



Foodborne Illness: What you Eat Can Kill You

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Objectives



- Identify at least 3 common causes of foodborne illness;
- Describe the clinical presentation specific to at least 3 types of foodborne illness;
- Discuss strategies to reduce the risk of acquiring a foodborne illness.

Case Study: Foodborne Illness

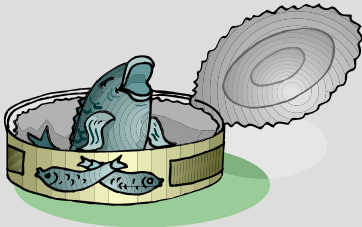
- 50 y.o. female had a sudden onset of intense facial flushing, headache, palpitations, bronchospasm with wheezing & dyspnea 10 min after eating a tuna burger at a local restaurant
- Presented to ED via private auto; self-administered albuterol & diphenhydramine 25 mg po prior to arrival
- Initial VS: HR 160 (SVT), BP 150/110, RR 40, temp 37C, pulse ox 96 on room air

Case Study: Foodborne Illness

- Immediate Interventions:
 - Oxygen
 - IV access / normal saline infusion
 - Diphenhydramine 25 mg IV push
 - Ranitidine 150 mg IV
 - Methylprednisolone IV
- Case Progression:
 - Intense, shaking chills began & then dissipated
 - Vital signs & skin color slowly returned to normal limits

Case Study: Foodborne Illness

- Differential diagnosis: anaphylaxis vs. foodborne toxin?



Case Study: Foodborne Illness

- Answer: A *chemical toxin* foodborne illness!
- Dx: Scombroid fish poisoning
- Etiology: Consuming improperly refrigerated tuna, mackerel, herring or mahi-mahi (fish from the Scombridae family)



Case Study: Foodborne Illness

- Scombroid Fish Poisoning Pathophysiology:
 - Bacterial decomposition converts "histidine" in fish flesh to histamine & other toxins (cadaverine & urocanic acid) – heat stable!
 - Cooking will NOT eliminate the toxin
 - Affected fish may have a peppery flavor or cause burning in the mouth when eaten

Case Study: Foodborne Illness

- Scombroid Fish Poisoning Pathophysiology:
 - Presentation varies with amount consumed
 - Case reports range from mild to severe (cardiogenic shock)
 - Often mistaken for anaphylaxis
 - Emergency treatment and/or hospitalization may be needed
 - Effects of toxin typically resolve in 4 to 48 hours

The Clinical Significance of Foodborne Illness

How safe is our food supply?



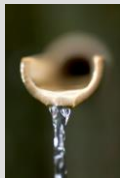
The Clinical Significance of Foodborne Illness

The statistics (CDC, 2015):

- >37 million cases of foodborne illness yearly in US
 - 31 major pathogens
 - Lead to >228,000 hospitalizations
 - Cause >2,600 deaths (CDC)
- Tracked by the Foodborne Disease Active Surveillance Network (FoodNet) of the CDC's Emerging Infections Program

The Clinical Significance of Foodborne Illness

- Global impact:
 - >2 million children die each year from diarrheal illness due to contaminated food & water



Contributing / Precipitating Factors

- Bacteria:
 - Used deliberately & safely in certain foods (cheese, yogurt, sauerkraut & pickles)
 - Pathogens pose greatest threat to food safety
 - Can produce toxins that poison food
 - Gastrointestinal illness most common
 - Symptoms can develop over hours to days
 - Treatment varies with the type of bacteria and/or toxin

Contributing / Precipitating Factors

■ Bacteria: Listeria

- Listeria outbreak in 2011 linked to whole *cantaloupes* from Jensen Farms, Colorado
- 146 people infected in 28 states with 30 deaths!
- Produces fever, sore muscles & GI symptoms (especially diarrhea); meningitis & septicemia in immunocompromised hosts
- Pregnancy: Listeria can cause premature birth, miscarriage & severe illness in newborn
- Prevented with safe food handling techniques



Contributing / Precipitating Factors

Parasites: Live on or in a host organism

- *Anisakis zoonosis* (larval nematode worm)
- Acquired from eating raw or undercooked fish (Pacific salmon, cod, herring, mackerel, halibut)
- Sensitizes host & causes allergic reactions to seafood that contains nematodes
- Invasive worms penetrate lining of stomach or small intestine; cause granulomas; can be removed via endoscope
- Usually resolves without intervention



Contributing / Precipitating Factors

Parasites:

- *Toxoplasma gondii*
- Causes toxoplasmosis
- Found in cat, rodent & bird feces
- May be present in undercooked or raw meat; cutting board or utensils may be contaminated
- Healthy people may be asymptomatic or have only flu-like symptoms; usually resolves spontaneously
- Serious parasitic infection occurs in unborn babies & the immunocompromised; may result in fetal abnormalities, encephalitis & death



Contributing / Precipitating Factors

Parasites:

- *Trichinella species*
- Causes trichinosis
- Transmission: eating under-cooked pork (often "pre-cooked, ready to eat" pork sausage)
- Asymptomatic to nausea, vomiting, diarrhea & fever in 1-4 weeks, then facial swelling, muscular & respiratory symptoms as parasites are deposited in tissues; immunologic response, encephalitis, myocarditis & VTE possible; death can occur (rare)
- Treatment: steroids & antiparasitic drugs



Contributing / Precipitating Factors

Parasites:

- *Ascaris* (Round worm); causes ascariasis
- Found in human feces & contaminated soil
- Acquired by eating unwashed fruit & vegetables
- Can cause diarrhea & vomiting; intestinal obstruction; worms may invade respiratory system
- Treatment: Anti-parasitic agents (anthelmintics)



Contributing / Precipitating Factors

Protozoa:

- *Cryptosporidium*
- Spread through contaminated milk, raw fruits, vegetables & fecal-oral transmission & drinking contaminated / swimming pool water
- Most common cause of water-borne illness in US
- Incubation period 2-10 days; lasts 10-15 days
- Nausea, cramping, prolonged episodes of watery diarrhea (1-2 weeks); very serious disease in the immunocompromised host



Contributing / Precipitating Factors

Protozoa:

- *Cryptosporidium*
- Caused largest infectious disease outbreak in 1 month in US history in 1993; Milwaukee municipal water supply was contaminated; 400,000 people moderately to severely ill
- Treatment: Supportive care; disease generally self-limited
 - Fluid & electrolyte replacement
 - Pharmacologic agents only in severe illness

Contributing / Precipitating Factors

■ Viruses:

- Transported by contaminated food or water into host, often by an infected food handler
- Difficult to detect in food
- Presence confirmed by epidemiological studies of disease outbreaks & detection of viruses in stool samples of carriers / affected individuals
- Viral carriers may be asymptomatic
- Food handlers who have had an enterovirus (esp. norovirus) may shed virus for *weeks*

Contributing / Precipitating Factors

- Viruses: Hepatitis A
- Fecal contamination of food & water
- GI symptoms, fever, malaise, jaundice, dark urine, clay-colored stools & joint pain in approx. 28 days
- Symptoms persist for < 2 months up to 6 months
- Children < 6 years may be asymptomatic; may not develop jaundice if symptoms do occur
- Prevention: Hepatitis A vaccine
- Post-exposure immune globulin may offer disease protection



Frozen berries sicken 118 in hepatitis A outbreak

Eight Western states are still reporting cases two weeks after recall

Elizabeth Weise
@eweise
USA TODAY

A nationwide outbreak of hepatitis A linked to frozen berries has sickened 118 people in eight states and sent 47 to the hospital, the Centers for Disease Control and Prevention reported Tuesday.

Although the berries were recalled June 3, people are still getting sick. A



Contributing / Precipitating Factors

- **Viruses:** Norwalk virus (norovirus):
- Spread by consuming raw oysters / shellfish, contaminated water, salad dressing, cake icing, ice or person-to-person
- Nausea, vomiting, diarrhea, cramps in 12-48 hours
- Large outbreaks common; generally self-limited course with complete recovery
- More common in winter
- Often impacts cruise lines & LTC facilities



Contributing / Precipitating Factors

- **Viruses:**
- H5N1 influenza (avian influenza): acquired by consuming or handling contaminated raw or undercooked poultry or eggs



Contributing / Precipitating Factors

- Fungi, yeasts & molds
- Chemical toxins – may be “heat-stable”
- Heavy metals, chemicals & pesticides
- Toxic mushrooms, plants & fish



Contributing / Precipitating Factors

- Contamination occurs during harvesting, processing, packaging & preparation
 - Poor conditions in processing plants
 - Lack of food worker hand hygiene
 - Inadequate refrigeration / temperature control
 - Inadequate cooking time / temperature
 - Contaminated water used in food preparation
 - Inadequate cleansing of cookware, serving ware & utensils

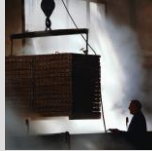


In the News...



Contributing / Precipitating Factors

- Products may be shipped nation-wide, leading to multi-state outbreaks of illness
 - Outbreaks from raw produce especially difficult to track due to perishable nature of food & rapid consumption



CDC Multistate Foodborne Illness Outbreak Investigations: 2016

- Alfalfa sprouts – Salmonella and E. coli
- Flour – E. coli
- Frozen vegetables – Listeria
- Raw milk – Listeria
- Wonderful Pistachios – Salmonella
- Raw meal organic shake & meal products -- Salmonella
- Packaged salads – Listeria

Common Types of Foodborne Illness

- Food allergy
- Botulism
- Staphylococcal enteritis
- Non-dysenteric gastroenteritis
- Bacterial dysentery



Food Allergy

- Food may trigger an antigen – antibody reaction
- Common: nuts, shellfish, eggs, berries, chocolate & dairy
- Clinical presentation: mild (rash) to severe
- Anaphylaxis: true medical emergency; may be fatal



Food Allergy

- Pathophysiology
 - Release of inflammatory mediators, including histamine, serotonin & bradykinin, causing:
 - Vasodilation, increased capillary permeability
 - Urticaria
 - Bronchoconstriction to bronchospasm
 - Decreased BP & cardiac output, progressing to cardiovascular collapse

Food Allergy

- Treatment
 - ✓ Epinephrine IM or IV
 - ✓ Antihistamines: H1 & H2 blockers
 - Diphenhydramine or similar agent (H1)
 - Ranitidine or cimetidine (H2)
 - ✓ Bronchodilator
 - ✓ Steroids
 - IV followed by an oral regimen

Botulism: Etiology



- Cause: Clostridium Botulinum toxin from an anaerobic, spore-forming gram-positive bacteria
- Found in dust, food, water, soil, vapors & sewage
- Enters body via mucosal membranes, wounds (particularly from IV black tar heroin injection) & intestines through ingestion
- Often linked to home-canned vegetables, meats & potatoes (food may have metallic taste)
- Causes neuroparalytic disease: decreases release of acetylcholine & produces blockade effect at neuromuscular junction

Botulism: Clinical Presentation

- Effects vary with serotype & amount of toxin:
 - Begin 2-36 hours after ingestion
 - ★ Oculobulbar muscle weakness (blurred vision; dilated, non-reactive pupils; drooping eyelids, ophthalmoplegia)
 - Dysarthria, dysphagia, drooling
 - ★ Descending pattern of weakness: Upper then lower extremities
 - Respiratory muscle fatigue / respiratory arrest
 - Lab: (+) toxin in serum, plasma or GI contents

Botulism: Treatment

- Prompt recognition! Take a food history!
- Bivalent *botulinum* equine antitoxin: potential for hypersensitivity; perform skin test before dosing
- Early treatment will halt further progression, but *will not reverse effects*
- Remainder of treatment is supportive; may include mechanical ventilation, critical care.
- Neuro rehab required; effects of toxin may last weeks to months
- Botox, anyone? ☺

Staphylococcal Enteritis

- Staphylococcus colonizes human skin; gastroenteritis caused by poor hand washing during food preparation
- Proliferates in high protein food containing dairy, meat & mayonnaise left at room temperature
- Produces **heat-stable bacterial toxin**
- **Can not be killed by re-heating or freezing**



Staphylococcal Enteritis

- **Presentation:** acute onset of nausea, severe vomiting, diarrhea & abdominal cramps; headache & myalgias may occur; will affect all who ate contaminated food
- **Treatment:** Supportive—fluid & electrolyte replacement primary goal
- **Self-limiting; antibiotics unnecessary; toxin is pre-formed & can not be eliminated**
- **Prevention:** hand sanitation & not leaving perishable foods at room temperature

Non-Dysenteric Gastroenteritis



- Organisms colonize inner-lining of small bowel via fecal-oral route, e.g., enterotoxigenic E. coli, Vibrio cholera, viruses
- Infection causes secretion of water & electrolytes into intestinal lumen
- **Non-bloody diarrhea illness** 12 to 72 hours after ingestion of contaminated food or water
- May be mild & self-limited, to explosive & life-threatening (up to 1 liter per hour)
- **Presentation:** profuse watery diarrhea, nausea, abdominal cramping & malaise; low grade fever

Non-Dysenteric Gastroenteritis



- **Treatment:**
 - Replacement of fluid & electrolytes (WHO oral rehydrating solution; sports drinks diluted to half strength, Pedialyte; IV replacement in severe cases)
 - Anti-diarrheal medications:
 - Loperamide (Imodium) for non-bloody diarrhea;
 - Bismuth subsalicylate (Pepto-Bismol®, Kaopectate®) for mild to moderate cases (especially effective for “travelers diarrhea”)

Non-Dysenteric Gastroenteritis



- **Treatment:**
 - Antiemetics:
 - Metoclopramide (Reglan)
 - Promethazine (Phenergan)
 - Ondansetron (Zofran); ODT form available
 - Antibiotics (severe cases)
 - Ciprofloxacin (drug of choice); or
 - Azithromycin; or
 - Trimethoprim / sulfamethoxazole

Bacterial Dysentery



- Fecal-oral transmission of invasive organisms that produce more severe symptoms, including bloody diarrhea & fever
 - Salmonella, Shigella, Campylobacter, enterohemorrhagic E. coli, Yersinia enterocolitica & Aeromonas hydrophilia
 - Spread from eating raw eggs, raw or undercooked poultry & meat, or drinking contaminated water, or person-to-person
 - Shigella – most severe form due to potent & deadly Shiga toxin (hemolytic uremic syndrome)

Bacterial Dysentery



- Presentation:
 - Acute onset of severe, intermittent abdominal cramps 8 hours to 8 days after ingestion
 - Copious diarrhea with mucous or blood
 - High fever & myalgias
 - Lower abdominal pain with rebound tenderness
 - Bacteremia & sepsis can develop, especially with Salmonella & Shigella infection
 - Symptoms persist for 1 to 10 days

Bacterial Dysentery



- Treatment:
 - Oral rehydration is of primary importance; IV fluid replacement in severe cases
 - Antibiotic drug of choice: Ciprofloxacin
 - Antidiarrheal medications classically contraindicated, but (depending on setting, e.g., wilderness) may be given to control diarrhea along with antibiotics
 - Bismuth subsalicylate (Pepto-Bismol®, Kaopectate®) is safe, but will slow antibiotic absorption

Toxic Plants: Jimsonweed (Datura Stramonium)

- aka Devil's Trumpet, thorn apple, Jamestown weed, stinkweed, locoweed, datura, moonflower, Hell's Bells



Toxic Plants: Jimsonweed
(Datura Stramonium)



Toxic Plants: Jimsonweed
(Datura Stramonium)



Jimsonweed (Datura stramonium)

- Case Report (MMWR Weekly Report, Feb 5, 2010)
- Family of 6 in Maryland ate "homemade stew" with potatoes & leaves from plants in backyard
- All 6 family members found to be laughing, confused, hallucinating, dizzy & thirsty by another family member who visited
- EMS called; 6 family members taken to ED
- Investigation by toxicologists identified Jimsonweed in stew & growing wild in yard
- All 6 family members were admitted to hospital (5 out of 6 to ICU) for 3 to 5 days; all recovered

Jimsonweed (*Datura stramonium*)

- Class: **Deliriant, anti-cholinergic in the Nightshade family**
- Toxicity: *All parts* of plant contain dangerous levels of poison; may be fatal if ingested by humans or animals
- Highest concentration of poison in seeds (0.1 mg atropine *per seed*)
- Active ingredients: tropane alkaloids (atropine, hyoscyamine, scopolamine)

Jimsonweed (*Datura stramonium*)

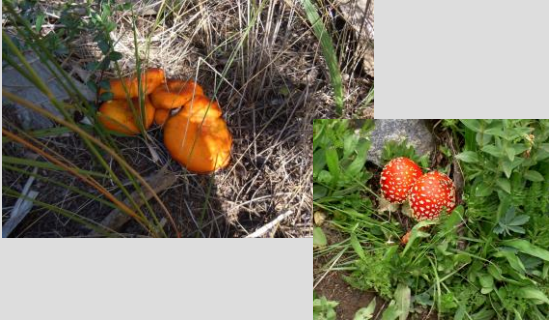
- Datura intoxication: *Delirium*
- Altered mental status, hallucinations, amnesia
- Inability to differentiate reality from fantasy, incoherence
- Hyperthermia
- Tachycardia, tachypnea
- Aggressive to violent behavior
- Anticholinergic crisis: severe mydriasis / painful photophobia, blurred vision, urinary retention



Jimsonweed (*Datura stramonium*)

- Antidote: **Physostigmine** (only indicated in severe cases to reverse anticholinergic toxicity)
- **Benzodiazepines** (e.g., Lorazepam (Ativan) for anxiety & agitation
- Supportive care: cardiac monitoring, oxygen, intensive care unit admission, bedside sitter / safety companion
- Note: green potatoes & sprouting potatoes contain a similar toxin to Jimsonweed! Do not eat green potatoes, leaves or their sprouts!

Toxic Foods: Mushrooms



Toxic Foods: Mushrooms



- Many varieties of toxic mushrooms in the world
- Toxic mushroom ingestion occurs in foragers, children, people seeking a "high" & those with suicidal intent
- Toxic & non-toxic varieties may look alike!
- Proper identification of non-toxic mushrooms requires focused study with experts
- Sometimes the difference between toxic & non-toxic varieties of mushrooms can only be found after *study under a microscope!*

Toxic Mushroom: Amanita muscaria

- Hallucinogen: various religions & cultures used Amanita muscaria over the centuries to achieve "enlightenment"
- Red mushroom with white spots that can *wash off* in rain



Toxic Mushroom: Amanita muscaria



Amanita muscaria



- Muscarinic poison – neurotoxic effects
- Stimulates cholinergic receptors, mimicking action of acetylcholine
- Stimulates GI secretions, contraction & peristalsis
- Urinary bladder contraction, bronchospasm, salivation & lacrimation
- Cardiac effects range from conduction abnormalities, usually with bradycardia
- CNS effects: altered sensorium, headache, visual disturbances & ataxia

Amanita muscaria: Clinical Presentation

- Effects in 15 to 30 minutes after ingestion
- Delirium, hallucinations, constricted pupils
- Bradycardia & conduction abnormalities
- Copious bronchial secretions, bronchospasm (may lead to respiratory failure)
- Salivation, lacrimation, urination, diaphoresis
- Abdominal pain, nausea, emesis, diarrhea
- Effects resolve spontaneously in 12 to 24 hours
- Death occurs from respiratory failure or CV collapse

Amanita muscaria: Treatment

- Supportive care: oxygen, IV access, monitoring, suctioning
- Atropine only to control severe secretions (not prophylactically – may worsen CNS effects in Amanita mushroom toxicity); no upper limit on atropine dose
- Endotracheal intubation if airway protection is needed
- Fluid & electrolyte replacement



Advice for the Road: Tips for Avoiding Illness

- Wash your hands
- Buy food from reputable sources
- Avoid eating raw or undercooked seafood & meat
- Cook pork to an internal temperature of 155F
- Thoroughly wash unpeeled fruits & vegetables in clean water
- Store refrigerated left-overs no more than 4 days
- Don't eat anything you can't definitively identify or that does not come from a trusted source (e.g., mushrooms, plants, food items)

Advice for the Road: Tips for Avoiding Illness

- When traveling to under-developed parts of the world, prevent "Travelers Diarrhea"
 - Piping hot, thoroughly cooked food is safest
 - Tap water, ice cubes, fruit juice, fresh salads, unpasteurized dairy products, sauces & foods in open buffets are "high risk" for causing illness
 - Peel fruits & vegetables yourself (locals may not have clean hands or have washed produce in contaminated water)
 - Choose bottled carbonated water over bottled tap water

Advice for the Road: Tips for Avoiding Illness

Chemoprophylaxis against Travelers Diarrhea

- Bismuth subsalicylate
 - Two tabs chewed four times a day
 - Avoid in those who should not take aspirin or are on anticoagulants. Black stool & tongue may occur.
- Fluoroquinolones : Ciprofloxacin 500 mg PO daily
 - GI upset, rash & allergic reaction
- Rifaximin 200 mg PO daily: Well tolerated because rifaximin is not absorbed.

From Auerbach, P.S. (2012). *Wilderness Medicine* (6th ed.). Philadelphia: Elsevier.

When in Doubt, Throw it Out!

■ Bon Appetite!



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