



PET-ASSOCIATED ZONOTIC DISEASES IN CAT: PREVENTION AND MANAGEMENT FOR PET OWNERS

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ABSTRACT

A zoonotic disease is an infectious disease that can be transmitted from animals to humans as well as from humans to animals. Unfortunately, many pet owners are unaware of the condition. Immunocompromised people, both young and elderly, will be vulnerable to the zoonotic disease. Children enjoy playing with cats, especially kittens, which carry more diseases than adult cats. This manuscript outlines the prevention and management of pet-associated zoonotic diseases for pet owners. Immediate and appropriate actions can be taken to prevent the disease from spreading to their family members and public. Educating the clients on the most common zoonotic diseases in cats will assist pet owners in taking care of their health and family members, as well as being able to properly care of their sick pet without abandoning them.

1.0 INTRODUCTION

In response to the pandemic Covid-19, the government has implemented Movement Control Orders in 2020-2021. This might cause a distress on the individuals and their family members due to the restriction of access to fresh air and less social contacts with family and friends. This also has contributed to a slew of socioeconomic problems. Due to the restriction on movement, family members cannot return to their hometowns and remote workers cannot see their loved ones.

Additionally, working from home contributes to mental health issues. As a result, many people resort to anything that can relax their minds or do activities at home that will solve the boredom especially children since they are not allowed to play outside. Many families also resort to buying pets to alleviate their stress as well as to entertain their children [1]. Common pets include hamsters, dogs, cats, fish as well as rabbits. This review paper will focus on zoonotic diseases in cats and how to manage and prevent disease transmission to pet owners. Cats have grown in popularity as companion animals. Many individuals attempt to adopt a cat in the hope that the cat will provide them with pleasure and happiness, particularly children. It can help people's physical and mental wellness. Cats and dogs are both domesticated pets that can spread a variety of zoonotic diseases [2].

2.0 LITERATURE REVIEW

Zoonosis is caused by bacteria, viruses, fungus, and parasites. Certain infections are self-limiting, but they can cause severe illness in young children, immunocompromised individuals, those with underlying conditions, and elderly. Majority of pet owners and their families are still unaware of the symptoms of zoonotic infection and the appropriate care for an infected cat. Occasionally, a cat appears to be healthy yet nonetheless transmits sickness to humans [3].

2.1 Sporotrichosis

Sporothrix is an infection that is caused by fungus from soil and decaying plants [4]. A cat with a non-healing wound is very likely to have sporotrichosis. Figure 1 shows the fungus is normally found on their claws, blood, and saliva [5]. Pet owners must take their afflicted pets to the veterinarian for proper treatment, and the owner will get a client education. Priority must be given to properly managing diseased cats. When handling or administering medication to their cat, the owner must wear gloves and a facemask. Owners should avoid scratching or biting from the cats, and do not encounter fluid from their infected cats. After handling their cats, the owners should immediately wash their hands with soap and water. Humans who encounter sporotrichosis-infected soil or cats will transmit the disease.



Figure 1. Sporotrichosis in a cat with several ulcerated skin lesions on the head [8]

The infection can spread to humans by skin breakdown or inhaling fungus spores. Although it is less common, inhaled sporothrix can cause lung infection. The symptoms could be cutaneous, disseminated, or pulmonary. The most common type of sign is cutaneous. In humans, the lesion appears as a tiny reddish bump that does not heal as shown in Figure 2. Later, the lump will grow larger and larger in size, resulting in the appearance of an ulcerated lesion with purulent discharge. When the fungus spreads to the lungs, joint, and bone, it causes difficulty in breathing and limb pain. If the owner experiences similar symptoms, go to the doctor immediately and provide a history of the infected cat during the checkup. Based on the severity of the disease, treatment for sporotrichosis infection takes a very long time [6]. Anorexia and increase liver enzyme are the common adverse effects of the treatment [7]. A recent study found that the adjuvant may cause feline vaccine-induced sarcoma [6].



Figure 2. The clinical presentation of patients with localised form sporotrichosis in images (A, B) and (C, D) is lymphocutaneous form of sporotrichosis [9]

2.2 Ring worm

Dermatophytosis is a type of ringworm caused by the fungus *Microsporus canis*. It may have clinical signs comparable to those of the cat and human. Alopecia, scaling, crusting, erythema, papules, circular lesion, hyperpigmentation, and inconsistent pruritus are all possible clinical symptoms as in Figure 3 and 4. Those who have a history of skin problems, such as allergies, or are immunocompromised, as well as elderly, small children, and organ recipients, are susceptible to ring worm infection [10]. Normally adult cat acts as asymptomatic carriers but kittens may show severe clinical signs due to their low immune system and poor hygiene. The mode of transmission to humans is through contact with sick cats or healthy carriers and fomite [11]. In humans, ringworms are treatable and curable, and it is a low-level zoonotic skin disease [12] and a circular lesion with an erythematous rim is a characteristic symptom. Cats will shed their hair and develop scaling. The most straightforward diagnosis is made with the use of a Wood's lamp examination and microscopic detection. Fungus from cats is cultured on Sabouraud agar using hairs and scales from the lesion to confirm the diagnosis [11]. Normally, the infection is hard to prevent in catteries and shelters. The best strategy to control the infection is to disinfect the environment where the cat lives and roams about.



Figure 3. Alopecia patches and crusty in face [13]



Figure 4. Erythema and circular lesion on leg region [13]

2.3 Toxoplasmosis

Toxoplasma gondii is a protozoan parasite that is responsible for toxoplasmosis. Normally, an infected cat has no clinical indications. Cats with underlying disorders such as Feline Leukemia virus (FELV) or Feline Immunodeficiency virus (FIV), as well as young kittens, may exhibit symptoms [14]. Typically, cats exhibit pyrexia, inappetence, and weakness. If *T. gondii* spreads to the lungs, the cat will develop pneumonia and dyspnea [15]. When toxoplasma infection affects eyes and central nervous system, cats will also exhibit symptoms such as lack of coordination, seizure, circling, head pressing, uveitis, and blindness. Pregnant women and immunocompromised individuals will be seriously infected with the sickness and only subclinical symptoms in healthy adults. The disease is spread through consumption of infective oocysts from an infected cat's excrement and tissue cysts in undercooked or raw meat.

Pregnant women infected with toxoplasmosis may experience spontaneous abortion, stillbirth, or premature birth, depending on the stage of pregnancy and the severity of the illness [10]. A child born with toxoplasmosis will develop mental impairment and eventually blindness [16]. Encephalitis is a common complication of immunocompromised people. Lymphadenopathy, fever, weariness, muscle soreness, sore throat, and headache are among clinical manifestations in humans. Cats should be kept indoors and fed commercial pet food of high quality [17]. Pregnant women must avoid contact with cats, emptying litter boxes, and gardening without gloves [16]. Before consuming any vegetables, they should be rinsed thoroughly with clean water. After chopping meat for cooking, they must thoroughly clean their hands, cooking utensils, and any other contact with raw meat with soap and water. Because tissue cysts can only be destroyed by heating meat to at least 67 °C and then cooling it to -13 °C, always cook the meat thoroughly [16]. Toxoplasmosis in humans cannot be diagnosed just based on clinical signs; it must also be confirmed using biochemical, serological, histological, or molecular approaches. This is because most infectious diseases have the same clinical symptoms [16]. Toxoplasmosis can be treated with drugs such as sulphadiazine, pyrimethamine, spiramycin, and clindamycin, which are available on the market. There is currently no vaccine available to protect humans from toxoplasmosis [16].

2.4 Bartonellosis (Cat-Scratch Disease)

Cat scratch disease (CSD) is caused by *Bartonella spp.* particularly *B. henselae*, and cats are a primary reservoir. Stray cats and kittens under the age of one year are more likely to be infected than pets and adult cats, and the infection can last for weeks, months, or even years [18]. Within 7 to 12 days of post infection in humans, the wound begins to fill with pus and regional lymphadenopathy develops as shown in Figure 5. Fever, headache, anorexia, and splenomegaly are all possible symptoms. Encephalitis, endocarditis, hemolytic anaemia, glomerulonephritis, pneumonia, and osteomyelitis may develop in more severe cases [18]. *B. henselae* is grown in *Ctenocephalides felis* or cat flea and flea feces [18]. Transmission to humans is most frequently transmitted through scratching of an infected cat's claw. The treatment of bartonellosis infection is determined on the disease's clinical manifestations and severity [19]. If an owner is scratched or bitten by a cat, the wound should be quickly treated with running tap water and antiseptic soap. The best way to prevent illness is to apply flea control to the cat's haircoat on a regular basis. According to certain research, cats infected with bartonella will have modest clinical signs and will be self-limiting [20]. When a cat is infected with another virus, such as Feline Immunodeficiency Virus, the symptoms are usually prominent. Clinical conditions that appear include fever, uveitis, neurologic disease, and stomatitis.



Figure 5. Lymphadenopathy at left axillary in 5 years old boy [21]

2.5 Worm infestation

Contact with cat paws, contaminated litter boxes, and contaminated surroundings is all it takes for humans to become infected with helminth eggs. Stray cats will continue to pose a risk to domestic and purebred cats because they are free to wander. After swallowing immature stages of eggs and intermediary hosts, such as rodents and fleas, cats become infected with endoparasite [22]. In humans, cutaneous larva migrans can be caused by hookworm larvae that ordinarily grow in the animal digestive tracts. The etiologic agents of cutaneous larva migrans (shows in Figure 6) and eosinophilic enteritis are two illnesses caused by *Ancylostoma spp.*, *Ancylostoma braziliense* and *Ancylostoma caninum* [23]. Animals with negative stool tests should nevertheless be treated with anti-helminthics to prevent environmental contamination, since this parasite poses a risk to both human and animal health.



Figure 6. Cutaneous larval migran on the foot [24]

Zoonotic intestinal nematodes (roundworms) called toxocara can develop in a variety of mammal species including cats. Children are particularly vulnerable to infection from parasitized animals' faeces, which contain enormous numbers of eggs that can be ingested by ingesting infected soil or objects. Toxocara eggs do not mature in humans, but the larvae can move around the body. Ocular abnormalities, blindness, and neurological disorders are all examples of human symptoms. Poverty-stricken children are at greater risk of contracting an infection. *T. canis* and *T. cati*, the two most common roundworm species in dogs and cats, are the primary causes of human toxocariasis. Toxocara can cause discomfort, diarrhoea, and poor growth in puppies and kittens, but severe instances can result in death.

2.6 Pasteurellosis

Pasteurella multocida, a gram-negative bacterium that is a commensal bacterium and part of the natural flora of the cat's nasopharynx and upper respiratory tract, is the causative agent for pasteurellosis [25]. Humans can become infected through cat bites, scratches, licks, or respiratory secretions from cats who come into close contact with them. *Pasteurella multocida* is one of the most common pathogens seen in infected wounds and abscesses under the skin. It is also one of the most prevalent bacteria in cats that causes pyothorax and has been linked to spinal empyema and meningoenophalomyelitis [25].

After a 3-6 hours' bite or scratch, the infection usually causes cellulitis and abscess in humans. Necrotizing fasciitis, septic arthritis, and osteomyelitis can develop from local infection. Respiratory infection pneumonia and bronchopneumonia are prevalent in patients with pre-existing lung illnesses. Children, pregnant women, patients undergoing chronic immunosuppressive therapy, and immunocompromised individuals are all susceptible to severe infection. Pasteurella species can cause sepsis and peritonitis in people with chronic liver disease, cirrhosis, and dialysis. Although serious diseases are usually associated with unhealthy people, one-third of septicaemia patients were previously healthy people [25]. Bacterial culture is used to isolate Pasteurella from infected tissues or secretions for definitive diagnosis. Antibiotic susceptibility testing is used to guide therapeutic decisions in severe instances.

2.7 Salmonellosis

A possible source of *Salmonella* spp. in humans can be found in cats' raw food diets [26]. Diarrhoea, cramping, fever, and nausea were all common signs of a salmonella infection. Enteric bacteria, such as *Salmonella* spp., are transmitted through the faecal-oral route, either directly through food and water and contact with infected animals, or indirectly by using contaminated utensils in places where infected animals live or by consuming food or drink in a contaminated environment [27]. For domestic cats, the danger of *Salmonella* spp. infection comes from the consumption of raw meat and some processed foods, whereas outdoor cats are at risk from scavenging, hunting rodents and birds and exposure to reptiles and environmental contamination [26]. Cats seldom get salmonellosis, but when they do, it's usually because the host's immune system has been suppressed. Mild self-limiting diarrhoea in cats to deadly gastroenteritis and septicaemia are the most common symptoms of the disease [26].

Domestic cats are increasingly being fed raw diets, and this trend is expected to continue. A wide variety of recipes for homemade raw food diets and commercial frozen food diets are available at some

pet shops. Raw meat, especially poultry and beef, vegetables, grains, and fruits are the primary ingredients of these products. Existing germs and parasites can be present in these diets because they are not heat processed or sterilised. As a result, foods based on raw meat, such as those sold in stores or those prepared at home, could be tainted with diseases like Salmonella. Zoonotic transfer of digestive diseases from sick pets to humans can occur even though cats are not often the source for human salmonellosis [28]. To ensure the health and well-being of their feline companions, cat owners and members of their families should practise good hygiene and refrain from feeding their pets raw meat. Families with immunocompromised members or young children should adhere to this practise.

2.8 Rabies

Rabies is caused by the rabies virus, an RNA virus belonging to the rhabdovirus family that infects humans. Dogs are the most common source of human rabies, accounting for up to 99 % of all rabies transmission to humans. However, rabies can infect any mammal, including cats, and can be fatal. The rabies outbreak began in Malaysia's peninsular region in the states of Perlis, Kedah, and Penang in 2015. The disease had already spread to Perak and Sarawak in 2017 [29]. From 2017 to 2021, a total of 35 rabies incidences have been reported in Sarawak. There have already been 33 deaths and two (2) survivors with significant neurological impairment among the cases [30].

To control the disease, the Department of Veterinary Services (DVS) takes swift action by controlling the stray dog's population, promoting vaccination, raising public awareness, conducting surveillance within a 10 km radius of the infected zone, restricting movement within the country, containing the infected zone, collecting rapid rabies samples, and properly disposing of carcasses. Cats within a 10 km radius of an infected area are also necessary to give rabies vaccinations. The Rhabdoviridae virus is responsible for the transmission of the rabies virus. Two veterinary laboratories in Malaysia have been authorized to diagnose the rabies virus, according to the Malaysian Gazette: The Veterinary Research Institute (VRI) in Ipoh and the State Veterinary Diagnostic Laboratory in Kota Samarahan, Sarawak [29]. Malaysia is endemic to this devastating disease. Animal bites and any open wound exposed to saliva, or any discharged or tissue from a rabid animal, will spread the virus. Humans often exhibit symptoms between one and five weeks after infection. [29]. The survival rate for rabies is estimated to be only 4 %, and cures are mostly unsuccessful. Fever, muscle cramps at the bite site, muscle weakness, and headache are the initial symptoms.

The rabies virus then begins to replicate in the central nervous system (CNS), resulting in severe encephalitis and unconsciousness. Avoid encountering stray animals and animals whose vaccination status is unknown to lessen the danger of being bitten by an animal. If there is a history of biting, clean the bite site immediately with running water and soap for at least 15 minutes to prevent infection. Visit a healthcare provider immediately to receive a post-vaccination injection and to submit a complete medical history to the doctor. As part of pet ownership, it is vital to raise public awareness about disease, health risks, and hazards. Rabies vaccination is a preventative measure for humans and animals.

3.0 DISCUSSION

Dermatophytosis, viral infection, and intestinal parasites are among the most common diseases in cats [31]. Strict hygienic measures, veterinary care, and no raw food [10] will significantly lower the risk of human infection. Owners should exercise excellent pet care by not feeding their pets raw meat, not allowing pets to enter the owner's bedroom, and not allowing their cats to lick the owner's face. Even if they are very attached to their cats, there should be some sort of barrier between them. To minimize disease transmission, strict regulations should be implemented, and cats should be in good health before being adopted, sold as pets, exchanged, or imported.

As soon as the cat to be adopted has been identified, it should be quarantined away from immunocompromised individuals until a thorough physical examination and zoonoses risk assessment have been completed by a veterinarian. Maintaining excellent hygiene habits, such as washing hands with soap after handling cats, is essential. Cats should not be given access to your kitchen items. All sick cats should be taken to the vet as soon as possible. Do not interact with cats that you are always not familiar with. Cat owners must adhere to a strict routine regimen that includes deworming, vaccination, ectoparasiticides, and basic environmental hygiene to maintain the health of their cats as well as other pets. Table 1 shows a summary of common zoonotic diseases in this study.

Table 1. Common zoonotic diseases, their aetiology, and preventive measures for owners

Zoonotic Diseases	Etiologic Agents	Possible Symptoms	Preventive Measures
Sporotrichosis	<i>Sporothrix schenckii</i>	Unhealing wound	Hold the infected cat with caution and avoid being bitten.
Ringworm	<i>Microsporus canis</i>	Alopecia patches & crusty skin	After playing with a cat, thoroughly wash your hands with soap.
Toxoplasmosis	<i>Toxoplasma gondii</i>	Fever, thin, inappetence, lack of coordination & seizures	Pregnant women and immunocompromised people should avoid handling the infected cat and emptying the litter box. Do not eat raw or uncooked meats.
Bartonellosis (Cat-Scratch Disease)	<i>Bartonella spp.</i>	Asymptomatic	Avoid being bitten or scratched by a cat.
Worm Infestation	<i>Ancylostoma braziliense</i> , <i>Ancylostoma caninum</i> , <i>Toxocara canis</i> , <i>Toxocara cati</i>	Thin, inappetence & abdomen distended	Maintain a strict deworming schedule. Wash your child's hands after they touch the ground and avoid walking barefoot.
Pasteurellosis	<i>Pasteurella multocida</i>	Asymptomatic	Avoid being bitten or scratched by a cat. Wash hand after handle a cat.
Salmonellosis	<i>Salmonella spp.</i>	Diarrhea	Do not feed raw food to your cat.
Rabies	<i>Rabies virus</i>	Excessive drooling, aggressive behavior, paralytic	Keep away from stray animals and animals whose vaccination status is unknown.

4.0 CONCLUSION

The list of common zoonotic diseases transmitted by cats is described in this study. Cat owners will obtain a certain degree of information about pet management and prevalent zoonotic diseases as a purpose of this research. As a result, pet owners will be more mentally, physically, and emotionally prepared before adopting a pet. Future recommendations for this study should include reaching out to specific populations in rural and urban areas to assess their knowledge of prevalent zoonotic diseases in pets, as well as their awareness and any risk factors associated.

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