

Lab Locations

Atlanta
Georgia

Chicago
Illinois

Dallas/
Fort Worth
Texas

Denver
Colorado

Honolulu
Hawaii

Houston
Texas

Los Angeles
California

Memphis
Tennessee

New York
New York

Phoenix
Arizona

Portland
Oregon

San Francisco
California

Tampa
Florida

CANINE ANEMIAS

Clinical presentation of dogs (or cats) with anemia varies with the severity and duration of the anemia, and with the underlying disease. There may be few historical findings related to anemia and often it is an incidental finding when labwork is performed. Listlessness (which may also be described as lethargy, weakness or reduced exercise tolerance) and inappetence, although common complaints in dogs with anemia, are non-specific findings. Other historical complaints seen in patients with anemia can include collapse, syncope, and evidence of hemorrhage or hemolysis (icterus or pigmenturia). You may need to ask the client more specific questions to reveal this background.

A careful physical examination can provide helpful information regarding anemia. Physical examination findings in dogs with anemia depend on the underlying disease process and severity of anemia. Findings may include mucous membrane pallor, tachypnea, tachycardia, a soft systolic heart murmur (not louder than grade III/IV), and pulse changes (hyperkinetic femoral pulses). Animals with hemorrhagic shock have the above findings except that pulses will be weak, extremities cool, and a heart murmur may or may not be present. Other findings associated with specific types of anemia may include icterus (hemolysis), fever (infectious, immune-mediated, or neoplastic disease), hemorrhages (hemostatic problem, trauma), hepatosplenomegaly (immune-mediated disease, neoplasia, splenic torsion, infection), and endocrine alopecia (hypothyroidism).

LABORATORY CLASSIFICATION OF ANEMIA

Classification of anemia is an important step in determining the cause, best approach to treatment, and prognosis.

1. **Severity based on hematocrit** (packed cell volume, PCV) – an arbitrary classification

Severity	PCV
Mild	30 - 37%
Moderate	20 - 30%
Severe	10 - 20%
Critical	< 10%

Mild, non-regenerative anemias are often caused by chronic disease and may not be worth pursuing. Anemia of chronic disease in dogs typically does not produce a hematocrit <20%, so the magnitude of anemia can be very helpful in determining cause.

2. **Regenerative versus non-regenerative**

There are many laboratory indicators that an anemia may be regenerative, including macrocytosis and perhaps hypochromasia (decreased MCHC), increased anisocytosis, and presence of Howell Jolly bodies, normoblastemia, polychromasia, and reticulocytosis. Antech Diagnostics grades polychromasia on the following scale:

Grade	% Polychromatic RBCs
1+	2 - 5%
2+	6 - 10%
3+	11 - 15%
4+	> 15%

CANINE ANEMIAS (CONT'D.)

The gold standard for evaluating whether anemia is regenerative or non-regenerative is the presence or absence and degree of reticulocytosis. A corrected reticulocyte percentage (%) or absolute reticulocyte number is required to correct the raw reticulocyte % for the effect of anemia.

WHY IS THIS IMPORTANT?

As an example, consider a reticulocyte % of 5. Five % reticulocytes in a dog with a PCV of 20% is twice as many reticulocytes as 5% reticulocytes in a dog with a PCV of 10%. There are 2 ways to correct the reticulocyte % for the degree of anemia, as follows:

a. Corrected retic. % =
$$\text{reticulocyte \%} \times \frac{(\text{patient PCV}\%)}{40}$$

A corrected reticulocyte % of < 1% indicates a non-regenerative anemia. The higher the corrected value, the stronger the regenerative response.

b. Absolute reticulocyte number =
$$\text{reticulocyte \%} \times \text{RBC count}$$

An absolute reticulocyte count of < 60,000 cells/ μ l indicates a non-regenerative anemia. The higher the reticulocyte count, the stronger the regenerative response.

These 2 methods do exactly the same thing (correct for the effect of anemia) and give the same interpretation.

The reticulocyte production index, which is a modification of the corrected reticulocyte %, is not an essential value and its validity has been questioned.

RULE OUTS FOR REGENERATIVE ANEMIAS:

1. Hemorrhage
 - a. Peracute (over minutes to hours) and acute (over hours to days) blood loss will initially be non-regenerative.

Development of a full regenerative response takes 5-7 days after the onset of anemia.

- b. Chronic blood loss anemia may become non-regenerative and microcytic due to iron deficiency.
 - c. Hemorrhage may be due to a coagulopathy or to some local disease (eg, tumor, ulcer, trauma).
 - d. Hemorrhage is often occult, such that the lack of visible bleeding cannot be used to exclude it as a cause for anemia.
2. Hemolysis (decreased RBC lifespan)
 - a. May occur intra- or extra-vascularly, and may be due to intrinsic red cell abnormalities (such as pyruvate kinase or phosphofructokinase deficiencies) or disorders outside the red cell (AIHA, zinc or onion toxicoses, hypophosphatemia, snake envenomation, and DIC).
 - b. Acute hemolytic anemia may be non-regenerative. Development of a full regenerative response takes 5-7 days after the onset of anemia.
 - c. Immune-mediated hemolytic anemia also can be non-regenerative, if it involves attack of bone marrow precursors.
 - d. Patient signalment, or client report of pigmenturia, orange stool, or toxin exposure (onion, zinc) can increase the clinical index of suspicion for hemolysis. Laboratory abnormalities that support hemolysis as a cause of anemia include: presence of marked regenerative anemia along with a normal total protein, hyperbilirubinemia, abnormal bilirubinuria, hemoglobinemia, hemoglobinuria, red cell autoagglutination, presence of Heinz bodies or numerous spherocytes.

WHEN IS BONE MARROW EVALUATION NECESSARY?

Indications for bone marrow evaluation include non-regenerative anemias without apparent cause, presence of pancytopenia or anemia and neutropenia, and reports of "blasts" or atypical cells on peripheral blood smear review.

RULE OUTS FOR NON-REGENERATIVE ANEMIAS:

1. Anemia of chronic disease
2. Renal failure
3. Endocrinopathies
 - a. Addison's disease
 - b. Hypothyroidism
4. AIHA with bone marrow involvement (maturation arrest or red cell hypoplasia).
5. Bone marrow disease such as myelodysplasia, hematopoietic neoplasia, myelophthisis (crowding out of marrow by cancer cells), aplastic anemia (phenylbutazone, estrogen, phenobarbital, radiation), ehrlichiosis, and systemic mycoses.
6. Nutritional
 - a. Iron deficiency
 - b. Folic acid deficiency (seen occasionally in severe intestinal disease)
 - c. Protein-calorie malnutrition
7. Early hemorrhage or hemolysis

LAB TIP

ACTH PREPARATIONS

We currently recommend using the synthetic ACTH product cosyntropin (Cortrosyn®; Organon Pharmaceutical) for ACTH response testing in dogs and cats. To reduce reagent cost, consider using the mini-dose regime: measure serum cortisol before and 1 hour after IV administration of 5 μ g/kg cosyntropin. The reconstituted vial can be stored refrigerated for up to 2 months without loss of bioactivity.