Public Health

Escherichia coli O157:H7

Epidemiology

Escherichia coli O157:H7 is one of hundreds of strains of the gram-negative bacillus *E. coli*. Most strains are harmless, colonizing the intestines of healthy humans and animals, where they suppress the growth of pathogenic bacterial species and synthesize appreciable amounts of vitamin K and vitamin B complex. But a few strains cause gastroenteritis in humans by 4 mechanisms: adherence to small-bowel mucosa, direct invasion of mucosal cells, disruption of the microvillous brush border and toxin release. The class enterohemorrhagic *E. coli*, which includes *E. coli* O157:H7, produces hemorrhagic colitis by elaborating one or more cytotoxins closely related to the *Shigella* toxin. These toxins, variably called Shiga's toxins or verotoxins, damage intestinal epithelium and appear to possess neurotoxic and enterotoxic properties.[1]

E. coli O157:H7 was not recognized as a human pathogen until 1982, when the serotype was identified in stool specimens from American patients with bloody diarrhea.[2] Since then at least 65 outbreaks of the infection have been reported,[3] most recently in Walkerton, Ont., where at least 7 residents died after drinking contaminated municipal water.[4] Most outbreaks occur after people eat undercooked ground beef that is likely contaminated during slaughtering and subsequent meat processing. Outbreaks have also been caused by unpasteurized milk and similar products.[3]

Clinical management

The incubation period to onset of diarrhea is 1–8 days. Young children may continue to excrete the bacteria for more than 3 weeks after infection, but prolonged asymptomatic infection with *E. coli* O157 is unusual.[5] Infection is typically characterized by severe abdominal cramping and diarrhea that is initially watery and may become bloody; occasionally vomiting occurs. Fever is either low grade or absent. The illness is usually self-limiting and lasts for 8 days on average. Many sporadic cases likely go unrecognized.

Hemolytic uremic syndrome (HUS) develops in about 8% of patients, with very young and elderly patients being most susceptible. HUS is characterized by the sudden onset of hemolytic anemia, with fragmentation of red blood cells, thrombocytopenia and acute renal failure. It is believed to be caused by the systemic absorption of Shiga's toxins and the resultant direct effects of the toxins on endothelial and renal tubular epithelial cells. A recent case series reported that the region of colon affected differed between patients with hemorrhagic colitis in whom HUS developed and patients without HUS, which suggests that different mechanisms of injury and absorption are involved.[6] Occasionally, thrombotic thrombocytopenic purpura develops in elderly patients and they display 2 additional symptoms: fever and neurologic deficits. Clinicians considering a diagnosis of *E. coli* O157:H7 infection should specifically request a stool culture of the isolate because some laboratories do not screen for it routinely.

Fluid and electrolyte replacement is the cornerstone of therapy. In a recent prospective study[7] children treated with antibiotics were at greater risk of HUS than children who were not treated (relative risk 14.3). Physicians are advised to withhold antibiotic treatment until the results of a stool culture identify a pathogen and rule out *E. coli* O157:H7 infection.[4]

There is no specific treatment for HUS. Health Canada, through its Special Access Program, approved the sale of the drug Synsorb PK, which is currently in phase III clinical trials, to the hospital in Walkerton. The drug is designed to prevent the progression to HUS in children who have recently been infected by *E. coli* O157:H7 by binding the Shiga's toxins in the lumen of the gastrointestinal tract.[8]

Prevention

Preventing this infection is difficult because the organisms colonize the intestines of healthy cattle and other food animals. They are also resistant to acidic conditions, dehydration and high salt concentrations.[4] Irradiation dramatically reduces the risk of foodborne infection from *E. coli* O157:H7.[4] In the future a toxoid vaccine may be available, but for now vigilant public health control is paramount. Preventive strategies include[9]

- cooking all ground beef thoroughly;
- thoroughly washing hands, surfaces and utensils that may have been contaminated by uncooked meat;
- limiting milk consumption to pasteurized products;
- frequently washing hands of people who are infected; and
- drinking municipal water that has been treated with adequate levels of disinfectants. — *Erica Weir*, CMAJ

References

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