Toxoplasmosis

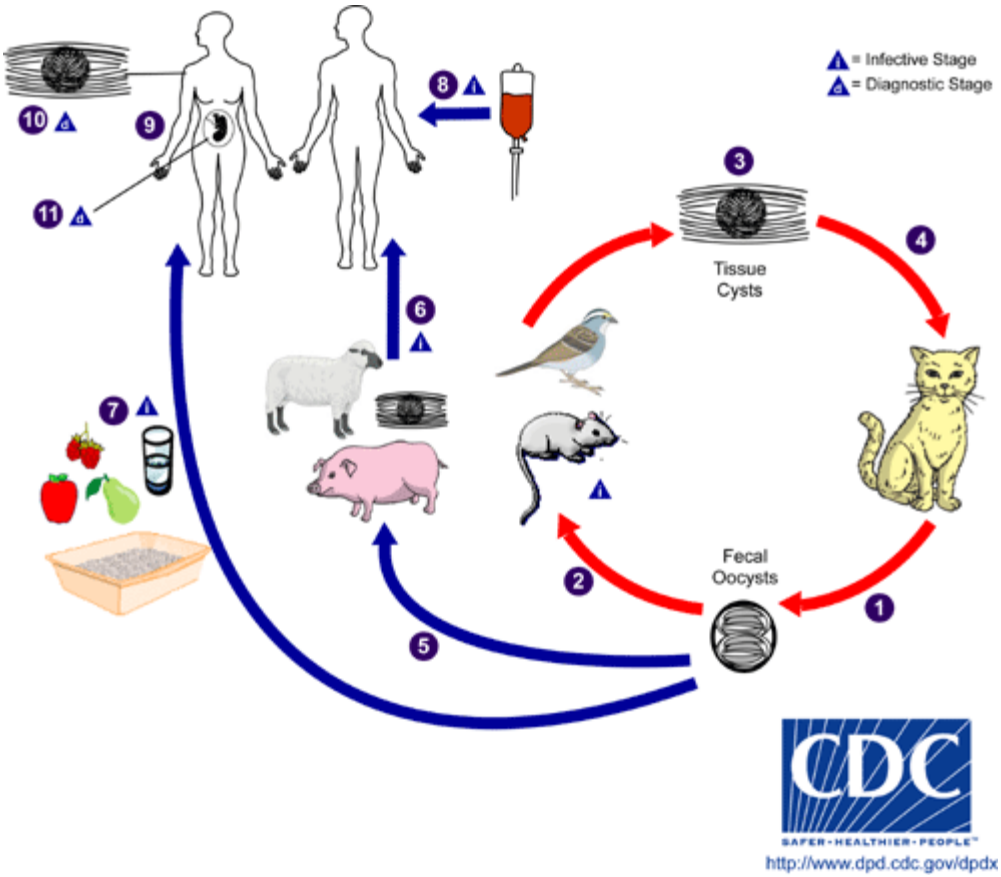
Toxoplasma gondii is a protozoan parasite that can infect many animals, including humans. It belongs to a larger group of parasites that are collectively called "coccidia". Toxoplasma occurs worldwide - an estimated 30% of all human beings have been infected by Toxoplasma gondii at some point in their lives.

Most infections are silent and have no ill effect on the patient. Occasionally, Toxoplasma gondii infections can be devastating. If a woman who has not previously been infected with Toxoplasma gondii becomes infected while she is pregnant, there is a significant chance that the organism will produce severe neurological damage in the developing fetus. Toxoplasma gondii is also a special risk in the case of individuals that may have weakened immune systems such as individuals receiving cancer or transplant therapy or individuals that are positive for HIV.

Biology

Toxoplasma gondii is a protozoan parasite that infects most species of warm blooded animals, including humans, and can cause the disease toxoplasmosis.

Life Cycle:



The only known definitive hosts for *Toxoplasma gondii* are members of family Felidae (domestic cats and their relatives). Unsporulated oocysts are shed in the cat's feces (1). Although oocysts are usually

only shed for 1-2 weeks, large numbers may be shed. Oocysts take 1-5 days to sporulate in the environment and become infective. Intermediate hosts in nature (including birds and rodents) become infected after ingesting soil, water or plant material contaminated with oocysts [2]. Oocysts transform into tachyzoites shortly after ingestion. These tachyzoites localize in neural and muscle tissue and develop into tissue cyst bradyzoites [3]. Cats become infected after consuming intermediate hosts harboring tissue cysts [4]. Cats may also become infected directly by ingestion of sporulated oocysts. Animals bred for human consumption and wild game may also become infected with tissue cysts after ingestion of sporulated oocysts in the environment [5]. Humans can become infected by any of several routes:

- eating undercooked meat of animals harboring tissue cysts [6].
- consuming food or water contaminated with cat feces or by contaminated environmental samples (such as fecal-contaminated soil or changing the litter box of a pet cat) [7].
- blood transfusion or organ transplantation [8].
- transplacentally from mother to fetus [9].

In the human host, the parasites form tissue cysts, most commonly in skeletal muscle, myocardium, brain, and eyes; these cysts may remain throughout the life of the host. Diagnosis is usually achieved by serology, although tissue cysts may be observed in stained biopsy specimens [10]. Diagnosis of congenital infections can be achieved by detecting *T. gondii* DNA in amniotic fluid using molecular methods such as PCR [11].

Information from: http://www.dpd.cdc.gov/dpdx/HTML/Toxoplasmosis.htm

Epidemiology & Risk Factors

In the United States it is estimated that 22.5% of the population 12 years and older have been infected with *Toxoplasma*. In various places throughout the world, it has been shown that up to 95% of some populations have been infected with *Toxoplasma*. Infection is often highest in areas of the world that have hot, humid climates and lower altitudes.

Toxoplasmosis is not passed from person-to-person, except in instances of mother-to-child (congenital) transmission and blood transfusion or organ transplantation. People typically become infected by three principal routes of transmission.

- Foodborne
- Animal-to-human (zoonotic)
- Mother-to-child (congenital)
- Rare instances

Always cook meat thoroughly and use clean knives, utensils and cutting boards on all foods. (CDC Photo)

Foodborne transmission

The tissue form of the parasite (a microscopic cyst consisting of bradyzoites) can be transmitted to humans by food. People become infected by:

- Eating undercooked, contaminated meat (especially pork, lamb, and venison)
- Accidental ingestion of undercooked, contaminated meat after handling it and not washing hands thoroughly (*Toxoplasma* cannot be absorbed through intact skin)
- Eating food that was contaminated by knives, utensils, cutting boards, or other foods that had contact with raw, contaminated meat

Animal-to-human (zoonotic) transmission

Cats play an important role in the spread of toxoplasmosis. They become infected by eating infected rodents, birds, or other small animals. The parasite is then passed in the cat's feces in an oocyst form, which is microscopic.

Kittens and cats can shed millions of oocysts in their feces for as long as 3 weeks after infection. Mature cats are less likely to shed *Toxoplasma* if they have been previously infected. A *Toxoplasma*-infected cat that is shedding the parasite in its feces contaminates the litter box. If the cat is allowed outside, it can contaminate the soil or water in the environment as well.

If your pregnant have someone else clean the litter box.

People can accidentally swallow the oocyst form of the parasite. People can be infected by:

- Accidental ingestion of oocysts after cleaning a cat's litter box when the cat has shed *Toxoplasma* in its feces
- Accidental ingestion of oocysts after touching or ingesting anything that has come into contact with a cat's feces that contain *Toxoplasma*
- Accidental ingestion of oocysts in contaminated soil (e.g., not washing hands after gardening or eating unwashed fruits or vegetables from a garden)
- Drinking water contaminated with the *Toxoplasma* parasite

Mother-to-child (congenital) transmission

A woman who is newly infected with *Toxoplasma* during pregnancy can pass the infection to her unborn child (congenital infection). The woman may not have symptoms, but there can be severe consequences for the unborn child, such as diseases of the nervous system and eyes.

Rare instances of transmission

Organ transplant recipients can become infected by receiving an organ from a *Toxoplasma*-positive donor. Rarely, people can also become infected by receiving infected blood via transfusion. Laboratory workers who handle infected blood can also acquire infection through accidental inoculation.

The diagnosis of toxoplasmosis is typically made by serologic testing. A test that measures immunoglobulin G (IgG) is used to determine if a person has been infected. If it is necessary to try to estimate the time of infection, which is of particular importance for pregnant women, a test which measures immunoglobulin M (IgM) is also used along with other tests such as an avidity test.

Diagnosis

Diagnosis can be made by direct observation of the parasite in stained tissue sections, cerebrospinal fluid (CSF), or other biopsy material. These techniques are used less frequently because of the difficulty of obtaining these specimens.

Parasites can also be isolated from blood or other body fluids (for example, CSF) but this process can be difficult and requires considerable time.

Molecular techniques that can detect the parasite's DNA in the amniotic fluid can be useful in cases of possible mother-to-child (congenital) transmission.

Ocular disease is diagnosed based on the appearance of the lesions in the eye, symptoms, course of disease, and often serologic testing.

Information taken from CDC: http://www.cdc.gov/parasites/toxoplasmosis/gen_info/index.html

Relative Risk in the Vivarium

Most human beings are infected by eating undercooked meat, but exposure to infected cat feces is also a significant hazard, especially for pregnant women. Cat feces can only be infective if the cat has had an opportunity to hunt within the last month. The risk is very low if the research cats have been housed in a rodent-proof facility for a month or more and fed only commercial cat food. If there is a chance that feral mice can find their way into the facility, then the risk is much greater. If the cats have been obtained from a random source within the last month, then there is a much greater possibility that their feces may be infectious.

Prevention

The most important step you can take to avoid toxoplasmosis is to avoid eating rare or undercooked meat - this remains the primary route of human exposure. If cats frequent your vegetable garden, then be sure that you peel and wash root crops thoroughly before eating them, or only grow root crops that must be cooked.

In the research facility, be sure that your facility is designed so that no rodents have access to the inside of your buildings.

You should consider that your cats may be at risk if:

- You ever see evidence of rodents in or around your facility.
- The cats are ever fed raw meat.
- The cats have been obtained within the last 30 days from an outside source.

- Routine health screens of your cats ever reveal coccidial oocysts.

Since we can never be 100% certain that a mouse could not have found its way into one of our cats, the safest policy is to assume that any cat's feces may potentially carry toxoplasma oocysts.

Toxoplasma oocysts are not immediately infectious when they are shed, but they may become infectious as early as 24 hours later. Cleaning the litter pan once each day dramatically reduces the chance of infection.

The route of transmission for the oocysts is fecal-oral. In order to avoid any possibility of contact with cat feces, workers changing cat litter should do so in a way that does not stir up dusts and aerosols from the litter pans. Workers should wear gloves while changing litter pans and should wear a mask or face shield if there is any possibility of infectious fecal material being splashed or splattered into their mouth or eyes. Finally, workers should be very scrupulous about thoroughly washing their hands before eating, drinking, or smoking after changing cat litter pans.

Women of Childbearing Age

Women who are of child bearing age, or who are contemplating pregnancy, and who work with cats in a research setting you are strongly advised to contact the Occupational Health Coordinator at 949-824-3757 to discuss this issue and arrange for follow-up with an occupational health physician and discuss the advisability of having their titer to T. gondii measured as a part of their routine prenatal care.

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Revised 07/2014