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Flea Infestation & Anemia in a Dog

A 12-year-old male Labrador retriever was presented for otitis externa and a moist exudative dermatitis.

History. In addition to the otitis externa and exudative dermatitis, the owner indicated that the dog exhibited decreased exercise tolerance but no coughing or sneezing.

Physical Examination. The dog had severe flea infestation, with marked flea excreta over some areas of the body. The mucous membranes appeared pale, multiple lymph nodes were enlarged, and the heart rate was increased. The rectal temperature was normal.

Laboratory Findings. The dog had severe microcytic (low MCV) hypochromic (low MCHC) anemia as measured by a Cell-Dyn 3500 hematology analyzer (www.abbott.com) (**Table**). The presence of reticulocytosis indicated regenerative anemia. Plasma was clear and colorless when examined after centrifugation of a microhematocrit tube. Total plasma protein concentration was within the reference interval when measured by a refractometer. Slight anisocytosis, slight poikilocytosis, moderate polychromasia, and marked hypochromasia were visible on a stained blood film (**Figure 1**). Thrombocytosis was present, and some platelets were large. The differential leukocyte count revealed slight leukocytosis with neutrophilia, eosinophilia, and basophilia. Numbers of nucleated erythrocytes in blood were slightly increased.

Laboratory Findings

Variable	Result	Reference Interval
Hematocrit (%)	11	37–54
MCV (fl)	51	62–74
MCHC (g/dl)	26	32–36
Reticulocytes (10^3/µl)	236	< 80
Total plasma protein (g/dl)	7.1	6–7.8
Platelets (10^3/µl)	618	160–430
Correct total leukocytes (10^3/µl)	21.3	6–17
Neutrophils (10^3/µl)	16.6	3–11.5
Lymphocytes (10^3/µl)	1.1	1–4.8
Monocytes (10^3/µl)	1.1	0.1–1.3
Eosinophils (10^3/µl)	2.1	0.1–1.2
Basophils (10^3/µl)	0.4	< 0.1
Nucleated erythrocytes (10^3/µl)	0.4	0

MCHC = mean cell hemoglobin concentration; MCV = mean cell volume

ASK YOURSELF ...

- What do the microcytic hypochromic erythrocytes indicate?
- What explains the eosinophilia and basophilia?
- What additional tests are indicated?

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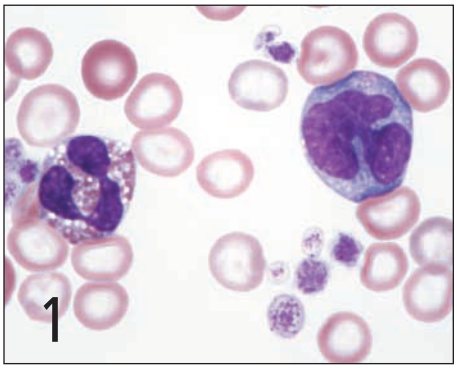
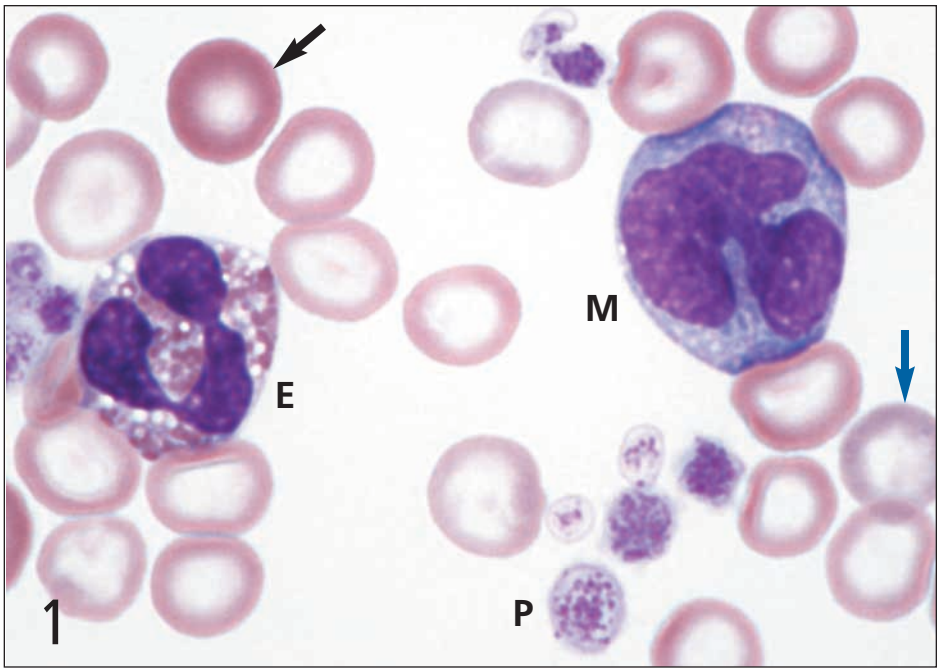


Wright-Giemsa stain; original magnification, 1200×

Diagnosis: Chronic iron deficiency anemia secondary to ongoing blood loss caused by a severe flea infestation

The hypochromic appearance of most erythrocytes on the stained blood film and the presence of severe microcytic hypochromic anemia indicate that chronic iron deficiency is highly likely in this dog (**Figure 1**). Less common causes of microcytosis in dogs, including portosystemic shunts and anemia of inflammatory disease, generally are associated with normal MCHC and normal-appearing erythrocytes.



Most erythrocytes are hypochromic in a stained blood film; compare tincture to the normocyte (normochromic erythrocyte, *black arrow*). A lightly stained polychromatophilic erythrocyte (*blue arrow*) is present. Polychromatophils are typically larger than normocytes, but in iron deficiency they may approximate the size of a normocyte, as seen here. An eosinophil (E), monocyte (M), and 10 variably sized platelets (P) are also present.

Iron Deficiency Anemia. Chronic iron deficiency anemia rarely results from dietary iron deficiency in adult animals but rather is almost always the result of chronic blood loss. About two thirds of total body iron is normally contained within erythrocytes, and substantial ongoing hemorrhage can result in iron deficiency when iron loss exceeds dietary iron absorption. Consequently, anemia in iron-deficient animals generally results from a combination of hemorrhage and impaired (iron-limited) erythrocyte production. However, iron-deficient erythrocytes also exhibit decreased life spans.[1]

Chronic iron deficiency anemia is common in adult dogs in areas where bloodsucking parasite infestations (especially hookworms and fleas) are severe. Iron deficiency may also result from hemorrhage associated with intestinal neoplasms, transitional cell carcinomas, gastrointestinal ulcers, thrombocytopenia, inherited hemostatic disorders, and hemorrhagic colitis.[2]

DID YOU ANSWER ...

- Chronic iron deficiency resulting from ongoing blood loss caused by a severe flea infestation
- Eosinophilia and basophilia may be a response to flea infestation, especially if a flea-bite allergic reaction occurs
- Fecal flotation for hookworms, fecal occult blood, serum iron and/or serum ferritin

Course/Progression. Depending on the initial MCV and MCHC values and the magnitude of ongoing blood loss, 1 or more months are required before the MCV and MCHC decrease below reference intervals. Body iron stores must be depleted, and then the microcytic hypochromic cells formed must make up a high enough percentage of the total erythrocytes present to decrease the MCV and MCHC below reference intervals.

Increased production and release of reticulocytes (and often nucleated erythrocytes) from bone marrow into blood typically occur in response to hemorrhage in dogs. As in this dog, absolute reticulocytosis is present in about half of the dogs recognized with chronic iron deficiency anemia.[3] As iron depletion becomes more severe, there is insufficient iron for reticulocyte production, and the absolute reticulocyte count is no longer increased.

Thrombocytosis (as seen in this case) is often present in animals with iron deficiency anemia. The platelet increase may in part be related to a stimulation of megakaryocytopoiesis by high erythropoietin concentration in plasma, but the mechanism has not been clearly defined.[1] The neutrophilia may have been in response to the dermatitis, and the eosinophilia and basophilia may have been in response to the flea infestation, especially if a flea-bite allergic reaction occurred.

Additional Diagnostics. In this case, the serum biochemical profile was unremarkable except for a serum iron level of 8 µg/dl (reference interval, 84 to 233 µg/dl). Although serum iron can be low in patients with anemia due to inflammatory disease, the markedly low serum

MCHC = mean cell hemoglobin concentration; MCV = mean cell volume

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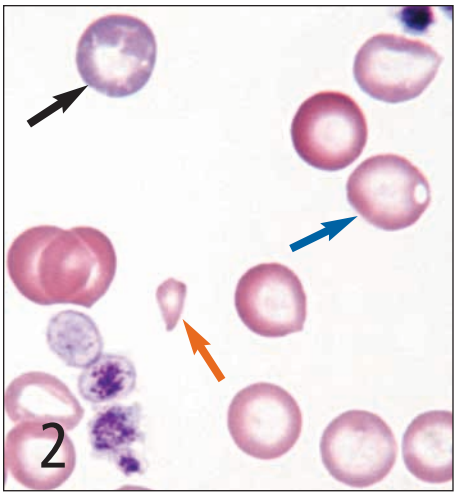
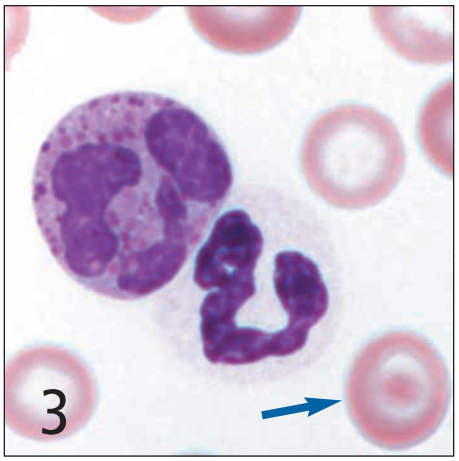


Note the polychromatophilic erythrocyte (*black arrow*), keratocyte (*blue arrow*), and schistocyte (*orange arrow*). (Wright-Giemsa stain; original magnification, 1000×)



A basophil (*left*) and neutrophil *(right)* on a stained blood film. A codocyte (target cell) is identified by the arrow. (Wright-Giemsa stain; original magnification, 1500×)

iron concentration associated with microcytic hypochromic anemia supports a diagnosis of iron deficiency. In addition, anemia due to inflammatory disease results in nonregenerative anemia.

The measurement of serum ferritin concentration (low in iron deficiency and normal or high with inflammation) or stainable iron in the marrow (low or absent in iron deficiency and normal or high with inflammation) can better differentiate iron deficiency from anemia due to inflammatory disease. Slight poikilocytosis was present in this case (**Figure 2**). Prominent poikilocytosis (especially keratocytes and schistocytes) may be pronounced in association with severe microcytosis.[4]

When iron deficiency is present, it is important to search for potential sources of blood loss; upper gastrointestinal bleeding is generally not recognized by the client. Hookworm infestations are a common source of bleeding in the southeastern United States, but in this case fecal flotation results for parasite ova were negative. Additional testing (such as a fecal occult blood test and diagnostic imaging) was not done because the flea infestation was considered severe enough to account for the anemia.

Heartworm infection is a common cause of eosinophilia and basophilia in dogs in our area. Results of a blood test for microfilaria were negative, but an antigen test for *Dirofilaria immitis* was not done. The eosinophilia and basophilia (**Figure 3**) in this case are believed to have occurred in response to the flea infestation.

Treatment & Outcome. After a 500-ml whole-blood transfusion was given, the hematocrit increased to 24%. The animal was treated to remove the fleas and was given 3 iron dextran injections over 3 days. In the absence of gastrointestinal signs, ongoing iron supplementation is generally given orally, rather than parenterally, as selected by the clinician in this case.

See Aids & Resources, back page, for references, contacts, and appendices.
Article archived on www.cliniciansbrief.com

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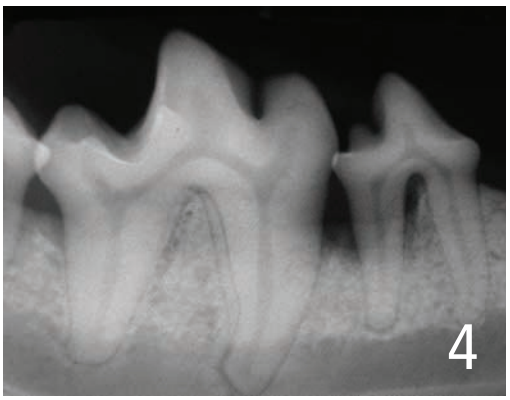
consultant on call

Correction

Brett Beckman, DVM, FAVD, Diplomate AVDC & AAPM, Florida Veterinary Dentistry & Oral Surgery/Veterinary Dental Education Center, Punta Gorda, Florida, and Affiliated Veterinary Specialists, Orlando, Florida

Pain Management & Periodontal Disease

In this article, published in the January 2008 issue of *Clinician's Brief*, Figure 4 was incorrect. The correct Figure 4 is pictured on the right and an updated article with correct figure is available at www.cliniciansbrief.com. The editors sincerely apologize for the mistake.



Radiograph of the right mandible of the patient in Figure 3. Bone loss is evident surrounding the roots of the fourth premolar. The patient was observably more active after surgery to correct the defect.