DataSavant

Analyzing feline anemia

By Hugh Bilson Lewis, BVMS, MRCVS, DACVP

Contributing Author

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

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 health care using the Banfield medical caseload and database.

DataSavant

Table 1: Prevalence and Geographic Distribution of Anemia and Regenerative Anemia in Cats from 2001 to 2005*

	Anemia			Regenerative Anemia		
Region	All	Mild	Severe**	All	Mild	Severe**
United States	257	198	63	88	60	30
North Central states	230	176	59	66	43	25
Northeastern states	239	184	58	74	51	24
Northwestern states	237	197	44	70	53	19
South Central states	233	179	57	94	66	30
Southeastern states	268	212	61	89	63	29
Southwestern states	297	216	86	108	68	43

*Prevalence per 10,000 feline patients.
**A few cats met both criteria during the same or different anemic episodes.

- 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*)

DataSavant

Table 2: Prevalence by Age of Anemia and Regenerative Anemia (Mild and Severe) in Cats*

	Anemia			Regenerative Anemia		
Age Group	All	Mild	Severe**	All	Mild	Severe**
All	257	198	63	88	60	30
<1 year	188	155	34	59	43	16
1–3 years	100	68	33	37	20	17
3–8 years	147	104	46	56	35	23
>8 years	430	345	95	143	108	40

*Prevalence per 10,000 feline patients.
**A few cats met both criteria during the same or different anemic episodes.

Table 3: Feline Survival by Age Group One Year After Anemia Diagnosis

	Age Range			
Group	<1 Year	1–3 Years	3–8 Years	>8 Years
All anemias	85%	78%	68%	49%
Regenerative anemia	27%	29%	28%	17%

Table 4: FIV and FeLV Test Positivity in Anemic Cats

Test*	20,487 Anemic Cats	7,019 Cats with Regenerative Anemia
FIV	58	25
FeLV	178	61
FIV and FeLV	104	30
Total FIV	162 (0.8%)	55 (0.8%)
Total FeLV	282 (1.4%)	91 (1.3%)
All test positive	444 (2.2%)	146 (2.1%)

*Tests (IDEXX Snap tests) found to be positive within six months of anemia diagnosis.

have been found to infect feline RBCs. *M. haemofelis* causes severe hemolytic anemia, whereas *M. haemominutum* causes minimal disease. It is not easy to identify these organisms on peripheral blood smears, particularly if a quick stain such as Diff-Quik is used. *M. haemofelis* infection is probably underdiagnosed for this and other reasons, including intermittent parasitemia and chronic carrier states. In the evidence-based diagnosis (EBD) schema, the finding of *M. haemofelis*-parasitized RBCs in smears from anemic cats meets the criteria for EBD-3 diagnosis of hemobartonellosis (See *Using Evidence to Make a Diagnosis*, page 23). 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:

Diagnoses	Number of Feline Patients
EBD-2	6,391
EBD-3	432 (292)*
EBD-4	196
Total	7,019

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

Suggested reading

Messick JB. New perspectives about hemotrophic mycoplasma (formerly, *Haemobartonella* and *Eperythrozoon* species) infections in dogs and cats. *Vet Clin North Am Small Anim Pract*. 2003 Nov;33:1453-1467.

Hugh Bilson Lewis, BVMS, MRCVS, DACVP, is senior vice president of practice development at Banfield, The Pet Hospital, and president of DataSavant.™ Before joining Banfield in 1996, he served as dean of the School of Veterinary Medicine at Purdue University for 10 years, and before that, he was senior director of pathology and toxicology at Smith Kline & French Laboratories in Philadelphia.