Feline immunodeficiency virus: A commentary

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Introduction

There is never a dull moment for anyone — microbiologist, pathologist or clinician — involved with infectious diseases. During the past twenty-five years in small animal practice, scientists have "discovered" feline leukemia, canine and feline coronaviruses, canine parvovirus, and now feline immunodeficiency virus. Feline immunodeficiency virus (FIV), also referred to as feline T-lymphotropic virus (FTLV), is the feline equivalent of human immunodeficiency virus (HIV), the cause of acquired immunodeficiency syndrome (AIDS).

Feline immunodeficiency virus was first isolated by Pedersen and colleagues (1) when they investigated a cattery that had increased incidence of chronic or recurrent infections with wasting disease. The infection could be transmitted to kittens by intraperitoneal inoculation of whole blood or filtered plasma. A lentivirus was cultured from these experimentally infected cats. An apparently identical virus has been isolated from cats in Japan (2) and the United Kingdom (3). Serological evidence shows the infection to be widespread. It has probably existed in the cat population for many years, but has been previously unrecognized.

The virus

Feline immunodeficiency virus is a member of the genus Lentivirus in the family Retroviridae. The relationship of FIV to the other lenti- and retroviruses is shown in Table 1. Retroviruses are uniquely characterized by genetically coding for the production of the enzyme reverse transcriptase (RT) in infected cells. The RT enzyme enables transcription of a DNA copy of the RNA genome of the retrovirus. The DNA copy is made double-stranded and can become inserted in the chromosomal DNA of the host cell as proviral genetic material. Provirus can initiate production of the virus (productive infection) or remain latent until subsequently reactivated. Assembly of the virus occurs at the cell membrane, and virus is released from the cell by a budding process. The cell is usually not lysed by this budding. With some retroviruses (mainly the oncornaviruses) the proviral DNA carries transforming genes which cause the cell to undergo, often on a delayed basis, a neoplastic change.

The lentiviruses, such as FIV, are morphologically distinct from other retrovirus genera. They possess a dense wedge-shaped nucleoid. Lentiviruses also resist neutralization by antibody so that viremia persists in spite of the presence of serum antibody. Feline immunodeficiency virus, like HIV, selectively replicates in T-lymphocytes. As T-cells are at the center of the immune response, the consequence of infection is immunodeficiency.

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Feline immunodeficiency virus can be isolated in the laboratory by coculturing buffy coat samples from infected cats with lymphocytes of healthy cats, or with certain cell lines, in the presence of mitogens. Cytopathic effects of ballooning degeneration, increased cell death and giant cell formation occur over several weeks. Infected cultures show increased levels of RT that is magnesium ion dependent (1,4).

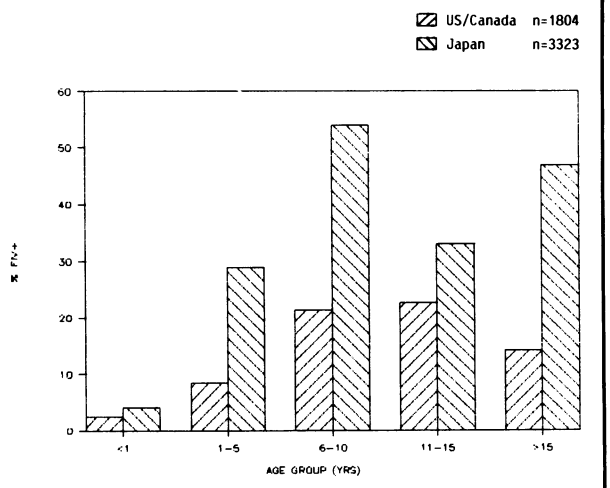

Figure 1. FIV: age association (Refs. 5, 8).

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TABLE 1
Relationship of FIV to other lentiviruses and retroviruses

Genera[a]	Oncornavirus (Tumor-forming)	Family: Retroviridae Lentivirus ("Slow")	Spumavirus ("Foamy")
HOSTS			
Cat	Feline leukemia (FeLV) Subtypes A,B,C Fibrosarcoma virus Endogenous oncornavirus (RD114)	Feline immuno-deficiency virus (FIV, FTLV)	Feline syncytial-forming virus (FeSFV)
Other species	Avian leukosis Mouse leukemia Human leukemia (HTLV-1) Bovine leukemia (BLV) Etc.	Human immuno-deficiency virus (HIV,AIDS) Equine infectious anemia Visna-maedi Bovine immuno-deficiency virus (BIV) Etc.	Foamy viruses of many species No known diseases

[a]Sometimes these are given sub-family status, e.g. lentivirinae

TABLE 2
Prevalence of FIV infection based on serological surveys of cats

	Ontario[a]	Canada[5]	U.S.A.[5]	N. Carolina[6]	Seattle, Wash.[7]	Japan[8]	Switzerland[9]	France[9]	U.K.[9]	Holland[9]
Sick cats tested	233	42	2212	40	226	1739	775	208	431	98
FIV +	34	8	310	6	23	764	29	46	55	3
FIV + %	14.6	19	14	15	10.2	44	3.7	22.1	12.8	3
Healthy cats tested	32	511		83	361	1584	178	—	98	123
FIV +	0	6		3	5	196	5	—	0	1
FIV + %	0	1.2		3.6	1.4	12	2.8	—	0	1

[a]Langford Laboratories unpublished

Epizootiology

Feline immunodeficiency virus appears specific for cats. Certainly no evidence of human infection has been found, and no close relationship exists with HIV. Feline immunodeficiency virus has been isolated in the United States, United Kingdom and Japan, and is widespread in the cat population of those countries, as well as in Canada, Switzerland and France (see Table 2).

The high prevalence of infection in cats in Japan is explained by the greater degree of roaming freedom allowed to many cats in Japan (8). Free-living cats have higher rates of infection than cattery or other confined cats. This is because virus is present in saliva and the major mode of transmission is via cat bites. In catteries, transmission of FIV may occur with prolonged intimate contact, but is much less frequent than is transmission of FeLV in an infected cattery (5,10).

As with other "slow" viruses, there may be a protracted prodromal period after infection before clinical signs become apparent. Therefore, immunodeficiency syndrome is seen mainly in cats five years of age or older. However, any age of cat may be affected (see Figure 1).

TABLE 3
Clinical signs associated with FIV infection in approximate order of frequency

Chronic oral lesions (gingivitis, periodontitis, stomatitis, glossitis, tonsillitis)
Anemia (of varying degree)
Chronic upper respiratory disease (rhinitis mainly)
Gastrointestinal disease (chronic enteritis or enterocolitis)
Wasting
Chronic fight wound abscesses
Chronic otitis externa
Chronic skin disease (including demodicosis)
Chronic urinary tract infection
Persistent lymphadenopathy
Neoplasia (particularly lymphosarcoma, myeloproliferative disease, usually associated with FeLV concurrent infection)
Neurological disturbance (vague behavior change, hysteria, rage, facial twitches, etc.)

Pathogenesis

There have been only limited experimental infection studies, and the immunodeficiency syndrome has not yet been observed experimentally (4). This is probably a function of the short time since the disease was first recognized. The likely sequence of events in the early pathogenesis of FIV is shown in Figure 2. Persistent infection of T-lymphocytes probably results in a progressively compromised immune system.

Clinical signs

Early signs of generalized lymphadenopathy and fever often go unrecognized. Lymphadenopathy may persist for several months. Most cases are presented because of chronic nonspecific infection problems. These parallel those seen also with the immunodeficiency syndrome related to FeLV infection. These syndromes have been referred to as FAIDS (feline acquired immunodeficiency syndrome) (11). Indeed FIV and FeLV infections may be concurrent (12). There is anecdotal evidence that such combined infections have more severe signs associated with them. The range of clinical signs reported with FIV cases is listed in Table 3. Concurrent infections recognized with FIV, besides FeLV, include demodicosis (13) and toxoplasmosis (14).

Progressively more frequent occurrence of disease and worsening infections culminate in emaciation and death. This course may take many months.

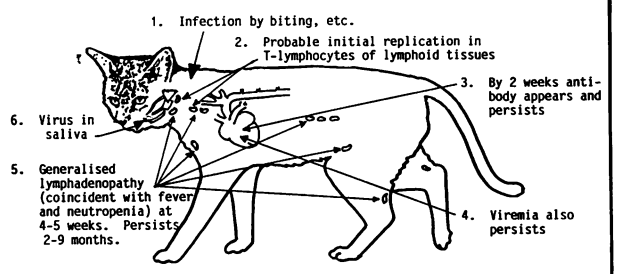

Figure 2. Postulated Pathogenesis of FIV.

Laboratory diagnosis

Clinical hematology is not particularly useful, although almost half the cases have varying degrees of anemia and about a third are leukopenic, typically lymphopenic. The leukopenia can be chronic (15). Terminally there may be pancytopenia.

Virus is present in blood and plasma and usually in saliva but isolation methods are not generally available. Laboratory diagnostic tests are based on the detection of specific antibody. This is correlated with active infection because viremia persists in the presence of antibody. Antibodies appear in serum about two weeks after infection and usually persist for life. The most widely available test is the rapid ELISA method CITE-FTLV (IDEXX Corp., Portland, Maine, distributed in Canada by Langford Inc., Guelph, Ontario). This test traps and concentrates FIV antibody from blood or plasma on a membrane where FIV antigen is spotted. The trapped antibody is revealed by an enzymatic color change. Positive and negative control spots are present in each test. The test is highly sensitive and specific, but occasional weak false-positives occur. In some cats this is due to cross-reaction with antibodies to feline syncytial-forming virus (9). A cat with a weak positive result should be retested in four to six weeks. A combination FIV and FeLV test is available also in CITE format. In the United States, an indirect fluorescent antibody assay (Hansen Veterinary Immunology, Dixon, California) has also been used.

Treatment, prognosis and control

Treatment will be directed towards controlling secondary infection and general supportive care. Although initial response may be encouraging, after time cases become more refractory. Progressive and recurrent chronic infection problems slowly lead to death over a period of months or years. Some treatments used in people with HIV are being evaluated in cats.

Development of vaccines for FIV will be a slow and difficult process. Meanwhile it is necessary to identify infected cats by widespread testing and to then segregate FIV-positive cats so that the transmission cycle is broken. Because transmission is apparently only by direct, intimate contact, particularly bitting,

such segregation should be highly effective. Neutering of males to reduce fighting, and general restriction of roaming, will be helpful. The virus is fragile, therefore extraordinary measures to disinfect premises are not essential, and most routine disinfectants should rapidly inactivate the virus.

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Role of veterinarians in the senior citizen–animal bond

Andrew F. Fraser

Abstract

As a result of increasing experience with the human–animal bond phenomenon, it is clear that senior citizens can gain much quality of life from such a bond whether it be a permanent and continuing one, resulting from the ownership of an animal, or even periodic, resulting from visitations. Dogs, and other animals, properly selected and trained, can be satisfactory pets for institutional visitation work. Voluntary work is increasingly being performed by people with pets suitable for being brought into custodial places. Evidently, the human–animal bond does much to ignite a spark of interest in people who are confined and who have lost many interests. It can stimulate the interest of elderly people who have lost various outlets for themselves in life due to the contemporary ways of institutionalizing the aged. Input of veterinarians is a significant requirement in these developments.

Introduction

In many regions and municipalities, legislation prohibits institutional pet ownership, and numerous senior citizens are parted from their pets when either special housing or custodial care has been arranged for them. The use of pets in institutional settings is discouraged widely, but as knowledge of pet-facilitated therapy becomes more keenly appreciated as supportive for the elderly, the trend to more liberal regulations for auxiliary companion animals will duly emerge for senior citizens. Veterinarians should be actively involved in this development. It is a veterinarian's responsibility, for example, to ensure that the animal's welfare is not overlooked in its use in an auxiliary role. In addition, a veterinarian should educate the owner or caretaker or institutional staff regarding the animal's needs and the specifics of animal care. Dangers from injury or transmissible conditions must be made clear.

Benefit for the aged from animal affiliation can be verified from the professional observations of veterinarians (1). An affiliation between a human and an animal can have significant beneficial effects on the mental health and general well-being of a person lacking in some social aspect of life. The effects spring from a phenomenal, natural property in the relationship (2). This has been termed the human–animal bond. This bond is formed very readily by most people who are able to make close physical contact with a friendly pet animal. Evidently this contact provides social stimulation for people who are not able, for any reason, to move widely in the community. It is also observed to make such people more expressive and more alert. Some of these effects show up in certain physiological criteria such as reduction in heart rate and blood pressure. Many senior citizens find that an affiliation with a pet animal gives psychological reassurance.

One point of basic importance is the need for consultation with each senior involved in any organized program of pet companionship. The senior should not be excluded from participation in the decision regard-

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