Feline immunodeficiency virus testing in stray, feral, and client-owned cats of Ottawa

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Abstract — *Feline immunodeficiency virus* (FIV) seroprevalence is evaluated in 3 groups of cats. Seventy-four unowned urban strays were tested, as well as 20 cats from a small feral cat colony, and 152 client-owned cats. Of the 246 cats tested, 161 (65%) were male and 85 (35%) were female. Seroprevalence for FIV was 23% in the urban strays, 5% in the feral cat colony, and 5.9% in the client-owned cats. Ten cats (4%) were also positive for *Feline leukemia virus* (FeLV) antigen, including 2 cats coinfected with FeLV and FIV. Seroprevalence for FIV in cats from Ottawa is similar to that found in other nonrandom studies of cats in North America.

Résumé — Analyse du virus de l'immunodéficience féline chez des chats errants, non apprivoisés et de clients à Ottawa. La prévalence du virus de l'immunodéficience féline (VIF) est évaluée chez trois groupes de chats. Soixante-quatorze chats errants urbains ont té vérifiés ainsi que 20 chats d'une petite colonie de chats non-apprivoisés et 152 chats de clients. Sur les 246 chats vérifiés, 161 (65 %) étaient des mâles et 85 (35 %) étaient des femelles. La séroprévalence du VIF était de 23 % chez les chats errants urbains, 5 % dans la colonie de chats non-apprivoisés et 5,9 % chez les chats de clients. Dix chats (4 %) étaient également positifs à l'antigène du virus de la leucémie féline (VLF) dont deux co-infectés au VIF et au VLF. La séroprévalence du VIF chez les chats d'Ottawa est semblable à celle retrouvée dans d'autres études non-aléatoires en Amérique du Nord.

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Introduction

Feline immunodeficiency virus (FIV) is a retrovirus (subfamily *Lentivirinae*), identified in 1986, that causes an acquired immunodeficiency syndrome in domestic cats (1). It is common worldwide, although prevalence based on serological testing for antibodies to FIV, varies geographically, ranging from ~2% (Taiwan) to > 24% (Australia) (2). The highest prevalence (28.9%) is recorded in Japan (3). One large serosurvey published over a decade ago in the United States found a prevalence rate of 7.4% in ill and at-risk cats, with some regional variation (4). A more recent large, nonrandom study in the United States found that 3.4% of cats tested were positive for antibodies to FIV (5). Prevalence in healthy cats from the United States and Canada with antibodies to FIV can be as low as 1.2% (6). Free-living, unowned cat populations in North America may have prevalence rates for antibodies to FIV ranging from 2.3% to 22% (7–10). Prevalence rates for antibodies to FIV in Canada have not been well evaluated and regional variations are largely unexplored.

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Infection with FIV is associated with a wide variety of signs of chronic disease (1,6). The primary mode of transmission is thought to be via bite wounds (6), although it is possible for a queen to infect her kittens in utero, intrapartum, or via colostrum and milk (11). There is also potential for venereal transmission of the virus (12).

The FIV is associated with a high degree of genetic diversity, leading to the existence of several subtypes, based on envelope gene sequences (13,14). The clinical significance of the various subtypes is currently unknown. The distribution of FIV subtypes varies geographically (13,15,16). Subtypes A, B, and C are found in Canada and the United States, although there are few published examples of Canadian subtypes (13,15,17). Recombinant viruses are also known to exist (15,17). An inactivated dual subtype (subtypes A, D) vaccine (Fel-O-Vax FIV; Fort Dodge Animal Health, Overland Park, Kansas, USA) became available in 2002 in the United States and in 2003 in Canada (18). During the time period of this study, the vaccine was not available in the testing area.

Testing for antibodies to FIV is recommended in a wide variety of circumstances; for example, when a new cat is acquired or when any cat is ill (19). The American Association of Feline Practitioners states that the FeLV and FIV status of all cats should be known (19). Routine diagnostic tests for FIV are based on the detection of antibodies. The most common screening tests are

enzyme-linked immunosorbent assay (ELISA) kits that are readily available and these are used to test blood samples in veterinary clinics.

This study examines the results of testing for the seroprevalence of antibodies to FIV in 3 groups of cats in Ottawa: unowned urban strays, cats from a feral cat colony, and cats owned by clients of a cat hospital.

Materials and methods

Group 1: Stray cats

A volunteer cat rescue group brought unowned, urban stray cats to a feline veterinary clinic for examination, vaccination, neutering, and medical treatment. These cats often originated in cat-dense areas within the city. Each cat's age was estimated on the basis of size, dentition and other physical characteristics. From January 2001 to February 2003, the rescue group presented 423 cats. Seventy-four cats were selected for FIV testing based on risk factors such as gender and reproductive status (intact mature male cats) or health status (signs of illness or fight wounds).

Group 2: Feral cats

Cats from a small feral colony (approximately 40 cats) established in a large commercial/industrial area of the city were presented as part of a trap-neuter-release (TNR) program. The cat density of the area was very low. The majority of the adult cats in the colony were determined to be feral (totally unaccustomed to human handling). Two adult cats (1 male, 1 female) appeared to be tame cats that had joined the colony. Once trapped, cats were anesthetized, examined, neutered, and vaccinated (Fel-O-Vax PCT-R; Ayerst Veterinary Laboratories, Guelph, Ontario). Each cat's age was estimated on the basis of size, dentition, and other physical characteristics.

An effort was made to test as many adults from the colony as possible with no selection criteria. Kittens were tested only if their mothers were not available for testing. All untested kittens were known offspring of tested queens, as most kittens were trapped with their mothers. A total of 20 cats were tested.

Group 3: Client-owned cats

From January 2001 to February 2003, 152 cats presented to the feline veterinary clinic by owners were screened for antibodies to FIV. Cats were selected for screening for various reasons:

a) To establish retrovirus status of new additions to a household;
b) To find the underlying cause of disease in ill cats;
c) To evaluate the status of cats exposed to known FIV-positive cats;
d) To confirm a previous positive test result.

Common clinical signs of illness that prompted testing included weight loss, anorexia, fever, chronic upper respiratory tract infection, or gingivitis/stomatitis.

Sample collection

Blood collection for testing for antibodies to FIV was done using 2 methods. In some cases, a small volume of blood (0.3 to 0.5 mL) was drawn into a 1-mL heparinized syringe with a 25-gauge needle from a cephalic vein. This method was most commonly used for kittens. For adult cats, blood was drawn from a jugular vein using a 3-mL syringe and 25-gauge needle and placed in either a 3-mL serum tube (Vacutainer; Becton Dickinson, Mississauga, Ontario) or a 3-mL EDTA tube (Vacutainer; Becton Dickinson). The blood in serum tubes was centrifuged and the serum collected.

Testing for antibodies to FIV

Testing was done with an in-house screening kit for FeLV antigen and FIV antibody (SNAP FIV Antibody/FeLV Antigen Combo Test; IDEXX Laboratories, Westbrook, Maine, USA) according to the manufacturer's instructions. Either serum or whole blood (heparinized or EDTA) samples were used. Tests were performed within 1 h of blood collection.

Results

Group 1: Stray cats

Most of the cats tested were intact males (75.7%). Intact females represented 10.8% of the tested cats, neutered males represented 8.1%, and neutered females represented 5.4%.

Cats judged to be $<$ 1 y of age represented 23% of the cats tested. Cats judged to be between 1 and 2 y of age represented 39.2% of the cats tested, and cats judged to be $>$ 3 y of age represented 37.8%. In total, 17.5% of the stray cats presented by the rescue group were selected for testing.

Using the in-house ELISA test, 17 of the 74 cats tested (23.0%) were identified as positive for antibodies to FIV. All were adult males. One cat (1.35%) was positive for FeLV antigen as well as FIV antibody. This was an intact male approximately 2 y old with evidence of chronic gingivitis. Four cats (5.4%) were positive for FeLV antigen but negative for antibodies to FIV.

Of the 17 cats positive for antibodies to FIV, 11 (64.7%) were judged to be young adult males approximately 1 to 2 y old. The remaining males were thought to be from 3 to 6 y old.

Group 2: Feral cats

The majority of the trapping was done during months of July to October in 2000. During this time, 38 cats were trapped (13 adult females, 5 adult males, 6 female kittens, 14 male kittens). Testing for antibodies to FIV was performed for 17/18 adult cats in the colony, as well as 3/20 kittens.

Trapped cats were usually in good body condition and bore few indications of fight wounds or chronic disease. Only 1 of 20 (5%) cats tested in the feral colony was found to be positive for antibodies to FIV, using the in-house antibody test. No cats were identified as positive for FeLV antigen. The cat that tested positive for antibodies to FIV was an intact adult male cat, approximately 2 to 3 y of age.

Group 3: Client-owned cats

Many cats were healthy cats tested as part of routine screening for feline retroviruses (55.9%). The gender and reproductive status of tested cats was as follows: neutered males 34.2%, intact males 26.3%, intact females 21.7%,

Table 1. Health status, source and estimated age of 27 male cats testing positive for antibodies to *Feline immunodeficiency virus*

Cat	Health status	Source	Estimated age (years)
39	Bite wounds, diarrhea	Feral	2 to 3
84	Military dermatitis	Stray	4
88	Conjunctivitis	Stray	3
95[a]	Gingivitis	Stray	2
81	Heart murmur, ear mites	Stray	2
82	Non-healing wound	Stray	1
92	Bite wounds	Stray	5
86	Dental disease, ear mites	Stray	2
96	Gingivitis, conjunctivitis, bite wounds	Stray	4
89	Dental disease, bite wounds	Stray	3
90	Upper respiratory tract infection, non-healing injury	Stray	1 to 2
KL	Upper respiratory tract infection	Owned	5
WN	Anorexia, pyrexia	Owned	11
MS[a]	Anorexia, weight loss	Owned	5
BW	Gingivitis	Owned	8
PC	Ear mites	Owned	2
87	Clinically healthy	Stray	2
93	Clinically healthy	Stray	4
97	Clinically healthy	Stray	1 to 2
83	Clinically healthy	Stray	2
91	Clinically healthy	Stray	1 to 2
94	Clinically healthy	Stray	2
85	Clinically healthy	Stray	2
GM	Clinically healthy	Owned	5
BP	Clinically healthy	Owned	5
TD	Clinically healthy	Owned	13
TB	Clinically healthy	Owned	3

[a]Co-infected with *Feline leukemia virus*

neutered females 17.8%. Many of the cats tested were $<$ 1 y of age (43.4%), since the clinic has a policy of recommending routine retrovirus testing for newly adopted cats and kittens. Cats aged 2 to 5 y were the next most commonly tested (34.9%), followed by cats $>$ 5 y old (21.7%).

Of the 152 cats tested for FIV with the in-house ELISA test, 9 (5.9%) were found to be positive for antibodies to FIV. The 9 cats were all males, 4 intact and 5 neutered, ranging in age from 1 to 11 y. Five of the cats (55.6%) were tested because they were ill. Three of the cats were tested to confirm a previously reported FIV-positive antibody test, although they were clinically well. One 5-year-old, neutered male cat was tested as part of routine screening for retroviruses. One cat (0.66%) was positive for FeLV antigen, as well as antibody to FIV. This cat was ill with weight loss and anorexia, and lived totally outdoors. Three cats (1.97%) were FeLV-positive, but FIV-negative.

Table 1 summarizes the health status, source, and age of the 27 cats positive for antibodies to FIV.

Discussion

The routine diagnosis of FIV infection relies on demonstrating circulating antibodies, since the amount of virus present in the blood after the acute stage of the infection is too low to be detected reliably with a diagnostic test kit (18). Since FIV is thought to produce a persistent infection from which few, if any, cats recover, antibody positive cats are considered FIV infected (20,21). Veterinary patients are often screened by using in-hospital ELISA test kits. A recent study demonstrated that ELISA testing for FIV appears to have excellent sensitivity and specificity (22). Use of whole blood samples, instead of serum or plasma, may increase the proportion of false positive test results (23).

The FIV is effectively transmitted via bite wounds and higher cat densities would lead to more intercat aggression and fighting. This could explain the high seroprevalence among the urban strays. The feral population studied lived in a larger geographic area. The single FIV-positive cat in this group probably did not originate in the colony, for it was clearly a socialized cat, whereas almost all other members of the group were truly feral. It may be that this single FIV-positive male had migrated into the colony recently from another area of the city. This cat was not released back into the colony but placed in a foster home.

Few studies have examined FIV seroprevalence in Canada. Yamamoto et al (6) identified a prevalence of 19.0% in 42 high-risk cats from Canada. No information was given on the geographic location of the cats. Hitt et al (24) found an FIV seropositive rate of 7.6% in 671 serum samples submitted to a diagnostic laboratory at the Atlantic Veterinary College. The majority of these samples (90.5%) came from Prince Edward Island. No breakdown was given specifically for stray or feral cats versus indoor cats. Gibson et al (9) found an FIV-positive rate of 10.1% among 139 adult feral cats tested as part of a TNR program on Prince Edward Island.

In this study, 246 cats were tested for antibodies to FIV by using an in-hospital ELISA kit. Twenty-seven cats (11%) were FIV-antibody positive. This study

suggests that the FIV seroprevalence in unowned strays, feral cats, and client-owned cats of Ottawa may be similar to that found in other nonrandom seroprevalence studies in North America. Veterinarians should be aware of the risk of infection with FIV for certain patients, especially adult stray male and ill cats, and recommend testing where appropriate. CVJ

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