

Evaluation of microcytosis in 18 Shibas

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Objective—To determine whether microcytosis is a typical finding in Shibas.

Design—Prospective study.

Animals—18 Shibas.

Procedure—Blood and serum samples were obtained for automated hematologic analyses (18 dogs) and for determination of ferritin concentration, using ELISA (14 dogs). Blood samples from 30 clinically normal dogs of various other breeds was analyzed to establish a reference range for ferritin concentration.

Results—Erythrocyte mean corpuscular volume in Shibas ranged from 55.6 to 69.1 fl (mean \pm SD, 61.2 \pm 4.3 fl; median, 60.6 fl; reference range, 63 to 73 fl). Microcytosis was identified in 12 of 18 dogs. Males and females were affected equally. Mean corpuscular hemoglobin concentration was slightly low (range, 32.0 to 33.9%; reference range, 34 to 38%) in 6 dogs, 4 of which had microcytic RBC. Serum ferritin concentrations ranged from 61.2 to 277.0 ng/ml (mean \pm SD, 110.6 \pm 51.4 ng/ml; median, 106 ng/ml). Reference range for serum ferritin concentration was 50.7 to 440.0 ng/ml (mean \pm SD, 121.2 \pm 67.1 ng/ml; median, 111.5 ng/ml). Thrombocytopenia (range, 110,000 to 196,000 platelets; reference range, 200,000 to 450,000 platelets) was found in 7 dogs, 6 of which also had microcytic RBC.

Clinical Implications—Microcytosis can be a typical finding in Shibas. Common origin of Shibas and Akitas, a breed predisposed to microcytosis, suggests a hereditary basis for this finding. (*J Am Vet Med Assoc* 1998;212:1258-1259)

Microcytic erythrocytes, which is defined as RBC with a mean corpuscular volume (MCV) $<$ 63 fl (reference range, 63 to 73 fl), can be found in dogs with congenital^{1,2} or acquired portosystemic shunts,¹ absolute or relative iron deficiency,³⁻⁶ and experimentally induced deficiency of pyridoxine (vitamin B₆)^{7,8} or copper.⁹ Microcytosis is a typical finding in Akitas.¹⁰ Detection of microcytosis in breeds other than Akitas should prompt evaluation of liver function and iron adequacy. Unexplained microcytosis

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Results of this study were presented in May 1997 at the American College of Veterinary Internal Medicine, Annual Forum, Orlando, Fla.

The authors thank Dr. M. Christine McGahan and Ms. Jill Harned for assay of serum ferritin concentrations.

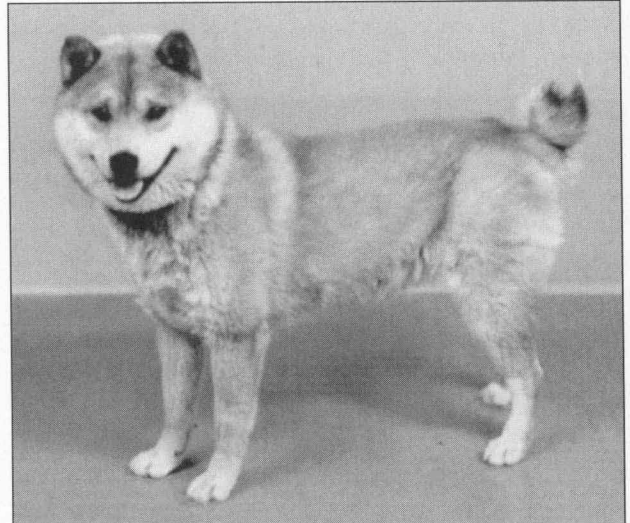


Figure 1—A typical 1.5-year-old sexually intact male Shiba.

was found in a Shiba with polydipsia and polyuria (Fig 1). The purpose of the study reported here was to determine whether microcytosis was a typical finding in Shibas.

Materials and Methods

Nineteen Shibas were studied. One dog with microcytosis, a low serum ferritin concentration, and Hct within the reference range was excluded from further analysis. Dogs were identified at a dog show (n = 14) or were admitted to the veterinary teaching hospital for vaccination (1) or evaluation of lumbosacral disease (1), physiologic heart murmur (1), or pelvic fracture (1). Dogs ranged in age from 3 months to 12 years (mean, 19 months; median, 7 months). There were 10 males and 8 females. Blood samples were obtained by jugular venipuncture for automated hematologic analysis⁴ of RBC count, MCV, hemoglobin concentration, and platelet count and calculations of mean corpuscular hemoglobin concentration and Hct in 18 dogs. Serum ferritin concentrations were determined, using ELISA,¹¹ in 14 dogs. Reference range for ferritin concentration was established by assay¹¹ of serum from 30 clinically normal dogs of various breeds admitted for vaccination or owned by hospital personnel.

Results

Results of hematologic analyses—Erythrocyte MCV ranged from 55.6 to 69.1 fl (mean \pm SD, 61.2 \pm 4.3 fl; median, 60.6 fl; reference range, 63 to 73 fl). Twelve of 18 dogs had microcytic RBC. Males and females were affected equally. Anemia (Hct, 25.8%; reference range, 33 to 56%) was found in 1 dog with microcytosis, thrombocytopenia, and recent bone fracture repair. Low mean corpuscular hemoglobin concentration (range, 32.0 to 33.9%; reference range, 34 to

38%) was found in 6 dogs, 4 of which also had microcytic RBC. Thrombocytopenia (range, 110,000 to 196,000 platelets; reference range, 200,000 to 450,000 platelets) was found in 7 dogs, 6 of which also had microcytic RBC. Platelet clumps were not observed in peripheral blood smears from thrombocytopenic dogs. Further diagnostic evaluation of thrombocytopenia was not performed.

Results of serum ferritin assay—Serum ferritin concentration ranged from 61.2 to 277.0 ng/ml (mean \pm SD, 110.6 ± 51.4 ng/ml; median, 106 ng/ml). Reference range for serum ferritin concentration was established at 50.7 to 440 ng/ml (121.2 ± 67.1 ng/ml; median, 111.5 ng/ml).

Discussion

Microcytosis was identified in 12 of 18 Shibas. Iron deficiency or portosystemic shunting were unlikely causes of microcytosis. Results of serum ferritin measurements, performed to assess iron adequacy in these dogs, did not support a diagnosis of relative or absolute iron deficiency.^{4,11,12} Although liver function tests were not performed, dogs appeared clinically normal on the basis of history and physical examination findings. A high prevalence of subclinical hepatic or portovascular disease seemed unlikely. Because deficiencies of pyridoxine (vitamin B₆) and copper are not naturally acquired conditions in dogs, these were not considered.

Microcytosis has been recognized in Akitas.¹⁰ Erythrocytes in Akitas and Shibas are uniquely characterized by sodium-potassium ATPase activity in the membrane and a high intracellular potassium content.^{10,13,14} Leakage of potassium from these erythrocytes in vitro can lead to increased plasma potassium concentration (ie, pseudohyperkalemia),^{10,13,14} so use of blood samples obtained from Akitas or Shibas for transfusion is not recommended.^{10,13} Results of our study demonstrated that microcytosis is a typical finding in Shibas, similar to clinically normal Akitas. Common origin of Akitas and Shibas—dogs indige-

nous to Japan¹⁵—suggests that microcytosis is hereditary.

*System 9010 plus, Serono-Baker Diagnostics Inc, Allentown, Pa.

References

1. Griffiths GL, Lumsden JH, Valli VEO. Hematologic and biochemical changes in dogs with portosystemic shunts. *J Am Anim Hosp Assoc* 1981;17:705-710.
2. Johnson CA, Armstrong PJ, Hauptman JG. Congenital portosystemic shunts in dogs: 46 cases (1979-1986). *J Am Vet Med Assoc* 1987;191:1478-1483.
3. Harvey JW, French TW, Meyer DJ. Chronic iron deficiency anemia in dogs. *J Am Anim Hosp Assoc* 1982;18:946-960.
4. Weeks BR, Smith JE, Stadler CK. Effect of dietary iron content on hematologic and other measures of iron adequacy in dogs. *J Am Vet Med Assoc* 1990;196:749-753.
5. Weiser G, O'Grady M. Erythrocyte volume distribution analysis and hematologic changes in dogs with iron deficiency anemia. *Vet Pathol* 1983;20:230-241.
6. Stone MS, Freden GO. Differentiation of anemia of inflammatory disease from anemia of iron deficiency. *Compend Contin Educ Pract Vet* 1990;12:963-966.
7. Fouts PJ, Helmer OM, Lepkovsky S. Production of microcytic hypochromic anemia in puppies on synthetic diets deficient in vitamin B₆. *J Nutr* 1938;16:197-207.
8. McKibbin JM, Schaeffer AE, Frost DV, et al. Studies on anaemia in dogs due to pyridoxine deficiency. *J Biol Chem* 1942;142:77-84.
9. Demayo A, Taylor MC, Taylor KW. Effects of copper on humans, laboratory and farm animals, terrestrial plants and aquatic life: water supply for livestock. *Crit Rev Environ Control* 1982;12:183-255.
10. Degen M. Pseudohyperkalemia in Akitas. *J Am Vet Med Assoc* 1987;190:541-543.
11. McGahan MC, Harned J, Grimes AM, et al. Regulation of ferritin levels in cultured lens epithelial cells. *Exp Eye Res* 1994;59:551-555.
12. Lipschitz DA, Cook JD, Finch CA. A clinical evaluation of serum ferritin as an index of iron stores. *N Engl J Med* 1974;290:1213-1216.
13. Maede Y, Amano Y, Nishida A, et al. Hereditary high-potassium erythrocytes with high Na, K-ATPase activity in Japanese Shiba dogs. *Res Vet Sci* 1990;50:123-125.
14. Nishida A, Kanaya K. Pseudohyperkalemia in Japanese indigenous Shiba breed dogs. *J Jpn Vet Med Assoc* 1990;43:595-598.
15. Linderman JM, Funk VB. *The new complete Akita*. New York: Howell Book House, 1994;1-12.