CD Summary

August 19, 2008
Vol. 57, No. 17

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OREGON PUBLIC HEALTH DIVISION • DEPARTMENT OF HUMAN SERVICES

ZOONOSES PART II: PARASITIC INFECTIONS

When many of us think of diseases caused by parasites, we imagine exotic tropical infections. Oregonians can, however, contract parasitic infections at home — sometimes from their beloved pets. This second of a two-part *CD Summary* series describes selected parasitic zoonoses.

GIARDIASIS

Giardia, a flagellate with worldwide distribution, causes significant gastrointestinal disease in dogs, cats, and people. The organism has a wide host range; mammalian isolates are all currently classified as *G. duodenalis.* Since mid-2006, 258 cases of giardiasis in pets have been reported through the (voluntary) veterinary reporting system; 83% were diagnosed in dogs and the rest in cats. Age ranged between 7 weeks and 15 years with a mean of 5 years; the sexes were equally represented. As for human cases, Oregon has reported 450–650 human cases annually since 2000, with no sex predilection. Children 1–4 years old and adults in their 20s and 30s lead in case counts. A single two-gram dose of tinidazole or three days' treatment with nitazoxanide (500 mg b.i.d.*) should cure the infection.

Can canine *Giardia* cause illness in humans? Maybe not. *Giardia* genotypes in people, appear to be distinct from those in dogs. On the other hand, evaluation of human and feline *Giardia* isolates suggests that cats could serve as a reservoir for human infections. For the time being, we recommend avoiding the consumption of feces from either dogs or cats.

BAYLISASCARIASIS

The first human case of infection by the raccoon roundworm *Baylisascaris procyonis* was reported in 1984 in a 10-month-old infant with fatal eosinophilic meningoencephalitis.

*JCAHO people: this means "twice daily."

The infant's family lived in a rural, wooded area of Pennsylvania, where raccoons were nesting in unused chimneys. Four additional cases of eosinophilic encephalitis with similar pathologic characteristics have been documented. Patients who survived central nervous system (CNS) invasion had severe neurologic sequelae.

No effective therapy exists for the visceral form of *B. procyonis* larval infection. In an experimental model, mice treated with albendazole and diethylcarbamazine within 10 days after infection were protected from CNS disease; however, several antihelminthic agents have been used to treat human cases without success.

Because the disease is transmitted by the fecal-oral route, human cases of *Baylisascaris* infection typically occur in younger age groups, mainly infants, who often engage in oral exploration of their environment and are, therefore, more likely to ingest *Baylisascaris* eggs. Raccoon activity near the patient's residence is often described. Eleven recognized human cases, four of them fatal, have been reported. All but one was male; however, there is no reason to believe that females are less susceptible.

We investigated the prevalence of *Baylisascaris procyonis* in raccoons living in metropolitan Portland, Oregon. Sixty-nine euthanized raccoons were collected from Portland wildlife control agencies. Infection with *B. procyonis* was determined through the harvesting of adult worms from raccoon intestines. Fifty-eight percent of sampled raccoons were found to be infected with *B. procyonis*. Juveniles had the highest prevalence (70%) and heavier adult worm burdens (mean=35 worms). The data suggest that juvenile raccoons are the major potential source of *B. procyonis* contamination in or about Portland.[1]

CRYPTOSPORIDIOSIS

Infection with the coccidian parasite *Cryptosporidium parvum* results in severe diarrhea, often with vomiting. Infection of immunosuppressed individuals may be life-threatening; people with AIDS may never be cured. Cryptosporidiosis has been documented in people as well as cats and/or dogs living in the same environment, suggesting zoonotic transfer. *Cryptosporidium parvum* oocysts have been documented in the feces of domestic dogs and cats in the United States, Japan, Scotland, Australia, and Spain.

On the heels of a large waterborne outbreak in Jackson County in 1992 and the huge outbreak in Milwaukee, Wisconsin in 1993, cryptosporidiosis was made reportable in Oregon at the end of 1994. During 1995–2007, 780 human cases were reported in Oregon. A few outbreaks have been investigated; the largest comprised 60 cases associated with a community swimming pool in Multnomah County in 1997.

Only one confirmed feline case has been reported in Oregon pets.

Until recently, no specific treatment was available. Nitazoxanide is now approved for treatment of cryptosporidiosis in immunocompetent patients 1–11 years of age. A review of (uncontrolled) data on nitazoxanide in the treatment of cryptosporidiosis in patients with HIV argued that it might also be useful in this population.[2]

TOXOPLASMOSIS

Toxoplasma gondii is one of the most common small animal zoonoses; approximately 30–40% of adult humans are seropositive, suggesting previous or current infection by *T. gondii.* People are most commonly infected after ingesting sporulated oocysts or tissue cysts. Thus, toxoplasmosis can be prevented by avoiding those two life stages.

In cats, *Toxoplasma gondii* multiplies in the wall of the small intestine and produces oocysts during what is known as the intra-intestinal infection cycle. These oocysts are then

The **CD Summary** (ISSN 0744-7035) is published biweekly, free of charge, by the Oregon Dept. of Human Services, Office of Communicable Disease and Epidemiology, 800 NE Oregon St., Portland, OR 97232 Periodicals postage paid at Portland, Oregon.
Postmaster—send address changes to:
CD Summary, 800 NE Oregon St., Suite 730, Portland, OR 97232

CD SUMMARY
AUGUST 19, 2008
Vol. 57, No. 17

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excreted in great numbers in the cats' feces. Cats previously unexposed to *T. gondii* will usually begin shedding oocysts 10 days after ingestion of infected tissue, and continue shedding for around 10 to 14 days, during which time many millions of oocysts may be produced. Oocysts are hardy and may survive in the environment for well over a year. The oocysts must be in the environment 1–5 days before they sporulate and become infective. Therefore, cat feces in litter boxes that are not cleaned daily are potentially hazardous.

Bioassay failed to detect oocysts on the fur of cats seven days after they were shedding millions of oocysts in their feces. These findings, supported by epidemiologic studies, suggest that touching cats is unlikely to lead to infection.

Ingestion of *T. gondii* in tissues can result in human toxoplasmosis, and eating undercooked meat is probably the most common means by which the infection is acquired in the U.S.

Outbreaks of toxoplasmosis have been reported from drinking contaminated water in British Columbia and Panama; and in a group of people with a common exposure in a riding stable.[3] Ingestion of raw goat's milk can also lead to human toxoplasmosis.

About 85 percent of women of childbearing age in the United States are susceptible to acute infection with *Toxoplasma gondii*. Transmission of the parasite to the fetus can result in mental retardation, seizures, blindness, and death. Some health problems may not become apparent until the second or third decade of life. An estimated 400 to 4,000 cases of congenital toxoplasmosis occur in the United States each year.[4]

In AIDS patients, toxoplasmosis presents as encephalitis, typically with multiple ring-enhancing lesions seen with computed tomography. *Toxoplasma* seroprevalence among HIV-infected patients has been estimated at 16% in southern California and >50% in some European countries.[5] First-line treatment for toxoplasmosis in HIV-infected patients includes pyrimethamine, sulfadiazine and folinic acid.

Prevention of foodborne toxoplasmosis includes washing produce from the garden thoroughly before eating; wearing gloves or carefully washing hands after working with raw meats; and cooking meats — particularly pork — to medium-well to inactivate cysts. Freezing meat at -12°C (10°F) for several days will also kill most tissue cysts. Avoid any unpasteurized milk. To prevent waterborne infection, boil or filter any drinking water collected from the environment.

To prevent infection from cats, cover the children's sandbox when it's not being used. If cats are owned, a litter box liner should be used and the litter box cleaned daily. Immunosuppressed persons should not clean litter boxes. Sporulated oocysts are extremely resistant to most disinfectants, and their inactivation requires exposure to 10% ammonia for 10 minutes; cleaning with scalding water or steam is most practical.

CLOSING COMMENTS

A 1987 study estimated that approximately 4 million pet-derived infections occur annually in the United States, with direct medical costs exceeding $300 million.[6] Most pet-associated infections are preventable with simple measures like adequate hand washing, proper disposal of animal waste, and ensuring that infected animals are diagnosed and treated. Increased communication between primary care physicians and veterinarians could improve treatment and prevention of these conditions.

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