

Peer Reviewed

Feline Retrovirus Infection

The decision to treat or euthanize a cat should not be based solely on the presence of retrovirus infection.



Cats infected with feline immunodeficiency virus (FIV) and feline leukemia virus (FeLV) are susceptible to the same diseases that occur in cats free of retrovirus infection, and many clinical signs found on examination may not be related to retrovirus infection. In addition, retroviral testing can only diagnose infection, not clinical disease, and cats infected with FIV or FeLV may live for many years. However, FIV and FeLV status should be ascertained in all cats, healthy or sick, because the presence of retrovirus infection impacts their health status and long-term clinical management.

MANAGEMENT OF FeLV & FIV

All cats in a household with a retrovirus-infected cat should be tested to determine their status. If positive and negative cats are identified in the same household, the owner must be informed of the potential danger to uninfected cats. Although the risk for transmission of FIV or FeLV is not high, the best method for preventing spread is to isolate the infected individuals and prevent them from interacting with housemates.

CONTINUES

Update on FIV

FIV can cause an acquired immunodeficiency syndrome in cats comparable to human immunodeficiency virus (HIV) infection in humans and can lead to increased risk for opportunistic infections, neurologic diseases, and tumors. However, FIV does not cause a severe clinical syndrome in most naturally infected cats.

With proper care, FIV-infected cats can live many years and die from unrelated causes. Therefore, FIV infection has little impact on feline populations. Overall survival times are similar to those in uninfected cats, and quality of life is usually fairly high for many years.

Update on FeLV

FeLV is more pathogenic than FIV, and for many years it was considered a major cause of death in cats. This is no longer the case, as the prevalence and importance of FeLV have decreased. FeLV can cause variable clinical signs, including tumors, immunosuppression, hematologic disorders, and immune-mediated diseases.

Diseases secondary to immunosuppression account for many clinical signs in FeLV-infected cats, and it is important to consider that many of these diseases are treatable. The death rate in FeLV-infected cats in multicat households is approximately 50% in 2 years and 80% in 3 years. However, with proper care, an FeLV-infected indoor cat (single-cat household) may live much longer with good quality of life.

FIV does not cause a severe clinical syndrome in most naturally infected cats.



MULTICAT HOUSEHOLDS

✓ FIV

- FIV is mainly transmitted through biting
 - If social structures are harmonious in the household and no fighting occurs, FIV is unlikely to be transmitted
- All cats in affected households should be spayed or neutered
- No new cats should be introduced because of increased risk for biting
- The benefit of vaccinating FIV-negative cats in such households is controversial

✓ FeLV

- FeLV is mainly transmitted through social contact but also through biting
 - If an FeLV-infected cat is identified in an otherwise uninfected household, other cats have most likely been in contact with the virus and are immune to new infection
- The risk that adult FeLV-negative cats will become FeLV positive is approximately 10% to 15% if cats are living with a viremic cat
 - This is likely secondary to reactivation of latent FeLV infection and not by transmission from other cats in the household
- If owners refuse or are unable to separate housemates, uninfected cats should be vaccinated against FeLV
 - Alert owners that vaccination does not provide high levels of protection in high-exposure environments

How I Treat FIV-Infected Cats

✓ If no clinical signs are present

- No treatment is indicated
- Cat should be kept strictly indoors and should not be vaccinated

✓ If clinical signs are present

- Always look for underlying disease
 - FIV alone is typically not responsible for clinical signs
- Treat underlying disease as indicated

✓ FIV with stomatitis

- Avoid use of glucocorticoids
- I begin with azidothymidine (AZT) 5–10 mg/kg PO q12h (see **Table 1**, page 83) and antibiotics

- If stomatitis persists, removal of all teeth (typically in 2 surgical events with total removal of all tooth roots confirmed by radiography) is recommended

✓ FIV with neurologic signs

- Look for any underlying disease responsible for neurologic signs
- Treat underlying disease as indicated
- If no underlying disease is present and neurologic signs are presumed to result from FIV infection, initiate treatment with AZT 5–10 mg/kg PO q12h (see **Table 1**, page 83)

✓ FIV with recurring secondary infection

- Treat recurring infection(s) aggressively (eg, long-term antibiotics)
- Monitor virus load by quantitative RNA qPCR testing
- Monitor CD4+ and CD8+ T-lymphocyte counts
- If virus load is high and CD4+ T-lymphocyte counts are low, consider treatment with antivirals (eg, plerixafor 0.5 mg/kg SC q12h or AZT 5–10 mg/kg PO q12h; see **Table 1**, page 83)

AZT = azidothymidine; COP = cyclophosphamide, vincristine, prednisone; SPA = staphylococcal protein A



INDIVIDUAL CATS

✓ FIV & FeLV: General measures

- Affected cats must be kept strictly indoors to avoid transmission to other cats and prevent exposure of immunosuppressed cats to other infectious agents
- Cats should be examined at least semiannually to detect changes in health status
- Intact male and female cats should be spayed or neutered to reduce stress associated with estrus and mating behavior (ie, aggressiveness, roaming)

✓ FIV & FeLV: Care & hospitalization

- Surgery is generally well tolerated, but peri-operative antibiotic administration should be used
- Retrovirus-infected cats can be housed in individual cages in the same ward as other hospitalized patients. They should not be placed in a “contagious ward” with cats suffering from other infections
- If a cat becomes ill, prompt identification of secondary illness is essential to allow early therapeutic intervention
- For medications, see sections on **Antiviral Chemotherapy** and **Immunomodulatory Therapy** in addition to **Tables 1** and **2**
 - Most cats with retrovirus infection respond as well as uninfected cats do to appropriate medications for treating secondary infection, although a longer and more aggressive course of therapy (eg, antibiotics) may be required

Retrovirus-infected cats must be kept indoors to avoid transmission to other cats and prevent the immunosuppressed cat from being exposed to other infectious agents.

CONTINUES

How I Treat FeLV-Infected Cats

✓ If no clinical signs are present

- No treatment is indicated
- Cat should be kept strictly indoors

✓ If clinical signs are present

- Always look for underlying disease
 - FeLV alone is often not responsible for clinical signs
- Treat underlying disease as indicated

✓ FeLV with lymphoma

- Initiate chemotherapeutic drug protocols (eg, COP [cyclophosphamide, vincristine, prednisone])
- Discuss guarded prognosis with owners

✓ FeLV with anemia

- Look for underlying disease that may cause anemia (eg, lymphoma, myelodysplastic syndrome)
- Treat underlying disease as indicated
- Administer blood transfusions if severe anemia is present
 - Erythropoietin (100 IU/kg SC q48h; see **Table 2**, page 84) may be beneficial
 - If no effect, administer glucocorticoids
 - Anemia in FeLV-infected cats may have an immune-mediated origin, so some cats may respond

✓ FeLV with neurologic signs

- Look for underlying disease (eg, lymphoma) responsible for neurologic signs

- Treat underlying diseases as indicated
- If no underlying disease is present and neurologic signs are assumed to result from FeLV infection, initiate treatment with AZT 5 mg/kg PO q12h (**Table 1**, page 83)

✓ FeLV with recurring secondary infection

- Treat recurring infections aggressively (eg, long-term antibiotics)
- Consider treatment with immunomodulator (eg, feline interferon- Ω 10⁶ IU/kg SC q24h or staphylococcal protein A [SPA] 10 μ g/kg intraperitoneal injection twice weekly)

- Corticosteroids and other immunosuppressive or bone marrow-suppressive drugs should be avoided
 - Griseofulvin can cause bone marrow suppression and should not be used
 - Filgrastim (granulocyte colony-stimulating factor, [G-CSF]) is contraindicated because it can lead to increased viral load
- Erythropoietin and insulin-like growth factor 1 (IGF-1) can be used safely in FIV-infected cats

✓ FIV: Additional measures

- Secondary infection in FIV-infected cats can cause clinical signs of secondary disease and may lead to progression of FIV infection
- When possible (ie, indoor-only adult cats), avoid vaccination
 - Vaccine-induced immunostimulation can lead to progression of FIV infection by altering the unstable balance between immune system and virus
- Perform CBC, serum biochemistry profile, and urinalysis annually

✓ FeLV: Additional measures

- Routine vaccination programs should be maintained in FeLV-infected cats.
 - FeLV-infected cats may not be able to mount an adequate immune response to vaccination
 - Protection is not comparable with that of a healthy cat; therefore, more frequent vaccination (eg, semiannually) should be considered
- Perform CBC semiannually; serum biochemistry profile and urinalysis annually

TREATMENT PROTOCOLS

✓ Antiviral chemotherapy

(Table 1, page 83)

- Most antivirals used in cats are licensed for humans and are specifically intended for treatment of HIV infection
 - Some may be used to treat FIV infection because most enzymes present in FIV and HIV have similar sensitivities to various inhibitors
- Nucleoside analogs are typically less effective against FeLV than against FIV, as FeLV is not as closely related to HIV
- Few controlled studies about antivirals have been performed in cats, and multidrug protocols routinely used in HIV infection have not been studied at all
- Many antiviral drugs are toxic and cause such events as myelosuppression
- Antiviral drugs are currently only used in exceptional cases of FIV and FeLV infection

✓ Immunomodulatory therapy

(Table 2, page 84)

- Some uncontrolled studies have suggested dramatic clinical improvement with immunomodulatory therapy, but these effects are typically not seen in controlled studies
 - Clear evidence of efficacy is lacking
- Theoretically, immunomodulatory therapy may restore compromised immune function and allow patients to control viral burden and recover from the disease
 - There is no conclusive evidence from controlled studies
- In FIV infection, nonspecific immune system stimulation may even be contraindicated, as it may lead to increased viral replication caused by activation of latently infected lymphocytes and macrophages



Retrovirus-infected cats managed with special care may live for many years in good health.

See Aids & Resources, back page, for references & suggested reading.

G-CSF = granulocyte colony-stimulating factor, IGF-1 = insulin-like growth factor 1

**Table 1. Antiviral Drugs for FIV & FeLV**

Drug	Infection	Efficacy in Vitro	Controlled Field Study in Vivo*	Efficacy in Vivo	Author's Opinion	EBM Level (1-4)**
NARTIS						
Azidothymidine (AZT)	FIV	Yes	Yes	Yes	Effective in some cats (eg, with stomatitis, neurologic disorders)	1
	FeLV	Yes	Yes	No	Not very effective	1
Stavudine (d4T)	FIV	Yes	No	ND	Possibly effective but no data in cats available	4
	FeLV	ND	No	ND	Possibly effective but no data in cats available	4
Didanosine (ddI)	FIV	Yes	Yes	Yes	Effective in 1 experimental study but neurologic side effects	2
	FeLV	Yes	No	ND	Possibly effective but no data in cats available	4
Zalcitabine (ddC)	FIV	Yes	No	ND	Possibly effective but no data in cats available	4
	FeLV	Yes	Yes	No	Not very effective	2
Lamivudine (3TC)	FIV	Yes	Yes	No	Not very effective & toxic in high doses	2
	FeLV	ND	No	ND	Possibly effective but also toxic	4
Non-NRTIS						
Suramin	FIV	ND	No	ND	Possibly effective but too toxic	4
	FeLV	ND	No	ND	Possibly effective but too toxic	2
Nucleotide Synthesis Inhibitors						
Foscarnet (PFA)	FIV	Yes	No	ND	Effective in vitro but too toxic	4
	FeLV	Yes	No	ND	Effective in vitro but too toxic	4
Ribavirin	FIV	Yes	No	ND	Possibly effective but too toxic in cats	4
	FeLV	Yes	No	ND	Possibly effective but too toxic in cats	4
Receptor Homologs/Antagonists						
Plerixafor	FIV	Yes	Yes	Yes	Some effect in study in privately owned cats, so can be considered	1
	FeLV	ND	No	ND	Very likely ineffective	4

EBM = evidence-based medicine, NARTI = nucleoside analog reverse transcriptase inhibitor, ND = not determined, NRTI = nucleoside reverse transcriptase inhibitor

* Available studies

** EBM level 1 = confirmed by at least one placebo-controlled double-blind field study

EBM level 2 = shown in a controlled experimental study

EBM level 3 = supported by case series

EBM level 4 = only based on expert opinion

CONTINUES

Table 2. Immunomodulators for FIV & FeLV

Drug	Infection	Efficacy in Vitro	Controlled Field Study in Vivo	Efficacy in Vivo	Author's Opinion	EBM Level (1-4)*
IFNs						
Human IFN- α SC high dose	FIV	Yes	No	ND	Likely ineffective	4
	FeLV	Yes	Yes	No	Ineffective	1
Human IFN- α PO low dose	FIV	Yes	Yes	Yes	Some effect (more likely on secondary infections)	1
	FeLV	Yes	Yes	No	Ineffective	1
Feline IFN- Ω	FIV	Yes	Yes	No	Ineffective	1
	FeLV	Yes	Yes	Yes	Some effect (more likely on secondary infections)	1
Cytokines & Growth Factors						
Filgrastim (G-CSF)	FIV	ND	Yes	No	Contraindicated (may increase viral replication)	3
	FeLV	ND	Yes	No	Ineffective	3
Sargramostim (GM-CSF)	FIV	ND	Yes	No	Contraindicated (may increase viral replication)	2
	FeLV	ND	No	ND	Likely contraindicated (may increase viral replication)	2
Erythropoietin (EPO)	FIV	ND	Yes	Yes	Weakly effective in cats with anemia & neutropenia	2
	FeLV	ND	No	ND	Possibly effective in cats with anemia & neutropenia	4
IGF-1	FIV	ND	Yes	Yes	Possibly effective in young cats	2
	FeLV	ND	No	ND	Likely ineffective	4
IFN & Other Cytokine Inducers						
Staphylococcal protein A (SPA)	FIV	ND	No	ND	Likely contraindicated	4
	FeLV	ND	Yes	Yes	Weakly effective	1
<i>Propionibacterium acnes</i>	FIV	ND	No	ND	Likely contraindicated	4
	FeLV	ND	No	ND	Likely ineffective	3
Bacille Calmette-Guérin	FIV	ND	No	ND	Likely contraindicated	4
	FeLV	ND	Yes	No	Ineffective	2
<i>Serratia marcescens</i>	FIV	ND	No	ND	Likely contraindicated	4
	FeLV	ND	Yes	No	Ineffective	2
PIND-AVI/PIND-ORF	FIV	ND	No	ND	Likely contraindicated	4
	FeLV	ND	Yes	No	Ineffective	1
Polyriboinosinic-polyribocytidylic acid (poly I:C)	FIV	ND	No	ND	Likely contraindicated	4
	FeLV	ND	No	ND	Likely ineffective	4
Acemannan	FIV	ND	No	ND	Likely contraindicated	3
	FeLV	ND	No	ND	Possibly weakly effective	3
Other Drugs with Immunomodulatory Activity						
Levamisole	FIV	ND	No	ND	Likely contraindicated	4
	FeLV	ND	No	ND	Likely ineffective	3
Diethylcarbamazine (DEC)	FIV	ND	No	ND	Likely contraindicated	4
	FeLV	ND	Yes	No	Ineffective	2
Lactoferrin	FIV	ND	No	ND	Possibly effective in cats with stomatitis	3
	FeLV	ND	No	ND	Possibly effective in cats with stomatitis	4
Nosodes	FIV	ND	No	ND	Likely contraindicated	4
	FeLV	ND	No	ND	Very likely ineffective	4

EBM = evidence-based medicine, IFN = interferon, IGF-1 = insulin-like growth factor 1, ND = not determined

* EBM level 1 = confirmed by at least one placebo-controlled double-blind field study, EBM level 2 = shown in a controlled experimental study, EBM level 3 = supported by case series, EBM level 4 = only based on expert opinion