

2.17 Verotoxigenic *Escherichia Coli*

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.

Case Definitions

Confirmed Case

Laboratory confirmation of infection with or without clinical illness:

- isolation of verotoxin producing *E. coli* from an appropriate clinical specimen (e.g. feces, urine, blood)

OR

- detection of verotoxin antigen or nucleic acid

Probable Case

Clinical illness¹³ in a person who is epidemiologically linked to a confirmed case, which would include persons with hemolytic uremic syndrome (HUS)

Clinical Presentation

Escherichia coli have more than 30 serotypes which produce verotoxin causing food-borne illness. The best known of these is *E. coli* O157:H7, a gram-negative bacterium. 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%.

¹³ Clinical illness is characterized by diarrhea (often bloody) and abdominal cramps; fever is often absent. Illness may be complicated by hemolytic uremic syndrome (HUS), thrombotic thrombocytopenic purpura (TTP) or pulmonary edema. Asymptomatic infections may also occur and the microorganism may cause extra-intestinal infections.

Diagnosis

The diagnosis is made by positive stool, urine and blood culture for *E. coli*. For confirmation on laboratory specimens go to the public health laboratory web site www.publichealthlab.ca or call 709-777-6583.

Epidemiology

Occurrence

First identified in Canada in 1982, the organism has been associated with outbreaks in North America and Europe. The incidence rate for Canada has been relatively consistent for 2001-2004 at 3-4/100,000 population. In Newfoundland Labrador the rate has ranged from 0.18 to 1.75/100,000 during the period 1997– 2004. In 2015, there were 10 reported cases.

Reservoir

Cattle are the most important reservoir; humans may also serve as a reservoir for person-to-person transmission.

Transmission

Transmission is primarily through the ingestion of contaminated food or water. Outbreaks have been associated with various food sources: beef (inadequately cooked ground beef), produce (including melons, lettuce, coleslaw, apple cider, alfalfa sprouts), and unpasteurized dairy milk. Human-to-human transmission can occur in families, child care centers and custodial institutions. Waterborne transmission occurs both from contaminated drinking water and contaminated recreational waters.

Incubation Period

The incubation period is from two to ten days, with a mean of three to four days.

Communicability

Usually one week, but may be up to three weeks in one third of children.

Control Measures

Management of Case

Investigations

- Obtain a food history.
- Determine 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.
- Determine the possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission.
- Determine history of contact with sewage contaminated recreational water (cattle nearby) or consumption of untreated surface water.

- Determine history of working with animals.
- Assess for recent visit to a farm or petting zoo.
- If necessary, determine history of high risk sexual practices, especially contact with feces.
- Identify 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 consumption.
- Suspected contaminated food may be destroyed.

Exclusion

- Exclusion (staying away from school or work) should be considered for symptomatic and asymptomatic cases 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, who, in 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.
- Older children or adults who are unable to implement good standards of personal hygiene (e.g., mentally or physically challenged).
- For patients with HUS, contact precautions should continue until diarrhea resolves and results of two consecutive stool cultures are negative for E coli O157.
- Reassignment to a low risk area may be used as an alternative to exclusion.

Treatment

- 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

Symptomatic contacts should be treated as cases. Cultures must be submitted to establish the diagnosis. Education must be provided to all contacts on the preventative measures.

Management of Outbreaks

An outbreak management team should be established to address infection prevention and control measures. If the outbreak is limited to one region the region is responsible to manage the outbreak; if more than one region is involved the outbreak will be managed by the province or in consultation with the province.

Education and Preventive Measures

- Prompt involvement of community health is essential Search intensively for the specific vehicle (food or water) of disease transmission if; foodborne outbreaks, a food recall may be necessary.
- Waterborne outbreak is suspected; an order to boil water is indicated.
- Swimming-associated outbreak is suspected, the pool or beaches affected must be closed.
- Drinking unpasteurized milk, pasteurization or boiling of the milk is recommended.
- Education of case/s and contacts on the importance of hygienic measures.
- Hand washing is the single most important way to prevent infection.
- Follow the Canadian Food Inspection Agency's 4 point plan for food safety;
- **Clean start** – Clean your hands before and after handling food, clean your countertop and utensils before and after preparing foods, wash fruits and vegetables with water before you prepare and eat them.
- **Chill your food** – keep cold food at or below 4°C.
- **Cross-contamination is to be avoided** – Separate raw meats from cooked meats; platters, utensils and cutting boards for raw meats must not be used for cooked meats; and separate raw foods from ready-to-eat foods while shopping, storing or preparing foods.
- **Cook safely** – Cook meat to a safe internal temperature; use a food thermometer – hamburgers can turn brown inside before they have been cooked safely; consult a safe cooking temperature chart for meats.
- Ensure that slaughterhouse operations meet recommended standards.
- Wash hands after contact with farm animals or the farm environment.
- Pasteurize milk and dairy products.
- Protect, purify and chlorinate public water supplies including swimming pools.
- Fact sheet available at
http://www.health.gov.nl.ca/health/publichealth/envhealth/E_coli_Food_Safety_Jan_2011.pdf

Reporting Requirements and Procedures

- The laboratory (hospital or public health laboratories) report case/s to the attending physician, the Chief Medical Officer of Health and the Medical Officers of Health (MOH)
- The MOH office will notify, as required, local physicians, nurse practitioners, environmental health officers, community health nurses, communicable disease

- control nurses (CDCNs) and infection control practitioners (ICP), in the particular region as required for follow-up and case investigation.
- EHO will conduct an investigation of the case under the direction of the MOH and provide case details as per the food history.
 - CDCN enters the case details into the electronic reporting system and uses the CNPHI tool, if indicated, for alerts or outbreak summaries

Provincial Disease Control

- Reports the aggregate case data to Public Health Agency of Canada
- Provides an analysis of the case/s with reports in the Quarterly Communicable Disease Report (CDR), also posted on the Public Health website
- Coordinates the response if an outbreak across RHAs (CMOH will likely coordinate an outbreak across RHAs with input from disease control and environmental health.)

References

Foodborne Pathogenic Microorganisms and Natural Toxins Handbook – Enterotoxic Escherichia coli. US Food and Drug Administration. Centre for Food Safety and Applied Nutrition. Bad Bug Book. January 1992. Retrieved June 3rd, 2013, from <http://www.fda.gov/downloads/Food/FoodSafety/FoodborneIllness/FoodborneIllnessFoodbornePathogensNaturalToxins/BadBugBook/UCM297627.pdf>

Public Health Agency of Canada. *Infectious substances: Escherichia coli.* Office of Laboratory Security. Material Safety Data Sheet. January 2001. Retrieved June 3rd, 2013, from <http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/escherichia-coli-eng.php>