CYCLOSPORIASIS

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_Cyclospora_ were described in 1870 by Eimer. Various species of _Cyclospora_ were found in snakes, myriapods and rodents. The first human cases were described by Ashford in three individuals living in Papua-New Guinea. Since then it was isolated in many countries but it was not until 1993 that it found its final taxonomic place as the genus _Cyclospora_. Until 1996 most of the documented cases of cyclosporiasis in North America were in overseas travelers.

_Cyclospora_ infection is caused by a protozoan parasite (_Cyclospora cayetanensis_) transmitted by food or water that is contaminated with infected stool.

**Epidemiology**

Infection occurs after the host ingest oocysts. This is the result of fecal contamination. The source of oocysts may be human or animal. Several animals (chickens, ducks, non-human primates) harbor _Cyclospora_ but their role has not yet been determined.

_Cyclospora_ requires time outside the host for sporulation to occur; thus human-to-human transmission is not likely. The oocysts excreted by humans are not infectious. The time required in nature for sporulation to occur is not yet known; under laboratory conditions, it takes about two weeks.

**Waterborne outbreaks** are frequent. Consumption of untreated water is a risk factor for travelers found infected with _Cyclospora_. The first outbreak described in the U.S. was linked to tap water in a physicians’ dormitory. In an outbreak in a British military detachment in Nepal, _Cyclospora_ oocysts were found in the water supply, a mixture of river and municipal water that had acceptable residual concentration of chlorine. _Cyclospora_ are highly resistant to chlorine disinfection.

**Foodborne outbreaks** were linked to raspberries, mezclun lettuce and basil.

There are no community based studies to determine the prevalence of cyclosporiasis in endemic countries. Surveys of laboratory stool specimens in the U.S. show a low prevalence: 0.5% of specimens examined.

Outbreaks tend to be seasonal, occurring more often in warmer months

The average **incubation period** for cyclosporiasis is one week; in some outbreaks it has been as short as 24 hours.

**Clinical Description**

_Cyclospora_ is an intracellular parasite in the enterocytes of the upper small bowel. There are some inflammatory changes, villous atrophy and crypt hyperplasia in the jejunal tissue of infected individuals.
Patients have diarrhea, abdominal cramps, nausea, fatigue, loss of appetite, eventually weight loss. The diarrhea is watery without blood or inflammatory cells. It often follows a cyclical pattern. Vomiting and fever are uncommon.

The infection is self-limited. In patients who are not treated with trimethoprim-sulfamethoxazole, illness can be protracted, lasting for a few weeks with remitting and relapsing symptoms. In some of these cases fatigue and weight loss may occur.

In immunocompromised individuals, the infection is severe with a high recurrence rate.

Some individuals have contracted the infection more than once within a few months; therefore, acquired immunity is not totally protective.

**Laboratory Tests**

The diagnosis is based on the demonstration of oocysts in the stools, duodenal, jejunal aspirates or biopsy specimens. The microorganisms are detected at the microscopic examination of a wet mount of fresh stools. *Cyclospora* is diagnosed by the identification of 8-9 mm ‘wrinkled spheres’ on a wet mount slide (from a stool sample). The spheres resemble large oocysts of cryptosporidium. This is a special laboratory test that is not routinely done and so, must be specifically requested.

Healthcare providers should consider the diagnosis of *Cyclospora* infection in persons with prolonged diarrheal illness, and specifically request testing of stool specimens for this parasite.

**Surveillance**

Cyclosporiasis is a reportable disease with reporting required within five business days.

**Case Definition**

**Clinical description**

An illness of variable severity caused by the protozoan *Cyclospora cayetanensis* and commonly characterized by watery diarrhea, loss of appetite, weight loss, abdominal bloating and cramping, increased flatus, nausea, fatigue, and low-grade fever. Vomiting also may be noted. Relapses and asymptomatic infections can occur.

**Laboratory criteria for diagnosis**

Laboratory-confirmed cyclosporiasis is defined as the detection—in symptomatic or asymptomatic persons—of *Cyclospora*

- oocysts in stool by microscopic examination, or
- in intestinal fluid or small bowel biopsy specimens, or
- demonstration of sporulation, or
- DNA (by polymerase chain reaction) in stool, duodenal/jejunal aspirates or small bowel biopsy specimens.

**Case classification**

**Confirmed, symptomatic**: a laboratory-confirmed case associated with one of the symptoms described above

**Confirmed, asymptomatic**: a laboratory-confirmed case associated with none of the above symptoms
**Intervention**

The purpose of investigation is to identify cases, to differentiate with other infections that cause diarrhea, to identify the source(s) of illness, and to institute disease control measures to prevent further spread of the disease.

- Upon receipt of a report of a case of *Cyclospora*, contact the physician and/or hospital to confirm the diagnosis.
- It is not necessary to follow-up on each individual, isolated case of *Cyclospora*; only when it is thought to be part of a food or waterborne outbreak.
- If the case is suspected to be part of an outbreak, the first concern should be to determine the source(s) of the infection. Check recent food history and water sources or other common exposures.
- Since *Cyclospora* needs days or weeks after being passed in a bowel movement to become infectious, it is unlikely that it is passed directly from one person to another; contact investigation is not useful.

**Case Management - Treatment**

The drug of choice is trimethoprim-sulfamethoxazole (160/800mg) bid for seven (7) days. In immunocompromised patients a dose of 160/800 mg qid for 10 days is recommended. Most standard treatments of gastroenteritis agents are ineffective: quinolones, quinacrine, tinidazole, metronidazole and macrolides.

**Prevention**

**Avoid food contamination**: Produce should be washed thoroughly before it is eaten; However, this practice does not eliminate the risk for transmission of *Cyclospora*.

**Food handlers**: Therefore, food workers should be particularly meticulous about handwashing.

**Public waters**: To reduce the risk for *Cyclospora* contamination of fountains, and pools, the following measures may be useful: showering before entering the fountain; excluding persons with diarrhea or incontinence; excluding children wearing diapers; and restricting food consumption in the fountain area. Exclusion of persons from decorative water displays not designed for interactive use should be instituted and enforced.

For recreational water facilities designed for human use, improved filtration may reduce risk.

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*Cyclosporiasis* can be acquired by the ingestion of contaminated foods or water. Direct person-to-person transmission is unlikely, as the excreted oocysts are not infectious and require more than 7 days outside the host to sporulate.

Strategies to prevent food-borne and waterborne contamination should therefore target the reduction or prevention of human infections and strive for improved sanitation. Proper hygiene habits and food washing and sanitizing may reduce, but would not be expected to eliminate, the risk of acquiring infections. It has been demonstrated that these practices do not completely remove *Cyclospora* oocysts from contaminated produce. Good agricultural practices would indeed contribute to reducing the burden of parasite contamination at the farm level. These practices would involve the use of properly treated irrigation water and the use of pathogen-free water for washing produce.

Several practices have been tested for the ability to inactivate or reduce the number of viable parasites in foods and in water. Because of the lack of animal or in vitro infectivity models, oocyst sporulation has been used as an indicator of viability. Methods that rely on temperature and time of storage have been
evaluated for killing parasites. For dairy substrates, storage at −15°C for 24 h did not inactivate Cyclospora oocysts. For basil or water, storage at −20°C for 2 days, 50°C for 1 h, and 37°C for up to 4 days did not prevent Cyclospora sporulation; however, extreme temperatures (70°C, −70°C, and 100°C) were effective in preventing oocysts from sporulating. Temperatures frequently used for produce storage, e.g., 4 to 23°C, do not affect sporulation of Cyclospora. Microwave heating of Cyclospora oocysts can inactivate oocysts; however, more time is required to kill Cyclospora oocysts than to kill Cryptosporidium oocysts. Short exposures to a high temperature (96°C for 45 s) did not completely prevent the sporulation of Cyclospora. Chemicals have been tested for the ability to interfere with the sporulation of Cyclospora. Gaseous chlorine dioxide at 4.1 mg/liter does not affect the sporulation of Cyclospora; however, this treatment does inactivate Cryptosporidium and microsporidia.

The lack of in vivo or in vitro methods to test viability has prompted researchers to use surrogate parasites, such as Eimeria and Toxoplasma, to evaluate other treatments. Gamma irradiation (137Cs) of sporulated and unsporulated Toxoplasma oocysts was evaluated as a model system for inactivation of Cyclosporaoocysts. Toxoplasma oocysts treated with ≥0.4 kGy could sporulate, excyst, and infect cells but did not cause infections in mice. It was recommended that 0.5 kGy be used to kill coccidian oocysts on fruits and vegetables. Inactivation of Eimeria acervulina oocysts was achieved by freezing, heating, and irradiation at 1 kGy and higher.

High hydrostatic pressure (550 MPa at 40°C for 2 min) and UV light (up to 261 mW/cm²) treatments of produce contaminated with E. acervulina as a Cyclospora surrogate were evaluated on experimentally inoculated basil and raspberries. Both treatments yielded smaller numbers of animals infected with E. acervulina but did not completely inactivate the oocysts recovered from these food matrices.

Toxoplasma oocysts (VEG strain) inoculated onto raspberries were rendered noninfectious to mice when a high-pressure processing treatment of 340 MPa for 60 s was applied.

**Hospital Precaution and Isolation:** Standard precautions