



## FELINE LEUKEMIA VIRUS DISEASES

Feline leukemia virus infection was, until recently, the most common fatal disease of cats. Because we can now protect cats with a leukemia virus vaccine, we are seeing fewer cases of the disease. However, it still remains a major cause of death in cats.

"Leukemia" means cancer of the white blood cells. This was the first disease associated with the feline leukemia virus (FeLV) and, thus, the source of its name. We often use the term "leukemia" rather loosely to include all of the diseases associated with the virus, even though most are not cancers of the blood. This virus causes many other fatal diseases, in addition to leukemia.

### What diseases are caused by the FeLV?

There are three major disease categories associated with the FeLV:

- 1) The **Leukemias** are cancers of the white blood cells.
- 2) **Lymphosarcoma** is a cancer which begins in lymphoid tissue, such as a lymph node. Almost any tissue may be affected; organs commonly involved include lymph nodes, intestinal tract, kidneys, liver, spinal cord, brain, bone marrow and blood.
- 3) The **Non-Cancerous Diseases** include a variety of somewhat unrelated diseases. Anemia, abortion, arthritis, and immune suppression are examples. When the immune system is suppressed, the cat becomes susceptible to many diseases it would ordinarily resist and mild diseases, such as respiratory infections, may become fatal.

### How is the virus transmitted?

The main means of transmitting the virus is through cat fights. Because large quantities of the FeLV are shed in cat saliva, puncture wounds associated with fighting result in injection of the virus into other cats. Other less frequent routes of viral spread include

sharing food and water bowls, cats grooming each other, and transmission from mother to kittens before birth.

### **What is a "leukemia test"?**

The "leukemia test" is used to determine if a cat harbors the virus. Any of three different tests may be used to detect one particular virus protein in the cat. Some tests detect earlier stages of infection, whereas others are used to detect later (i.e., irreversible) stages of infection.

1. The blood ELISA test is performed on a blood sample and detects the FeLV at any stage of infection. This test turns positive within a few days of infection and, in some cases, may later turn negative if the cat's immune system eliminates the infection.
2. The IFA test is performed on a blood smear and turns positive only after the FeLV infection has progressed to a late stage of infection. Once positive, the IFA test usually means that the cat has a permanent infection. A cat who tests IFA positive is only rarely able to successfully eliminate the virus.
3. The tears/saliva ELISA test is performed on a sample of tears or saliva. It turns positive only in a late stage of infection; therefore, it may yield a false negative result in cats who are in the early stage of FeLV infection. It also has been associated with some false positive results due to inherent errors in the way the test is performed. Because of these problems, the tears and saliva tests are not used routinely.

### **What can happen if a cat is infected with the FeLV?**

When we are exposed to a virus, such as a flu virus, there are two possible outcomes. Either our immune system responds to the challenge and protects us, or it is unable to respond successfully and we develop the flu. A number of factors determine which outcome occurs and whether or not we will get sick:

- The amount of the virus (Did someone sneeze directly in your face?).
- The strain of the virus (Some strains are more potent than others).
- The status of our immune system (are immune suppressing drugs being taken?)
- Age (the very young and very old are more likely to become infected).
- The presence of other infections which might cause debilitation.

The behavior of the feline leukemia virus in the cat's body is not so black or white. Instead of the two possible outcomes described above (i.e., we get sick or we get well), there are four possible outcomes for cats with FeLV. Understanding these allows one to more fully comprehend some of the unusual situations which may arise in cats.

**OUTCOME 1: IMMUNITY** The cat mounts an immune response, eliminating the infection.

This is the most desired outcome because it means that the cat will not become persistently infected with the virus. During this period of virus challenge, the cat may actually develop a mild form of illness. Fever, poor appetite, lethargy, and swollen glands (lymph nodes) in the neck may develop and last for 3 to 10 days. Outcome 1 occurs about 40% of the time after a cat is challenged by the FeLV. Immunity to the virus is more likely to develop in the adult cat than in the kitten.

**OUTCOME 2: INFECTION** The cat's immune system is overwhelmed by the virus.

This is the least desired outcome because the cat becomes permanently infected with the virus. Although the cat may be sick for a few days initially (as described above), it usually recovers and appears normal for weeks, months, or years. Ultimately, most of these cats die of FeLV-related disease, but as many as 50% will still be healthy after 2-3 years and 15% after 4 years. Vaccination of these cats will not cause any problems, but doesn't help the cat, either. Outcome 2 occurs an estimated 30% of the time after a cat is challenged by the FeLV.

**OUTCOME 3: LATENCY** The cat harbors the virus but we cannot easily detect it.

Unlike other viruses, the FeLV does not directly kill the cat's cells or make them become cancerous. Instead, it inserts a copy of its own genetic material (called DNA) into the cat's cells; these cells may later be transformed into cancer cells or cells which will no longer function normally. In Outcome 3, the genetic change in the cat's cells will remain undetected for an average of 2 1/2 years, during which time the cat will appear completely normal.

In the early stages of infection, the blood ELISA and IFA tests will remain consistently negative. The PCR test, a recently available diagnostic tool, will detect the latent infection. However, this test is somewhat expensive and not widely available so it is not used for routine testing.

**OUTCOME 4: IMMUNE CARRIER** The cat becomes an immune carrier.

The FeLV becomes hidden in some of the cat's epithelial cells. Although the FeLV is multiplying, it is not able to get out of these cells because the cat is producing antibodies against the virus. The cat will appear normal in every way. This situation is uncommon and probably occurs only 1-2% of the time.

## **How are cats with leukemia treated?**

Some forms of leukemia (blood cancer) are unresponsive to all available forms of cancer treatment. Other types of leukemias may respond to chemotherapy, though most of these have an average survival time of less than one year. Because the virus is not affected by treatment, the cat will always remain infected with FeLV. Also, relapse of leukemia is possible (and expected). These factors cause us to recommend treatment of leukemia in very few situations.

## **What should I do to disinfect my house?**

The FeLV lives, at most, only a few hours outside the cat if the environment is dry. Therefore, extensive environmental disinfection is not necessary. If you wait even two days to get a new cat, you can be assured that none of the virus from a previous cat will remain in your house.

## **I have a healthy cat that is infected with the virus. What does that mean?**

Healthy infected cats may remain apparently unaffected by the virus for several years. However, such cats should be considered infectious and potentially dangerous to other cats. Such cats should be isolated from non-infected cats to prevent spread of infection. Many people find this undesirable or impossible and elect euthanasia to protect non-infected cats.

## **Is there any danger to my family?**

Extensive tests have been conducted for over 15 years to determine if the FeLV can be transmitted to humans. Thus far, no conclusive evidence has shown any FeLV-related disease in humans or other animal species, including the dog. However, persons with compromised immune systems are of concern to many researchers. Newborn babies, persons on chemotherapy, AIDS patients or transplant recipients on anti-rejection drugs should probably not be unnecessarily exposed to this or any other virus.

## **Can I protect my other cats?**

A vaccine is available to protect cats from the FeLV. Although not 100% of cats are totally protected, the vaccine is strongly recommended for cats who are exposed to open populations of cats (i.e., outdoor cats). We have seen a definite decline in the incidence of feline leukemia virus infection and related diseases since vaccine use became widespread. We recommend it. If your cat stays indoors at all times and is not in contact with another cat that goes outdoors, the need for the vaccine is minimal.

Cats who are already infected with the FeLV will not be helped by the vaccine. (They will not be hurt by it, either). We recommend pre-vaccination testing for the FeLV for:

- 1) cats with a history of cat fights or fight wounds (i.e., abscesses)
- 2) cats exposed to FeLV-infected cats

- 3) cats from unknown backgrounds (particularly animal shelters, humane societies, or pet shops)
- 4) routine health care, especially in multicat households

We recommend that healthy cats not have chronic exposure to a cat that is positive for FeLV.

**Will vaccinating my cat with the FeLV vaccine cause the leukemia test to be positive?**

No. The vaccine will not cause a cat to test positive for the virus. While the history of vaccination is important for us to know, it does not alter our ability to interpret the feline leukemia virus test.

**Are there any possible adverse effects associated with the leukemia virus vaccine?**

Possibly. In the last 10 years, several million doses of leukemia vaccine have been given without any adverse side-effects. However, a form of cancer that will arise at the injection site has been found in a small subset of cats (estimated at between 1 in 10,000 and 1 in 100,000) that have received leukemia vaccine. This tumor is called a fibrosarcoma, or tumor of the connective tissue. In many cats, it is not possible to remove the tumor with surgery. However, in most cats, the risk of contracting a feline leukemia virus disease and dying of it is considered far greater than for development of vaccine-related tumors.

