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The Thistle QA CEU No is: **MT-11/00142**.

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.

MICROBIOLOGY LEGEND

CYCLE 32 ORGANISM 2

SHIGELLOSIS

Shigellosis is an infectious disease caused by various species of *Shigella*. People infected with *Shigella* develop diarrhoea, fever and stomach cramps starting a day or two after they are exposed to the bacterium. The diarrhoea is often bloody. Shigellosis usually resolves in 5 to 7 days, but in some persons, especially young children and the elderly, the diarrhoea can be so severe that the patient needs to be hospitalized. A severe infection with high fever may also be associated with seizures in children less than 2 years old. Some persons who are infected may have no symptoms at all, but may still transmit the bacteria to others.

Shigella was discovered over 100 years ago by the Japanese microbiologist, Shiga, for whom the genus is named. There are four species of *Shigella*: *S. boydii*, *S. dysenteriae*, *S. flexneri*, and *S. sonnei*. *Shigella sonnei*, also known as **Group D Shigella**, accounts for over two-thirds of the shigellosis in the United States. *Shigella flexneri*, or **Group B Shigella**, accounts for almost all of the rest.

Transmission

Shigella is transmitted from an infected person to another usually by a faecal-oral route. *Shigella* are present in the diarrheal stools of infected persons while they are ill and for a week or two afterwards. Most *Shigella* infections are the result of the bacterium passing from stools or soiled fingers of one person to the mouth of another person. This happens when basic hygiene and hand washing habits are inadequate. It is particularly likely to occur among toddlers who are not fully toilet-trained. Family members and playmates of such children are at high risk of becoming infected. The spread of *Shigella* from an

infected person to other persons can be stopped by frequent and careful hand washing with soap, practiced by all age groups.

Part of the reason for the efficiency of transmission is because a very small inoculum (10 to 200 organisms) is sufficient to cause infection. As a result, spread can occur easily by the faecal-oral route and readily occurs in settings where hygiene is poor.

Epidemics may be food borne or waterborne. *Shigella* infections may be acquired from eating food that has become contaminated by infected food handlers. Vegetables can become contaminated if they are harvested from a field with contaminated sewage or wherein infected field workers defecate. *Shigella* can also be transmitted by flies. Flies can breed in infected faeces and then contaminate food. *Shigella* infections can be acquired by drinking or swimming in contaminated water. Water may become contaminated if sewage runs into it, or even if someone with shigellosis swims or bathes or, worse, defecates, in it.

Pathogenesis

Shigella causes dysentery which results in the destruction of the epithelial cells of the intestinal mucosa in the caecum and rectum. Some strains produce enterotoxin and shiga toxin, similar to the verotoxin of *E. coli* O157:H7 and other verotoxin-producing *Escherichia coli*. Both shiga toxin and verotoxin are associated with causing hemolytic uremic syndrome.

Shigella invades the host through the M-cells in the gut epithelia of the large intestine, as they cannot enter directly through the epithelial cells. Using a Type III secretion system acting as a biological syringe, the bacterium injects IpaD protein into cells, triggering bacterial invasion and the subsequent lysis of vacuolar membranes using IpaB and IpaC proteins. It uses a mechanism for its motility by which its IcsA protein triggers actin polymerization in the host cell (via N-WASP recruitment of Arp2/3 complexes) in a "rocket" propulsion fashion for cell-to-cell spread. The most common symptoms are diarrhea, fever, nausea, vomiting, stomach cramps and flatulence. The stool may contain blood, mucus, or pus. In rare cases, young children may have seizures. Symptoms can take as long as a week to show up, but most often begin two to four days after ingestion. Symptoms usually last for several days, but can last for weeks. *Shigella* is implicated as one of the pathogenic causes of reactive arthritis worldwide.

Each of the *Shigella* genomes includes a virulence plasmid that encodes conserved primary virulence determinants. The *Shigella* chromosomes share most of their genes with those of *E. coli* K12 strain MG1655.

Diagnosis

Shigella species are negative for motility and are not lactose fermenters. (However, *S. sonnei* can ferment lactose). They typically do not produce gas from carbohydrates (with the exception of certain strains of *S. flexneri*) and tend to be overall biochemically inert. *Shigella* should also be urea hydrolysis negative. When inoculated to a triple sugar iron (TSI) slant, they react as follows: K/A, gas -, H₂S - Indole reactions are mixed, positive and negative, with the exception of *S. sonnei*, which is always indole negative. Growth on *Hektoen enteric agar* will produce bluish-green colonies for *Shigella* and bluish-green colonies with black centers for *Salmonella*.



Colonial Morphology displayed by *Shigella* cultivated on a Hektoen enteric agar surface.

Treatment

Shigellosis can usually be treated with antibiotics. The antibiotics commonly used are ampicillin, trimethoprim/sulfamethoxazole (also known as Bactrim or Septra), nalidixic acid and the fluoroquinolone, ciprofloxacin. Appropriate treatment kills the bacteria present in the gastrointestinal tract and shortens the course of the illness.

References

1. <http://en.wikipedia.org/wiki/Shigella>
2. <http://textbookofbacteriology.net/Shigella.html>

Questions

1. Discuss the Laboratory Diagnosis of *Shigella*.
 2. Discuss the pathogenesis of *Shigella*.
 3. Discuss the symptoms of *Shigella*.
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