

SHIGELLA spp.

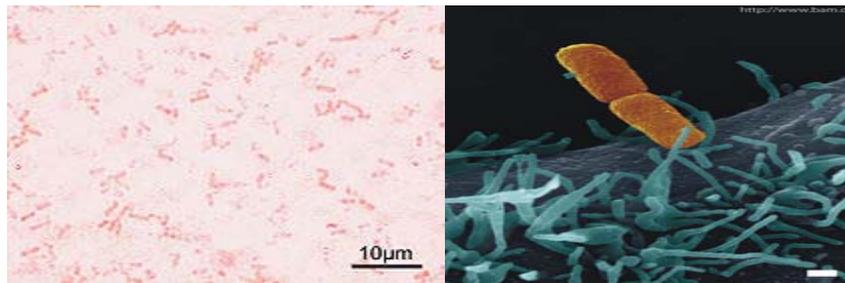
PATHOGEN SAFETY DATA SHEET - INFECTIOUS SUBSTANCES

INFECTIOUS AGENT

NAME: *Shigella* spp.

SYNONYM OR CROSS REFERENCE: Serogroup A: *S. dysenteriae*, serogroup B: *S. flexneri*, serogroup C: *S. boydii*, serogroup D: *S. sonnei*, shigellosis, and bacillary dysentery.

CHARACTERISTICS: *Shigella* spp., of the Enterobacteriaceae family, are gram-negative rod-shaped pathogenic bacteria. They are non-motile, non-encapsulated, and facultative anaerobes that do not ferment lactose, or do so slowly. Different serogroups, considered as species, can be differentiated by their biochemical properties, phage or colicin susceptibility, and polyvalent antisera can detect specific polysaccharide antigens. *S. dysenteriae* is considered the most virulent, and can produce a potent cytotoxin known as Shiga toxin.



Shigella flexneri, gram-stained¹⁾

Shigella flexneri cells (orange)²⁾

HAZARD IDENTIFICATION

PATHOGENICITY/TOXICITY: Ingested pathogens can survive gastric acidity and cause illness by infecting the colonic mucosa and multiplying in the colonic epithelial cells, and spreading laterally to adjacent cells. Infection may be mild and asymptomatic, but it is most commonly characterized by acute intestinal infections upon ingestion, resulting in mild watery diarrhea to severe inflammatory bacillary dysentery or shigellosis, manifested by severe abdominal cramps, nausea and vomiting, fever, tenesmus, anorexia, and stool containing blood and mucus. Further complications include Reiter's syndrome which has been associated with *S. flexneri*, severe dehydration, intestinal perforation, toxic mega colon, bacteremia, toxemia, septicemia, seizures, toxic encephalopathy with headache and alterations of consciousness, septic shock and convulsions (very rare), and hemolytic uremic syndrome, which have been linked to Shiga toxin (a potent cytotoxin produced by *S. dysenteriae* that can also cause other neurotoxic effects). Virulence of *Shigella* is temperature-regulated, as

organisms are able to invade HeLa cells at 37°C, and cannot do so *in vitro* at 30°C. Infections are usually self-limiting, but can become life-threatening in immunocompromised patients or if not properly treated. Severity of infection depends on the host, dose, and serotype. *S. dysenteriae* is the most pathogenic species, with a fatality rate up to 20%, whereas *S. sonnei* usually cause mild forms of shigellosis.

EPIDEMIOLOGY: Worldwide distribution. 5 – 15% of all diarrhea cases can be linked to *Shigella* spp. infection, where two-thirds of all cases and deaths occur in children younger than 5 years. Rate of infection is high during the weaning period due to risk of ingesting contaminated foods; increasing age is associated with decreasing prevalence and severity. *S. flexneri* is most common in developing countries where there is poor hygiene and limited clean drinking water; however, outbreaks are usually caused by *S. dysenteriae*. *S. sonnei* is most common in developed countries. Infections are most prevalent during summer and early fall in temperate regions and during rainy seasons in tropical regions. High risk groups include children in day-care centers, homosexual men, individuals in custodial institutions, migrant workers, travelers to developing countries, and certain First Nation reserves.

HOST RANGE: Humans and higher primates.

INFECTIOUS DOSE: Infection can result from ingestion of 10 – 200 organisms.

MODE OF TRANSMISSION: Organisms are spread through the fecal-oral route, and transmission is typically through one of three mechanisms: ingestion of contaminated foods (washed with water that is contaminated with feces, or handled with poor hygiene, commonly in tossed salads, chicken, and shellfish); contaminated drinking water (or in swimming pools); or by person-to-person contact by anal sexual contact. Spread of infection linked to flies has also been recorded.

INCUBATION PERIOD: Ranges from 1 – 7 days. Acute diarrhea can develop within 1 – 2 days. Symptoms and shigellosis may occur within 12 – 50 hours.

COMMUNICABILITY: Agents begin to be shed in feces 4 weeks after infection, and it is communicable as long as the organisms are present in excrement. Although rare, asymptomatic carriers can also spread the infection for up to some months.

DISSEMINATION

RESERVOIR: Humans are the most common; infections have been observed in primates.

ZOONOSIS: None

VECTORS: Organisms have been found to survive on flies.

STABILITY AND VIABILITY

DRUG SUSCEPTIBILITY: Susceptible to ampicillin, trimethoprim, sulfamethoxazole, naldixic acid, ofloxacin, chloramphenicol, fluoroquinolones, and ciprofloxacin.

DRUG RESISTANCE: Multidrug-resistant strains are emerging, including those against trimethoprim-sulfamethoxazole (TMP-SMX), ampicillin, and chloramphenicol.

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to 1% sodium hypochlorite, 70% ethanol, 2% glutaraldehyde, iodines, phenolics, and formaldehyde.

PHYSICAL INACTIVATION: Organisms can be heat-killed by steaming using an autoclave for 1 hour at 100°C under normal atmospheric pressure.

SURVIVAL OUTSIDE HOST: Can survive up to months on dry surfaces, up to 10 days in citric juices and carbonated soft drinks, several days on contaminated vegetables, over 3 hours on fingers, 2 – 28 days on metal utensils at 15°C or 0 – 13 days at 37°C, in feces for 12 days at 25°C, and water for under 3 days. Growth is possible at 25°C – 37°C and bacteria can survive at 5°C on MacConkey agar. Flies can carry *Shigella* for up to 20 – 24 days.

FIRST AID / MEDICAL

SURVEILLANCE: Monitor for symptoms. Serological testing of stool isolates can distinguish and confirm serogroups.

FIRST AID/TREATMENT: Administer appropriate drug therapy. Oral rehydration or electrolyte replacement in dehydrated patients can lead to recovery within days. Antibiotics usually are not needed in mild cases, but should be administered for infections involving *S. dysenteriae*. Antimicrobials may reduce duration of infection, carriage state of the patient, and mortality. Other treatments aids for severe cases include mechanical ventilation, anticonvulsants, and inotropics.

IMMUNIZATION: No vaccines are currently available; however, live and subunit parental vaccine candidates are under review. Live attenuated, conjugate, broad spectrum, and proteosome-based vaccines are also currently being studied.

PROPHYLAXIS: None available – hand-washing, strict hygiene control during food preparation, providing safe drinking water, improving toilet facilities and excreta disposal can limit dissemination of the bacteria.

LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: *Shigella* species have been recently identified to be the most frequently identified agent of laboratory-acquired infections because of their high virulence and low infectious dose.

SOURCES/SPECIMENS: Organisms can be found in stool and rarely in blood samples.

PRIMARY HAZARDS: Infection may be acquired through ingestion or accidental parenteral inoculation.

SPECIAL HAZARDS: Experimentally infected guinea pigs and other rodents have been previously reported to transmit infection to laboratory personnel, although rare.

EXPOSURE CONTROLS / PERSONAL PROTECTION

RISK GROUP CLASSIFICATION: Risk Group 2. This risk group applies to the genus as a whole, and may not apply to every species within the genus.

CONTAINMENT REQUIREMENTS: Containment Level 2 facilities, equipment, and operational practices for work involving infectious or potentially infectious materials, animals, or cultures. These containment requirements apply to the genus as a whole, and may not apply to each species within the genus.

PROTECTIVE CLOTHING: Lab coat. Gloves when direct skin contact with infected materials or animals is unavoidable. Eye protection must be used where there is a known or potential risk of exposure to splashes.

OTHER PRECAUTIONS: All procedures that may produce aerosols, or involve high concentrations or large volumes should be conducted in a biological safety cabinet (BSC). The use of needles, syringes and other sharp objects should be strictly limited. Additional precautions should be considered with work involving animals or large scale activities.

HANDLING AND STORAGE

SPILLS: Allow aerosols to settle and, wearing protective clothing, gently cover spill with paper towels and apply appropriate disinfectant, starting at the perimeter and working towards the centre. Allow sufficient contact time before clean up.

DISPOSAL: Decontaminate all wastes that contain or have come in contact with the infectious organism before disposing by autoclave, chemical disinfection, gamma irradiation, or incineration.

STORAGE: Properly labeled and sealed containers.

REFERENCE

Pathogen Safety Data Sheet (PSDS) for *Shigella* spp. has been modified from the ones produced by the Public Health Agency of Canada as educational and informational resources for laboratory personnel working with infectious substances.

- 1) Picture from Wikipedia
- 2) Picture from www.bam.de