

Food Poisoning

Case #9

Have you ever taken a chance on Aunt Martha's potato salad that's been sitting in the sun for a few hours at the family picnic? Find out what happens when employees feast on a catered outdoor picnic. You may think twice before eating again!

Case Objectives

- 1) Define and/or differentiate the following terms:
 - a. [gastroenteritis](#)
 - b. Enterotoxin
 - c. Exotoxin
 - d. Cytotoxin
 - e. Intoxication
- 2) List the 3 main causes of bacterial gastroenteritis.
- 3) List bacteria that cause food poisoning by:
 - a. Enterotoxins
 - b. Exotoxins
- 4) Define the following terms associated with digestive function (use an Anatomy and Physiology text).
 - a. Peristalsis
 - b. bile production
 - c. stomach acid
 - d. villi and microvilli
- 5) List foods that are high-risk for bacterial food poisoning. Define why these foods are high risk.
- 6) Define symptoms of *Salmonella* food poisoning.
- 7) Define diagnostic tests to determine bacterial food poisoning. List other tests that assess the seriousness of the patient's condition.
- 8) Define dehydration as it relates to food poisoning. List diagnostic tests that indicate the patient is in a state of dehydration. Define conditions that may result from dehydration.
- 9) Summarize an overview of treatments provided for the patients in this case study to include treatments for dehydration.
- 10) Outline the role of public health services in outbreaks of food poisoning.

- 11) Define the roles of clinical laboratory scientists, nursing, and physicians in diagnosing and treating a case of food poisoning.
- 12) Compare the onset time, symptoms and sources of staphylococcal (*Staphylococcus aureus*) food poisoning and that of *Salmonella*.
- 13) Define precautions that can be taken to prevent food poisoning to include:
 - a. Purchasing and storing food
 - b. Preparing food
 - c. Serving food
 - d. Storing leftovers
- 14) Define populations at higher risk for contracting Salmonellosis.

On a Friday afternoon in June of 1998, 65 individuals attended a farewell party for an employee of a local company. The ages of the people attending ranged from 4 to 78 years of age. The event was held in a nearby city park and food was provided by a local catering company. Festivities were planned to occur most of the afternoon and the [food](#) was brought to the party by the caterers at approximately 12:30 p.m., and placed on a long table near the picnic area. A canopy was erected over the serving table. Once set up, the caterers left the area and people were instructed to eat whenever they were hungry.

Within 20-24 hours after the food had been served, several people began to experience vomiting and diarrhea with moderate to severe abdominal cramps, headache and muscle aches. Some of the elderly patients experienced some typical symptoms of dehydration, such as thirst and dryness of the mucus membranes. Some were taken to the hospital emergency room by family members since their symptoms appeared after most clinic facilities were closed for the business day. By the next morning, over two dozen additional individuals called their health care providers or family physicians complaining of symptoms of malaise, vomiting, diarrhea and headaches. Three older patients were admitted to the hospital to limit the dehydration from the vomiting and diarrhea.

- 1) *What symptoms are several party attendees exhibiting?*

Instructor's Notes:

As we can see from this initial information, these multiple patients all complaining from similar symptoms that strongly suggests a classical case of community-acquired food poisoning. Based on this, several series of events will occur: First, the patients will be treated for their symptoms and tested for agents of food poisoning. Second, the State and/or County Health Departments will need to investigate to determine the source of the poisoning. Since the food was prepared by a licensed commercial agency, public health personnel will need to see that corrective actions are taken if necessary. As an introduction to the nature of how bacteria cause food borne illness, we have included a brief [primer on bacterial food poisoning](#) to help clarify these mechanisms.

- 2) *What are the 3 main causes of bacterial gastroenteritis?*
- 3) *What is the most common cause of bacterial food poisoning?*
- 4) *What are the 2 types of bacterial toxins?*
- 5) *How do enterotoxins contribute to the pathogenicity of bacteria?*

- 6) *How is a cytotoxin more damaging than other enterotoxins?*
- 7) *What entity can be tested for in a patient's feces that demonstrates the invasiveness of a bacterium?*
- 8) *List some bacteria that can cause food poisoning through enterotoxins.*
- 9) *How does an enterotoxin differ from an exotoxin?*
- 10) *List some examples of diseases caused by exotoxins.*
- 11) *What precautions can be taken to prevent diseases caused by exotoxins?*

As an example of how patients are treated for food poisoning, we'll follow a 69 year old female that was admitted to the hospital. She had the following tests ordered on admission:

- serum electrolyte panel
- complete blood count
- exam for fecal leukocytes ([click to see relevant results](#))
- culture of the stool and vomitus for bacterial pathogens

12. *Based on this patient's lab results, can the physician determine if this is an invasive or noninvasive bacteria?*
13. *Does this patient show clinical signs of dehydration?*

Instructor's Notes:

The laboratory values reveal a patient in a slight state of dehydration. As you recall, dehydration results due to an excessive loss of water and essential electrolytes from the body's tissues. The intense vomiting and diarrhea and subsequent water loss will cause sodium levels to fall below the low normal of 135 mEq/L, a condition called hyponatremia. If the dehydrated state is prolonged, shifts of essential cations from the intracellular environment to the extracellular will occur, leading to cardiac and respiratory failure and other conditions such as acidosis or alkalosis.

The patient's white blood cell count is also elevated due to the inflammatory process occurring in the intestinal tract. The hematocrit is slightly elevated due to the dehydrated state of the patient. The fecal leukocyte test is positive.

14. *What are possible problems resulting from dehydration?*

(The original site for the following link has changed. Answer the questions the best that you can from the new site. You can check your answers with the "answers to case questions link.)

Overview of [pathogenic bacteria](#) capable of causing food poisoning.

15. *Do bacteria or their toxins cause illness associated with food-poisoning?*
16. *How can food-borne illnesses be prevented?*
17. *List practices that can help prevent food-borne illness when purchasing and storing food.*
18. *List practices that can help prevent food-borne illness when preparing food.*
19. *List practices that can help prevent food-borne illness when serving food.*
20. *List practices that can help prevent food-borne illness when handling leftovers.*

Culture Report:

After overnight incubation, the culture from the patient's fecal sample showed nearly a pure growth of *Salmonella enteritidis*. The sample was submitted to the State Health Laboratory for a definitive serological identification. In the meantime 11 more cultures from other patients that sought medical care showed identical culture results, presumptively confirming *community-acquired Salmonella* food poisoning.

21. *In a case of Salmonellosis, how long does it take after exposure before symptoms are evident?*
22. *When is Salmonellosis life threatening?*
23. *What populations are most susceptible to severe illness?*
24. *How is Salmonella spread?*
25. *How are Salmonella infections diagnosed.*
26. *What health care professional would be responsible for identifying the causative agent of the gastroenteritis?*
27. *How can Salmonella infections be treated?*

Instructor's Note:

Once all the information had been compiled, Salmonella species, serotype enteritidis was recovered from the stool samples of 29 of the 65 individuals attending the picnic. Serological grouping (fingerprinting) of the bacterium in the State's Public Health Lab confirmed Salmonella as the cause of the epidemic. State health personnel did extensive culturing of the foodstuffs served at the picnic. Unfortunately, most of the "leftovers" had been discarded and no Salmonella was recovered from catering service sources. Catering service personnel were tested for Salmonella, as some cases can be traced to asymptomatic carriers. All seven of the service's employees tested negative.

Based on past outbreaks, the most likely sources were either the potato salad since it containing eggs, or possibly the cold meats. Roughly 80% of food-borne Salmonella illness is associated with contaminated dairy or poultry products. Interviews conducted by public health personnel revealed that all of the stricken patients had consumed potato salad and either beef or turkey as their sandwich meat choice. Unaffected individuals had not consumed either of these foods. In all, 37 of the 65 attendees become ill. Fifteen of the affected individuals did not seek medical care and were notified by public health officials to have fecal cultures performed. Of these 15, 12 tested positive for the responsible Salmonella strain. Ages of the affected individuals ranged from 6 years to 78 years of age.

The patient was given 2 liters of [Ringer's lactate](#) to restore normal fluid/electrolyte balance and released the following day. Most of the patients were told to drink clear fluids. In patients with severe vomiting, a suppository with medications such as chlormpromazine is given to help alleviate symptoms. Additionally, medications that help reduce the symptoms of severe diarrhea were prescribed. Those patient's with severe cases were hospitalized and started on antibiotics.

28. *What is a lactated ringer?*
29. *Why are lactated ringers given?*
30. *What health care professional would be responsible for administering a lactated ringer solution to a patient?*

Case Summary

1. Of the 65 people attending a retirement picnic, 37 patients ranging in age from 6 to 78 years acquired symptoms of classical community-acquired food poisoning. Gastroenteritis can be caused by bacterial enterotoxins or exotoxins. In this case, the causative agent was determined to be *Salmonella* species, serotype *epidermitidis*, which produces enterotoxins.
2. Symptoms consisted mainly of acute abdominal cramps, diarrhea and vomiting. Only three elderly patients were admitted to the hospital for overnight observation and treatment for mild dehydration.
3. The diagnosis is made by isolating the causative agent from the patient's stool. New laboratory techniques make this possible within 24 hours. A fecal white blood count determines if the organism is invasive. Serum electrolytes and hematocrit help determine the degree of dehydration.
4. Treatment of *Salmonella* food poisoning consists of managing the main symptoms (vomiting and diarrhea), and when indicated, replacement of fluids and electrolytes. Hospitalization is only required when patients exhibit severe symptoms, or have an underlying condition (e.g. poor renal function or gastrointestinal disease) which could worsen the illness. Antibiotics are not indicated except in severe cases when the bacteria spreads to the bloodstream or other body sites.
5. Even though public health agency personnel conducted through examination of the company which provided the picnic foods, the source of the *Salmonella* could not be confirmed by standard examination procedures. Suspected foods were sliced sandwich meats (turkey and roast beef) and the potato salad. *Salmonella* is prevalent in nature, found in meats, dairy products, especially eggs (poultry carry *Salmonella* in their intestinal tracts), and reptiles such as lizards and turtles. Every year, approximately 40,000 cases of salmonellosis are reported in the United States. Because many milder cases are not diagnosed or reported, the actual number of infections may be twenty or more times greater. Salmonellosis is more common in the summer than winter. Children are the most likely to get Salmonellosis. Young children, the elderly, and the immunocompromised are the most likely to have severe infections. It is estimated that approximately 1,000 persons die each year with acute salmonellosis. " Taken from the CDC Public health agencies, county state and federal all have distinct guidelines for consumers and food vendors. State agencies require food handlers permits and facilities preparing and serving food are regularly inspected for compliance to established guidelines. In spite of this, there are tens of thousands of cases of bacterial food poisoning each year, many unreported.
6. Prevention of food poisoning in general requires careful attention during food processing and preparation. Un-refrigerated foods such as salads prepared with dairy products such as mayonnaise should be avoided. Meats, especially cold meats that have been allowed to sit in warm environments are also a common source. Unwashed vegetables can also be a source of *Salmonella*.
7. Public health personnel have the responsibility to investigate any public outbreak of disease. In this case they investigated the catering company which they could shut down if they found

they were at fault. They also must follow all of the cases involved and inform others who may have been at the picnic and may be at risk. The emergency and family physicians treated the dehydration, ordered necessary laboratory tests, and prescribed antibiotics to those patients with severe infections, hospitalizing patients when necessary. Nursing personnel monitored severe cases, administered lactated ringers to alleviate dehydration and other medications. Clinical laboratory personnel cultured the patients' stool samples, identified the Salmonella, and tested for appropriate antibiotics.

Answers to Case Questions

Question 1

Vomiting and diarrhea with moderate to severe abdominal cramps, headache and muscle aches, and dehydration.

Question 2

Ingestion of viable (living) bacteria, ingestion of bacterial toxins (intoxication), dissemination of organisms from intestine to other tissues and organs.

Question 3

Ingestion of viable bacteria.

Question 4

Enterotoxins and exotoxins.

Question 5

Facilitate ability of bacteria to invade tissue triggering inflammation.

Question 6

A cytotoxin can directly destroy the hosts intestinal tissue.

Question 7

White blood cells.

Question 8

Salmonella, Shigella, Staphylococcus aureus.

Question 9

An exotoxin is a toxin produced externally from the bacteria either outside the host or after the bacterium have colonized the intestinal tract. The toxin can be ingested through contaminated food or drink.

Question 10

Botulism, cholera.

Question 11

Adequate cooking of food.

Question 12

This is an invasive bacteria because there are elevated WBC's in the patient's feces sample.

Question 13

Yes. Serum electrolytes are slightly lower than usual and the hematocrit (the ratio of RBC's to plasma) is elevated showing more cells and less fluid in the blood.

Question 14

Acidosis or alkalosis from a shift of essential electrolytes. This can lead to cardiac arrest or respiratory failure.

Question 15

Toxins

Question 16

Sanitation and proper heating and refrigeration practices will help prevent food- borne illness.

Question 17

- 1) Keep packages of raw meat and poultry separate from other foods, particularly foods to be eaten without further cooking. Use plastic bags or other packaging to prevent raw juices from dripping on other foods or refrigerator surfaces.
- 2) Buy products labeled "keep refrigerated" only if they are stored in a refrigerated case. Refrigerate promptly.
- 3) Buy open-dated products only if label sell-by, use-by or pull-by date has not expired and packaging is sound.
- 4) Buy unpackaged meat or poultry from deli refrigerated cases only if it is not in contact with other foods, especially raw foods.

Question 18

- 1) Wash hands (gloved or not) with soap and water for 20 seconds before preparing foods and after handling raw meat or poultry, touching animals, using bathroom, changing diapers, smoking or blowing nose.
- 2) Thaw only in refrigerator, under cold water changed every 30 minutes, or in microwave (followed by immediate cooking).
- 5) Scrub containers and utensils used in handling uncooked foods with hot, soapy water before using with ready-to-serve foods. Use separate cutting boards to help prevent contamination between raw and cooked foods.
- 6) Stuff raw product immediately before cooking, never the night before.
- 7) Don't taste meat, poultry, eggs, fish or shellfish when it's raw or during cooking. Use pasteurized milk and milk products.
- 8) Use a meat thermometer to judge safe internal temperature of meat and poultry over 2 inches thick (160°F or higher for meat, 180°F or higher for poultry). If your microwave has a temperature probe, use it.
- 9) For meat or poultry less than 2 inches thick, look for clear juices and lack of pink in the center as signs of "doneness."
- 10) When using slow cookers or smokers, USDA advises starting with fresh rather than frozen, chunks rather than roasts or large cuts, and recipes that include a liquid. Also, check internal temperature in three spots to be sure food is thoroughly cooked.

- 11) Avoid interrupted cooking. Never partially cook products, to refrigerate and finish later. Also, don't put food in the oven with a timer set to begin cooking later in the day.
- 12) If microwave cooking instructions on product label are not appropriate for your microwave, increase microwave time for product to reach a safe internal temperature. Rotate, stir and/or cover foods to promote even cooking during microwaving.
- 13) Boil all home-canned vegetables and meats 10 minutes plus 1 minute per 1,000 feet before tasting.

Question 19

- 1) Wash hands with soap and water before serving or eating food. Serve cooked products on clean plates with clean utensils and clean hands.
- 2) Keep foods to be served hot above 140°F and foods to be served cold below 40°F.
- 3) In environmental temperatures of 90°F or warmer, leave cooked food out no longer than one hour before reheating, refrigerating or freezing. At temperatures below 90°F, leave out no more than two hours

Question 20

- 1) Wash hands with soap and water before handling leftovers and use clean utensils and surfaces.
- 2) Remove stuffing before cooling or freezing.
- 3) Refrigerate or freeze cooked leftovers in small, covered SHALLOW containers within two hours after cooking. Leave airspace around containers to help assure rapid, even cooling.
- 4) Avoid tasting old leftovers to determine safety.
- 5) If reheating leftovers, cover and reheat to appropriate temperature before serving (a rolling boil for sauces, soups, gravies, "wet" foods; 165°F for all others).
- 6) If in doubt, throw it out. Discard outdated, unsafe or possibly unsafe leftovers in garbage disposal or in tightly wrapped packages that cannot be consumed by people or animals.

Question 21

12-72 hours.

Question 22

If it spreads to the bloodstream and other body sites.

Question 23

Elderly, infants, and persons with impaired immune systems.

Question 24

Through the feces of people or animals. Salmonella are usually transmitted to humans by eating foods contaminated with animal feces.

Question 25

By culturing Salmonella from the stool of an infected person.

Question 26

Clinical laboratory scientist

Question 27

No treatment is necessary unless there is severe dehydration of the bacteria spread from the intestinal tract. I.V. fluids are given to rehydrate and antibiotics administered if the bacteria has spread.

Question 28

Fluid that contains electrolytes in about the same concentrations as blood.

Question 29

Expand blood volume, provide electrolytes.

Question 30

Nursing personnel.

Health Professionals Introduced in this Case

[Emergency Physician](#)

[Family Physician](#)

[Nursing](#)

[* Public Health Personnel](#)

[Clinical Laboratory Scientist](#)

**Provides a link the professions serving the public's health. Related links may be found in the Additional Resources section.*

Additional links of Interest

[Medmicro](#) (Chapter21). A higher level description of the nature of *Salmonella*. This site is still being constructed, but those students interested in microbiology should take a look.

[Mereck Manual](#) a summary of the pathophysiology of gastroenteritis. The Mereck manual is written at a higher level than is needed for this case, but it does present other causes of gastroenteritis other than *Salmonella*.

[Phlinks](#). This is the UCLA website for their Public Health programs. It also contains links to other schools of epidemiology and public health and should provide the student interested in a career with some useful information.