

Nutrition Assessment in a Dog with Sarcoma & Anemia

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Diet in Disease is a series developed by the WSAVA, the Academy of Veterinary Nutrition Technicians, and *Clinician's Brief*.



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THE CASE

Kelsey, an 11-year-old spayed Maltese, was referred to a nutrition service for inappetence and weight loss one week post-splenectomy following a diagnosis of splenic histiocytic sarcoma. She was being treated postoperatively with lomustine (CCNU; 70 mg/m² PO q4wk). Before surgery, Kelsey weighed 12.1 lb (5.5 kg), but on presentation to the nutrition service, she weighed 11 lb (5 kg) and had a BCS of 3/9 (ideal BCS, 5/9) and a muscle condition score of moderate muscle loss (on a scale of normal, mild, moderate, to marked muscle wasting or



loss). Historic medical records showed the patient's weight typically ranged from 13.2 lb to 15.4 lb (6-7 kg), with an average BCS of 5/9; no muscle condition score had previously been documented.

Dietary History

Kelsey had reportedly been fed a variety of commercial dog foods until age 7. However, she reportedly did not appear to enjoy any of the commercial diets and was transitioned to a mixture of cooked tofu or cooked white fish with steamed vegetables offered ad libitum 3 times a day. The homemade diet did not contain any animal or human vitamin-mineral supplements. The owner reportedly did not offer treats or other human foods. Water intake was reported to be normal.

Preoperative serum chemistry profile and urinalysis results were normal, but CBC revealed microcytic hypochromic anemia and thrombocytosis. CBC with a reticulocyte count performed 2 weeks postsurgery (ie, 1 week after presentation to the nutrition service) showed further decrease in hematocrit and nonregenerative, microcytic hypochromic anemia (*Table 1*).

DIAGNOSIS: SPLENIC HISTIOCYTIC SARCOMA & NONREGENERATIVE ANEMIA

Because Kelsey had been consuming an unbalanced homemade diet and had undergone surgical splenectomy, a serum iron panel was ordered and sent to a veterinary diagnostic laboratory to better characterize the nonregenerative, microcytic hypochromic anemia (*Table 2*).¹⁻⁴ Serum iron and total iron-binding capacity supported a diagnosis of iron deficiency anemia, although serum ferritin was slightly elevated. Serum ferritin is typically low in patients with iron deficiency anemia, as it correlates with body iron stores, but serum ferritin is an acute phase protein and may be elevated in patients with underlying disease such as neoplasia, liver disease, or hemolytic disease.²⁻⁴ Hyperferritinemia has specifically been reported in dogs with histiocytic sarcoma and hemangiosarcoma.^{5,6} Kelsey's discordant serum ferritin, although increased, was not as high as the values that have been reported with neoplastic disease and perhaps indicated concurrent disease effects.⁴⁻⁶ It was postulated that Kelsey may have both anemia of chronic disease (secondary to

TABLE 1

CBC VALUE RESULTS OF IMPORTANCE

Test	Preoperative	2 Weeks Postsurgery	4 Weeks Postsurgery	2 Months Postsurgery	3 Months Postsurgery	Reference Range
Hematocrit	33%	27%	41.8%	41.6%	46%	41%-60%
Mean corpuscular volume	60 fL	59 fL	62 fL	73 fL	72.9 fL	62-74 fL
Mean corpuscular hemoglobin	22.3 pg	20.8 pg	23.6 pg	23.9 pg	24.6 pg	22-26.2 pg
Platelets	$789 \times 10^3/\text{mL}$	$939 \times 10^3/\text{mL}$	$906 \times 10^3/\text{mL}$	$707 \times 10^3/\text{mL}$	$453 \times 10^3/\text{mL}$	$147-423 \times 10^3/\text{mL}$
Reticulocytes	N/A	$30.8 \times 10^3/\text{mL}$	$149.6 \times 10^3/\text{mL}$	$80.4 \times 10^3/\text{mL}$	$106.3 \times 10^3/\text{mL}$	$12.5-93 \times 10^3/\text{mL}$

neoplasia) and iron deficiency anemia (secondary to diet).^{2,3,7}

Treatment & Follow-Up

Two iron dextran injections (20 mg/kg IM) were administered approximately one month apart at 2 weeks and 2 months postsplenectomy (**Table 1**), and a nutrition plan was instituted. The nutrition plan was formulated by a boarded veterinary nutritionist and included a complete and balanced homemade diet of cooked skinless chicken breast, sweet potato, vegetables, canola oil, and a vitamin-mineral supplement. The owner was given specific instructions for preparing the diet using cooked gram weights of each ingredient and was educated on the importance of adding the vitamin-mineral supplement. To ensure adequate intake of the homemade diet by the patient, the owner was given a computerized spreadsheet food journal to record daily gram intake. Three times a day, the owner offered the recommended gram amount of the recipe, weighed any food remaining, recorded the gram intake of each meal, then calculated total gram intake per day. The nutritionist reviewed the food journal weekly to ensure Kelsey was not only consuming the homemade diet but consuming adequate kcals for weight gain. Body weight was also reported to the nutritionist biweekly. Follow-up examination was conducted at 2 weeks and 1, 2, and 3 months after diet implementation to assess patient and owner compliance with the homemade diet. Food intake gradually increased, and at the 3-month recheck, the patient weighed 14.3 lb (6.5 kg) and BCS had improved to 4/9, although MCS remained at 2/3.

Follow-up CBCs showed a marked regenerative response and resolved anemia. The owner declined a repeat serum iron panel due to financial constraints but reported that the dog's appetite had improved after the iron injections and implementation of the nutrition plan.

Repeat diagnostics and imaging after 9 months of lomustine therapy showed no evidence of histiocytic sarcoma; thus, the oncology service recom-

mended discontinuing treatment. The owner was counseled to continue the homemade diet as outlined and to contact the nutrition service if there were any changes in the patient's medical condition. Two and half years after cancer diagnosis, Kelsey was euthanized for poor quality of life with no specific diagnosis.

Conclusion

This case illustrates the importance of nutritional assessment and management in veterinary cancer patients. Veterinary patients can often sustain a reasonable quality of life on an unbalanced diet, but in patients with neoplasia, inadequate nutrient intake can impact patient outcomes and quality of life. Anemia is common and is most often assumed to be anemia of chronic disease. An in-depth dietary history and further laboratory assessment of nutritional status can help identify dietary factors that can affect quality of life in cancer patients. This case also illustrates the importance of providing nutritional follow-up when prescribing a homemade diet, as nutritional follow-up can help ensure owner compliance and that the nutritional goals—in this case, weight gain and resolution of anemia—are met.

TABLE 2

SERUM IRON PANEL RESULTS

Test	Result	Reference Range
Serum iron	30 µg/dL	33-147 µg/dL
Total iron-binding capacity	298 µg/dL	282-386 µg/dL
Serum ferritin	811 ng/mL	80-800 ng/mL

Continues ►

ASK YOURSELF ...

QUESTION 1

Anemia of chronic disease is typically represented by:

- A. Normocytic, normochromic anemia
- B. Nonregenerative anemia
- C. Low serum iron and high ferritin
- D. All of the above

MOST ACCURATE ANSWER: D

Anemia of chronic disease is the most common cause of non-regenerative anemia. It is characterized by mild-to-moderate normocytic, normochromic anemia with low serum iron and high ferritin levels.⁴

QUESTION 2

Iron deficiency anemia is best described as:

- A. Regenerative or nonregenerative microcytic hypochromic anemia, thrombocytosis, and low serum iron
- B. Nonregenerative microcytic hypochromic anemia with low serum iron and high serum ferritin
- C. Regenerative microcytic hypochromic anemia with concurrent pancytopenia
- D. Nonregenerative macrocytic anemia and thrombocytopenia with low cobalamin

MOST ACCURATE ANSWER: A

Iron deficiency anemia can be regenerative then progress to nonregenerative. It is characterized by microcytic hypochromic RBCs, low hemoglobin, low serum iron, and low serum ferritin. Thrombocytosis can also be observed with many large platelets.⁴

QUESTION 3

Thrombocytosis can be observed with:

- A. Endocrine disease
- B. Iron deficiency anemia
- C. Immunosuppressive therapy
- D. All of the above

MOST ACCURATE ANSWER: D

Thrombocytosis is common and can be observed with iron deficiency anemia, endocrine disease, splenectomy, neoplasia, and immunosuppressive therapy (eg, prednisolone, vincristine).⁸

QUESTION 4

Which of the following statements regarding the risks associated with parenteral iron in veterinary medicine is correct?

- A. Iron overload is a common problem in both dogs and cats.
- B. Anaphylaxis is common.
- C. Pain or soreness at the injection site may occur.
- D. Acute vomiting and diarrhea are frequent side effects.

MOST ACCURATE ANSWER: C

Dogs and cats are relatively resistant to iron overload. Anaphylaxis is a rare complication with parenteral iron. Gastric upsets may be observed with oral iron administration, whereas pain or soreness may be observed with intramuscular injections.³

QUESTION 5

Which of the following in a dietary history should increase concern for potential nutritional problems?

- A. A homemade diet
- B. A raw diet
- C. Frequent and large quantities of treats, snacks, or table food
- D. All of the above

MOST ACCURATE ANSWER: D

Patients on any of these diets are at risk for important nutritional deficiencies and excesses, and a thorough nutritional assessment is indicated. ■■■

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