

# Diagnosis and Management of Foodborne Illnesses

A Primer for Physicians  
and Other Health Care Professionals

## *Escherichia coli* O157:H7 Infection Patient Scenario

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**T**his learning scenario can be used to reinforce medical management information pertaining to foodborne illnesses, such as that provided from the other booklets of this primer. This case study provides questions that need to be considered when dealing with a potential case of foodborne illness. Answers are provided immediately following the questions to enhance the learning process.

Similar learning scenarios are also available for other foodborne pathogens.

### ***Escherichia coli* O157:H7 Infection, a Patient Scenario**

Pierre is a 3-year-old who was brought to the outpatient clinic by his mother. He had a 2-day history of severe abdominal cramps and diarrhea (5 to 7 watery stools daily). He has had no fever or vomiting. His mother was especially alarmed this morning when she noticed blood in his diarrheal stools. He refuses to eat, but has been drinking a few ounces of liquids every 2 to 3 hours. She has been unable to assess his urine output because of his diarrhea. Pierre previously has been healthy, and has had no significant weight loss or other symptoms.

On physical examination, he is afebrile with normal blood pressure, respirations and capillary refill. His oral mucosa and skin are dry, but his skin turgor is normal. His abdomen has hyperactive bowel sounds, mild distension, and diffuse tenderness, but is soft with no rebound or guarding. He has loose stool in the rectal vault, which is grossly bloody.

### **What is the possible differential diagnosis for his chief complaint?**

Inflammatory bowel disease

Polyps

Meckel's diverticulum

Intussusception

Coagulopathy

Infectious enteritis

### **What additional information would assist with the diagnosis?**

Has he had similar symptoms before?

Is there a family history of inflammatory bowel disease?

Is there a family history of bleeding disorders?

Do other household members or close acquaintances have diarrhea or bloody diarrhea?

Does he attend child care? If "yes," have there been reports of diarrhea or bloody diarrhea in other children attending the child care facility?

There is no family history of inflammatory bowel disease or bleeding disorders. Pierre's mother reports that he usually has 1 to 2 episodes of self-limited diarrhea each year, but has never had bloody diarrhea. No other household members have had diarrhea or bloody diarrhea; however, his grandmother and 15-year-old sister have had mild abdominal cramps. He does not attend child care; his mother has not heard that any of his playmates have been ill.

### **How does this information assist with the diagnosis?**

Inflammatory bowel disease is an unlikely diagnosis because of his young age, the acute onset of diarrhea, and the absence of a history of recurrent diarrhea and other symptoms such as weight loss, fever, and arthritis. Even if inflammatory bowel disease is suspected, it would be appropriate to rule out an infectious etiology before proceeding with further work-up. Polyps and Meckel's diverticulum usually cause painless hematochezia. They can be complicated by intussusception, which is characterized by a tense abdomen and absent bowel sounds. If intussusception is suspected, evaluation with abdominal radiography and therapeutic enema may be performed. There is no family history of coagulopathic disorders and Pierre has not had a history of abnormal hemostasis. The symptoms of abdominal pain in other household members suggest an infectious etiology.

### **The most likely diagnosis is infectious enteritis. What additional historical information could assist with the identification of the etiologic agent?**

What foods has he consumed within the last week?

Specifically, has he consumed undercooked ground beef, unpasteurized juices, or alfalfa sprouts?

Has he traveled to a foreign country within the last month?

Does he have any pets, specifically reptiles such as an iguana or turtle?

What is the family's source of drinking water?

Have there been any outbreaks of diarrhea in the community, at church, or at his sibling's school?

Has he recently visited a petting zoo?

The most worrisome diagnosis in a child with bloody diarrhea is infection with Shiga toxin-producing *E. coli*, the most common being *E. coli* O157:H7. *E. coli* O157:H7 is associated with serious complications including the hemolytic uremic syndrome (HUS). *Campylobacter*, *Salmonella*, and *Shigella* infections also may cause bloody stools. The incubation periods for these four bacterial infections are 1 to 8 days, 2 to 5 days, 1 to 3 days, and 1 to 2 days, respectively. Therefore, any contaminated food that he consumed within the prior week could have contributed to his illness. Pierre's favorite and most frequently consumed foods are hot dogs and spaghetti. He usually has cereal for breakfast, although he occasionally eats an egg, which he prefers sunny-side-up. He has hot dogs or spaghetti with cheese or fruit for lunch, and has dinner with other family members. During the last week, his mother recalls that dinner has included baked chicken, meatloaf, hamburgers, and pizza from the local pizzeria. She reports the meatloaf was well cooked to 165°C; she checked the internal temperature with a meat thermometer before serving. The burger appeared to be well cooked; it was brown in the middle. The family doesn't eat alfalfa sprouts.

The family vacationed at a United States resort but has not traveled to a foreign country for 2 years. They have a menagerie of pets including a dog, a cat, two hamsters, a parrot, a Sicilian worm, and a new iguana. Pierre has not visited a petting zoo nor had contact with other animals. They live on a vegetable farm; they have no cows, pigs, or sheep. Their main source of water is from a well, but they use bottled water for drinking. They know of no other outbreaks of diarrhea or bloody diarrhea in the community, church, or school. The local health department has not had other reports of bloody diarrhea or *E. coli* O157:H7 infection from the community.

Just as you are about to leave the room, the mother recalls that the nanny, who is a vegetarian and loves to introduce Pierre to various "veggie delights," related a story last week about how

she prepared for Pierre a veggie sandwich with cucumber, cream cheese, and alfalfa sprouts. The nanny said he ate only one bite of the sandwich and refused the rest, begging for spaghetti instead.

### **Are diagnostic tests needed?**

Identification of the cause of Pierre's diarrhea is important because it will influence antimicrobial therapy, follow-up, and prognosis, and may obviate the need for invasive diagnostic procedures such as laparotomy or colonoscopy. The child's dietary, environmental, and travel history suggest he is at high risk for three of the infectious agents discussed above (ie, *Salmonella*, *Campylobacter*, and *E. coli* O157:H7). For example, *E. coli* O157:H7 infection has been associated with undercooked ground beef. Although the hamburger he consumed appeared to be well-cooked (brown in the middle), recent studies have shown that a significant proportion of ground beef patties are brown in the middle before they have reached an internal temperature high enough to kill *E. coli* O157:H7 (160°F). Recently, *E. coli* O157:H7 outbreaks have also been associated with fresh produce such as unpasteurized apple juice, cabbage, and alfalfa sprouts. The infectious dose of *E. coli* O157:H7 is low; ground beef patties with less than 700 organisms per uncooked patty have been associated with illness.

Pierre also could have *Campylobacter* infection. Transmission of *Campylobacter* infection has been associated with the preparation or consumption of raw or undercooked chicken, and consumption of contaminated water and unpasteurized milk. *Campylobacter* can cross-contaminate fruits and vegetables when they contact surfaces that may have touched raw chicken such as knives and cutting boards. *Campylobacter* also has a low infectious dose.

Finally, Pierre is at risk for *Salmonella* infection. Children living in households with reptiles, such as iguanas, are at increased risk. Since 1985, *Salmonella* serotype Enteritidis has emerged as a pathogen in raw shell eggs. Chickens may become bacteremic with *Salmonella* Enteritidis, which seeds the eggs transovarially. Therefore, an egg that is clean and has a normal appearance may be contaminated. Many outbreaks of *Salmonella* infection have been associated with foods that contain raw or undercooked eggs. *Salmonella* infections also have been associated with undercooked meat and poultry and fresh fruits and vegetables.

*Shigella* is a less likely cause of his illness; it usually causes outbreaks in child care settings where person-to-person transmission is common. However, food products such as raw produce can be contaminated with *Shigella* and lead to illness.

### **What diagnostic tests are needed?**

Routine stool cultures will detect common enteric bacterial enteropathogens such as *Campylobacter* and *Salmonella*. However, many clinical laboratories do not screen stools routinely for *E. coli* O157:H7; it is incumbent upon the clinician to request such testing when *E. coli* O157:H7 infection is suspected, especially for patients with bloody diarrhea. Bloody diarrhea is very common in patients with *E. coli* O157:H7 infection, although the absence of bloody diarrhea does not rule out the diagnosis. Culturing for *E. coli* O157:H7 is relatively simple and inexpensive; this bacteria does not ferment sorbitol and, therefore, appears as a colorless colony on sorbitol-MacConkey (SMAC) agar. Colorless colonies on SMAC agar are selected and assayed

for O157 antigen using a commercial kit. All strains of *E. coli* that agglutinate with the O157 antibody are presumed to be *E. coli* O157:H7 and should be reported to the local public health authorities. Confirmation of the H flagellar antigen is usually done by a reference laboratory. Recently, rapid diagnostic kits that test for the presence of Shiga toxin have become available for use in clinical laboratories. Specimens that test positive should be forwarded to the public health laboratory for further evaluation.

The lab calls you with the results of the stool culture. Pierre's stool grew *E. coli* O157:H7.

### **What treatment is needed?**

The treatment of *E. coli* O157:H7 infection is largely supportive. Dehydration should be treated with liberal oral or intravenous rehydration to reduce the stress of volume depletion on the kidneys. This is often best accomplished in the hospital with intravenous fluids and close monitoring.

The use of antimicrobial therapy is controversial. Data suggest that antimicrobial agents may be harmful. Antimicrobial agents may kill or disrupt intracolonic *E. coli* O157:H7 organisms, allowing them to release toxin that is absorbed systemically, and may increase the risk of hemolytic uremic syndrome (HUS). Antimicrobials also have not been shown to decrease illness severity.

Antidiarrheal medications, especially those that slow intestinal motility, should be avoided. They may delay clearance of the organism, increase the time for toxin absorption, and increase the risk and severity of HUS.



## **What are the complications of *E. coli* O157:H7 infection? What follow-up is needed?**

Within one week after the onset of diarrhea, 10% of children <10 years of age with *E. coli* O157:H7 infection develop HUS, which is characterized by hemolytic anemia, thrombocytopenia, oliguria-anuria, and rarely seizures. Children with visible blood in their stools are at increased risk of developing HUS. If HUS has not developed within 2 to 3 days after the diarrhea has resolved, this complication is unlikely to occur. Pierre's parents should be instructed to watch for signs and symptoms of HUS, and he should be evaluated by a clinician if he develops these. Regardless of other symptoms, if his diarrhea continues longer than 4 to 5 days, a complete blood count, platelet count, and blood smear analysis should be considered.

Adults with *E. coli* O157:H7 infection may develop HUS or thrombotic thrombocytopenic purpura (TTP), a microangiopathic disorder that resembles HUS but is accompanied by neurologic abnormalities. The mortality rate with *E. coli* O157:H7-associated HUS is approximately 3% to 5% in children, but may be higher in elderly patients who develop TTP.

## **Should this case be reported to the local health department?**

All cases of *E. coli* O157:H7 infection, post-diarrheal HUS, and post-diarrheal TTP should be reported to the local public health department. The ease with which person-to-person transmission occurs, especially from children who are not toilet-trained, makes diagnosis and reporting very important. The health department can use this information to identify clusters of infection, discover common sources of exposure, and take measures to remove the source of the infection (ie, remove the contaminated food) and prevent transmission of the organism to others.

In addition to reporting cases of *E. coli* O157:H7 infection, it also is helpful to send *E. coli* O157:H7 isolates to the local health department. Isolates can be subtyped by pulsed-field gel electrophoresis (PFGE) to determine if other reported cases of *E. coli* O157:H7 infection are related. Many state public health laboratories now have the capacity to do molecular subtyping. In 1995, the Centers for Disease Control and Prevention (CDC) initiated PulseNet, a national computer network of public health laboratories that employs standard methods to subtype *E. coli* O157:H7 strains. As of May 2000, there were 34 public health laboratories from various states participating in PulseNet, as well as laboratories from the US Department of Agriculture Food Safety and Inspection Service (USDA-FSIS), and the Food and Drug Administration (FDA). Laboratories within the network can transmit PFGE patterns electronically to a databank at the CDC where they are automatically compared to patterns of other isolates. If the patterns submitted by laboratories in different locations during a defined time period are found to match, the CDC computer will alert PulseNet participants of a possible multi-state outbreak. The information can be used by the CDC, the USDA-FSIS, the FDA, and the state health departments to rapidly initiate outbreak investigations and preventive actions.

## **How can *E. coli* O157:H7 infection be prevented?**

Consumers should avoid eating undercooked ground beef. The most reliable way to determine whether ground beef is cooked to a temperature high enough to destroy *E. coli* O157:H7 is to use a meat thermometer and cook to an internal temperature of 160°F. Use of meat thermometers when cooking ground beef is especially important for children, older persons, and the immunocompromised who are at highest risk of contracting foodborne diseases, of developing severe foodborne illness, and of dying from foodborne diseases. If a meat thermometer is not available, consumers should not eat ground beef that is pink in the middle. If served an undercooked (pink) hamburger at a restaurant, consumers should send it back and have it cooked longer.

Consumers should avoid unpasteurized juices and milk, and should wash all fresh produce thoroughly before consumption. Children under 5 years of age, immunocompromised persons, and the elderly should avoid eating alfalfa sprouts. Infected persons, especially children, should be encouraged to wash their hands carefully and frequently with soap and water to reduce the risk of spreading the infection.

Preventive measures to reduce the number of cattle that carry *E. coli* O157:H7 and to reduce contamination of meat during slaughter and grinding are also underway.

Pierre continued to have bloody diarrhea. On the fifth day of illness, a complete blood count showed a hemoglobin of 9g/dL and a platelet count of  $79 \times 10^3/\mu\text{L}$ . A peripheral blood smear revealed evidence of hemolysis. Despite hydration and appropriate supportive care, he developed renal insufficiency, which required dialysis. His renal function improved after 4 weeks of dialysis, and he eventually recovered with no other complications.

