

Escherichia coli 0157:H7 Infections

*Enterohemorrhagic Escherichia coli (EHEC),
Verotoxin producing Escherichia coli
(VTEC), Shiga toxin
producing Escherichia coli (STEC)*

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Etiology

Escherichia coli 0157:H7 is a pathogenic, verotoxin-producing serotype of *E. coli*. This Gram negative motile rod belongs to the family Enterobacteriaceae and is responsible for many cases of hemorrhagic colitis in humans.

Geographic Distribution

Escherichia coli 0157:H7 infections occur worldwide.

Transmission

Transmission is by the fecal-oral route. Humans can be infected by direct contact with animal or human carriers; transmission by fomites, including water and food, is also common. Birds are potential vectors. Human outbreaks are often associated with eating improperly cooked or prepared animal products, particularly ground beef but also unpasteurized milk and processed meats (including acidic meats such as salami). Cider, alfalfa sprouts and other contaminated vegetable products have also been sources of epidemics.

Escherichia coli 0157:H7 remains viable for more than 2 months in feces and soil, and survives well in ground beef. It remains infectious for weeks to months in acidic foods such as mayonnaise, sausage, apple cider and cheddar at refrigeration temperatures. It is destroyed fairly quickly in slurry systems; in one experiment, organisms could no longer be recovered after 9 days.

Disinfection

E. coli 0157:H7 can be killed by numerous disinfectants including 1% sodium hypochlorite, 70% ethanol, phenolic or iodine-based disinfectants, glutaraldehyde and formaldehyde. It can be inactivated by moist heat (121° C for at least 15 min) or dry heat (160–170° C for at least 1 hour). Foods can be made safe by cooking them to a minimum temperature of 160°F/71°C. The infective dose is very low; washed vegetables may contain enough organisms to cause disease.

Infections in Humans

Incubation Period

The incubation period ranges from one to eight days in humans; one to two days is most common.

Clinical Signs

Human infection results in hemorrhagic colitis; this infection is characterized by cramps, abdominal pain, and watery diarrhea followed by bloody diarrhea. A low-grade fever may be present or absent in the initial stages. Dehydration is possible. In healthy adults, infections are usually self-limiting and last about a week.

Serious complications can develop in a small percentage of cases. Hemolytic uremic syndrome (HUS) occurs in 2–10% of patients, usually a week after the diarrhea begins. HUS is characterized by kidney failure, which may result in permanent damage, and hemolytic anemia. Seizures, strokes, pancreatitis, colonic perforation, hypertension and coma may also be seen. Some patients develop permanent insulin-dependent diabetes. HUS can affect all ages but is most common in children under 10 years old.

Thrombotic thrombocytopenic purpura (TTP) is usually seen in adults, particularly the elderly. This disease resembles HUS and some sources consider it to be the same syndrome; there is typically less kidney damage but neurologic signs including stroke, seizures and CNS deterioration are more common.

Communicability

Yes, by the fecal oral route. Most people shed *E. coli* 0157:H7 infections for approximately 7 to 9 days; a third of infected children can excrete this organism for as long as 3 weeks. Transmission is particularly common among children still in diapers.

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Diagnostic Tests

E. coli O157:H7 infections are diagnosed by isolating the organism from fecal samples. This serotype is not detected in routine cultures but can be recognized by incubation on sorbitol–MacConkey agar. Antiserum can rapidly identify sorbitol–negative cultures as *E. coli* O157:H7. Fecal samples may be negative after one week. Another method of diagnosis is to test the feces for *E. coli* verotoxin. Hemorrhagic colitis agar is used to isolate bacteria from food samples.

Treatment and Vaccination

Treatment of hemorrhagic colitis is supportive and may include fluids and a bland diet. Antibiotics are not typically used: they do not seem to reduce symptoms, prevent complications or decrease shedding and do appear to increase the risk of HUS. Patients with complications may require intensive care, including dialysis. Vaccines are not available.

Morbidity and Mortality

In the United States, approximately 73,000 infections are thought to occur yearly. Hemorrhagic colitis is generally self-limiting and illness usually lasts about a week. HUS develops in 2–10%. Complications and deaths are particularly common in young children, the elderly, and those with debilitating illnesses. HUS is fatal in 3–5% of patients and TTP in up to 50% of the elderly. Death can occur even in cases of uncomplicated colitis.

Infections in Animals

E. coli O157:H7 has been found in cattle, sheep, goats, pigs, deer, dogs and poultry. The major reservoir of this organism is cattle; young animals are most likely to shed bacteria in the feces. Fecal shedding may last only weeks to months and can be intermittent.

Currently, there is no published evidence that *E. coli* O157:H7 causes disease in animals; however, B. Fenwick and colleagues have suggested that this organism may be linked to Idiopathic Cutaneous and Renal Glomerular Vasculopathy of Greyhounds (CRGV). Experimental infection of calves results in no clinical signs. Sheep also appear to carry the organism asymptotically.

Internet Resources

Animal Health Australia. The National Animal Health Information

System (NAHIS)

<http://www.brs.gov.au/usr-bin/aphb/ahsq?dislist=alpha>

Centers for Disease Control and Prevention (CDC)

http://www.cdc.gov/ncidod/dbmd/diseaseinfo/escherichiacoli_t.htm

Material Safety Data Sheets –Canadian Laboratory Center for Disease Control

<http://www.hc-sc.gc.ca/pphb-dgsp/msds-ftss/index.html#menu>

Medical Microbiology (textbook)

<http://www.gsbs.utmb.edu/microbook>

The Institute of Food Technologists

<http://www.ift.org>

The Merck Manual

<http://www.merck.com/pubs/mmanual/>

U.S. FDA *Foodborne Pathogenic Microorganisms and Natural Toxins Handbook* (Bad Bug Book)

<http://vm.cfsan.fda.gov/~mow/intro.html>

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