Anemia is relatively common in cats. It can be a primary condition, such as in feline infectious anemia, but it is often secondary to a variety of other disease conditions, such as chronic inflammation or blood loss. Even a primary cause of anemia such as *Mycoplasma haemofelis* (formerly known as *Haemobartonella felis*) can be quiescent until disease is precipitated by stress associated with other conditions. Also, the specific diagnosis of anemia is complicated by concomitant infection with immunosuppressant viruses such as feline immunodeficiency virus (FIV) and feline leukemia virus (FeLV), which themselves can cause anemia. For these reasons, and because in general Pet practice, clinicians do not always get client agreement for complete diagnostic workups, we decided to analyze our data on anemia and a subset of regenerative anemias, rather than concentrate only on feline infectious anemia—this issue’s disease focus.

First, a question must be considered: What does relatively common mean? Cats represent about 20 percent of our Banfield caseload. We see them for wellness examinations, preventive medicine visits and, of course, when they are sick. We reviewed our feline patient data from January 1, 2001, to December 31, 2005, and determined the overall prevalence of anemia and regenerative anemia. We also analyzed the data on anemic cats for geographic distribution, concurrent flea infestation, FeLV and FIV status, age, survival after anemia diagnosis, development of myeloproliferative disease and the presence of *M. haemofelis* organisms on red blood cells (RBCs) in peripheral blood smears. Unfortunately, we did not analyze the data for gender, indoor or outdoor living status or seasonality.

The criteria for identifying anemia were:
- **Mild anemia:** hematocrit (packed cell volume [PCV]) of 15 percent to 25 percent
- **Severe anemia:** PCV of less than 15 percent

A PCV of 25 percent was the cutoff point because it is unequivocally below our normal feline range (29 percent to 48 percent), and 15 percent is the point at which many cats start to exhibit clinical signs of anemia.

Additional criteria for identifying regenerative anemia in the Banfield Medical Database included:
- Appropriate diagnoses of regenerative anemia (e.g., feline infectious anemia, Heinz body anemia, blood loss anemia)

DataSavant’s mission is to:
- Explore the health and well-being of Pet populations
- Evaluate new clinical treatments
- Monitor Pets as sentinels of zoonotic disease in family environments
- Transform Pet medical data into knowledge, *i.e.*, open new windows into Pet healthcare using the Banfield medical caseload and database.
Physical examination findings such as splenomegaly, icterus and fever

Most importantly, laboratory findings, including reticulocytosis, polychromasia, metarubricytosis (nucleated RBCs), macrocytosis, hemoglobinemia and hemoglobinuria, bilirubinemia and bilirubinuria.

We also reviewed the data on anemic cats for evidence of the specific cause of anemia (i.e., the presence of M. haemofelis on RBCs in peripheral blood smears).

Disease prevalence

The number of feline patients with recorded diagnoses seen at Banfield hospitals during 2001 to 2005 was 797,129. Of these, 20,487 were anemic by the previously mentioned criteria, a prevalence of 2.57 percent. The majority of the anemias were mild (15,764 or 77 percent), with 5,046 or 24.6 classified as severe. It is important to note that some cats met both criteria during the same or different anemic episodes.

By the aforementioned criteria, 7,019 of the 20,487 anemic cats (34.2 percent) had evidence of a regenerative anemia. Of the 7,019 regenerative anemias, 4,785 were mild and 2,415 severe. (In time, some cats met both criteria.) Given the dynamics of this disease, not all anemias with some signs of regeneration are considered regenerative. Because of the progression of anemia, the diagnosis may not be confirmed until days after signs are present.

The prevalence of both mild and severe anemia and both mild and severe regenerative anemia was generally higher in Southern states than in Northern states (Table 1). The prevalence of both diseases was also higher in the oldest cats (Table 2, page 22). Overall, and despite a considerable increase in the number of feline patients, the prevalence of anemia and regenerative anemia was fairly constant over five years, although there was a gradual increase in severe regenerative anemias from 20 percent to 34 percent. A year after diagnosis with anemia, 69 percent of cats were alive (Table 3, page 22).

Diagnosis

M. haemofelis-like organisms were seen in the peripheral blood smears of 292 of the 20,487 anemic cats (1.4 percent) and in 147 of the cats with regenerative anemia (2.1 percent). These organisms were more common in South Central and Southeastern states. Two species of Mycoplasma (M. haemofelis and Mycoplasma haemominutum)
Signs of a regenerative erythron may not have been present or recorded. A sensitive polymerase chain reaction test for hemotrophic Mycoplasmas is available at commercial laboratories and is more reliable than searching for parasitized RBCs on blood smears.

As noted, infection with the immunosuppressive viruses FIV and FeLV may lead to secondary disease, including anemia caused by *M. haemofelis*. Testing for these viruses is part of our standard protocol for evaluating anemic cats. As such, most of the anemic cats were presumably tested before or at the time of diagnosis. Of the 20,487 cats with anemia, 444 tested positive (2.2 percent) for one of these viruses within six months of being diagnosed with anemia. Of the 7,019 cats with evidence of regenerative anemia, 146 tested positive for either virus (2.1 percent). The breakdown of these positive tests is in Table 4. The historical norms for these tests in Banfield feline patients is 0.9 percent positive for FeLV and 1.2 percent positive for FIV. Thus, the results for anemic cats more
or less mirror the results for our general cat population.

The mode of *M. haemofelis* transmission includes fleas and cat bites. We determined and recorded the presence of fleas within six months of anemia diagnosis. Historically, 12.7 percent of cats seen at Banfield hospitals are diagnosed with fleas at some point during a year. Our data show that approximately 20 percent of anemic cats and cats with regenerative anemia had fleas within six months of anemia diagnosis. In kittens, flea infestation alone can cause severe blood-loss anemia. Initially, this may appear as a regenerative anemia, but it may become nonregenerative as iron depletion develops.

**Caring for patients**

The treatment of choice for *M. haemofelis* infection is doxycycline or enrofloxacin. Of the 20,487 anemic cats, 2,110 (about 10 percent) were treated in this way, presumably because of suspicion that *M. haemofelis* was at least a contributing cause of the anemia. Recovery (PCV returned to normal) was seen in 196 cats, suggesting that these anemias were possibly caused by *M. haemofelis*.

**Conclusion**

These data reveal the limitations of a data query applied to a population sharing a clinical syndrome associated with mixed diagnoses. Determining disease associations and risk factors for specific diagnoses was not possible under the conditions. In order to make such associations with feline infectious anemia caused by *M. haemofelis*, we must: 1) identify cases that meet our criteria from the pool of regenerative anemias, 2) identify a matched control set (breed, age, gender, reproductive status, indoor or outdoor status) and 3) compare these two groups for a variety of influences such as FIV-FeLV infection, RBC parasitemia, flea infestation and impact of specific therapy. We plan to do this as we continue to learn more about the disease.

**Using Evidence to Make a Diagnosis**

A reality of general Pet practice is that clients do not always agree to a complete clinical and laboratory diagnostic evaluation. Thus, not all records are perfect for retrospective analysis; some are more complete than others. To accommodate this variability in the evidence supporting a diagnosis, we have adopted a method of weighing and reporting diagnoses based on the amount and quality of the supporting data. We call this evidence-based diagnosis (EBD). The minimum level of diagnosis is EBD-1 and indicates that the diagnosis is based on a licensed veterinarian’s recorded clinical judgment. EBD-2 indicates that there are also supporting clinical signs or a clinical syndrome present or there is confirmatory laboratory data. EBD-3 indicates that there is also evidence of specific cause, e.g., *Mycoplasma haemofelis*-infected red blood cells (RBCs) in a peripheral blood smear of an anemic cat. EBD-4 is EBD-3 plus evidence of effective treatment (doxycycline or enrofloxacin.) Using Banfield data, the diagnoses of regenerative anemia would be classified as the following:

<table>
<thead>
<tr>
<th>Diagnoses</th>
<th>Number of Feline Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBD-2</td>
<td>6,391</td>
</tr>
<tr>
<td>EBD-3</td>
<td>432 (292)*</td>
</tr>
<tr>
<td>EBD-4</td>
<td>196</td>
</tr>
<tr>
<td>Total</td>
<td>7,019</td>
</tr>
</tbody>
</table>

*292 instances of *M. haemofelis*-infected RBCs in blood smears.

**Suggested reading**


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