Advances in Feline Hematology

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Hematologic abnormalities in cats have been well characterized for several decades. In the last few years, results of basic and clinical research have provided information that has resulted in improvements in patient management. Recent work in several areas is discussed in this paper.

ANEMIA

Anemia is defined as a hematocrit (Hct), packed cell volume (PCV), hemoglobin (Hgb) concentration, or red blood cell (RBC) count below the reference range. Because the Hct and PCV are the most commonly used values in feline practice, a PCV of under 27% is diagnostic of anemia; however, reference ranges vary among diagnostic laboratories.

According to the bone marrow response, anemias are classified as regenerative (if appropriate numbers of reticulocytes are present in circulation) and nonregenerative (if they are not). Regenerative anemias are always due to extra–bone marrow causes (i.e., hemorrhage or hemolysis), whereas nonregenerative anemias can be due to extra– or intra–bone marrow causes.

Regenerative Anemias

Several mechanisms of hemolysis have been increasingly recognized during the past few years. Given the fact that Hgb in cats is very susceptible to oxidative injury, resulting in the formation of Heinz bodies that are subsequently removed by the spleen, several articles on Heinz body formation and hemolysis have recently appeared in the literature.[1–6]

Christopher and associates demonstrated that propylene glycol (PG) in the diet results in a dose-dependent increase in Heinz body formation and a decrease in PCV in cats.[1] Propylene glycol fed at concentrations found in commercial cat food (i.e., 12% on a dry-weight basis) resulted in Heinz body formation in 11.3% of the RBCs by day 7 and in 28% by day 35; PCVs decreased from 34.8% to 31.2% by the end of the study. Cats fed 41% PG (on a dry-weight basis) had Heinz bodies in 92% of the RBCs by day 9, but the percentage decreased to 68.6% by day 22; PCVs decreased from 33.5% to 26.3% by the end of the study. RBC survival was shortened in both groups of cats.[1]

In another study, kittens fed either a commercial salmon-based PG-containing diet or purified diets containing 5% or 10% PG developed Heinz bodies and shortened RBC life span.[2] Bauer and coworkers demonstrated that diets containing only 6% PG also result in Heinz body formation.[3] Weiss and associates reported that cats on PG-containing diets are more susceptible to acetaminophen-induced methemoglobinemia than cats on a control diet.[4]

Robertson and coworkers described the development of Heinz body formation and regenerative anemia in cats fed commercial chicken baby food containing onion powder.[5] Cats ingesting chicken baby food with onion powder had a significantly higher percentage of Heinz bodies (37.8%) than cats fed chicken baby food without onion powder (<2%); however, there was no significant difference in PCV between both groups of cats.

Finally, Heinz body formation was reported in association with repeated propofol anesthesia in cats.[6] There was a significant increase from baseline in Heinz body percentage by day 4 in cats anesthetized daily for a mean of 6 days (range 5–7 days) with propofol (6 mg/kg, IV); Heinz bodies peaked at 31% on day 7 (baseline 0.6%). There were no other changes in the erythrogram throughout the study.

These studies support the fact that Heinz body formation may be a clinically relevant cause of anemia in cats. For the past few years, cat food manufacturers have eliminated PG from semi-moist diets.

Nonregenerative Anemias

Pure Red Blood Cell Aplasia

A syndrome of pure RBC aplasia/hypoplasia was recently reported in nine cats that were not infected with retroviruses,[7] and it is increasingly recognized at The Ohio State University Veterinary Hospital. Most cats reported were under 4 years of age and there was no gender predilection. They typically were presented

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for evaluation of nonspecific signs associated with anemia, such as lethargy and anorexia, and their physical examination findings consisted primarily of pallor and other signs associated with anemia (e.g., systolic heart murmur, depression).

The complete blood count (CBC) was characterized by severe normocytic, normochromic, nonregenerative anemia (PCV <15%) and absence of punctate and aggregate reticulocytes; there were no other relevant hematologic findings. A direct Coombs' test was positive in approximately half of the cats evaluated. Cytologic bone marrow evaluation revealed primarily normal or decreased cellularity, although hypercellularity was found in one cat; there was severe erythroid hypoplasia, and 12% to 45% of the nucleated cells were composed of small lymphocytes.[7]

Treatment with immunosuppressive drugs resulted in resolution of the signs and hematologic abnormalities in all cats evaluated. The authors used prednisone (3.5–5.5 mg/kg orally [PO] in divided doses) and cyclophosphamide (Cytoxan® [Bristol-Myers Squibb] 2.5 mg/kg PO q 24 h for 4 days, then off for 3 days); supportive therapy was also used. Three cats had transfusion reactions after having received multiple units of noncrossmatched blood.[7] At The Ohio State University Veterinary Hospital we have used a combination of prednisone (4–8 mg/kg PO divided in two daily doses) and chlorambucil (Leukeran® [Glaxo Welcome] 20 mg/m^2, PO q 2 weeks) with excellent results. In our experience, administration of cyclophosphamide using the described protocol results in a high prevalence of anorexia.

Anemia of Renal Disease

Anemia of renal disease (ARD) has been recognized for decades. A contributing mechanism to this anemia is decreased production of erythropoietin (EPO) by the chronically failing kidneys.[8] A recent study documented the therapeutic value of human recombinant EPO (r-HuEPO) in 6 dogs and 11 cats with anemia associated with chronic renal failure.[8] The pretreatment Hct was 17.6% in the dogs and 20.7% in the cats; the posttreatment Hct on week 4 was 44.2% in the dogs and 38.3% in the cats. However, two of three dogs treated for more than 90 days and five of seven cats treated for more than 180 days developed severe refractory nonregenerative anemia, and the majority of the patients had detectable anti–r-HuEPO antibodies. Some of these patients became transfusion dependent.[8]

TRANSFUSION MEDICINE

Considerable advances in the understanding of blood groups and transfusion reactions in cats have occurred during the past few years. The blood group system in cats consists of three groups: A, B, and AB; group B cats have strong anti-A alloantibodies and, if transfused with group A blood, will develop severe life-threatening transfusion reactions.[9]

Giger and associates also determined the prevalence of blood groups in different cat breeds across the United States.[10] The researchers concluded that the prevalence of B group blood was highest on the West Coast (4%–6% of cats) and lowest in the Midwest (<1% of cats); the prevalence of B group blood was between 2% and 3% in the South Central United States, and 1% to 2% on the East Coast.[10] The prevalence of B-type blood was also different among breeds; for example, B-type blood is extremely rare in Siamese and related breeds (<1%), whereas it is quite common in some British breeds, such as the Devon Rex and British Shorthair, in which it may exceed 40%. The prevalence of B-type blood in Domestic Shorthairs, Domestic Longhairs, Maine Coon cats, and Norwegian Forrest cats is less than 5%; between 5% and 25% of Abyssinians, Somalis, Himalayans, Sphinxes, Persians, and Japanese Bobtails are type B.

Transfused autologous or allogeneic type A or type B RBCs in cats have a circulating half-life of 29 to 39 days; in contrast, type B RBCs transfused into type A recipients have a half-life of 2.1 days. Half of the type A RBCs given to type B cats were destroyed within 6 hours and resulted in systemic anaphylactic reactions and intravascular hemolysis.[9] Because of the high prevalence and severity of reactions when transfusing A-type blood to a B-type cat, all recipients and donors should be typed beforehand or crossmatching should be performed prior to transfusion.

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