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Should Immunocompromised Patients Have Pets?

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ABSTRACT

Purpose: To evaluate the risks and benefits of pet ownership by immunodeficient patients, focusing primarily on organisms that colonize animals and are transmitted to humans. Those diseases that are known to be progressive or more severe in patients with altered immune function are emphasized.

Methods: A review of the medical and veterinary literature pertaining to zoonoses transmitted by domestic animals was completed. Information pertaining to issues involving immunosuppressed patients including AIDS was carefully evaluated and summarized for inclusion.

Results: There are significant clinical and psychosocial benefits to pet ownership. However, numerous diseases can be acquired from these animals which may be more severe in immunocompromised individuals.

Conclusion: Simple guidelines for pet ownership by immunosuppressed patients can be implemented to reduce their risk of disease and allow them to safely interchange with their pets.

Patients commonly seek the advice of their primary care physicians (PCPs) concerning pets, often because they have recently been diagnosed with medical conditions that require immunosuppression; common diagnoses include cancer, autoimmune disorders, and acquired immunodeficiency syndrome (AIDS). To answer their questions better, PCPs must have an accurate understanding of the benefits and, more importantly, the medical risks associated with pets, which can transmit 30 to 40 infectious diseases[1] and are likely to have intimate contact with these immunosuppressed individuals.[1,2]

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This review of zoonoses transmitted by domestic animals is based on an evaluation of both the medical and the veterinary literature and pays particular attention to issues involving immunouppressed patients. Some clinical data are available concerning the diseases pets can transmit to these patients,[3] and the recent publication of the Centers for Disease Control and Prevention (CDC) on opportunistic infections in adult AIDS patients offers a primary resource for information about zoonoses that represent risks to immunocompromised persons.[4]

Our positive perceptions of household animals are molded by images of Lassie, Benji, Sylvester, Tweety, Flipper, and even Babe, although these Hollywood creations hardly typify the family pet. The late veterinarian and author James Herriot extended our warm feeling to many different furred and feathered creatures with his amusing and touching portraits of pets and farm animals, more like friends than livestock. Although his anecdotes are certainly not the stuff of most people's everyday experience, relationships between pets and their owners are real and can have great benefits to patients.

Numerous studies have documented that pets can improve medical illnesses, both organic and psychiatric, and hasten recovery from surgery.[5] The most comprehensive studies have examined benefits to patients with hypertensive cardiovascular disease. The simple act of petting an animal can lower blood pressure and reduce anxiety believed to be related to acute vascular events.[6] Other prospective investigations have shown that pet ownership can protect against potentially life-threatening coronary heart disease and shorten recovery time for coronary vascular events.[7]

In children and adults with handicapping conditions, companion animals stimulate beneficial physical activity, improve self-esteem, enhance overall attitudes, and reduce the need for sedating drug therapy.[5] Because psychosocial factors such as isolation can contribute to disease, the benefits most likely result from the fact that pets enable patients to be alone without being lonely.

The three most important considerations in making decisions about pet ownership are allergies to animal dander among household members, the age of children in the family, and the presence of family members who are immunosuppressed. Allergic reac-

tions following contact with animals occur in 6% of patients treated by allergists. Manifestations include rhinitis, conjunctivitis, and asthma and are more commonly associated with long-haired pets.

Age is important because toddlers and young children, some of whom are immunosuppressed, cannot understand the limitations in handling pets and are likely to provoke biting or scratching, which would not really be the animal's fault. Common sense should dictate whether certain types of pets are appropriate for young patients as well as for adults with mental status changes. A family that includes such members and who wants a dog, for example, should avoid the breeds most likely to bite, such as chows, German shepherds, Saint Bernards, pit bulls, bull terriers, Akitas, rottweilers, Doberman pinschers, Chihuahuas, and dachshunds.

Immunocompromised patients are obviously at increased risk of contracting diseases transmitted by pets. The approach to this issue involves primarily careful pet selection and frequent monitoring of the animal for potential pathogens.

BITE-RELATED INFECTION

Bite injuries constitute the greatest risk of contact with animals—dogs, cats, ferrets, and others. Bites are the most common, though not the only, way of acquiring an infection from an animal.

An estimated 1 million animal bites occur each year, half to children, accounting for 1% of all emergency room visits.[8] Dogs are responsible for 80% to 90% of all reported pet-inflicted trauma, cats for 5% to 10%. The animals involved almost always live in the household of the victim or belong to friends or neighbors.

Around 30% of cat bites and 6% of dog bites result in cellulitis; this incidence is high enough in both these animals to warrant antibiotic prophylaxis. Cat bites are more likely to cause infection because they produce puncture wounds that bury organisms deep in tissue, whereas dog bites cause tearing injuries than can be opened and irrigated, reducing the likelihood of skin and soft tissue infection.

Bacteria in dog and cat bites that produce cellulitis are, in order of frequency, *Pasteurella multocida*, *Staphylococcus aureus*, *Staphylococcus intermedius*, and anaerobic streptococci.[8] A much less common pathogen in dog bites, but a particularly dangerous one for the immunocompromised or asplenic patient, is *Capnocytophaga canimorsus*, formerly DF-2. It can cause cellulitis progressing to fulminant septicemia, shock, and disseminated intravascular coagulopathy; reported mortality is 27%.

A particularly unpredictable animal with regard to biting is the ferret, an increasingly popular pet that is generally perceived to be playful, gentle, and nonaggressive. Ferrets, which are related to skunks and weasels, are sold in pet stores in spite of being classified as wild animals by the CDC. Because they are easily housebroken, they often are allowed to run freely in owners' homes. They are strongly attracted by the scent of milk and can inflict severe facial injuries on incapacitated individuals who have milk products around their mouths.[1]

SALMONELLA

Of potential human pathogens, the most likely to be recovered from all animal species, both domestic and wild, is *Salmonella*, which is transmitted to humans by the fecal-oral route. Surveys of zoo animals have shown a high carriage rate, and roughly half the geckos running around the beaches of Hawaii are infected with *Salmonella weltevreden*. These reptiles appear to be the major source of salmonella infection in Hawaii. Turtles are so commonly infected and so often the cause of human disease that in 1975 the US Food and Drug Administration banned interstate shipment and sale of turtles.

It seems prudent for households with immunocompromised members, who are most likely to develop disseminated disease, to have a veterinarian periodically culture the stools of pets for salmonella. Also, animals brought from zoos to hospitals so that patients can pet them, a popular program nationwide, should be cultured for pathogens such as *Salmonella* spp before such visits.

GROUP A β-HEMOLYTIC STREPTOCOCCI

Early studies implicated domestic dogs and cats as potential sources of group A β-hemolytic streptococci (GABHS) infection in patients, particularly those with recurrent streptococcal tonsillopharyngitis, and some current textbooks still emphasize this epidemiologic information. A recent survey of 26 households where children had culture-proven GABHS, however, did not identify any colonization among pets, nor was GABHS recovered from an additional 230 dogs and cats included in the study.[9] Several other investigations also have shown very low carriage rates in domestic pets. The earlier reports probably failed to distinguish GABHS from streptococci that also produce β-hemolysis, particularly groups B, C, and G, which are common in the oropharyngeal flora of domestic animals.

CAMPYLOBACTER JEJUNI

Campylobacter jejuni is one of the most common causes of gastroenteritis in the United States and other industrialized nations. Many reports have documented fecal-oral transmission of *C jejuni* to

humans from infected pets, including dogs, cats, and birds. Farm animals, especially poultry, also appear to be a common reservoir; however, infection usually results from consuming contaminated poultry products. Person-to-person transmission is rare, and outbreaks in nursing facilities are extremely rare.

The clinical features of *C jejuni* infection range from asymptomatic carriage to fulminant sepsis. Systemic and postinfectious manifestations are common in immunocompromised persons, necessitating early and aggressive therapy. Two unusual postinfectious manifestations that can occur in both normal and immmunocompromised hosts are arthritis and Guillain-Barré syndrome.

RABIES

Rabies is an almost uniformly fatal neurotropic viral infection. It is primarily a disease of animals; the epidemiology of human cases reflects the geographic distribution of diseased animals. In areas where canine rabies has not been adequately controlled, such as Asia, Africa, and many parts of Latin America, domestic dogs account for 90% or more of reported animal disease. In the United States, the primary reservoir of rabies has shifted from domestic to wild animals during the last half century, necessitating an emphasis on strategies to control disease in bats, raccoons, skunks, foxes, and wolves.

Rabies control in household pets—including vaccination of all dogs and cats and removal of strays and unwanted animals—must continue to be pursued aggressively because domestic animals are likely to interact with diseased animals in the wild. Control measures in the United States have reduced rabies cases among domestic dogs from 6949 in 1947 to 146 in 2005. Because more cases are currently reported among cats than dogs, vaccination of cats must receive greater emphasis. Both dogs and cats are usually vaccinated at 3 months of age and then annually or triennially. Ferrets also carry rabies, which poses a special hazard when they are kept as pets because no effective rabies vaccine for ferrets is available at present.

All patients exposed to rabies who have not been vaccinated previously should receive human rabies immunoglobulin at a total dose of 20 IU/kg of body weight, all infiltrated around the wound if possible, and five 1-mL doses of human diploid cell vaccine given intramuscularly on days 0, 3, 7, 14, and 28. In the immunocompromised patient, postexposure prophylaxis must include serologic documentation of antibody conversion following vaccination. This is usually done 42 days after completing the 5-dose vaccine series.

CRYPTOSPORIDIOSIS

Cryptosporidium parvum, a coccidian parasite found in many animal species, is a common cause of diarrhea in essentially all human populations. This pathogen causes an estimated 0.3% to 4.3% of all diarrheal illnesses in the United States.[1] Serologic evidence of past infection has been found in 15% or more of the US population. In otherwise healthy persons, disease caused by *C parvum* usually takes the form of self-limited gastroenteritis. Although person-to-person spread by the fecal-oral route is the most common method of transmission, contact with infected animals and occupational exposure to contaminated animal products are well recognized. An increasing number of animals, both pets and farm animals, are naturally infected. Recent studies have revealed asymptomatic colonization of reptiles and rodents.[1] Preventive measures include screening pets for disease in high-risk families, avoiding very close contract with animals, and washing the hands after contact.

PARASITES

The incidence of intestinal parasites is 50% in dogs and somewhat less in cats. Giardiasis is a recognized cause of diarrhea in both dogs and cats, although their role in transmitting *Giardia lamblia* to humans has not been defined.

The most common nematode of both dogs and cats is *Toxocara* (*Toxocara canis* in dogs, *Toxocara cati* in cats), which causes the syndrome called *visceral larva migrans*, marked by pneumonia with hypereosinophilia. Toxocariasis is currently the most common cause of hypereosinophilia in the United States. Prominent eosinophilia can persist for several months.

Other parasites that occasionally cause human disease are *Ancylostoma caninum* (dog hookworm); *Ancylostoma braziliense*, which commonly colonizes the intestinal tract of both dogs and cats; and *Dirofilaria immitis* (dog heartworm). Tapeworms include *Echinococcus granulosus*, recovered from dogs, and the dog and cat tapeworm, *Dipylidium caninum*.

Parasites are transmitted to humans by the fecal-oral route. The risk of transmission can be reduced by screening pets for infection, by avoiding very intimate contact, and by washing the hands after contact.

DERMATOMYCOSES

Dogs and cats can transmit fungal infections to human hosts, causing readily recognized ringworm (tinea corporis and capitis). The most common causative organisms are species of *Trichophyton* and *Microsporum*. About 25% of this type of human disease is attributed to animal contact, and effective management often must include treatment of the pet

to prevent reinfection. Unlike mange, which is caused by a mite, fungal infections may be hard to recognize, especially in long-haired animals, requiring examination by a veterinarian.

DOGS AND THEIR ASSOCIATED PATHOGENS

Dogs are reservoirs for two additional bacterial infections that can be passed along to their human companions: leptospirosis and brucellosis.

Leptospirosis is caused by the spirochete *Leptospira interrogans*, which includes 19 serogroups and more than 250 serotypes. Although dogs are the most common reservoir among pets, leptospires have been isolated from reptiles, amphibians, fish, birds, and invertebrates.[1] The organism is transmitted by contact with the urine of the infected animal.

Most patients experience a febrile, self-limited illness that is biphasic. Fever, headaches, generalized myalgia, abdominal pain, vomiting, and conjunctival suffusion characterize the initial phase, lasting 3 to 8 days. After 1 to 5 days, a second phase of fever, myalgia, aseptic meningitis, rash, and uveitis begins. This phase lasts 3 to 14 days. Vaccinating dogs against this infection reduces but does not eliminate transmission to humans, although animals are rarely symptomatic when they become infected after immunization.

Brucellosis, caused by *Brucella canis*, produces a chronic bacteremia in dogs that occasionally is transmitted to humans, usually by contact with the blood of an aborting dog. Human infection is characterized by an indolent fever, headache, and myalgias. Because treatment of canine disease is often ineffective, infected animals should be kept from contact with immunocompromised individuals.

CATS AND THEIR ASSOCIATED PATHOGENS

Cat-Scratch Disease

Cat-scratch disease, caused by *Bartonella henselae*, is an increasingly prevalent illness transmitted by kittens. It is the most common cause of chronic (longer than 3 weeks) lymphadenopathy and adenitis as well as Parinaud's oculoglandular syndrome, a combination of conjunctivitis and preauricular adenitis. Other manifestations include prolonged fever of unknown origin, multifocal hepatosplenic abscesses, encephalitis, and retinitis. Disseminated disease is well documented in AIDS patients and in other immunosuppressed hosts.

In kittens, *B henselae* produces an asymptomatic chronic bacteremia. Heavy flea infestation is a risk factor for transmission, although the exact mechanism is not known. Cats older than 1 year are less likely to carry this disease and therefore are preferred pets for high-risk children.

Toxoplasmosis

Toxoplasma gondii is an intracellular protozoan parasite for which cats are the only natural hosts. Transmission to humans results from ingestion of oocysts during exposure to cat feces. Toxoplasmosis is often asymptomatic or mild, but it can also cause ocular disease; lead to miscarriage, stillbirth, or serious congenital infection when acquired during pregnancy; and produce severe central nervous system manifestations in immunocompromised hosts.

To prevent transmission of toxoplasmosis to immunocompromised patients, these persons should carefully avoid exposure to cat feces; however, there is no risk if the litter box is changed every day and gloves are used. Serologic testing of cats is not useful in preventing transmission because by the time a positive test is obtained, it is too late to protect the human host.

Q Fever

The rickettsial organism *Coxiella burnetii* infects a wide range of mammals and birds, constituting a reservoir for human disease. Although farm animals, particularly sheep, have been the most commonly identified source of outbreaks in rural regions, cats are the most likely animals to transmit disease in urban settings.[1] An important risk factor for transmission is exposure to the placenta or products of conception of an infected animal, either directly or following aerosolization. Atypical pneumonia is the usual presentation of Q fever in the United States.

Plague

Plague, caused by *Yersinia pestis*, is a potentially epidemic disease, transmitted by the bite of infectious fleas or by handling infected animals. Between 5 and 20 cases occur in the United States each year. Manifestations include regional lymphadenitis (bubonic plague), severe pneumonia (pneumonic plague), and septic shock (septicemic plague). Cases in the United States have been traced to diseased cats, most likely infected by interaction with fleas infected by rats, but transmission of plague to dogs by fleas is rare. Avoidance of sick animals and frequent insecticidal treatment of pets to eliminate fleas are appropriate preventive measures.

DISEASES TRANSMITTED BY BIRDS

Parakeets, pigeons, and other birds can transmit several diseases to humans.

Psittacosis

Both healthy and sick birds are reservoirs for *Chlamydia psittaci*, the cause of a prolonged febrile lower respiratory illness in humans called psittacosis.

Table 1. Guidelines for Pet Ownership by Immunosuppressed Patients

1. Choose a healthy animal (preferably a dog or cat) that is older than 1 year to reduce the likelihood of colonization with animal and human pathogens.
2. Do not choose birds, reptiles, turtles, or rodents as pets because they are more likely to carry unusual human pathogens, cannot be immunized, and are difficult to screen for transmissible diseases.
3. Neuter the pet at an early age to minimize roaming and interaction with animals in the wild.
4. Bring the pet to the veterinarian for yearly examinations and annual booster immunizations for rabies, distemper, canine hepatitis, leptospirosis, parvovirus, and feline leukemia virus.
5. Ensure that your pet has yearly stool examinations for *Salmonella*, *Campylobacter*, *Giardia*, and *Cryptosporidium* spp.
6. Keep the animal indoors as much as possible to limit interactions with other animals and reduce exposure to disease.
7. Have cats tested annually for feline leukemia because animals that test positive are more likely to acquire human infectious agents such as *Giardia* and *Cryptosporidium* spp.
8. Treat the animal for fleas weekly during flea season to reduce scratching in animals that are infected with *Bartonella henselae* (cat-scratch disease) and to prevent transmission of disease by these ectoparasites.
9. Do not feed pets raw meat. Feed them only cooked meat and foods unlikely to be contaminated with animal feces to minimize gastrointestinal colonization with potential pathogens.
10. Avoid petting zoos because zoo animals are highly likely to be colonized with human pathogens such as *Salmonella* and *Campylobacter* spp.

Birds with *C psittaci* characteristically look ill, with characteristic ruffled feathers, but sometimes aerosolize organisms for weeks or months without being suspected of disease.

Patients may have pneumonia, often accompanied by headache and rash, but a milder flulike illness is more characteristic in cluster outbreaks; such outbreaks affect people in contact with a single infected animal, as often happens in turkey-processing plants, for example. Psittacosis is rare in immunosuppressed individuals and thus is not, by itself, reason to discourage bird ownership. Preventive measures consist primarily of avoiding close contact with sick birds.

Cryptococcosis

Cryptococcosis is the primary reason for excluding birds from households with immunocompromised members. *Cryptococcus neoformans*, an increasingly common pathogen in immunocompromised patients, has a unique ecologic relationship with pigeons and, to a lesser extent, other bird species. Aersolization of organisms in contaminated bird feces mixed with soil is the route of transmission to humans. Human infection usually affects the lower respiratory tract, but infection often disseminates rapidly to the central nervous system and skin in the immunocompromised host. Disease is also identified occasionally in cats, dogs, farm animals, and wild animals.

Histoplasma capsulatum

Histoplasma capsulatum can also colonize the intestinal tracts of birds and may be excreted into the soil, where contaminated aerosols can infect humans. Disease in humans, both pulmonary and disseminated, is similar to that seen with *C neoformans*.

FISH AND THEIR ASSOCIATED PATHOGENS

Mycobacterium marinum, an organism antigenically related to *Mycobacterium tuberculosis*, is found on fish in aquariums. It causes chronic ulcerated skin lesions at sites of minor trauma in persons who clean fish tanks or who sustain cuts from fish spines. Disseminated disease has been reported in normal children, although the risk of severe disease appears greater in immunosuppressed patients.[3] These reports support the recommendation that high-risk individuals not handle tropical fish or clean fish tanks.

ADVICE FOR IMMUNODEFICIENT PATIENTS

Not only are immunocompromised patients at greater risk of acquiring zoonotic infections from pets, but they are also more likely to develop disseminated disease.[3] Additional measures are therefore warranted to prevent colonization of pets by potential pathogens and to reduce the likelihood of transmission because absolute control of colonization can never be assured. Table 1 summarizes these suggestions.

The first step is to select a pet that is less likely to harbor zoonotic disease and for which effective preventive and screening measures are readily available. Dogs and cats are preferred primarily because numerous vaccines have been developed for them, and methods of testing for infectious agents are more advanced. Animals older than 1 year are also preferable because younger dogs and cats are much more likely to carry disease.

Pets most likely to transmit disease include birds, turtles, and rodents, and these animals cannot be readily screened for potential pathogens. It is therefore wise to recommend against their selection. Reptiles, too, cannot be screened and so are not considered good choices.

Interaction of pets with other domestic and wild animals greatly increases the probability of colonization with human pathogens. Control of roaming by measures such as early neutering and indoor confinement is therefore desirable.

CONCLUSION

Patients who are immunodeficient are at increased risk for developing progressive disease with microorganisms that commonly colonize animals. For this reason, special considerations are warranted. Still, the risk for these patients is slight, and the psychosocial benefits afforded by pets must be kept in mind for those with chronic illnesses.

It is possible to modify the behavior of high-risk patients with their pets to reduce the risk of infection. Certainly these patients should avoid such intimate contact as kissing pets and allowing an animal to sleep in bed with them. Exposure to animal feces should also be avoided. Otherwise, the usual petting and play activities represent minimal risk. Patients should be encouraged to wash their hands after handling a pet. The consequences of contact with zoo animals (petting programs) have not yet been adequately evaluated, so it is probably best to discourage immunocompromised patients from participating in such programs until more information is available.

Pets represent a minimum risk to immunocompromised patients for the transmission of disease, except for bite injuries and secondary infection, which are relatively common. It is always prudent to give patients and the parents of children sound information on which to base decisions about matters that could affect their or their children's health, and in this case significant reassurance can be offered. On the other hand, pet ownership is an important part of the medical history of a patient with a febrile illness that could be caused by unusual pathogens transmitted by animals.

REFERENCES

1. Steele RW. Sizing up the risks of pet-transmitted diseases. Contemp Pediatr 1997;14:43–68.
2. Krauss H, Weber A, Appel M, Enders B, Isenberg HD, Schiefer HG, eds. Zoonoses: Infectious Diseases Transmissible from Animals to Humans. 3rd ed. Washington DC: ASM Press; 2003.
3. Hemsworth S, Pizer B. Pet ownership in immunocompromised children: a review of the literature and survey of existing guidelines. Eur J Oncol Nurs 2006;10:117–127.
4. Centers for Disease Control and Prevention, USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with human immunodeficiency virus: a summary. MMWR 1995;44(RR-8):1.
5. Serpell J. Beneficial effects of pet ownership on some aspects of human health and behavior. J R Soc Med 1991;84:717–723.
6. Vombrock JK, Grossberg JM. Cardiovascular effects of human-pet interactions. J Behav Med 1988;11:509–514.
7. Beck AM, Meyers NM. Health enhancement and companion animal ownership. Annu Rev Public Health 1996;17:247–256.
8. Brook I. Microbiology of human and animal bite wounds in children. Pediatr Infect Dis J 1987;6:29–34.
9. Wilson KS, Maroney SA, Gander RM. The family pet as an unlikely source of group A beta-hemolytic streptococcal infection in humans. Pediatr Infect Dis J 1995;14:372–377.