

Clinical study of acquired immunodeficiency syndrome in domestic cats in São Paulo*

Estudo clínico da síndrome de imunodeficiência adquirida em gatos domésticos de São Paulo

Archivaldo RECHE JR¹; Mitika Kuribayashi HAGIWARA¹;
Sílvia Regina Ricci LUCAS¹

CORRESPONDENCE TO:
Mitika Kuribayashi Hagiwara
Departamento de Clínica Médica
Faculdade de Medicina
Veterinária e Zootecnia da USP
Av. Prof. Dr. Orlando Marques
de Paiva, 87 - Cidade
Universitária Armando de Salles
Oliveira - 05508-900 - São Paulo
SP - Brasil
e-mail: mkhagiwa@usp.br

1 - Departamento de Clínica
Médica
Faculdade de Medicina
Veterinária e Zootecnia da USP
- SP

SUMMARY

In order to study the magnitude of distribution of feline leukemia virus (FLV) and feline immunodeficiency virus (FIV) among domestic cats in São Paulo, 401 animals from both sexes, different ages and breeds, were tested for antibodies (FIV) and viral soluble antigens (FLV) by means of ELISA (feline leukemia virus antigen / feline immunodeficiency virus antibody - CITE® - Agrytech Systems Inc.). Among these animals, 123 were healthy cats and 278 were patients at the Department of Medical Clinics / Veterinary Hospital of Faculdade de Medicina Veterinária e Zootecnia, Universidade de São Paulo due to various diseases eight (6,5%) FIV positive cats and two (1,6%) FLV positive cats were found among healthy animals in opposition to 39 (14%) and 30 (10,8%) sick cats regents to FIV and FLV antigens and antibodies, respectively. All animals but one presented single infection. FIV infection was four times more frequent among males when compared to females; nevertheless, no difference was found related to FVL infection. Opportunistic infections as those caused by *Hemobartonella felis* were the most common baseline disease found among FIV or FLV infected cats. When tumors, were considered the mediastinal lymphoma was the most frequent type found among FVL infected cats. A variety of other diseases was observed, associated to both retroviruses infection. The mean age of FIV infect animals was $4,4 \pm 3,0$ years old and $2,4 \pm 1,7$ years old FLV infected cats. All infected, symptomatic animals died during the two years of observation, while all healthy, infected cats survived, allowing the conclusion that period of latency post-infection may be long.

UNITERMS: Feline leukemia virus; Feline immunodeficiency virus; Virus; Infectious diseases; Cats

INTRODUCTION

Feline leukemia virus (FLV) and feline immunodeficiency virus (FIV) are two pathogenic retroviruses which frequently infect the population of domestic cats. Although animals infected by one and / or the other virus may present similar clinical signs, there are differences regarding the physical properties of those viruses¹³. FLV was first isolated by Jarret *et al.*⁹ (1964) and belongs to subfamília *Oncornavirinae* whereas FIV belongs to subfamília *Lentivirinae* and was identified by Pedersen *et al.*¹², in 1987.

The isolation of FLV evidenced viral aetiology in tumoral processes, mainly lymphomas which are frequently observed in cats. Nevertheless, this retrovirus presents a much wider pathogenicity spectrum, causing the development of not only blood cells and leukocytes⁴ in animals; the interference in the function of lymphocytes leads to alterations in the immune response mechanism of infected animals¹⁴.

FIV, like FLV, also leads to changes in host immunologic responses¹³, though there is a basic difference between both viruses. While the former does not remain in the host organism in the presence of neutralising antibodies, the latter is able to persist in the infected animals, even in the presence of large amounts of antibodies.

The clinical aspects of immunosuppression caused by FLV or FIV are similar, but differentiation between infections demands appropriate serological tests¹⁷. In addition, immunodetection of felines infected by one and / or the other virus is quite relevant to control the spread of those retroviruses.

Among tests used for the diagnosis of feline retrovirus infection, ELISA has deserved special attention since it first appeared in the market in 1979, due to its low cost and facility to perform¹⁰. Therefore, determination of the prevalence of infection by FLV or FIV in different continents has become a frequent procedure through the use of ELISA^{7,9,11}. In Brazil, the study of feline leukemia virus infection¹ and the report of the three cases of FIV infection in cats² clearly shows the existence of retrovirus in the population, highlighting the need of other studies to analyse the

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extension of the problem in Brazilian feline population.

For this purpose, 401 serum samples from housed or sheltered, healthy or sick cats were studied, trying to evaluate occurrence of infection by one or both viruses within the two groups, tested by ELISA for the presence of FIV antibodies and FLV antigens.

MATERIALS AND METHODS

Animals

Four hundred and one cats, of both sexes, of various ages and breeds from the São Paulo were used in this study. They were divided in two groups, the first one comprised one hundred and twenty-three healthy cats and the second one, two hundred and seventy sick animals, examined at the Veterinary Hospital of Faculdade de Medicina Veterinária e Zootecnia, Universidade de São Paulo.

Methods

All animals were examined by usual clinical procedures. Blood samples were collected from each animal for immunoenzymatic analysis of serum. From ELISA positive animals, a second blood sampling was performed thirty days later, in order to confirm prior results and therefore, infection by one, the other or even both viruses. Enzyme-linked immunosorbent assay was carried out using commercial kits (feline leukemia virus antigen / feline immunodeficiency virus antibody test - CITE® Agritech Systems Inc) according to the recommendation of the manufactures results were analysed by means of χ^2 test, $\alpha = 0.05^{18}$.

RESULTS

Among the samples analysed, 11.7% (n = 47) were ELISA positive for FIV, 8.0% (n = 32) were positive for FLV and only 0.25% (n = 1) were positive for both. Infection by FIV was significantly higher among sick cats (39/278) than among healthy animals (8/123) ($p < 0.05$). The same pattern was observed regarding animals infected by FLV that is, of all animals tested, the number of sick and infected animals was greater (30/278) than the number of infected but healthy animals (02/123). The higher proportion of males infected by FIV (4:1) showed that they are more susceptible to FIV infection when compared to females. Regarding FLV infected animals, there was no difference in the number of infected males or females. There was no breed susceptibility related to FIV infection, however, in FLV infection, siamese cats were the most affected.

No age-related susceptibility to FIV or FLV infection could be observed ($p > 0.05$). The mean age of FIV infected animals was 4.4 ± 3.0 years.; the youngest cat was eight weeks old and the oldest, six years old. For FLV the mean age of infected animals was 2.4 ± 1.7 , the youngest infected animal being 8 weeks old and the oldest, twelve years old (Tab.1).

The majority of infected animals was sick in the moment of examination, 39 out of 47 for FIV infected cats and 30 out of 32 for FLV infection. Baseline disease or clinical signs presented by FIV or FLV infected cats are presented in Tab. 2 and 3. All FIV infected and sick cats died within the two years of observation, while all of the infected, but healthy animals survived.

Table 1
Distribution of FIV, FLV or FIV/FLV infected animals among 401 cats, according to clinical status, sex, age and breed.

	n°	FIV(+)	FLV(+)	FIV/FLV(+)
Clinical status				
asymptomatic	123	08	02	0
sick	278	39	30	01
Sex				
male	220	38	21	01
female	181	09	11	0
Age (years)				
<1	96	05	13	0
1 to 5	204	25	15	01
5 to 10	62	13	02	0
11 to 15	10	0	0	0
> 15	05	0	0	0
unknown	24	04	02	0
Breed				
mongrel	249	34	13	01
siamese	101	12	19	0
persian	41	01	0	0

n = number of cats

DISCUSSION

The rate of 6,5% FIV infection within the group of healthy cats and that of 14% among sick animals is quite near those found in UK⁶ and USA^{11,15}, though different from those found in Japan⁷, where the prevalence of 12,4% in healthy cats and 43,9% in sick

Table 2
Distribution of FIV infected cats (n = 47) according to baseline disease clinical conditions.

Disease / Clinical conditions	Frequency
Cryptococcosis	02
Gingivitis	02
Multicentric lymphoma	01
Unknow origin fever	01
Sporothrycosis	01
Enteritis	03
Upper respiratory disease	03
Epidermoid carcinoma	01
Encephalomyelitis	02
Icterus	10
Cachexia	02
Feline infectious anemia	03
Pleuris	01
Mesenteric tumor	01
Leukopenia	01
Anemia	01
Low urinary tract disease	02
Healthy	08
Total	47

Table 3
Distribution of FLV infected cats according to baseline disease or clinical conditions.

Disease / Clinical conditions	Frequency
Anemia	02
Carcinoma	01
Icterus	03
Uveitis	01
Feline infectious anemia	07
Mediastinal Lymphoma	06
Eosinophilic complex	01
Feline infectious peritonitis	02
Upper respiratory disease	01
Gastroenteritis	02
Gingivitis	02
Thymus atrophy	01
Abcess	01
Asymptomatic	02
Total	32

animals was observed. The high prevalence of the infection among cats is, according to the authors, due to the popularity of those animals as pets and their roaming freely, being more exposed to the risk of infection⁷.

The large difference found in the proportion between males and females (4:1) infected by FIV in the present study and already reported by other researchers^{6,8,9,11}, could be explained by the virus transmission mechanism (through bite and infective saliva) and by the behavior of male cats, constantly fighting with others males for the defense of their territory¹⁹.

Regarding racial predisposition¹⁹, cats of mixed breed are mentioned as those most frequently infected by FIV, again for roaming freely and also for being of the feline population¹⁹.

Yet, the highest prevalence of infection among older cats is explained by the long period of latency of lentivirus^{16,19}. Infected animals would remain asymptomatic for a long period of time. Infection is diagnosed only when because of some other disease, animals are submitted to immunoenzymatic test for detection of

FIV infection. This hypothesis is supported by the number of positive cats among healthy animals.

FLV seems to be less disseminated in São Paulo, when compared to FIV, if it is taken into account the frequency of FLV-positive animals observed in this report. In addition to this fourteen of the infected animals belonged to the same owner, and shared the same housing, thus leading to the conclusion that infection rate among general population might be lower when compared to that found in literature¹⁹. Besides despite the predominance of siamese cats among infected animals, twelve cats shared the same housing, causing therefore, a false impression of higher breed susceptibility to FLV infection.

There was no sex-related predisposition to infection, as previously reported by other researchers^{5,6,11}.

Infection due to opportunistic agents, like *Hemobartonella felis*, that was found in 22.0% (n = 7) of FLV seropositive cats and 6.4% (n = 3) of FIV seropositive animals could be highlighted among baseline diseases observed in animals infected either by FLV or by FIV. Icterus was the most frequent clinical sign observed among FIV positive cats, though for most of the animals the cause could not be determined. Among lymphoproliferative diseases following FLV infection, multicentric lymphoma is considered the most common form⁵. However, in this study, only mediastinal form of tumoral mass was found.

The broad spectrum of diseases observed among FIV or FLV infected cats¹³ seems to be related to the characteristics of both viruses. Regarding to FLV, infection of hematopoietic cells or lymphocytes takes place, leading either to lympho- or myeloproliferative or degenerative processes⁵, or even to changes in the immunologic defense mechanisms¹³, thus making easier the onset of other infections or diseases. Regarding FIV, the infection of lymphocytes happens along time, with changes in the function and number of cells, with development of feline immunodeficiency syndrome¹⁶.

The death of FIV or FLV seropositive, sick animals can be explained by the very ethiopathogenic mechanism previously mentioned, whereas the survival of healthy, seropositive cats clearly shows the chronic nature of the infection caused these two retroviruses.

RESUMO

Com a finalidade de estudar a magnitude da ocorrência do vírus da leucemia felina (VLF) e do vírus da imunodeficiência dos felinos (VIF) entre os felinos domésticos de São Paulo, 401 animais de ambos os sexos, idade e raças variadas, foram submetidos à pesquisa de anticorpos humorais (VIF) e de antígenos virais solúveis (VLF) através do teste imunoenzimático - ELISA (Feline Leukemia Virus Antigen / Feline Immunodeficiency Virus Antibody - CITE® - Agritech Systems Inc.). Desses, 123 eram felinos sadios e os demais 278 animais eram felinos doentes atendidos no Departamento de Clínica Médica / Hospital Veterinário da FMVZ/USP. Foram observados 8 (6,5%) reagentes ao VIF entre os felinos sadios e 39 (14%) entre os gatos doentes. Em relação ao VLF, 2 (1,6%) dos animais sadios e 30 (10,8%) entre os gatos doentes foram reagentes ao teste imunoenzimático e apenas um animal foi reagente a ambos os vírus. A infecção pelo VIF foi mais freqüente entre os machos, quando comparada às fêmeas, na proporção de 4:1, não tendo sido, no entanto, observada diferença entre machos e fêmeas infectados em relação ao VLF. As infecções oportunistas, como a causada por *Haemobartonella felis*, foram as doenças associadas mais freqüentemente observadas tanto nos felinos VLF positivos quanto nos VIF positivos. Em relação aos tumores, a forma mediastinal do linfoma foi a mais freqüente entre os felinos VLF positivos. As demais condições mórbidas que se associaram à infecção pelos dois Retrovírus foram de natureza e freqüência variáveis. A idade média dos animais infectados pelo VIF foi de $4,4 \pm 3,0$ anos e dos felinos infectados pelo VLF, de $2,4 \pm 1,7$ anos. Todos os animais reagentes e sintomáticos não sobreviveram mais do que dois anos. Por outro lado, não houve nenhum óbito entre os animais assintomáticos infectados por qualquer um dos Retrovírus durante o mesmo período de observação, demonstrando que o período de pré-patência pós-infecção pode ser bastante longo.

UNITERMOS: Vírus da leucemia felina; Vírus de imunodeficiência felina; Vírus; Doenças transmissíveis; Gatos

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