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"WHICH PARASITES CAN I CATCH FROM MY PET?"

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Which parasites can be transmitted by household cats and dogs? This difficult question is frequently asked to family physicians. Certainly a variety of potentially dangerous helminths and protozoa can be transmitted to humans from pets but, for the most part, very special conditions must be present before this occurs. Small children, pregnant women and immunocompromised persons are three groups at greater potential risk than the general population. Pregnant women are at special risk for toxoplasmosis[1]. Immunocompromised persons (including those with acquired immunodeficiency syndrome) are susceptible to multiple infections, especially to cryptosporidiosis, an underdiagnosed zoonosis present in contaminated water supplies. The risk of disease transmission from pets can be minimized by taking a few simple precautions such as avoiding fecal-oral contact, pregnant women not emptying the pet's litterbox, washing hands carefully after handling pets, worming pets regularly and supervising toddler-pet interactions. In most cases, the psychologic benefits of pet ownership appear to outweigh the reducible risks of disease transmission[2]. Zoonotic infections,which are those transmissible from animals to people include innumerable viruses,bacteria,fungi and parasites(Table I).

Key words: *Pets, parasites*

" Evde beslenen kedi ve köpek gibi hayvanlardan hangi parazitler bulaşabilir? "

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Evde beslenen kedi ve köpeklerden hangi parazitler insanlara bulaşabilir? Sık sık aile hekimlerine bu zor soru sorulmaktadır. Potansiyel olarak çok çeşitli tehlikeli helmint ve protozoonlar evcil hayvanlardan insanlara bulaşabilir ancak çogunlukla bu durum öncesinde çok özel koşullar bulunmalıdır. Küçük çocuklar, gebe kadınlar ve bağışıklık yetmezliği olan kişiler genel popülasyona göre daha çok risk altındaki üç grubu olşturur. Gebe kadınlar toksoplazmosisi açısından büyük risk altındadırlar[1]. Bağışıklık yetmezliği olan kişiler (edinilmiş bağışıklık yetmezliği sendromu olanlar da dahil olmak üzere), kontamine su kaynaklarında yer alan teşhis edilmemiş bir zoonoz olan kriptosporidiozis gibi çok sayıda enfeksiyona eğilimlidir. Evcil hayvanlardan hastalık bulaşma riski fekal oral ilişkiden kaçınarak, gebe kadınların evcil hayvanların dışkı kaplarını boşaltmasının engellenmesiyle, evcil hayvanları sevdikten sonra elleri dikkatlice yıkanmasıyla, evcil hayvanların düzenli veteriner kontrolleri ile ve küçük çocukların evcil hayvanlarla ilişkileri denetlenerek en aza indirgenebilir. Bir çok durumda evcil hayvan sahibi olmanın psikolojik yararları, hastalık bulaşmasının azaltılabilir risklerinden ağır basmaktadır.

Anahtar kelimeler: *Evcil hayvan, parazitler*

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Zoonotic infections, which are those transmissible from animals to people, include innumerable viruses, bacteria, fungi and parasites and comprise a complex, confusing topic[3].

Many worm eggs such as those of roundworm (Toxocara) and hookworm (Ancylostoma), must embryonate briefly outside their host before they become infectious. Protozoal infections may pose a greater risk because they are both widespread and easily transmitted by fecal-oral contamination. Toxoplasmosis, which is transmitted from cat litter boxes, is a real threat to immunocompromised and pregnant members of a household. Cryptosporidiosis and giardiasis are other relatively host-non-specific protozoans that could also be transmitted from an infected pet's feces [4].

Ownership of either cats or dogs increases the potential for fecal-oral contact, especially while the pets are being house broken or during their litter boxes are cleaned[5]. The differential diagnosis of pet borne parasitic zoonoses is given in **Table 2**.

Visceral and Ocular Larva Migrans (Toxocariasis)

Dog and cat roundworms (Toxocara canis and Toxocara cati, respectively) are the most common pet parasites with a fascinating life cycle. Older dogs with good immune systems tend to have dormant infections, but pregnancy reactivates Toxocara, ensuring transmission to the next generation. Cats are less important carriers than dogs but may transmit eggs to children through sandbox contamination[6].

Young children usually become infected by eating contaminated dirt or by placing soiled objects in their mouths. Adults may become infected by eating raw liver. Symptoms of patients infected with roundworms are non-specific and may include nausea, fever, myalgia and hepatomegaly, with allergic manifestations such as urticaria, asthma and edema[7].

Diagnosis of visceral larva migrans depends on a high degree of clinical suspicion when a child (often under age three) presents with likely symptoms and eosinophilia. Leukocytosis with with more than 20 percent persistent eosinophilia is the rule in patients with visceral larva migrans, although the complete blood cell count may be normal in patients with isolated ocular larva migrans. An ELISA test for larval antigens confirms the diagnosis[8].

Treatment options include mebendazole (Vermox), 100 to 200 mg twice daily for five days, or diethylcarbamazine (Hetrazan), 6 mg per kg per day in three divided doses for 7 to 10 days. Corticosteroids may be added to the regimen in patients with severe disease or eye involvement[9].

Cutaneous Larva Migrans

(Creeping Eruption)

Dog and cat hookworms (Ancylostoma braziliense and Ancylostoma caninum) are blood-sucking nematodes related to human hookworm and inhabiting the small intestines of a variety of carnivores. The infection occurs when larvae in the ground enter ito the body by penetrating the skin, by direct ingestion or transplacentally (as with Toxocara). The filariform (infective stage) larvae develop only after fecal matter is deposited on moist warm soil or sand if these larvae penetrate human skin they first form a pruritic papule at the entry site and then wander about the skin, leaving a characteristics serpiginous tract that advances noticeably each day (Figure 1).

Figure 1. Tunnels of creeping eruption (cutaneous larva migrans) on a foot

Table 1. Summary of Pet-borne Parasitic Zoonoses

Disease	Epidemiology	Symptoms	Diagnosis	Treatment
Visceral larva migran (VLM)	Ingestion of contaminated soil or raw liver; usually child under age 3	Nausea, fever, hepatomegaly, edema, urticaria, seizures	Eosinophilia, increased white blood cell count, ELISA	Mebendazole (Vermox) or diethylcarbamazine (Hetrazan)
Ocular larva migrans	Same as VLM, usually older child	Visual loss, discomfort; other symptoms of VLM absent	Endophthalmitis, leukokoria, choroidal granulomas; eosinophilia rare	No satisfactory treatment corticosteroids(?), surgery(?)
Cutaneous larva migrans	Skin contact with contaminated soil	Serpiginous tracks, itching	Characteristic appearance	Thiabendazole cream or freezing
Dipylidiasis	Ingestion of infected fleas, usually toddler	Passage of proglottids, pruritus ani	Microscopy	Praziquantel (Biltricide)
Echinococcosis (hydatid disease)	Fecal-oral (egg ingestion)	Mass effect, usually liver rupture associated with urticaria, edema or even anaphylaxis	CT/ultrasound, serology	Surgery, albendazole (Albenza)
Dirofilariasis	Infected mosquito bite	Coin lesion on chest radiograph	Biopsy	None required
Toxoplasmosis	Fecal/oral (cat litter box), raw or undercooked meat, transplacental transmission	Acute mononucleosis-like infection, congenital defects, retinochoroiditis	Serology, CT of the head, funduscopic examination	Pyrimethamine (Daraprim) plus sulfadiazine
Cryptosporidiosis	Fecal/oral (animal feces), contaminated water supply	Self-limited diarrhea	Acid-fast stool stain	None required unless patient is immunocompromised
Giardiasis	Fecal/oral, contaminated water supply	Bloating, diarrhea, cramps, flatulence	Stool ova and parasite examination, giardia stool antigen	Metronidazole (Flagyl)

CT = computed tomographic; ELISA = enzyme-linked immunosorbent assay.

Ethyl chloride spray directed at the advancing aspect of the track or topical use of thiabendazole cream, Ivermectin (Stromectol), 150 to 200 µg per kg in a single dose, is an alternative systemic agent. The rare eosinophilic enteritis syndrome may be treated with mebendazole, in a dosage of 100 mg twice daily for three days[10].

Dipylidiasis (Dog or Cat Tapeworm Infection)

Dipylidium caninum, the common dog or cat tapeworm , occasionally causes an asymptomatic infection in toddlers.

The infection is treated with praziquantel (Biltricide), 5 to 10 mg per kg in a single dose[11].

Echinococcosis (Hydatid Disease)

Echinococcus granulosus is a small (3 to 8 mm) canine tapeworm endemic to certain sheep-herding regions around the world. Hydatid disease is not a concern for most pet dog owners[12].

Human contracts echinococcus hydatid cysts by ingesting eggs from dog feces. Dog feces, which contain ova, are left on grass. Sheep and other herbivores eat grass contaminated by dog feces(Figures 2). Hydatid cysts develop in the herbivore liver and other internal organs. Dog eats contaminated entrails of slaughtered sheep[13].

Humans acquire hydatid disease through close contact with infected dogs. Eggs may be immediately infective or may persist for months in the environment before ingestion. Although hydatid cysts may slowly develop in any organ , they are most likely to settle in the liver, with the lung being the next most likely site.

The lung is the most common location of hydatid. Symptoms take years or decades to develop and mimic those of any space-occupying tumor. On ultrasound or computed tomographic (CT) study, these parasites appear

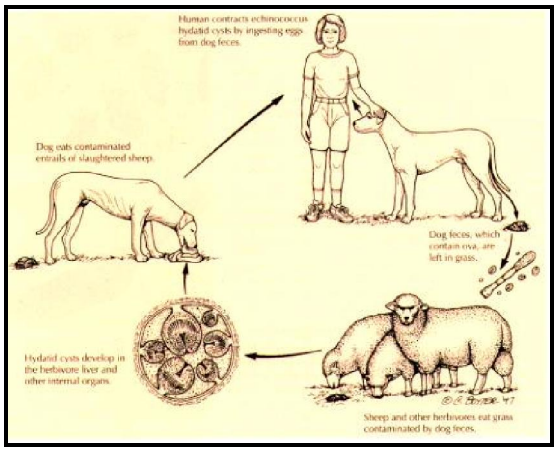

Figure 2 . Life cycle of Echinococcus granulosus

as spherical, thick-walled cysts. The cysts often contain brood capsules and hydatid "sand" consisting of innumerable protoscolices, each capable of spreading the infection (Figure 3). Spontaneous or traumatic rupture of these cysts may cause widespread dissemination of the organism throughout the body, and even anaphylaxis with sudden death. Specific serologic tests are available to confirm the diagnosis[14].

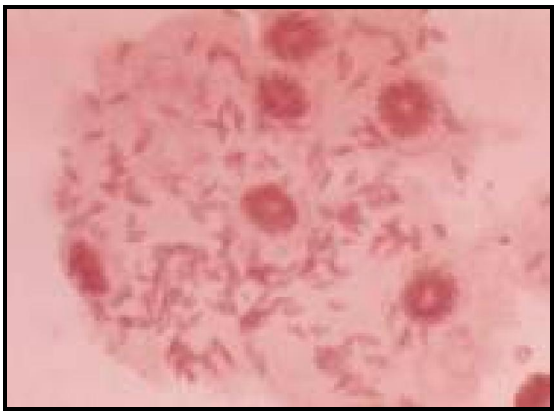

Figure 3. Echinococcocus granulosus "sand" in a human liver

Treatment consists of meticulous surgical removal and albendazole (Albenza), in a dosage of 400 mg twice daily for 28 days starting at least two weeks before the surgery.

Using the PAIR technique (puncture, aspiration, injection, reaspiration), a scolicide is injected into the cyst (after an equivalent amount of cyst fluid is withdrawn) to kill its contents before removal. This step minimizes the risk of intra-operative cyst rupture. Small, slow-growing lung hydatids may not require any surgical intervention[15].

Prevention efforts focus on interrupting the lifecycle by not feeding uncooked organ meats to dogs, by eliminating infected stray dogs and by regular worming of at-risk pets with praziquantel. In the absence of reinfection, the adult tapeworms only survive for several years and egg production therefore ceases. Personal hygiene factors, such as careful hand washing, prevent transmission to humans[16].

Toxoplasmosis

Toxoplasma gondii is a ubiquitous intracellular protozoan capable of infecting humans and other mammals. Outdoor cats are the primary carriers of this parasite which they aquire from ingesting tissue cysts in their ingested prey. Toxoplasma undergoes sexual reproduction in the feline intestine, producing infectious oocysts. These oocysts contaminate any soil (or sandbox or litterbox) in which cat feces are deposited and

Table 2. Differential diagnosis of Pet-borne Parasitic Zoonoses

Disease	Differential diagnosis	Distinguishing features
Visceral larva migrans	Hepatitis, encephalitis, viral myalgia, epilepsy, pneumonia, trichinosis, eosinophilic leukemia, periarteritis nodosa	Marked eosinophilia, biopsy results, ELISA
Ocular larva migrans	Retinoblastoma, other endophthalmitis, strabismus, exudative retinitis (Coats' disease)	Slit lamp, serology, eosinophils in aqueous humor
Cutaneous larva migrans	Usually distinctive pattern but occasionally confused with contact dermatitis	Serpiginous track
Diplylidiasis	Other tapeworms, pinworms (anal itch)	"Cucumber seed" proglottid egg clusters on microscopy
Dirofilariasis	Lung neoplasms, pulmonary infarction	Biopsy
Toxoplasmosis	Mononucleosis cytomegalovirus, TB, cat-scratch disease, lymphoma, sarcoidosis, AIDS, congenital rubella and herpes	Serology, biopsy
Cryptosporidiosis	Acute bacterial or viral illness, sprue, giardiasis, isosporiasis	Acid-fast stain of stool
Giardiasis	Acute diarrheal illness, irritable bowel syndrome, cryptosporidiosis	Stool ova and parasite examination, giardia stool antigen

ELISA = enzyme-linked immunosorbent assay; CT = computed tomographic; TB = tuberculosis; AIDS = acquired immunodeficiency syndrome.

are capable of infecting any animal that ingests them. Should this animal be a mouse , the life cycle is repeated when the mouse is captured and eaten by cat (Figure 4). Human infections are usually rapidly controlled by the immune system . People are likely to become infected in three ways: transplacentally, through oral contact with infected cat feces or through ingestion of undercooked meat containing cysts. Transplacental transmission is by far the most serious route, occurring when pregnant women acquire a primary infection, often through emptying cat-litter boxes[14,15,16,17].

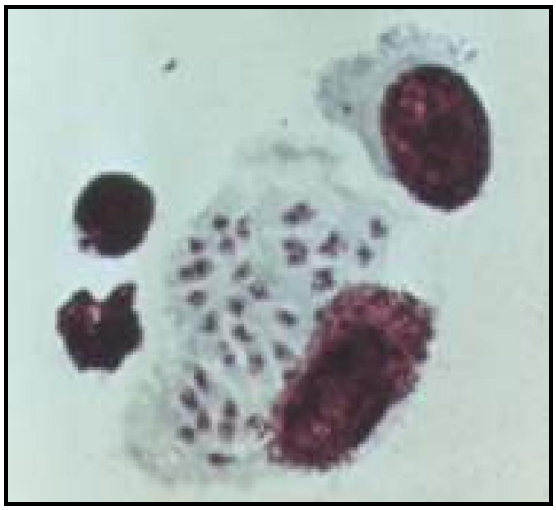

Figure 4. Toxoplasma gondii trophozoite in a peritoneal fluid of a mouse

Although the pregnant patient may have mild, even negligible symptoms, the effect on the fetus can be devastating especially in the first trimester . Infection early in pregnancy may result in miscarriage or stillbirth, while infections at the end of pregnancy may have milder results.

Congenital toxoplasmosis is characterized by a host of neurologic sequelae: intracerebral calcifications, seizures, mental retardation, microcephaly and blindness. Hepatosplenomegaly, jaundice, chorioretinitis and thrombocytopenia are also common in this syndrome. Signs and symptoms may progress and, in milder cases,come to medical attention years after birth[1,2,7,9,17,18].

In contrast with congenital toxoplasmosis, disease acquired later in life by immunocompetent persons is mild or even asymptomatic. A common presentation mimic mononucleosis, with lymphadenopathy, fatigue and mild fever. Retinochoroiditis occasionally affecting vision, may be another manifestation.

Diagnosis of any acute toxoplasma infection is usually accomplished serologically, because symptoms are very nonspecific. Acutely, IgM antibodies appear for several months, followed by IgG antibodies that persist to provide life-long protection. CT scans or magnetic resonance imaging (MRI) may demonstrate intracerebral calcifications from previous infections, and scars from previous retinochoroiditis may be seen on funduscopic examinations[19].

Treatment is indicated in pregnant women, newborns with acute disease and immunocompromised patients. Standard therapy is pyrimethamine (Daraprim), in a dosage of 25 to 100 mg per day for four weeks in adults and 2 mg per kg per day for three days, then 1 mg per kg per day for four weeks, with a 25-mg per day maximum dose in children, plus sulfadiazine, 1 to 1.5 g four times daily for four weeks in adults and 100 to 200 mg per kg per day for four weeks in children. Congenital infections or cases in immunocompromised persons are exceptions and require very long-term treatment[20].

Cryptosporidiosis

Cryptosporidiosis is a zoonotic protozoan infection capable of causing a self-limited diarrheal illness. It is spread by fecal-oral routes, through either infected water, people or animals. Cryptosporidium is resistant to chlorination and may persist even in treated swimming pools and municipal water systems[21].

Diagnosis is achieved through acid-fast staining of a stool specimen on which Cryptosporidium appears red (acid-fast positive). On regular stool ova and parasite examinations, Cryptosporidium is either missed or confused with yeasts (which are acid-fast negative). Treatment, other than rehydration, is unnecessary unless the condition persists in the immune-impaired patient but,

even here, no medical therapy has been agreed on. Paromomycin (Humatin), a nonabsorbable aminoglycoside, in a dosage of 500 to 750 mg orally four times daily has been suggested, along with many other agents, as a potentially helpful control measure[22].

Giardiasis

Giardiasis is a common protozoan infection of the small intestine acquired through fecal-oral contact or drinking contaminated water. In Turkey, the infection is commonly associated with drinking water or beaver ponds, but municipal water systems also become infected from time to time and other cases occur in travellers and children in day care facilities. Although Giardia is most commonly associated with beavers there is evidence of sporadic transmission between infected dogs and people[23].

The parasite exists as both a motile, pear shaped trophozoite in the duodenum and dormant but infectious, 8 to 12 μm cyst (Figure 5) that passed in the stool.

Figure 5 .Giardia Cyst

Diagnosis is usually accomplished through stool ova and parasite examinations. Because cysts can be shed intermittently, however, up to three tests may be necessary to demonstrate the infection, if present. An ELISA test for Giardia antigen in the stool is an increasingly useful alternative that may be used with a single stool examination[19]. Once diagnosed, giardiasis may be treated with metronidazole (Flagyl), 250 mg orally three times daily for five to 10 days[24].

Preventive Measures

One question that invariably arises when zoonotic infections are considered "Do the benefits of animal companionship outweigh the risks of disease transmission? "For most people, the risks can be minimized if the rules of basic hygiene (good handwashing,no kissing, licking or sharing food with pets) are observed. Several groups, however, may be more susceptible to infection: very small children, pregnant women and immunocompromised patients. Even here, the evidence warrants general rather than absolute recommendations[25].

Several authorities suggest that families postpone acquisition of a dog or cat until children are past the toddler stage. Very young children crawl about on the floor with pets and are almost certain to ingest the debris they find there. Traces of animal feces on the carpet or lawn easily get on the child's fingers and into the mouth. Small children also appear to be immunologically more susceptible than adults[26].

Risk can be further reduced by keeping cats indoors, by not feeding cats raw meat, by scrupulous hand washing and by proper disposal of cat feces.

Conclusion

The general consensus seems to be that the psychological benefits of pet ownership outweigh the potential health risks if reasonable precautions are taken. This may be even more true in patients with HIV disease, who often experience a significant degree of social isolation. Insisting that these patients relinquish a beloved pet to minimize potential health risks is not justifiable in most instances[1,6,11,17,19,19,22,27,28].

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