

**Please read this bit first**

The HPCSA and the Med Tech Society have confirmed that this clinical case study, plus your routine review of your EQA reports from Thistle QA, should be documented as a "Journal Club" activity. This means that you must record those attending for CEU purposes. Thistle will **not** issue a certificate to cover these activities, nor send out "correct" answers to the CEU questions at the end of this case study.

The Thistle QA CEU No is: **MT00025**.

Each attendee should claim **THREE** CEU points for completing this Quality Control Journal Club exercise, and retain a copy of the relevant Thistle QA Participation Certificate as proof of registration on a Thistle QA EQA.

**Cycle 24 - Organism 4:**

***E. coli* 0157**

*E. coli* O157:H7 is a gram-negative rod-shaped bacterium. The letter "O" in the name refers to the somatic antigen number, whereas the "H" refers to the flagella antigen. *E. coli* O157:H7 was first recognized as a pathogen as a result of an outbreak of unusual gastrointestinal illness in 1982. The outbreak was traced to contaminated hamburgers, and the illness was similar to other incidents in the United States and Japan. The etiologic agent of the illness was identified as a rare O157:H7 serotype of *Escherichia coli* in 1983. This serotype had only been isolated once before, from a sick patient in 1975.

*E. coli* O157:H7 serotypes are closely related, descended from a common ancestor, divergent in plasmid content more than chromosomal content, and are no more related to other shiga toxin producing strains than any other randomly chosen *E. coli* serotype. *E. coli* O55:H7 and *E. coli* O157:H7 are most closely related and diverged from a common pathogenic ancestor that possessed the ability to form attaching and effacing lesions. *E. coli* O157:H7 serotypes apparently arose as a result of horizontal gene transfer of virulence factors.

Among these virulence factors are a periplasmic catalase and shiga-like toxins. Shiga-like toxins are iron regulated toxins that catalytically inactivate 60S ribosomal subunits of eukaryotic cells blocking mRNA translation and causing cell death.<sup>[10]</sup> Shiga-like toxins are functionally identical to toxins produced by virulent *Shigella* species. Strains of *E. coli* that express shiga-like toxins gained this ability due to infection with a prophage containing the structural coding for the toxin, and non-producing strains may become infected and produce shiga-like toxins after incubation with shiga toxin positive strains. The periplasmic catalase is encoded on the pO157 plasmid and is believed to be involved in virulence.

A major source of infection is undercooked ground beef; other sources include consumption of unpasteurized milk and juice, raw sprouts, lettuce, and salami, and contact with infected live animals. Waterborne transmission occurs through swimming in contaminated lakes, pools, or drinking inadequately treated water. The organism is easily transmitted from person to person and has been difficult to control in child day-care facilities.

*E.coli* O157:H7 is found on cattle farms and can live in the intestines of healthy cattle. The toxin requires highly specific receptors on the cells' surface in order to attach and enter the cell; species such as cattle, swine, and deer which do not carry these receptors may harbor toxigenic bacteria without any ill effect, shedding them in their feces from where they may be spread to humans. Meat can become contaminated during slaughter, and organisms can be thoroughly mixed into beef when it is ground into hamburger. Bacteria present on the cow's udders or on equipment may get into raw milk.

Although the number of organisms required to cause disease is not known, it is suspected to be very small. *E. coli* O157:H7 infection often causes severe, acute bloody diarrhea (although non-bloody diarrhea is also possible) and abdominal cramps. Usually little or no fever is present, and the illness resolves in 5 to 10 days. It can also be asymptomatic.

A stool culture can detect the bacterium, although it is not a routine test and so must be specifically requested. The sample is cultured on sorbitol-MacConkey (SMAC) agar, or the variant cefeximine potassium tellurite sorbitol-MacConkey agar (CT-SMAC). However, like all cultures, diagnosis is slow using this method, and more rapid diagnosis is possible using PCR techniques. Newer technologies using fluorescent and antibody detection are also under development.

---

**CPD Questions:**

1. What distinguishes one *E. coli* O157 serotype from another?
  2. Define a "shiga-like toxin".
-