



**Research Article**

**OCCURRENCE OF FELINE DISEASES – GLOBAL PERSPECTIVES**

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**ARTICLE INFO**

**Article History:**

Received 13<sup>th</sup> April, 2020

Received in revised form 11<sup>th</sup>

May, 2020

Accepted 8<sup>th</sup> June, 2020

Published online 28<sup>th</sup> July, 2020

**ABSTRACT**

The field of infectious diseases is constantly changing posing challenges for clinician in hospital settings. This review summarizes the current state of feline infectious diseases caused by viruses, bacteria, fungi, parasitic and protozoan agents. Some feline diseases are endemic in many part of world and threats from old and new pathogens continue to emerge with changes in global climate. This article addresses about overall information on prevalence of infectious diseases of felines.

**Key words:**

feline, infectious diseases, occurrence, transmission, pathogenesis, control

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**INTRODUCTION**

Outdoor cats suffer a much higher incidence of injury, parasites, and disease than cats kept indoors. Although some diseases are specific to cats such as feline Immunodeficiency Virus and feline Leukemia Virus, which are two clinically important viral infections in cats, others can afflict a wide variety of species, including people.

**Viral diseases of felines**

**Feline Immunodeficiency and Feline leukemia viral infection**

Feline immunodeficiency virus (FIV) is a lentivirus that affects cats worldwide. From 2.5percent up to 4.4percent of cats worldwide are infected with FIV (Lara *et al.*, 2008). Seroprevalence of 2.2 percent was reported in Islands of Newfoundland, Canada (Munro *et al.*, 2014). A high seroprevalence of FIV (10 percent) was reported in Malaysia (Sivagurunathan *et al.*, 2018). Feline leukemia virus (FeLV) is a feline *Gamma retrovirus* that is associated with multiple fatal disease syndromes in cats, including lymphoma (Chiu *et al.*, 2018). Endogenous FeLV is a replication-defective provirus found in species belonging to the *Felis* genus, which includes the domestic cat (*Felis catus*) (Powers *et al.*, 2018). The overall seroprevalence was 6.2% for FeLV in Islands of New found and, Canada (Munro *et al.*, 2014).

High seroprevalence of FeLV was found in China (11.33 percent), Turkey (5.6percent) and Malaysia (12 percent). (Cong *et al.*, 2016; Firth *et al.*, 2015; Sivagurunathan *et al.*, 2018). Both FIV and FeLV can occur simultaneously and 2.6 percent of cats had both these infections (Sivagurunathan *et al.*, 2018). Ninety-six feral cats from Prince Edward Island were used to determine the prevalence of selected infectious agents. The prevalence rate was 5.2% for feline immunodeficiency virus. (Stojanovic and Foley, 2011).

**Feline Panleukopenia viral infection**

Feline panleukopenia virus (FPV) also known as feline infectious enteritis, feline distemper or cat plague is a parvovirus that causes enteritis and panleukopenia in domestic and wild cat species worldwide. Both adults and young are affected; kittens are the most vulnerable population and suffer mortality rates as high as 90% (Truyen *et al.*, 2009). Prevalence of feline panleukopenia was found to be 45percent in Egypt and all the cats exhibited lethargy, fever, anorexia, thirst, vomiting, diarrhea, dehydration and leukopenia (Awad *et al.*, 2018).

**Feline infectious peritonitis**

Feline infectious peritonitis (FIP) is a coronaviral disease that can affect cats of any age, but is most prevalent among cats less than 3 years of age and especially from 4 to 16 months of age (Pedersen, 2009). FIP has also been identified in wild felids and FIP-like disease is now a growing problem among pet ferrets (Pedersen, 2014). It is assumed that the virus causing FIP develops via an *in-vivo* mutation from the feline enteric coronavirus and during the past few years, the

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prevalence of FIP has been increasing, affecting mostly young animals (Held and Neiger, 2013). FIP results from mutations in the viral genome during a common feline enteric coronavirus (FECV) infection and is aberrant immune response to infection with feline coronavirus (Desmarests *et al.*, 2016).

#### **Feline Calici virus infection**

Feline calicivirus (FCV) is an important pathogen of cats for which vaccination is regularly practised. The prevalence of FCV was found to be 9.2% in a multi-national European cross sectional study (Afonso *et al.*, 2017). A convenience-based prospective sample of oropharyngeal swabs obtained from five European countries showed a prevalence of FCV as 22.2 percent by virus isolation (Hou *et al.*, 2016).

#### **Feline gamma herpes virus infection**

Felis catus gammaherpesvirus 1 (FcaGHV1), the first gammaherpesvirus (GHV) to be identified in domestic cats, has been detected in blood samples from cats in the USA (16 percent), Australia (11.5 percent), Singapore (9.6 percent) and, most recently, Central Europe (Beatty *et al.*, 2014; Troyer *et al.*, 2014; Ertl, 2015). FcaGHV1 infection was commonly detected among pet cats from the UK, indicating that this virus is widely endemic and prevalence of FcaGHV1 was found to be 11.6 percent (McLuckie *et al.*, 2016). Concurrent infection with one or more hemoplasma species was detected in all FcaGHV1 infected cats (McLuckie *et al.*, 2016). FcaGHV1 was detected by PCR among Japanese domestic cats and showed a prevalence of 1.3 percent. Older age (>5 years old) and Feline immunodeficiency virus infection were identified as risk factors for GHV infection (Tateno *et al.*, 2017).

#### **Feline viral rhinotracheitis**

Feline viral rhinotracheitis (FVR)/Feline herpesvirus 1 (FHV-1) infection contributes to feline respiratory disease and acute and chronic conjunctivitis. FHV-1 can successfully evade the host innate immune response and persist for the lifetime of the cat. Several mechanisms of immune evasion by human herpesviruses have been elucidated, but the mechanism of immune evasion by FHV-1 remains unknown. (Tian *et al.*, 2018). Prevalence for FHV-1, FCV, *Chlamydomydia felis* (*C. felis*) and *Mycoplasma felis* was reported for the first time in Spain FHV-1, FCV and *C. felis* were associated with upper respiratory tract disease and conjunctivitis. FCV was strongly associated with gingivostomatitis. (Fernandez *et al.*, 2017). Feline herpesvirus may affect the corneal epithelium or stroma and epithelial replication results in severe ulcerative keratitis (Gould, 2011).

#### **Rabies**

Rabies is caused by viruses in the genus *Lyssavirus* in the family *Rhabdoviridae*, order *Mononegavirales* (Marston *et al.*, 2012). Rabies is an acute viral encephalomyelitis that affects wild and domestic mammals. Transmission of rabies is usually through the bite of a rabid animal, which introduces the virus present in its saliva into the bite wound. Rabid animals of all species commonly exhibit typical signs of central nervous system disturbance. Among 3,454 rabies-suspicious animals

tested, almost half (48 percent) of the animals were confirmed to be rabid (Thiptara *et al.*, 2011). Rabies surveillance in the USA during 2013 showed 4.2 percent of rabies among animals was contributed by cats (Dyer *et al.*, 2014).

#### **Bacterial diseases of Felines**

Bacteria are everywhere and while most microorganisms do not have much impact on our daily lives, some types can cause disease. Our pets are exposed to bacteria daily and most of the time their immune system is able to fight it off without showing any signs of sickness. Bacterial disease occurs when a cat's immune system is weakened and the bacteria are able to replicate and spread in the cat's body.

#### **Salmonellosis**

Salmonellosis is an infection found in cats caused by the *Salmonella* bacteria. Along with causing gastroenteritis and septicemia in cats, salmonellosis is a zoonotic bacterial disease. The prevalence of *Salmonella* in cats (3 of 542) was found to be less than one percent in USA. Consumption of raw food was identified as a major risk factor for *Salmonella* infection (Reimschuessel *et al.*, 2017).

#### **Campylobacteriosis**

Campylobacteriosis infection is a gastrointestinal disease caused by bacteria of the *Campylobacter* genus. The overall prevalence of *Campylobacter* species was 42.9 per cent in the cats by PCR in Ireland. *Campylobacter upsaliensis* was the species most commonly isolated from the cats, and *Campylobacter jejuni* was the second most commonly isolated. High prevalence was detected in the few cats with diarrhoea, and in the cats that were six months old or younger (Acke, 2018). A higher prevalence of *C. jejuni* was found in kittens with 14.3 percent and in diarrhoeic cats (23.8 per cent) in Austria. All positive diarrhoeic cats were positive for *C. jejuni*. As the resistance rates of *C. jejuni* isolates partly were very high, it could be possible for transmission of (multi) resistant *C. jejuni* strains to humans especially from kittens and diarrhoeic animals (Polzler *et al.*, 2018).

#### **Streptococcal infection**

*Streptococcus canis* is most prevalent in cats, but recently *S. equisubspzooepidemicus* has been recognised as an emerging feline pathogen. Up to 10 percent of cats suffering from chronic upper respiratory tract disease, *S. canis* can be isolated from the nasal cavity. Young queens (up to 2 years of age) may carry *S. canis* in the vagina, and the prevalence of infection is generally higher in cats housed in groups. Up to 70-100 percent of young queens in breeding catteries may carry this bacterium in the vagina, resulting in infection of the kittens, but also in the transfer of passive immunity against *S. canis* via colostrum (Frymus *et al.*, 2015). *Streptococcus equi subspecies zooepidemicus* (SEZ) in cats maintained in shelters, research facilities and catteries cause outbreaks of a severe fatal respiratory disease (Truyen and Mostl, 2015).

#### **Clostridial infection**

*Clostridium perfringens* (*C. perfringens*) is a gram-positive anaerobic bacillus that is commonly part of the microbiota of humans and animals. It is considered a common enteric

pathogen, but the pathogenesis and the predisposing factors of the disease commonly differ between host species. The role of *C. perfringens* type A as an enteropathogen in dogs and cats is not fully understood, but it is suspected to be associated with anything from mild, self-limiting diarrhea to rapidly fatal necrohemorrhagic enteritis. Prevalence of *C. perfringens* and *C. difficile* was 20 percent and zero percent in cats analyzed in diverse Veterinary Clinics from Spain. *C. perfringens* isolates mostly belonged to toxinotypes A (97.2 per cent ) (Britton *et al.*, 2017). *Clostridium difficile* is an important cause of nosocomial diarrhoea in humans. Pet animals and livestock are considered as potential natural reservoirs and sources of infection. *C. difficile* was isolated from 3.7 percent feline samples from animal shelters in Thuringia, Germany. Five PCR ribotypes were identified. Dogs and cats kept in animal shelters are a reservoir of *C. difficile* PCR ribotypes which can infect also humans (Alvarez-Perez *et al.*, 2017; Schneebeeg *et al.*, 2012).

### **Bordetella infection**

*Bordetella bronchiseptica* frequently causes nonfatal tracheobronchitis, but its role in fatal pneumonia is less recognized. In a study comprised of 31 feline cases of bronchopneumonia, *B. bronchiseptica* was identified in 45 percent feline cases based on immunohistochemistry (IHC) using serum from a rabbit hyperimmunized with pertactin, PCR testing (Fla2/Fla12), and/or bacterial culture. Examination of histological sections stained with hematoxylin and eosin revealed bronchial cilia-associated bacteria in 16 percent of *B. bronchiseptica* infected cats (Alvarez-Perez *et al.*, 2017).

### **Cat scratch disease**

*Bartonella henselae*, a zoonotic agent, induces tumors of endothelial cells (ECs), namely bacillary angiomatosis and peliosis in immunosuppressed humans but not in cats (Abdelaziz *et al.*, 2016). *Bartonella henselae* (*B. henselae*) is considered as the main agent of cat scratch disease (CSD) in humans and is also responsible for a growing number of diseases in patients. Prevalence of bartonella species DNA in blood of southern german cats checked by PCR targeting a fragment of the 16S-23S rRNA intergenic spacer region and found that the prevalence of Bartonella bacteremia was 2.5percent. Thrombocytopenia is evident in clinically affected cats. The prevalence is much less but the chance of zoonotic infection (Cat Scratch Fever) is very high in owners (Berrich *et al.*, 2011). Bartonella organisms were isolated from 32.8percent of cats including 25.9 per cent kittens and 41.1 per cent young adults. *B. henselae* genotype II was more commonly isolated from young adults, and genotype I was more frequently isolated from kittens (Bergmann *et al.*, 2017).

### **Chlamydia philosis**

Feline chlamydia philosis is one of the most important causative agents of feline upper respiratory tract diseases. Studies to check the prevalence of *Chlamydia felis* infection in domestic cat population of Iran estimated a prevalence rate of 20 per cent (Fleischman *et al.*, 2015). However, recent work has highlighted a high prevalence of *C. felis* in stray cats (Maazi *et al.*, 2016) including those with follicular

conjunctivitis( Wu *et al.*, 2013). The majority of cases occurred in young cats, particularly under one year of age. *C. felis* was the infectious organism most frequently associated with conjunctivitis in cats and was isolated from up to 30 percent of affected cats, particularly in those with chronic conjunctivitis and more severe ocular disease (Fernandez *et al.*, 2017). Recently *Chlamydia pneumoniae*, a well-recognized human pathogen, has been identified in a small number of cats (Won *et al.*, 2017) although transmission from cats to humans has not been documented.

### **Fungal Diseases of felines**

Systemic mycoses generally produce a combination of clinical signs related to the target sites of infection, including the respiratory tract (which usually is the primary focus), bone, CNS, eyes, lymph nodes and skin. Histoplasmosis, Coccidioidomycosis and Blastomycosis are rare systemic mycoses in cats (Sibitz *et al.*, 2011).

### **Aspergillosis**

Aspergillosis is an opportunistic fungal infection caused by the *Aspergillus*, a species of common mold found throughout the environment, including dust, straw, grass clippings, and hays which affecting wide range of animals and birds including humans and cats. Two forms of Aspergillosis is mainly seen in the case of cats ie; Sino nasal aspergillosis (SNA) and Sino orbital Aspergillosis (SOA) and the most common in cats is SOA (65per cent ) and was invasive (Lloret *et al.*, 2013). *Aspergillus felis* was isolated from cats with invasive fungal rhinosinusitis (Tamborini *et al.*, 2016). Prevalence of fungal infection in mammals is predicted to increase due to global warming (Bas *et al.*, 2013).

### **Malasseziosis**

*Malassezia* yeasts belong to normal cutaneous or mucosal microbiota of many warm-blooded vertebrates. Malassezia yeast colonies were obtained from dermal swabs that are collected from cats with generalized dermatitis presented to Veterinary College of Alfort, France. Skin lesions occurred on the face, ventral neck, abdomen and ear canals and were characterized by some degree of alopecia, erythema and crusting. In most cases, pruritus was intense (Gacia-Solache and Casadevall , 2010).

### **Dermatophytosis**

Dermatophytosis is prevalent worldwide and is one of zoonotic skin diseases that cat owners are at risk of contracting (Crosaz *et al.*, 2013). Ringworm is an infection of skin, hair, or claws caused by a type of fungus known as a dermatophyte. In cats, about 98% of ringworm cases are caused by the fungus *Microsporum canis* (Moriello, 2014). The fungus is spread easily in the environment and often infects people. The percentage of cats suspected of having ringworm that actually test positive for the fungus varies widely, from 14-92 per cent (Verrier and Monod, 2017).

### **Sporotrichosis**

Sporotrichosis (also known as “rose gardener’s disease”), which is caused by the dimorphic fungus *Sporothrix schenckii*, and infection generally occurs by traumatic inoculation of soil,

plants, and organic matter contaminated with the fungus (Moreillo *et al.*, 2017). More than 4000 cases of the disease were diagnosed at Fundacao Oswald Cruz, Brazil, between 1998 and 2012 (Barros *et al.*, 2011). Human sporotrichosis related to cats was reported from Brazil (Gremiao *et al.*, 2015) Mexico (Gremiao *et al.*, 2017) Argentina (Zhang *et al.*, 2015) Malaysia (Fernandez *et al.*, 2015) India (Siew, 2017).

### Parasitic diseases of felines

*Toxoplasma gondii* is an obligate intracellular protozoan parasite that has a worldwide distribution and infects a wide range of warm-blooded vertebrates, including humans. The seroprevalence of *T. gondii* infection was 16.67 per cent in purebred cats and 23.89 per cent in mixed-breed cats. Moreover, significantly higher seroprevalence was found in rural cats (29.26 per cent), compared to that of cats raised in urban area (16.35 per cent) (Yegneswaran *et al.*, 2009). Toxocariosis is caused by a nematode species (ascarids) that routinely infect dogs and cats throughout the world. The national prevalence of eggs in the feces of pet cats during the four-year period (2011-2014) was 4.6–5.1 per cent in USA. *Toxocara cati* remain considerably prevalent and geographically distributed in pet populations in spite of the availability of effective and safe treatments. Pet cats are found to be shedding *Toxocara* eggs more commonly than pet dogs. This high prevalence of egg shedding poses a significant public health risk, so renamed to the list of the top five neglected parasitic infections of Americans. Therefore, it is essential to place greater emphasis on the importance of testing and treatment of parasitic infections in cats (Wang *et al.*, 2017).

### CONCLUSION

Nowadays, many people are keeping cats as pets and also feline cases are increasing in clinics. It is much necessary to understand common infectious diseases of cats so as to take appropriate therapeutic and preventive approaches for cure and prophylaxis measures. Some of the diseases are zoonotic, awareness about these diseases helps in preventing spread of disease to humans also.

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**How to cite this article:**

Surjith. J. Kumar, Silpa Chandran and Deepa P.M. (2020) ' Occurrence of Feline Diseases – Global Perspectives', *International Journal of Current Advanced Research*, 09(07), pp. 22664-22669.  
DOI: <http://dx.doi.org/10.24327/ijcar.2020.22669.4480>

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