

Escherichia coli Verotoxigenic Infections

Revision Dates

Case Definition	March 2011
Reporting Requirements	May 2018
Epidemiology/Public Health Management	March 2011

Includes O157:H7

Case Definition

Confirmed Case

Laboratory confirmation of infection with or without clinical illness^(A)

- Isolation of verotoxin-producing *Escherichia coli* (includes but not limited to O157:H7) from an appropriate clinical specimen (e.g., feces, urine, blood)

OR

- Detection of verotoxin antigen or nucleic acid in an appropriate clinical specimen.

Probable Case

Clinical illness^(A) in a person who is epidemiologically linked to a confirmed case which would include persons with haemolytic uremic syndrome (HUS).

^(A) Clinical illness is characterized by diarrhea (often bloody) and abdominal cramps, although asymptomatic infections do occur. Illness may be complicated by hemolytic uremic syndrome (HUS), thrombocytopenia purpura (TTP) or pulmonary edema. Asymptomatic infections may also occur and the microorganism may cause extra-intestinal infections.

Reporting Requirements

1. Physicians, Health Practitioners and Others

Physicians, health practitioners and others shall notify the Medical Officer of Health (MOH) (or designate) of the zone, of all confirmed and probable cases in the prescribed form by mail, fax or electronic transfer within 48 hours (two business days).

2. Laboratories

All laboratories shall report all positive laboratory results by mail, fax or electronic transfer within 48 hours (two business days) to the:

- Chief Medical Officer of Health (CMOH) (or designate), and
- MOH (or designate) of the zone.

3. Alberta Health Services and First Nations and Inuit Health Branch

- The MOH (or designate) of the zone where the case currently resides shall forward the initial Notifiable Disease Report (NDR) of all confirmed and probable cases to the CMOH (or designate) within two weeks of notification and the final NDR (amendment) within four weeks of notification.
- For out-of-province and out-of-country reports, the following information should be forwarded to the CMOH (or designate) by phone, fax or electronic transfer within 48 hours (two business days):
 - name,
 - date of birth,
 - out-of-province health care number,
 - out-of-province address and phone number,
 - positive laboratory report, and
 - other relevant clinical / epidemiological information.

Etiology

Escherichia coli is a gram-negative bacilli. The bacteria cause illness by creating a toxin referred to as a verotoxin (VTEC) or shiga-like toxin (STEC).

The organism has a low infective dose (10 organisms by ingestion) and is resistant to cold storage, acid conditions, and drying.

Clinical Presentation(1)

Illness occurs in a two-step process. The first phase is the intestinal phase characterized by acute diarrhea, abdominal cramps, nausea, emesis and occasionally fever. Diarrhea can range from mild and non-bloody to stools that are virtually all blood. The illness is often self-limited, lasting seven to 10 days with an average of eight days. Most individuals recover without residual sequelae.

The second phase is the elaboration of the toxin. It is the action of the toxin on the intestinal cells has the potential to cause complications. The toxin breaks down the lining of the intestines and in some cases, damages the kidneys. This occurs in up to 15% of cases and is most common in children under 14 years of age and the elderly. Complications include hemorrhagic colitis, hemolytic uremic syndrome (HUS: renal failure associated with hemolysis of red blood cells) or thrombotic thrombocytopenic purpura (TTP: hemolytic anemia with thrombocytopenia). The overall case fatality rate is about 1%.

Diagnosis

The diagnosis is made by positive stool, urine and blood culture for *E. coli*. The diagnosis of *E. coli* should be considered in the presence of severe diarrhea, HUS, TTP or hemorrhagic colitis. Confirmation can be obtained by isolation of *E. coli* of the same serotype from the incriminated food (1).

Epidemiology

Reservoir

Cattle are the principle reservoir of *Escherichia coli* including O157:H7. Humans may serve as an accidental host and therefore, act as a reservoir for person to person transmission.

Transmission

The predominant mode of transmission is through the ingestion of contaminated food, often related to inadequate cooking or through cross-contamination during food preparation. Foods (in particular fruits and vegetables) contaminated by cow manure have been documented modes of transmission. Serious outbreaks have occurred in North America from inadequately cooked hamburgers, unpasteurized milk or cheese, apple cider, alfalfa sprouts, dry-cured salami, lettuce, game meat, and cheese curds (1). Transmission also occurs directly from person to person (in families, daycares, and institutions). Infection can occur after swimming in or drinking contaminated water.(2)

Incubation Period

The incubation period is typically three to four days with a range of one to 10 days.

Period of Communicability

The infection is communicable for the duration of excretion of the pathogen, commonly a week or less in adults and approximately three weeks in about one-third of children. Prolonged carriage is uncommon.

Host Susceptibility

The elderly and children appear to be at higher risk for illness. Children less than five years of age are at greatest risk of developing HUS.

Occurrence

General

The diarrheal illness was first recognized in the United States in 1982. Since that time it has become an important concern in North America, Europe, South Africa, Japan, the southern cone of South America, and Australia. The highest age-specific incidence rates occur in children under the age of 15 years, although all age ranges are susceptible.

Canada(3)

Sporadic cases and outbreaks have occurred in Canada since the first reported outbreak in the United States in 1982. The incidence of *E. coli* from 1990 to 1999 has remained stable at 4.1 to 7.1/100,000 with an average of 1407 cases reported annually. The highest age specific rate is among children one to four years old. Overall, the highest incidence is found in children under the age of 15 years.

Alberta(4)

Alberta typically has a higher incidence than the national average. Disease incidence rates are consistently higher in the south of the province. Since 1995 fewer than 325 cases of *E. coli* have been reported annually in Alberta (rate 5.6 – 10.9/100,000). Disease is most prevalent in children aged one to 14 years and adults over 39 years of age (1997 to 2004).

Key Investigation

Single Case/Household Cluster

- Determine the possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission. Assessment may include:
 - determining ingestion of potentially contaminated food and the time of consumption, in particular, undercooked meats (primarily ground beef), unpasteurized milk and juices, raw fruits and vegetables,
 - obtaining a food history,
 - determining history of contact with sewage contaminated recreational water (cattle nearby) or consumption of untreated surface water,
 - determining history of working with animals,
 - assessing for recent visit to a farm or petting zoo,
 - determining history of high risk sexual practices, especially contact with feces, and
 - identifying history of recent travel.
- Identify history of residing in areas with poor sanitation including improper water treatment and sewage disposal and include recent immigration.
- Assess for history of similar symptoms in other members of the household.
- Obtain implicated food samples, if possible.
- Suspected contaminated food may be held to prevent of consumption.
- Suspected contaminated food may be destroyed.
- Identify contacts. Contacts include:
 - persons living in the household,
 - children and childcare workers in a daycare/dayhome, and
 - individuals exposed to the same source (if it is identified).

Control

Management of a Case

- All cases should be instructed about disease transmission, appropriate personal hygiene, routine practices, and contact precautions.
- Exclusion should be considered for symptomatic and asymptomatic persons who are:
 - food handlers whose work involves
 - touching unwrapped food to be consumed raw or without further cooking and/or
 - handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking,
 - healthcare, daycare or other staff who have contact through serving food with highly susceptible patients or persons in whom an intestinal infection would have particularly serious consequences,
 - involved in patient care or care of young children, elderly or dependent persons,
 - children attending daycares or similar facilities who are diapered or unable to implement good standards of personal hygiene, and
 - older children or adults who are unable to implement good standards of personal hygiene (e.g., mentally or physically challenged).
- Exclusion applies until two stool specimens taken from the infected person not less than 24 hours apart and at least 48 hours after normal stools have resumed are reported as negative.
- Reassignment to a low risk area may be used as an alternative to exclusion.
- Contact precautions should be used in healthcare settings where children or adults have poor hygiene or incontinence that cannot be contained. Otherwise, routine practices are adequate.

Treatment of a Case

- The use of antibiotics is not recommended and may be harmful by enhancing the release of toxins.
- Antimotility agents should be avoided.
- Replace fluids and electrolytes as required.

Management of Contacts

- Contacts should be instructed about disease transmission, appropriate personal hygiene, routine practices, and contact precautions.
- Symptomatic contacts
 - Contacts who are symptomatic should be assessed by a physician.
 - Contacts who are symptomatic may be excluded from daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons as per MOH assessment and until they are no longer symptomatic.
 - One stool specimen or culture may be requested from symptomatic contacts.
 - The specimen must be reported as negative prior to returning to daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons.
- Asymptomatic contacts
 - Asymptomatic contacts are generally excluded from daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons. Consultation with the MOH is appropriate.
 - Asymptomatic contacts who have been excluded from work or daycare may be required to submit one stool specimen, if deemed appropriate (e.g., past recent illness, on the advice of the MOH).

- The specimen must be reported as negative prior to returning to daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons.

Preventive Measures

- Provide public education about personal hygiene, especially the sanitary disposal of feces and careful hand washing after defecation and sexual contact, and before preparing or eating food.
- Educate food handlers about proper food and equipment handling, preparation, and hygiene especially in avoiding cross-contamination from raw meat products, and thorough hand washing.
- Advise infected individuals to avoid food preparation.
- Educate about the risk of sexual practices that permit fecal-oral contact.
 - Educate about condom use for safer sex.
- Test private water supplies for presence of bacterial contamination, if suspected.
- Advise individuals to not use public recreational water (e.g., pools, lakes, ponds) for two weeks after the symptoms resolve.
- Advise individuals to consume only pasteurized milk, dairy products, and juices.
- Thoroughly cook meats. Heat beef to 74°C during cooking especially ground beef.

Superseded

References

- (1) *Foodborne Pathogenic Microorganisms and Natural Toxins Handbook – Enterotoxigenic Escherichia coli*. US Food and Drug Administration. Centre for Food Safety and Applied Nutrition. Bad Bug Book. January 1992.
<http://www.cfsan.fda.gov/~mow/chap13.html>
- (2) Public Health Agency of Canada. *Infectious substances: Escherichia coli*. Office of Laboratory Security. Material Safety Data Sheet. January 2001.
<http://www.phac-aspc.gc.ca/msds-ftss/index.html>
- (3) Public Health Agency of Canada. *Notifiable Diseases On-Line*. 2003.
http://dsol-smed.phac-aspc.gc.ca/dsol-smed/ndis/index_e.html
- (4) Alberta Health and Wellness, Disease Control and Prevention. *Notifiable Diseases – Alberta*. Communicable Disease Reporting System Mid Year Population. March 2003.