

FOODBORNE ILLNESSES

By James A. Butler M.D., FACP, CAPT MC USN
Chief, Gastroenterology Service
National Naval Medical Center
and
Greg Martin, M.D.
Chief, Infectious Disease Service
National Naval Medical Center

1. What are foodborne diseases?

Foodborne illnesses are caused by organisms or harmful chemicals in the food we eat and drink. Most of these illnesses are caused when certain bacteria, viruses or parasites contaminate food. Others occur when food is contaminated by harmful chemicals or toxins. Over 250 different foodborne diseases have been described. It's not surprising that since most of these infections or chemicals enter the body through the stomach and intestines, the most common symptoms are nausea, vomiting, diarrhea and abdominal discomfort.

2. What are the most common types of food borne illnesses?

Around a hundred years ago, typhoid fever, tuberculosis and cholera were some of the most common diseases caused by bacteria contaminating food and water. Improvements in food processing and water treatment have almost eliminated these problems in the United States at the present time. Today, other bacteria and viruses have become common causes of foodborne disease, including *Campylobacter*, *Salmonella*, *E. coli* O157:H7, *Shigella*, *Clostridium botulinum*, Hepatitis A and Calciviruses. A bacteria called *Vibrio parahaemolyticus*, and a parasite called *Cyclospora* have been found to be the cause of a few recent outbreaks of food borne illnesses.

Campylobacter

Campylobacter is the most common bacteria causing food borne diarrhea in the world. These bacteria live in the intestines of birds, and can often contaminate raw poultry such as chicken. Eating undercooked chicken, or eating food contaminated by juices from raw chicken are common ways of contracting this illness. Diarrhea that is often bloody, abdominal cramps and fever are common symptoms. Most people recover from *Campylobacter* diarrhea with no special treatment. The illness can also be treated with antibiotics such as erythromycin, ciprofloxacin or azithromycin. Rarely, patients can develop arthritis after an infection with *Campylobacter*. A small number of people develop a type of paralysis called Guillain-Barre' syndrome 2-4 weeks after recovering from *Campylobacter* infection.



Escherichia coli O157:H7

Escherichia coli (E. coli) bacteria are normally found in everyone's colon, and most types of E. coli cause no problems at all. Certain types of E. coli can however cause serious illness, most commonly diarrhea. E. coli O157:H7 is a certain type of E. coli that lives in the intestines of mammals such as cattle. Humans become ill when they eat food contaminated by feces of animals infected with this organism. Hamburger meat seems to be a common source, as the grinding process allows organisms that were only on the surface of meat to be mixed throughout. Also, one infected cow can contaminate a large amount of hamburger as meat from many cattle is often mixed together. Outbreaks of E. coli O157:H7 have also been caused by eating contaminated salami, lettuce and alfalfa sprouts, or drinking unpasteurized milk and apple juice, and contaminated well water.

E. coli O157:H7 can cause severe and bloody diarrhea with painful abdominal cramps. Most people recover without problems in 5 to 10 days. Antibiotics are not particularly helpful. Less than one in twenty patients, most commonly children, can develop a severe complication with low blood count, bleeding, and kidney failure, called hemolytic uremic syndrome.

Enterotoxigenic E. coli is another type of E. coli that can cause severe watery diarrhea. It is very common in developing countries, where it's often spread on unwashed fruits and vegetables, and in drinking water. It is probably responsible for the majority of traveler's diarrhea, and is very likely the leading cause of childhood diarrhea in developing countries.

Salmonella

Salmonella is a bacterium found in the intestines of birds, reptiles and mammals. It can be spread through eating raw poultry, eggs, meat, and unwashed fruit. A person with this infection usually develops fever, diarrhea and abdominal cramps. Most people get better on their own, and do not need medication. Some sicker patients require antibiotics, intravenous fluids and hospital admission. In people with weakened immune systems, salmonella can get into the bloodstream and cause severe illness and even death. Occasionally, people recovering from salmonella infection can develop irritated eyes, painful joints and pain with urination, a condition called Reiter's syndrome. Some people infected with salmonella can have no symptoms at all, but become chronic carriers who can spread disease to others. "Typhoid Mary" Mallon, for example, was a cook in the early 1900's, who was never sick with salmonella, but had salmonella bacteria in her stool. Over the course of many years, many people she cooked for became ill, probably from bacteria passed to food from her hands.

Shigellosis

Shigellosis, also known as bacillary dysentery, is caused by Shigella bacteria. It is also spread through eating contaminated food and drink. Persons with this infection develop



fever, bloody diarrhea, and abdominal pain. Although patients can usually recover without any specific treatment, many patients are treated with antibiotics once they are diagnosed.

Botulism

Botulism is a disorder caused by a toxic chemical produced by a bacterium called *Clostridium botulinum*. This bacteria grows best in sealed containers such as cans that have not been heated enough to kill the botulinum spores. The bacteria grows best where there is little or no oxygen. It produces a toxin that can cause paralysis, breathing failure, and even death. Patients ingesting this toxin can develop double vision, drooping eyelids, slurred speech, difficulty swallowing, and difficulty breathing.

3. What foods are most likely to carry illnesses?

Uncooked meat, raw eggs, and unpasteurized milk are the most likely foods to be contaminated. Foods such as ground beef, pooled raw eggs or unpasteurized milk, which are prepared by combining sources from many different animals, are especially problematic, as a whole batch can be contaminated by one infected animal. Vegetables that are eaten raw are also a problem, as they can be contaminated by washing with impure water or by fertilization with manure from infected animals. Raw shellfish are easily contaminated by sewage because these animals are filter feeders that feed by straining large quantities of seawater.

Even properly prepared food can be cross contaminated when juices from raw foods are dripped onto cooked food or when utensils or cutting boards used for raw food are also used for cooked food.

4. How can we prevent food borne illnesses?

The Centers for Disease Control has a few simple recommendations for how to decrease the risk of developing a foodborne disease.

1. Cook meat, poultry and eggs thoroughly
2. Separate cooked and uncooked food. Avoid cross-contamination by not using platters or utensils contaminated by raw foods for cooked foods. Put cooked foods on clean platters, not the ones that held the raw meat.
3. Chill leftovers promptly. Don't leave food out for more than 4 hours
4. Clean produce. Wash hands before preparing food and immediately after handling raw foods.
5. Report suspected food borne illness to the local health department.



WATERBORNE ILLNESS

5. Where does drinking water come from, and how is it treated?

Drinking water comes from two main sources: groundwater (wells and springs) and surface water (rivers, lakes, and reservoirs). Although smaller water utility companies use groundwater sources, most people in the United States live in big towns and cities, which get their water from surface water sources.

Water treatment suppliers use different methods to treat water to make it safe for drinking. Most suppliers use a process that makes water pass through different steps, including flocculation, filtration, and disinfection. Flocculation is a process where chemicals added to the water make dirt and other contaminants clump together and settle at the bottom. The water is then passed through filters, which remove smaller particles, and then disinfected, most commonly with chlorine.

6. Is tap water safe to drink?

Drinking water in the United States is, for the most part, very safe. Nationwide, over 22 billion dollars a year is spent operating and maintaining drinking water systems to deliver clean water to our faucets. The Environmental Protection Agency (EPA) requires all water companies serving more than 25 people to test for over a 100 different possible contaminants on a regular basis.

Bottled water is not necessarily safer than drinking water, as the same tests and standards recommended by the EPA are used in preparing bottled water as with tap water. Bottled water can be useful in times when tap water may become contaminated, such as during **floods or chemical spills**.

7. Could my drinking water have contaminants?

No water is absolutely pure. Trace amounts of many different substances are normally found in drinking water, and are usually not dangerous unless they occur in abnormally high levels. Minerals and metals such as selenium, lead and arsenic are naturally present in water in small amounts, but can also be present in larger amounts from mining operations. Chemicals from industrial wastes or pesticides and herbicides from farm runoff can contaminate drinking water. Harmful parasites and bacteria from either humans or farm animals can also be washed into rivers and lakes during heavy rains.

8. What are the organisms and other contaminants of most concern today?

Cryptosporidium

Cryptosporidium is an organism first noticed as a problem in the 1980's. It is a parasite that lives in the intestines of infected animals. It can get into drinking water when heavy



rains wash animal wastes into reservoirs, and it is extremely resistant to disinfection with chlorine. The symptoms of infection include stomach cramps and diarrhea. There is no good treatment, but people with healthy immune systems will recover without any treatment after approximately 14 days. For patients with weakened immune systems, such as those infected with HIV, the disease can be severe, and sometimes can lead to death.

Although there was a major outbreak in Milwaukee in 1993 during which 400,000 people were infected and 40 people died, "crypto" outbreaks are extremely rare: There have been only six documented outbreaks in the United States.

Giardia

Giardia is another parasite that usually infects human through drinking water. It also lives in the intestinal tracts of animals, and can get into surface water similar to cryptosporidium. It commonly infects hikers who drink untreated water from lakes and streams, and is not an uncommon disease in travelers. Giardia also causes abdominal cramping and diarrhea. Although most people recover uneventfully in 1 to 2 weeks, it can cause chronic illness, especially in persons with compromised immune systems. Fortunately, this infection can be treated with medication. Like Cryptosporidium, Giardia is resistant to chlorine disinfection.

E. coli and fecal coliforms

E. coli and other similar stool 'coliform' bacteria levels are often reported in the news. Although these organisms themselves usually do not cause significant illnesses, they are found in human feces. When these bacteria are found in water supplies, they suggest that the water may be contaminated with human waste.

Arsenic

Arsenic can naturally be found in water in low levels, but high levels can be caused by contamination from manufacturing or mining operations. High levels can cause vomiting, abdominal pain, diarrhea, jaundice and difficulty swallowing. Chronic exposure to low levels can cause skin cancer, cirrhosis and liver cancer.

Lead

Lead can leak into drinking water from old pipes, or can be found in water as a result of mining operations. It can cause low blood count, mouth ulcers, constipation, and abdominal pain. In children it can cause delays in physical and mental development.



Disinfection byproducts

Disinfection byproducts are produced when substances such as chlorine, which are used to disinfect the water supply, bind with other chemicals found in water. Although testing has suggested that very high levels of disinfection byproducts can cause cancer in laboratory animals, the EPA has been unable to link the low levels of disinfection byproducts found in American water supplies to any problems.

9. How do you make sure your tap water is safe?

The best source of information on your own tap water is your local water company. Each water supplier is required to publish a yearly water quality report, which may be found on the web at <http://www.epa.gov/safewater/dwinfo.htm>. If you have your own well, recommendations on how to get your water tested can be found at <http://www.epa.gov/safewater/pwells1.html>. The water supplier is supposed to let you know if there are problems. In emergencies, the supplier may give you recommendations on how to disinfect your water by boiling it or by adding small amounts of bleach or iodine.

10. What should you do if you develop a food borne or water borne illness?

Most persons with food borne or water borne illness recover spontaneously. Vomiting and diarrhea can lead to dehydration, so replacing lost fluids and chemicals in the blood are very important. When the diarrhea or vomiting is severe, it's best to use oral rehydration fluids such as pedialyte or oralyte, as juices or even sport drinks such as Gatorade do not have enough important minerals. Bismuth subsalicylate (Pepto-Bismol) may help slow down the symptoms. Diarrhea medication such as loperamide (Imodium) can be used, but if you have a fever or blood in the stools, this medication can actually make things worse and should not be used. If you develop fever over 101.5, dizziness, dry mouth, bloody diarrhea, or if the diarrhea lasts for more than 3 days, you should see a doctor. Suspected food or waterborne illnesses should be reported to your local health department.

11. Bioterrorism and the Gastrointestinal Tract

The biologic agents thought to most likely be used in a bioterrorism attack, such as Anthrax, Plague, and Smallpox, would be most dangerous if spread through the air, and are not likely to be very effective as a food or water contaminant. These agents don't usually enter the human body by way of the intestines, and therefore intestinal symptoms are not often the most important problems with these diseases. Many of the food or waterborne illnesses described above could potentially be used to contaminate our food and water supply. Fortunately, it is not likely that such attempts would be very likely to cause widespread illness.



There have been attempts to cause illness with foodborne and waterborne diseases in the past. In 1984, members of the Rajneeshee cult in Oregon contaminated salad bars in local restaurants with Salmonella, causing over 700 people to become ill with nausea, vomiting and diarrhea. In 1996, a hospital laboratory worker in Texas intentionally contaminated muffins with Shigella bacteria, and 12 people who ate those muffins developed bloody diarrhea. Another group, the Aum Shinrikyo tried to spray botulinum toxin through the streets of Tokyo in 1990, but failed to cause any harm. There have been quite a few reports of people trying to contaminate municipal water supplies with a variety of bacteria, but it appears none of these were successful, in part because of chlorination in modern water treatment plants.

12. How should I prepare for a bioterrorism attack?

In reality, there is little that a person could or should do to prepare for a bioterrorism attack. Purchasing gas masks, stockpiling antibiotics at home, or getting immunizations for bioterrorism agents is not advisable. To quote the American Medical Association, "The best protection is a strong and prepared public health system".

Useful Links

Foodborne disease

[CDC-Foodborne Infections](#)

[Foodborne Diseases, NIAID Fact Sheet](#)

www.foodsafety.gov - Consumer Advice

Waterborne Illness

[EPA Drinking Water and Health: What You Need to Know](#)

[American Water Works Association](#)

Bioterrorism

[American Medical Association](#)

[CDC Bioterrorism FAQ's](#)

