

Table 1. Diagnosis of Anaplasmosis, Lyme Disease, and Piroplasmosis

Disease	Signs and Symptoms	Diagnostic Tests
Anaplasmosis (<i>Anaplasma phagocytophilum</i>)	<ul style="list-style-type: none"> ▪ Fever for 1–12 days ▪ Depression ▪ Loss of appetite ▪ Limb edema ▪ Petechia ▪ Icterus ▪ Ataxia or cranial nerve deficits ▪ Myositis ▪ Colic ▪ Orchiditis ▪ Neutropenia, mild anemia, thrombocytopenia 	<ul style="list-style-type: none"> ▪ Identification of morulae in granulocyte inclusions in blood or buffy coat smear ▪ Chemistry profile ▪ Antibody test but titers slow to peak ▪ PCR
Lyme disease (<i>Borrelia burgdorferi</i>)	<ul style="list-style-type: none"> ▪ Low-grade fever ▪ Depression, lethargy ▪ Weight loss ▪ Regional lymphadenopathy ▪ Arthritis, recurrent lameness ▪ Behavior change ▪ Neurologic disease ▪ Uveitis ▪ Abortion ▪ Cardiomyopathy 	<ul style="list-style-type: none"> ▪ Serum antibody ▪ Cornell multiplex test to identify OspA, OspC, and OspF antibodies ▪ ELISA ▪ PCR on synovial biopsy or CSF ▪ CSF lymphocytic pleocytosis ▪ Culture synovial tissue (ideal) or joint fluid ▪ Histopathology of tick bite site or regional lymph nodes
Piroplasmosis (<i>Babesia caballi</i> and <i>Theileria equi</i>)	<ul style="list-style-type: none"> ▪ Fever ▪ Labored breathing ▪ Pale or yellow mucous membranes ▪ Ecchymoses ▪ Dark urine ▪ Gastrointestinal symptoms ▪ Splenomegaly 	<ul style="list-style-type: none"> ▪ Identification on blood smear ▪ ELISA ▪ PCR

PCR=polymerase chain reaction; CSF=cerebrospinal fluid; ELISA=enzyme-linked immunosorbent assay.

immune-mediated disease, and leptospirosis. Diagnosis is based on identification of the organism and serum antibodies. Oxytetracycline is the first choice for treatment. Alternatives include high-dose penicillin, oral doxycycline, and minocycline. NSAIDs are used to reduce inflammation. The blood antibody level falls if treatment is successful.

Piroplasmosis is a tropical protozoal disease caused by *Babesia caballi* or *Theileria equi*. It is common worldwide but not in the United States, Canada, Australia, the United Kingdom, Ireland, and Japan. Testing is required before importation into the United States. In 2009, however, an outbreak occurred in Texas in illegally imported horses, which led to ticks becoming infected and subsequently transmitting the disease to horses in at least 15 states. Diagnosis is made by identifying the organism (Table 1). Piroplasmosis is treated with intramuscular imidocarb for 2 days.

Tick-borne diseases can be prevented by daily inspection and removal of ticks from horses. Pastures should be mowed, horses kept out of woodlands, exposure to leaf litter reduced, and deer excluded from the pasture. Mice can be treated with fipronil, and their nests with

permethrin. Tick repellents such as permethrin and DEET (N,N-diethyl-meta-toluamide) should be used on the horses and their riders.

Leukemia and Myeloproliferative Disorders Summarized

Written by Muriel Cunningham

Amy N. Schnelle, DVM, University of Illinois, Urbana, Illinois, USA, gave an overview of leukemia and myeloproliferative diseases in veterinary medicine. The clinical signs of leukemia can be vague and include lethargy, change in behavior, weight loss, petechiation, cytopenias, and enlarged peripheral lymph nodes or spleen. Often, these cases are detected incidentally, particularly with chronic lymphocytic leukemias (CLLs). The survival times for acute leukemias (days to months) are generally worse than for the chronic leukemias (months to years). Biochemistry results can be highly variable. Sometimes, they are normal; however, abnormalities may include hyperglobulinemia, unexplained hypercalcemia, or others related to specific organs that are affected.



Although the human criteria and nomenclature were revised by the World Health Organization in 2008, the veterinary classifications have remained unchanged. Acute myeloid leukemia includes myeloblastic, monocytic, and myelomonocytic subtypes. Treatment response is comparable among subtypes, with a survival time ranging from 1 to 4 months. Chronic myeloid leukemia is rare, consisting of many well-differentiated cells. One of the difficulties in diagnosing acute lymphoid leukemia (ALL) is distinguishing Stage V lymphoma that has spread to bone from a true lymphocytic leukemia that has originated in the bone. The survival time for ALL ranges from 2 to 4 months. In animals with CLL, a lymphocyte count $>20,000/\mu\text{L}$ becomes a cause for concern.

Acute erythroid leukemias are not as common as in the past. This disease consists of increased blasts with a predominance of erythroid cells, and in cats it is associated with feline leukemia virus (FeLV) infection. Chronic erythroid leukemia, also referred to as *polycythemia vera*, is characterized by a very high hematocrit. In these cases, it is important to rule out other possible causes of erythrocytosis. Cases of megakaryocytic leukemias are very rare and usually have a poor prognosis. Chronic megakaryocytic leukemia is also extremely rare and is characterized by essential thrombocytopenia and a platelet count >1 million/ μL .

Atypical cell morphologies are the hallmark of myelodysplasia. Cell characteristics include binucleation, last-stage mitotic figures, megaloblastic cells, and hyper- or hyposegmented nuclei. This disorder is also associated with feline retroviruses such as FeLV and may develop into leukemia. Multiple myeloma is a proliferation of plasma cells. Monoclonal gammopathy, lytic bone lesions, light-chain (Bence-Jones) proteinuria, and $>20\%$ plasma cells in bone marrow are the criteria for a multiple myeloma diagnosis.

Several testing methodologies are used to diagnose and characterize leukemias. A complete blood count provides a white blood cell count and helps determine the presence of concurrent cytopenias or an inflammatory leukogram. Blood smear review identifies blast cells or dysplastic morphology. A bone marrow evaluation provides more cytologic detail and makes it easier to evaluate blast percentages. Cytochemical staining is an older method that has largely been replaced by immune-based methods, but it remains useful in some cases. Different lymphomas, such as B cell lymphoma and T cell lymphoma, can be differentiated with immune-based methods. Flow cytometry and polymerase chain reaction are also used to further delineate lymphoproliferative disease.

As leukemia research in humans continues to make advances in research, veterinary medicine is further behind in the field. But, concluded Dr. Schnelle, the hopes in the future are to find correlations with effective therapies and testing for minimal residual disease as well as further research into mutations with prognostic value.

Thorough Ear Cleaning and Control of Infections for Difficult Canine Otitis

Written by Toni Rizzo

Most difficult problems in managing canine otitis are the result of inadequate treatment, chronic inflammation, or failure to identify and control the underlying cause. According to James O. Noxon, DVM, Iowa State University, Ames, Iowa, USA, 2 key concepts are important to appropriate management of otitis. First, appropriate standard-of-care topical therapy must be used and any infections cleared, not just suppressed. Second, long-term maintenance is necessary to prevent recurrence.

Otitis treatment involves thorough cleaning and administration of medication to the entire ear canal. Oil-based ointments penetrate the skin better than do aqueous solutions but should be based on a light oil so that the medication can reach the entire length of the canal. The amount of medication to apply depends on the size of the ear canal, which varies according to weight. According to Dr. Noxon, the volume recommended on most ear products is too low and is a major source of treatment failure. He recommended applying medication by volume (mL) rather than drops but cautioned that too much can cause systemic effects. Once-daily administration is sufficient for most conditions. To completely clear otitis, medication should be applied for 30 days.

After treatment is completed, the patient should be rechecked. Maintenance therapy involves client education and intermittent use of antiseptics, therapeutics, and mild glucocorticoids until the primary cause is identified and controlled.

Pseudomonas infections, ceruminous otitis externa, and hyperplastic ear changes can be difficult to treat. *Pseudomonas* should be strongly suspected when a single population of gram-negative rods is seen on cytology. The identification can be confirmed with culture and susceptibility testing. Antibiotics are the primary treatment for *Pseudomonas* infection (Table 1). *Pseudomonas aeruginosa* can form a biofilm in the ear, increasing resistance to treatment; in such infections,