



**Veterinary Emergency
+ Referral Center**
of Hawaii

**Ettinger: Textbook of
Veterinary Internal Medicine, 7th Edition
Leukemia
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What is Leukemia?

Leukemia is not one disease. In fact, it is actually a group of cancers involving the bone marrow and blood. It can be acute or chronic and involve any one of the types of blood cells. It seems to start with one abnormal cell that multiplies and spreads throughout the body. Most animals with leukemia are middle aged or older, although younger animals are sometimes affected, especially with acute leukemia.

Several possible causes are known to exist. In cats, many cases of leukemia are caused by a retrovirus, the feline leukemia virus, which can spread from cat to cat by close contact. No such virus has been found in dogs. Genetic predisposition and environmental factors may be involved as well. Most pets have no known cause.

In order to understand leukemia, it is first necessary to understand normal blood. Normal blood is composed of red blood cells, white blood cells, and platelets. The red cells carry and deliver oxygen. There are several types of white cells:

- Neutrophils which are the first line of defense against bacterial infections.
- Lymphocytes and monocytes, which are involved with the immune response against several types of invading organisms.
- Eosinophils and basophils that are involved with allergies and response to parasites.

Platelets are fragments of cells involved in clotting. The liquid portion of the blood is called plasma. Blood cells are made in the bone marrow, a living tissue in the center of bones. Stem cells in the marrow can give rise to any of the blood cells depending on the number needed at any time. After a period of maturation, the cells leave the marrow and circulate in the blood for anywhere from hours (neutrophils) to almost 4 months (red cells).

Leukemia can be either acute or chronic.

What is acute leukemia?

In acute leukemia, the malignant cell is an undifferentiated cell called a blast, resulting in one of two different varieties of acute leukemia:

- Acute lymphoblastic leukemia (ALL) occurs when this blast is an immature lymphocyte.
- Acute myelogenous leukemia (AML) occurs when this blast is of any other cell type.

In any type of acute leukemia, these undifferentiated blast cells continue to multiply in the marrow until they make up most of the cells present. The malignant blasts do not mature into normal cells, and they are unable to function in any useful way. They may also be released into the blood, sometimes in high numbers. In other cases, no malignant cells are present in the blood. As the marrow fills with blasts, the normal blood cells are unable to multiply as they should.

As a result, the blood does not have enough:

- Red cells - anemia.
- Normal white blood cells - leukopenia, which increases the risk for infections.
- Platelets - thrombocytopenia, which increases the risk of bleeding.

What is chronic leukemia?

Like acute leukemia, chronic leukemia can arise from any of the blood cell lines. In chronic leukemia, the malignant cell does not mature into a normal looking cell, but there are just too many of them in the blood. The bone marrow usually is able to continue to produce all of the normal blood cells, so the typical signs of acute leukemia are not seen.

Several variations of the disease exist:

- Chronic lymphocytic leukemia (CLL) occurs when lymphocytes are involved.
- Chronic myelogenous leukemia (CML) occurs when neutrophils are involved.
- Polycythemia vera (P vera) occurs when red cells are involved.
- Essential thrombocythemia occurs when megakaryocytes (which make platelets) are involved. This variation is rare.

CLL is the most common form of chronic leukemia in dogs and cats. The malignant lymphocytes look normal, but do not function. Thus an affected animal might have some loss of immune function. However most chronic leukemias are discovered when a high lymphocyte count is noted when a blood count is done on an older animal, for some other reason. If the change is mild, no treatment may be needed immediately, since early treatment does not seem to affect survival time.

CML is uncommon in dogs and rarely seen in cats. The blood count shows a high neutrophil count, sometimes with some relatively young cells (not blasts), the same change that might be seen when an infection is present. In fact, CML can be difficult to distinguish from an infection. The malignant cells appear to function normally, despite the fact that they continue to be produced despite no need for them. A diagnosis is often made when no evidence of an infection is found on physical examination.

Polycythemia vera is characterized by an over-production of red cells which function normally, but are produced in excess needs of the body. When the red cell count rises above normal, the blood becomes thicker than normal. Sometimes there may be damage to the heart and brain from poor circulation.

What are the signs of leukemia?

Signs of leukemia may include:

- Pale mucous membranes and weakness from anemia.
- Fever and loss appetite from an infection caused by low white blood cell count.
- Bruising or other bleeding.
- Enlarged spleen, liver or other organs, caused by the spread of malignant cells.
- Dark red color to mucous membranes.

What tests are needed?

- Blood work, including a complete blood count (CBC) and platelet count.
- Bone marrow aspirate is sometimes recommended.

What treatment is needed?**Acute Leukemia**

Although ALL has a better prognosis than AML, both are difficult to treat. Because the malignant cells will have to be killed before the normal cells can repopulate the marrow and blood, response to treatment will take time. Supportive care is very important.

Treatment protocols can include:

- Blood transfusions
- Intravenous fluids
- Antibiotics
- Nutritional support

Most dogs and cats that respond to treatment will show evidence of improvement in their blood count in the first 2 weeks. Some maintenance therapy is required during remission to try to delay relapse. Eventually the malignant cells tend to become resistant to chemotherapy and relapse can occur. Second remissions with different drugs are hard to obtain.

Chronic Leukemia

Treatment protocols can include:

- Chemotherapy
- Blood removal, for polycythemia vera.

What is the prognosis?

Unfortunately, most dogs and cats with acute leukemia do not respond well to current chemotherapy protocols. Acute leukemia is not curable, although some will achieve a complete remission, meaning that all evidence of disease goes away.

Fortunately, CLL is easy to treat and most pets will respond for long periods of time. Treatment is also relatively free of side effects, and not very expensive.

As with other chronic leukemias, pets with CML can survive for long periods of time with appropriate chemotherapy.

Polycythemia vera, once diagnosed and treated, is often a manageable disease. Response is usually good, with long survivals common.