Research in Veterinary Science 89 (2010) 306–310

Contents lists available at ScienceDirect

Research in Veterinary Science

journal homepage: www.elsevier.com/locate/rvsc

Feline immunodeficiency virus, feline leukemia virus and *Toxoplasma gondii* in stray and household cats in Kerman–Iran: Seroprevalence and correlation with clinical and laboratory findings

Baharak Akhtardanesh [a,*], Naser Ziaali [b], Hamid Sharifi [c], Shirin Rezaei [a]

[a] Department of Clinical Science, Faculty of Veterinary Medicine, Shahid Bahonar University, Kerman, P.O. Box 76169133, Iran
[b] Department of Medical Parasitology and Mycology, Lishmaniosis Research Center, School of Medicine, Kerman University of Medical Sciences, Kerman, P.O. Box 444, Iran
[c] Department of Food Hygiene, Faculty of Veterinary Medicine, Shahid Bahonar University, Kerman, P.O. Box 76169133, Iran

ARTICLE INFO

Article history:
Accepted 9 March 2010

Keywords:
FIV
FeLV
T. gondii
Seroepidemiology
Iran

ABSTRACT

This study was carried out to determine the seroprevalence of feline leukemia virus (FeLV), feline immunodeficiency virus (FIV) and *Toxoplasma gondii* (*T. gondii*) infection among stray and owned cats in southeastern Iran and to identify the influence of age, sex, lifestyle, health status, and laboratory findings on seropositivity. The overall infection rate for FIV, FeLV, and *T. gondii* was 19.2%, 14.2%, and 32.1% respectively. Results of the multivariate logistic regression analysis showed that old adults more likely to be seropositive than juveniles for FIV, FeLV, and *T. gondii* (adjusted odds ratios [ORs], 1.84, 1.56, and 2.57 respectively). Anemic and diseased cats ([ORs], 6.62 and 0.9) were at a greater risk of testing positive for FeLV. Male cats were 4.91 times as likely to have FIV as were female and hyperglobulinemia was significantly more prevalent in FIV-infected cats ([ORs], 3.4). In conclusion, FIV and FeLV seem to be endemic in Iran and retroviral-associated immunosuppression may be a risk factor for active toxoplasmosis in infected cats.

1. Introduction

Regarding to Iranian society for the Prevention of Cruelty to Animal (IRAN, SPCA) announcement, more than 90% of cats (*Felis catus*) in Iran are strays. Owned cats, which are more often kept outdoors, are vaccinated routinely for feline panleukopenia, herpesvirus-1, calicivirus, and rabies according to American Association of Feline Practitioners vaccination guidelines. The risk of exposure to other feline pathogens, such as feline immunodeficiency virus (FIV) and feline leukemia virus (FeLV) is undetermined in Iran and no preventive programs are in place for these diseases.

Cats are typically infected with FIV through biting, but mucosal infection and vertical transmission from infected queens to kittens is possible. Cats with FIV are persistently infected in spite of their ability to mount antibody and cell-mediated immune response, so they can easily be screened by serologic tests (Hosie et al., 2009). FeLV virus is mainly transmitted horizontally in felines by close contact through saliva, blood and other body fluids. The role of the cat flea (*Ctenocephalides felis*) has also been confirmed as a vector in transmission (Vobis et al., 2003).

Seroprevalence of FeLV and FIV are highly variable depending on age, gender, lifestyle, physical condition, and geographical location (Levy et al., 2008). Seroprevalence of FIV ranges from less than 1% in healthy cats in North America to 30% in sick cats in Japan and Italy (Sellon and Hartman, 2006). In contrast to considerable geographical variation of FIV prevalence, the FeLV infection rate is less divergent throughout the world, ranging from 1% to 8% in healthy cats and up to 21% in sick ones (Hartman, 2006).

Toxoplasma gondii is a zoonotic agent, which infects up to one-third of the world's human population. Cats are important in the epidemiology of *T. gondii* because they are the only hosts that can excrete environmentally resistant oocysts (Sharif et al., 2009). Clinically unapparent toxoplasmosis is manifested by the presence of IgG antibodies, but the opportunistic character of the infection could appear in immunosuppression. Associated FIV and FeLV immunosuppression may be a risk factor for active toxoplasmosis in cats that increase the risks of human toxoplasmosis (Witt et al., 1989; Svobodova et al., 1998).

Precise information is needed on the seroprevalence of FeLV and FIV infection in cats in Iran to define effective prophylactic and management programs. However, seroprevalence of toxoplasmosis in immunosuppressed cats has not been surveyed yet in Iran. Therefore, our objectives were to determine seroprevalence of FeLV, FIV, and *T. gondii* among household and stray cats in Kerman (southeast of Iran). The correlation of seropositivity with laboratory findings and epidemiological parameters such as health status, sex, age, and lifestyle were also studied in infected cats.

* Corresponding author. Tel.: +98 9123585186; fax: +98 341 3222047.
E-mail address: Akhtardanesh@mail.uk.ac.ir (B. Akhtardanesh).

0034-5288/$ - see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.rvsc.2010.03.015

2. Material and methods

During February–August 2008, a volunteer cat rescue group trapped 70 urban stray cats and brought them to a veterinary hospital for vaccination and neutering. These cats often originated in cat-dense areas within the city. In the same period, 70 client-owned cats were randomly selected with no limitation for age, sex, and clinical status. Informed consent was obtained from each cat owner prior to the study. A detailed questionnaire was completed for each animal to gather information about age, sex, lifestyle, vaccination, and clinical histories. Blood samples (3 ml) were drawn from jugular vein of adult cats, but in kittens, a small volume of blood (1.5 ml) was taken. Collected blood divided to plain and anticoagulant containing tubes (ethylenediamine tetraacetic acid). Serum samples were separated after centrifugation for serological and biochemical testing. Complete blood counts were performed manually for all cats and the presence of hematological disorders such as anemia (Hematocrit < 20), leucopenia or leucocytosis (less than 5500 to more than 19,500 leukocyte/μl of blood) and changes in differential leukocyte count was recorded. Total protein, globulin, blood urea nitrogen (BUN), creatinine, alkaline phosphatase (ALP), alanine aminotransferase (ALT) and aspartate aminotransferase (AST) level were measured by an autoanalyser (Autolab, AMS-18A, China).

Immunochromatography assay (ICA) was carried out with a commercial kit (Speed Duo® FeLV/FIV, BVT Company, France) for detecting p27 antigen of FeLV and anti-Gp40 antibody for FIV according to the manufacturer's instructions. The sensitivity and specificity of kits in comparison to viral isolation was recorded as 89.1% and 97.7% for FeLV and 97.3% and 98.6% for FIV. Afterward, sera were tested for *T. gondii* specific IgG antibodies by modified direct agglutination test (MAT) as described by Desmonts and Remington (1980) and IgG titers of $\geqslant$1:20 were considered positive.

In statistical analysis, positive immunochromatography and presence of anti-*T. gondii* antibodies test was set as an outcome variable and the independent variables were animal source (client-owned, stray), sex, age, health status (sick, healthy), anemia, leukocytosis, leukopenia, globulin and hepatic enzymes elevation

Table 1
Source, signalment, health and *T. gondii* infection status of FIV and FeLV infected cats.

Cat No.	Source[a]	Sex[b]	Age[c]	FIV Ab	FeLV Ag	MAT[d]	Health status
2	O	M	1Y	+	–	+	Anorexia, weight loss
4	S	F	5Y	+	–	+	Gingivitis
9	S	M	9M	+	–	+	Clinically healthy
11	S	M	6Y	+	–	+	Gingivitis, bite wounds
12	S	F	3Y	–	+	–	Chronic diarrhea
15	O	F	5M	–	+	–	Chronic diarrhea
16	S	M	2Y	–	+	–	Clinically healthy
17	S	M	5Y	+	+	+	Gingivitis, upper respiratory tract infection, bite wounds
19	S	M	3Y	+	–	–	Clinically healthy
20	S	F	2Y	+	–	+	Pregnant, bite wounds
21	S	M	2Y	–	+	+	Clinically healthy
22	O	F	6Y	+	+	+	Upper respiratory tract infection, gingivitis, bite wounds, chronic diarrhea
25	O	M	3y	–	+	–	Chronic diarrhea
28	S	M	2Y	+	–	–	Clinically healthy
29	S	M	7M	+	–	–	Military dermatitis
32	S	M	3Y	+	+	+	Clinically healthy
37	O	M	3Y	+	–	+	Diarrhea, anorexia, weight loss
39	S	F	2Y	+	–	+	Clinically healthy
41	O	F	1Y	–	+	–	Clinically healthy
42	S	M	2Y	+	–	–	Clinically healthy
43	S	F	2Y	–	+	–	Clinically healthy
46	O	M	4M	+	–	–	Clinically healthy
47	O	M	2Y	–	+	+	Lymphadenomegaly, anorexia, weight loss
48	S	F	2Y	–	+	–	Clinically healthy
56	S	M	3Y	+	+	–	Clinically healthy
57	S	M	3Y	+	+	+	Gingivitis, bite wounds
58	S	M	2Y	+	–	+	Clinically healthy
59	S	M	1Y	+	–	–	Clinically healthy
60	S	M	9M	+	–	–	Lymphadenomegaly, gingivitis
61	S	M	4M	+	–	–	Clinically healthy
62	O	M	7Y	+	–	+	Lymphadenomegaly, gingivitis
63	O	M	5Y	+	–	+	Upper respiratory tract infection
64	O	M	6Y	+	–	+	Feline urinary syndrome, gingivitis
65	O	M	2Y	–	+	+	Clinically healthy
66	O	M	2Y	–	+	–	Clinically healthy
67	O	M	M5	–	+	–	Clinically healthy
69	S	M	1y	–	+	–	Clinically healthy
84	O	F	2Y	+	–	+	Clinically healthy
85	S	M	1Y	+	–	+	Clinically healthy
86	O	F	4Y	+	–	+	Bite wounds
87	S	F	3Y	–	+	–	Clinically healthy
88	O	F	3Y	–	+	–	Alimentary lymphoma, diarrhea, anorexia, weight loss
Total	42	–	–	27	20	21	*Clinically healthy: 23* *Sick:19*

[a] S = stray; O = owned.
[b] M = male; F = female.
[c] M = year; M = month.
[d] MAT = modified agglutination test.