, low appetite, bloody diarrhea, rectal urgency, discomfort, and weight loss for 2 weeks
- This AM, noticed “red eye”, reports “back pain”
- Exam:
  - Vital signs: P, 110/min; BP, 90/40mmHg; R, 17/min; T, 37.9C (100.2F); SpO_2, 100%
  - Abdomen: distended; diffuse, generalized tenderness
  - Rectal Exam: guaiac positive for blood

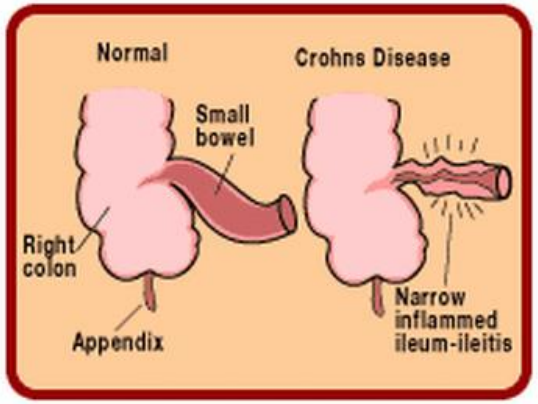
- Patient was admitted to the hospital and a colonoscopy was performed

What do you think she has?

Case 18 Answer

Crohn's disease

Crohn's Disease



CROHN'S DISEASE

- Familial Tendencies
- Peaks Ages 15-40 Yrs
- ? Autoimmune Factors
- Nausea & Vomiting

- Severe Diarrhea
- Low Grade Fever
- Bloody Stools
- Weight Loss
- Severe Malabsorption

- Abdominal Pain and Distention
- Tenderness in RLQ

*** Later S & S's ***

- Dehydration
- Electrolyte Imbalance
- Anemia

*** Complications ***

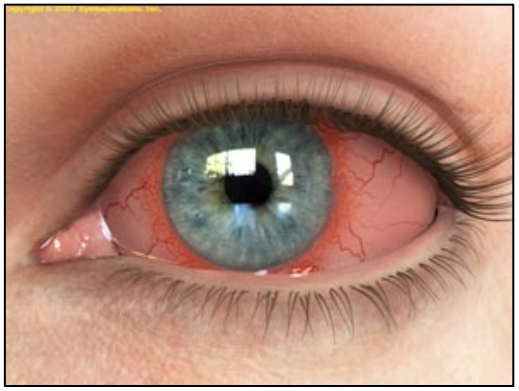
- Intra-abdominal Abscesses
- Intestinal Fistulas
- Peritonitis
- Development of Fistulas

Crohn's Disease

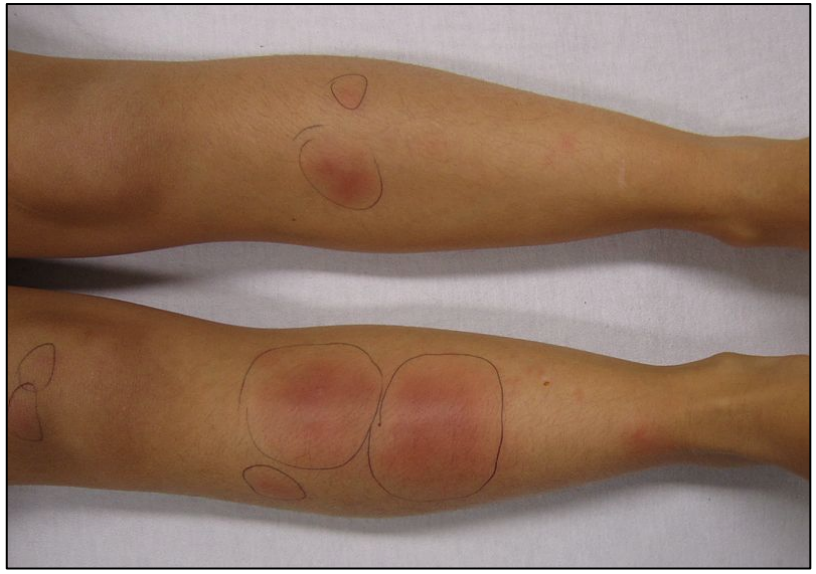
- **Inflammatory bowel disease** which is **idiopathic chronic** inflammatory disease of the GI tract that likely involves genetic predisposition with immunological problems

- Mostly involves the colon, but has extraintestinal manifestations
  - Arthritis – most common
  - Sacroilitis and ankylosing spondylitis in associated with HLA B27
  - Uveitis and episcleritis
  - Erythema nodosum
  - Pyoderma gangrenosum
  - Primary sclerosing cholangitis

Pyoderma gangrenosum – this ulcerative lesion typically originates as an innocent appearing tender papuleor pustule surrounded by an erythematous base



Anterior Uveitis – inflammation of the middle layer of the eye, which includes the iris and adjacent tissue



Erythema nodosum is an inflammatory disorder that involves tender, red bumps (nodules) under the skin.

Case 19

- 59-year-old alcoholic man with fever, chills, nausea, vomiting, dizziness, leg pain and “rash”
- Vital signs: BP, 80/40mmHg, P, 135/min; R, 22/min; T, 41C (103F)
- Both lower extremities: subdermal ecchymoses, petechial rash, blisters, and 2+ edema
- Sheepishly states he indulged in raw oysters two days ago
- Wife convinced illness is “from the oysters”, because his doctor advised never to eat raw seafood again

Case 19

Why would his physician have told him that?

Case 19 Answer

Vibrio vulnificus

Vibrio vulnificus

- Patients with liver disease, immunodeficiency diseases, cancer, insulin-dependent diabetics, patients on steroids, or alcoholics should be told to ***never*** eat raw seafood—they may acquire Vibrio vulnificus systemic illness/septicemia
- Mortality rate is > 60%
- Treatment
  - The optimal treatment is not known
  - in one retrospective study of 93 patients in Taiwan, use of a third-generation **cephalosporin** and a **tetracycline** (e.g., ceftriaxone and doxycycline, respectively) were associated with an improved outcome

Liu JW, Lee IK, Tang HJ et al. (2006). *Archives of Internal Medicine* **166** (19): 2117–23. doi:10.1001/archinte.166.19.2117. PMID 17060542.

DOI: 10.1177/2324709617707978
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April-June 2017: 1–3

Case 20

- 83-year-old female presents with AMS and non-bloody diarrhea (14 episodes within last 24 hours)
- Recent travel (Israel, for family event); Family reports headache, arthralgia, myalgia two days ago
- History: DMt2, CAD, HTN, HLD, and chronic LBP
- Exam:
  - Vital signs: BP, 95/60mmHg; P, 134/min; R, 14/min; T, 38.9°C (102F)
  - Stuporous, lethargic, unable to follow commands, withdraws to painful stimuli

Case 20: Diagnostics

- Complete blood count
  - WBC count: 23,000/mm^3
  - Sodium: 130 mEq/L
  - Bicarbonate: 16 mEq/L
  - Creatinine 2.8 mg/dL
  - Serum glucose: 394 mg/dL
- CT abdomen/pelvis
  - “Findings consistent with non-specific enteritis”

Case 20: Diagnostics

- Lumbar puncture
  - CSF protein 150 (high)
  - CSF WBC 40 (neutophil predominant)
  - CSF Glucose 20 mg/dL (low)
  - Smear: Gram positive rods

Case 20 Answer

Listeria monocytogenes

Listeria is bad: Think of the "list"

1. Pregnant woman in third trimester get sepsis and bacteremia without meningitis
2. Neonatal meningitis
3. Meningitis in elderly, alcoholics, and immunosuppressed patients
   - Second most common cause of meningitis after pneumococcus in elderly immunosuppressed patients

CLNICAL PEARL: Pregnant woman should not eat cheese or cold cuts

CLNICAL PEARL: Cover at risk patients with ampicillin

Listeria monocytogenes

- Other considerations
  - Travel history (outbreaks in Europe, Israel reported)
  - Third-highest mortality among food-borne infections
- Keys to diagnosis
  - Fever, diarrhea, arthralgias, myalgias, headache
  - Nausea, vomiting, diarrhea, abdominal pain (at least one)
  - Major virulence factor: listerolysin O (can test for this)
  - Blood cultures (often positive if systemic disease)

Listeria monocytogenes

- Treatment
  - Ampicillin
  - Penicillin G
  - TMP-SMX

ORGANISM	COMMON NAME OF ILLNESS	ONSET TIME AFTER INGESTING	SIGNS & SYMPTOMS	DURATION	FOOD SOURCES
Bacillus cereus	*B. cereus* food poisoning	10-16 hrs	Abdominal cramps, watery diarrhea, nausea	24-48 hours	Meats, stews, gravies, vanilla sauce
Campylobacter jejuni	Campylobacteriosis	2-5 days	Diarrhea, cramps, fever, and vomiting; diarrhea may be bloody	2-10 days	Raw and undercooked poultry, unpasteurized milk, contaminated water
Clostridium botulinum	Botulism	12-72 hours	Vomiting, diarrhea, blurred vision, double vision, difficulty in swallowing, muscle weakness. Can result in respiratory failure and death	Variable	Improperly canned foods, especially home-canned vegetables, fermented fish, baked potatoes in aluminum foil
Clostridium perfringens	Perfringens food poisoning	8–16 hours	Intense abdominal cramps, watery diarrhea	Usually 24 hours	Meats, poultry, gravy, dried or precooked foods, time and/or temperature-abused foods
Cryptosporidium	Intestinal cryptosporidiosis	2-10 days	Diarrhea (usually watery), stomach cramps, upset stomach, slight fever	May be remitting and relapsing over weeks to months	Uncooked food or food contaminated by an ill food handler after cooking, contaminated drinking water

http://www.fda.gov/downloads/Food/FoodborneIllnessContaminants/UCM187482.pdf

ORGANISM	COMMON NAME OF ILLNESS	ONSET TIME AFTER INGESTING	SIGNS & SYMPTOMS	DURATION	FOOD SOURCES
Cyclospora cayetanensis	Cyclosporiasis	1-14 days, usually at least 1 week	Diarrhea (usually watery), loss of appetite, substantial loss of weight, stomach cramps, nausea, vomiting, fatigue	May be remitting and relapsing over weeks to months	Various types of fresh produce (imported berries, lettuce, basil)
***E. coli (Escherichia coli)* producing toxin**	*E. coli* infection (common cause of "travelers' diarrhea")	1-3 days	Watery diarrhea, abdominal cramps, some vomiting	3-7 or more days	Water or food contaminated with human feces
***E. coli* O157:H7**	Hemorrhagic colitis or *E. coli* O157:H7 infection	1-8 days	Severe (often bloody) diarrhea, abdominal pain and vomiting. Usually, little or no fever is present. More common in children 4 years or younger. Can lead to kidney failure	5-10 days	Undercooked beef (especially hamburger), unpasteurized milk and juice, raw fruits and vegetables (e.g. sprouts), and contaminated water
Hepatitis A	Hepatitis	28 days average (15-50 days)	Diarrhea, dark urine, jaundice, and flu-like symptoms, i.e., fever, headache, nausea, and abdominal pain	Variable, 2 weeks-3 months	Raw produce, contaminated drinking water, uncooked foods and cooked foods that are not reheated after contact with an infected food handler; shellfish from contaminated waters
Listeria monocytogenes	Listeriosis	9-48 hrs for gastro-intestinal symptoms, 2-6 weeks for invasive disease	Fever, muscle aches, and nausea or diarrhea. Pregnant women may have mild flu-like illness, and infection can lead to premature delivery or stillbirth. The elderly or immunocompromised patients may develop bacteremia or meningitis	Variable	Unpasteurized milk, soft cheeses made with unpasteurized milk, ready-to-eat deli meats

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ORGANISM	COMMON NAME OF ILLNESS	ONSET TIME AFTER INGESTING	SIGNS & SYMPTOMS	DURATION	FOOD SOURCES
Noroviruses	Variously called viral gastroenteritis, winter diarrhea, acute non-bacterial gastroenteritis, food poisoning, and food infection	12-48 hrs	Nausea, vomiting, abdominal cramping, diarrhea, fever, headache. Diarrhea is more prevalent in adults, vomiting more common in children	12-60 hrs	Raw produce, contaminated drinking water, uncooked foods and cooked foods that are not reheated after contact with an infected food handler; shellfish from contaminated waters
Salmonella	Salmonellosis	6-48 hours	Diarrhea, fever, abdominal cramps, vomiting	4-7 days	Eggs, poultry, meat, unpasteurized milk or juice, cheese, contaminated raw fruits and vegetables
Shigella	Shigellosis or Bacillary dysentery	4-7 days	Abdominal cramps, fever, and diarrhea. Stools may contain blood and mucus	24-48 hrs	Raw produce, contaminated drinking water, uncooked foods and cooked foods that are not reheated after contact with an infected food handler
Staphylococcus aureus	Staphylococcal food poisoning	1-6 hours	Sudden onset of severe nausea and vomiting. Abdominal cramps. Diarrhea and fever may be present	24-48 hours	Unrefrigerated or improperly refrigerated meats, potato and egg salads, cream pastries
Vibrio parahaemolyticus	*V. parahaemolyticus* infection	4-96 hours	Watery (occasionally bloody) diarrhea, abdominal cramps, nausea, vomiting, fever	2-5 days	Undercooked or raw seafood, such as shellfish
Vibrio vulnificus	*V. vulnificus* infection	1-7 days	Vomiting, diarrhea, abdominal pain, bloodborne infection. Fever, bleeding within the skin, ulcers requiring surgical removal. Can be fatal to persons with liver disease or weakened immune systems	2-8 days	Undercooked or raw seafood, such as shellfish (especially oysters)

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Diagnostics

History…History…History

- **5S DT**:

1) **Sexual Preference:**
   a) Gay man has proctitis (herpes, GC, chlamydia, syphilis)
   b) Colitis – salmonella, shagella, campylobacter, amebas
   c) Enteritis (giardia)
   d) HIV → Isospora, microsporidia, cyclosporidia

2) **Seafood (Food):**
   - Vibrio parahemolyticus infection in raw oysters, ciguatera poisoning, large fish, scrombroid, shellfish (Vibrio)
   - Fried Rice (*Bacillus cereus*)
   - Rewarmed food (*Clostridium perfringes)*
   - Unpasteurized Milk (*Campylobacter jejuni*)
   - Canned Food (Botulism)

Diagnostics

3) Stool Quality:

Blood suggests: Salmonella, Shigella, Campylobacter, or Shiga toxin-

Patient with **small bowel movements** (squirts) left, low Q-pain and tenesmus tend to have **colonic infection** while **large volume** of stool is watery and associated with periumbilical pain are typical **small bowel pathogens**

- Foul Smell = Giardia
- Greasy, Fatty Stool = Whipple Disease

4) Season:

Viral gastroenteritis is a winter illness, while bacterial enteritis is more common in warm summer months.

5) Symptoms:

Vomiting, fever, blood in stool, tenesmus

6) DT

Diet

Drugs (Antibiotics, laxative, colchicin, antihypertensive)

Day care centers, hospital (c. diff colitis)

Traveling

E histolytica if travel from Africa, Asoia, Latin America

Hiking – protozoal pathogen: *Giardia, Cryptosporidium*

Physical Exam

- Assess fluid status (Orthostatistics)
- Presence of peritoneal signs
- Rectal exam for blood
- Look for rash and conjunctivitis

Labs

- CBC: for eosinophilia and infection
- Electrolytes: for dehydration and renal function
- Liver Function test: for hepatitis
- Urine: HUS and dehydration

- Stool Wright stain for + fecal leukocytes

- + Test has 3 or more polyps per high power field

- Test for lactoferrin – glucoprotein find in fecal leukocytes more accurate than the microscopic exam

Positive Fecal Leukocytes in Acute Diarrhea

Infectious Causes	Noninfectious Causes
Shigella	Inflammatory bowel disease
Salmonella	Radiation colitis
Campylobacter	Ischemic colitis
Invasive E. coli	
Yersinia	
C. difficile	
Aeromonas	

Absent Fecal Leukocytes in Acute Diarrhea

V. Cholera – rice-looking stool, severe watery diarrhea, abnormal electrolytes
Enterotoxigenic E. coli
Enteropathogenic E. coli
Viral infections
Giardia
E. Histolytica
Food poisoning

Could this be Food Poisoning?

Diarrhea

↓ ↓

Characteristics	**Infectious** – mucosae invasion	**Toxigenic** – no mucosae invasion
Incubation period	1-3 days	2-12 hours
Onset	Gradual	Sudden
Duration	1-7 days	≤ 10-24 hours
Fever	Present	Absent
Abdominal pain	Common: tends to be severe, persistent and associated with tenesmus	Less common: generally mild, crampy and intermittent

Could this be Food Poisoning? (cont'd)

Characteristics	**Infectious** – mucosae invasion	**Toxigenic** – no mucosae invasion
Systemic symptoms	Common: nausea, vomiting, headache, malaise, myalgias	Uncommon
Physical findings	"Toxic" appearance: abdominal tenderness prominent	Nontoxic appearance: minimal if any abdominal tenderness
Stool blood, mucus and inflammatory cells (fecal WBC)	Present	Absent

Could this be Food Poisoning? (cont'd)

Characteristics	**Infectious** – mucosae invasion	**Toxigenic** – no mucosae invasion
Pathogenesis of Acute Diarrhea:	1. Salmonella, Shigella, Campylobacter, Yersinia enterocolecitica, Vibrio vulnificus, Mycobacterium avium-intracellularae 2. Ulcerative colitis, Crohn's disease of the colon 3. Clostridium difficile, Enterohemorrhagic Escherichia coli 0157:H7	1. Staphylococcus aureus 2. Bacillus cereus 3. Ciguatera fish poisoning / scrombroid fish poisoning 4. Enterotoxigenic Escherichia coli 5. Clostridium perfringens 6. Vibrio cholera 7. Viruses: Norwalk agent, rotovirus, adenoviruses 8. Giardia lamblia 9. Cryptosporidium

Table 89-2. Antibiotic Therapy for Diarrhea in Immunocompetent Adults

Pathogen	Antibiotic*†	Dose
Campylobacter	1. Ciprofloxacin	500 mg PO bid × 7 days
	2. Erythromycin	500 mg PO qid × 7 days
Salmonella	1. Ciprofloxacin	500 mg PO bid × 7 days
	2. TMP/SMX	160 mg/800 mg PO bid × 7 days
Shigella	1. Ciprofloxacin	500 mg PO bid × 7 days
	2. TMP/SMX	160 mg/800 mg PO bid × 7 days
Vibrio parahaemolyticus	1. Tetracycline or doxycycline	500 mg PO qid × 7 days
		100 mg PO qid × 7 days
E. coli 0157:H7	1. None recommended	
Enterotoxigenic *E. coli*	1. Ciprofloxacin	500 mg PO bid × 7 days
	2. TMP/SMX	160 mg/800 mg PO bid × 7 days
Plesiomonas hominis	1. TMP/SMX	160 mg/800 mg PO bid × 7 days
	2. Ciprofloxacin	500 mg PO bid × 7 days
Clostridium difficile		
Diarrhea	1. Metronidazole	250 mg PO qid × 10-14 days
	2. Vancomycin	125 mg PO qid × 10-14 days
Colitis	1. Metronidazole or vancomycin	500 mg PO qid × 10-14 days; 1 g IV q day
Aeromonas	1. TMP/SMX or tetracycline	500 mg PO bid × 7 days
	2. Ciprofloxacin	160 mg/800 mg PO bid × 7-14 days
		500 mg PO qid × 7-14 days
Giardia lamblia	1. Metronidazole	250 mg PO tid × 5 days
	2. Furazolidone	100 mg PO qid × 7-10 days
Entamoeba histolytica	Symptomatic intestinal disease	
	1. Metronidazole followed by iodoquinol	750 mg PO tid × 10 days; 650 mg PO tid × 20 days
	2. Paromomycin	500 mg PO tid × 7 days
Cryptosporidium	1. Paromomycin	500-750 mg PO qid × 14-21 days
	2. Indomethicin	50 mg PO tid
Isospora belli	1. TMP/SMX	160 mg/800 mg PO qid × 10 days then bid for 3 wk
Cyclospora cayetanensis	1. TMP/SMX	160 mg/800 mg PO bid × 7 days
Strongyloides stercoralis	1. Ivermectin	200 μgm/kg/PO day × 1-2 days
	2. Thiabendazole	50 mg/kg/day in two doses × 2 days (max 3 g/day)
Enterobius vermicularis	1. Mebendazole or pyrantel pamoate	100 mg PO × 1 dose, repeated after 2 wk
		11 mg/kg PO × 1 dose, (max 1 g) repeated after 2 wk
	2. Albendazole	400 mg PO × 1 dose, repeated after 2 wk

*Another quinolone agent, norfloxacin, can be substituted for ciprofloxacin in the treatment of diarrheas. The equivalent dosage is 400 mg bid.
†1 indicates drug of first choice; 2 indicates alternative drug(s).