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## KEY POINTS

- ▶ Cobalamin (vitamin B<sub>12</sub>) deficiency is common in both dogs and cats.
- ▶ Patients with gastrointestinal (GI) disease and cobalamin deficiency may not appropriately respond to treatment of the underlying disease process without concurrent cobalamin supplementation.
- ▶ Cobalamin deficiency can be diagnosed by measuring serum cobalamin concentration.
- ▶ Recent studies have suggested that oral supplementation of cobalamin is equally efficacious to parenteral administration.

## Treatment of Cobalamin Deficiency in Dogs and Cats

### Cobalamin Deficiency

Cobalamin (vitamin B<sub>12</sub>) is a water-soluble vitamin that is essential to energy production, DNA and RNA synthesis, and metabolism of sulfur-containing amino acids. The most common causes of cobalamin deficiency in dogs and cats are chronic and severe distal or diffuse small intestinal disease and exocrine pancreatic insufficiency. Short-bowel syndrome, hereditary cobalamin deficiency, and an exclusively vegetarian or vegan diet are less common causes of cobalamin deficiency.

Most dogs and cats with cobalamin deficiency show clinical signs of gastrointestinal disease, which could either be a cause or effect of cobalamin deficiency. Other clinical signs include weight loss, central and peripheral neuropathies, and immunodeficiencies. In a recent case study, a border collie with selective cobalamin deficiency presented with hyperammonemic encephalopathy that fully responded to cobalamin supplementation.<sup>1</sup> In another case report, a 4-year-old cat that presented with severe encephalopathy was found to have organic acidemia and cobalamin deficiency.<sup>2</sup>

### Diagnosing Cobalamin Deficiency

Although a decreased or low-normal serum cobalamin concentration provides good evidence for cobalamin deficiency, a definitive diagnosis can be challenging. Clinical signs are ultimately caused by cobalamin deficiency on a cellular level, but the cellular cobalamin status is difficult to assess. Serum concentrations have traditionally been used to help

### DOSING SCHEDULE FOR ORAL COBALAMIN SUPPLEMENTATION

- ▶ Cyanocobalamin orally once a day for 3 months
  - 250 µg in cats or small dogs weighing up to 10 kg
  - 500 µg in dogs weighing 10 to 20 kg
  - 1,000 µg in dogs weighing more than 20 kg
- ▶ Re-measure serum cobalamin concentration 1 week after finishing cobalamin supplementation



COBALEQUIN™ cobalamin supplement, introduced in January 2016, is formulated specifically for dogs and cats as a once-daily chicken-flavored chewable tablet. Two formulations are offered:

- ▶ 250 µg strength for cats and small dogs (< 22 pounds/10 kg), 45-count bottle
- ▶ 1000 µg strength for medium and large dogs (≥ 22 pounds/10 kg), 45-count bottle

## The cause of cobalamin deficiency may not play a role in determining the success of oral supplementation.

assess cobalamin status, but some patients with cobalamin deficiency on a cellular level do not have severely decreased serum cobalamin concentrations.

Several assays for serum cobalamin determination are available for humans, but they must be analytically validated for use in dogs and cats. Reference intervals are not transferable between labs, and each lab should establish their own reference intervals.

Serum or urine methylmalonic acid (MMA) concentration can be used as an indicator of cellular cobalamin status. Cobalamin deficiency leads to accumulation of MMA, and serum or urine concentrations of MMA are often dramatically increased in patients with cobalamin deficiency. However, measurement of serum or urine MMA concentration is technically involved and expensive; therefore, these assays are not routinely used to evaluate for cobalamin deficiency. Interestingly, serum MMA concentrations have been found to be increased in some dogs and cats with low-normal serum cobalamin concentrations, demonstrating that a severely decreased serum cobalamin concentration is not optimally sensitive for the diagnosis of cobalamin deficiency on a cellular level.

### Cobalamin Supplementation

To avoid missing patients with cobalamin deficiency, cobalamin supplementation should be considered even when serum cobalamin concentration is low-normal. Patients with severe cobalamin deficiency often do not respond to therapy of the underlying gastrointestinal disorder unless or until cobalamin is being supplemented.

The most common form of cobalamin used for supplementation is cyanocobalamin, but hydroxocobalamin or methylcobalamin may also be used in patients that have not responded to traditional therapy or in those perceived to be experiencing side effects to cyanocobalamin. Supplementation has traditionally been administered parenterally because cobalamin deficiency has been shown to lead to malabsorption of cobalamin in the ileum; however, recent data have shown that oral supplementation may be just as efficacious. Dosing for oral supple-

mentation is empiric (see **Dosing Schedule**), with daily supplementation administered for 3 months. Serum cobalamin concentrations should be re-evaluated 1 week after discontinuation of supplementation.

In one retrospective study of 51 client-owned dogs with low-normal or decreased serum cobalamin concentrations, patients received oral cyanocobalamin (250 µg to 1000 µg cobalamin orally once daily) for a variable period.<sup>3</sup> On follow-up, serum cobalamin concentrations had increased in all of the dogs.

Interestingly, not all patients had the same underlying cause of cobalamin deficiency, suggesting that the cause of cobalamin deficiency may not play a role in determining the success of oral supplementation. Also, more recently, a small retrospective study in 13 cats with chronic enteropathy or intestinal lymphoma and low or low-normal serum cobalamin concentrations showed dramatic increases in serum cobalamin concentrations in all 13 cats after oral cobalamin supplementation.<sup>4</sup>

While prospective studies are needed and ongoing, these initial data are very promising, suggesting that oral supplementation may be applied routinely unless there is evidence that a particular patient may not respond.

### References

1. Battersby IA, Giger U, Hall EJ. Hyperammonaemic encephalopathy secondary to selective cobalamin deficiency in a juvenile Border collie. *J Small Anim Pract.* 2005;46(7):339-344.
2. Kelmer E, Shelton G, Williams D, Ruaux C, Kerl M, O'Brien D. Organic acidemia in a young cat associated with cobalamin deficiency. *J Vet Emerg Crit Care.* 2007;17(3):299-304.
3. Toresson L, Steiner JM, Suchodolski JS, Spillmann T. Oral cobalamin supplementation in dogs with chronic enteropathies and hypcobalaminemia. *J Vet Intern Med.* 2016;30(1):101-107.
4. Toresson L, Steiner JM, Suchodolski JS, Göransson M, Elmgren L, Spillmann T. Oral cobalamin supplementation in cats with hypcobalaminemia. *J Vet Intern Med.* 2016;30(1):417(abstract).

### Additional Resource

The Gastrointestinal Laboratory at Texas A&M University  
[www.vetmed.tamu.edu/gilab](http://www.vetmed.tamu.edu/gilab)

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