



## What Is Your Diagnosis?



**Figure 1**—Right lateral (A) and ventrodorsal (B) radiographic views of the abdomen of a 12.5-year-old 27.6-kg (60.8-lb) neutered male Shepherd mix that was evaluated because of decreased activity, heavy breathing, and difficulty rising.

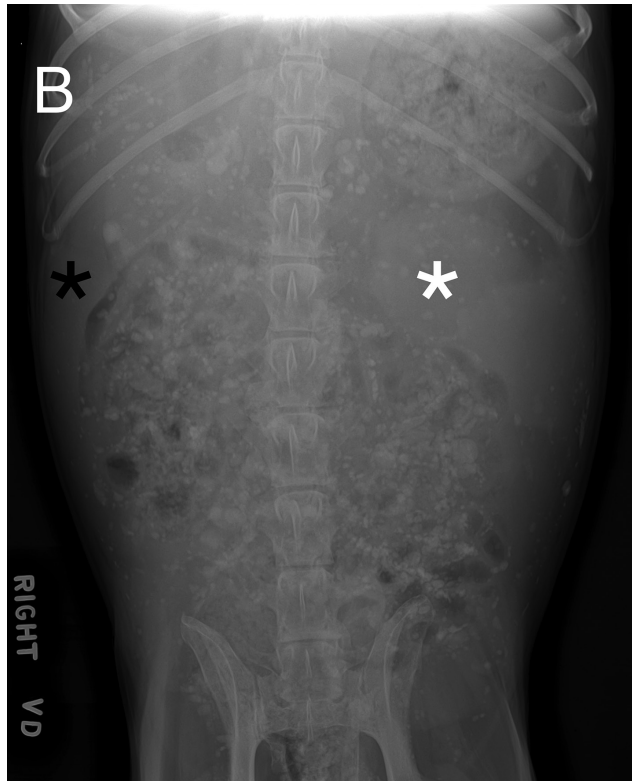
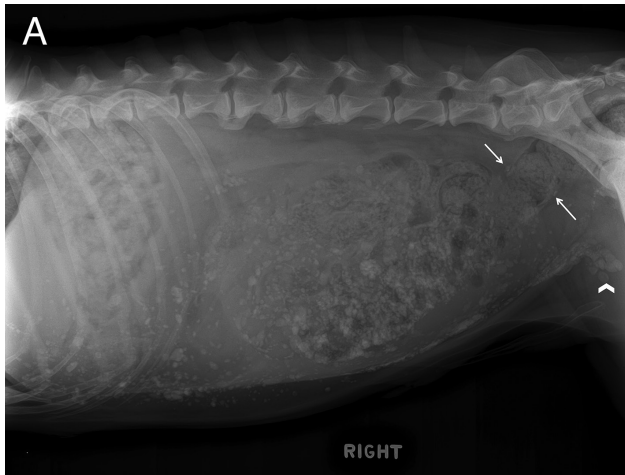
### History

A 12.5-year-old 27.6-kg (60.8-lb) neutered male Shepherd mix was evaluated at Peninsula Center Pet Hospital for decreased activity, heavy breathing, and difficulty rising. Abnormalities found during physical examination included thin body condition, pendulous abdomen, and hepatosplenomegaly. A CBC revealed mild eosinophilia (1,280 eosinophils/ $\mu$ L; reference range, 60 to 1,230 eosinophils/ $\mu$ L). Values obtained on serum biochemical analysis were within reference ranges. Abdominal radiography was performed (**Figure 1**).

**Determine whether additional imaging studies are required, or make your diagnosis from Figure 1—then turn the page →**

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**Figure 2**—Same radiographic images as in Figure 1. A—Mineral opaque bodies line the wall of the colon on its course through the pelvic canal (white arrows) and appear to extend through the inguinal rings (white arrowhead). B—Notice the soft tissue opaque mass associated with the dorsal extremity of the spleen (white asterisk) and extension of the hepatic silhouette caudal to the right 13th rib (black asterisk).

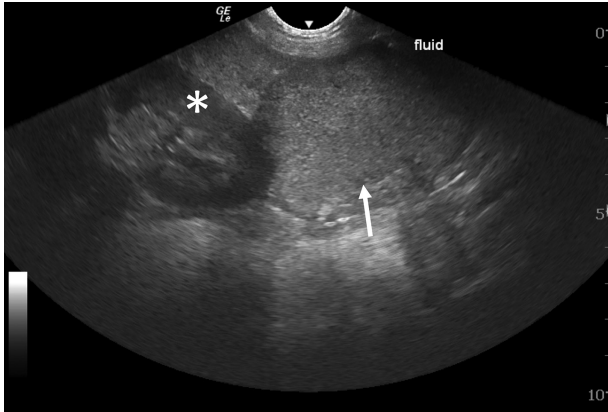
## Diagnostic Imaging Findings and Interpretation

In the lateral projection, the serosal detail is decreased and there is loss of the definition of the margins of the small intestine, colon, and other organs in the midabdomen. Innumerable, peripherally well-defined and variably sized mineral opaque bodies measuring up to 1 cm in diameter, which appear to be serosal in origin, are distributed throughout the abdomen. Along the periphery of the abdomen, the bodies line the wall of the colon as it courses through the pelvic canal and appear to extend through the inguinal rings attenuating a short distance caudodorsal to the os penis (**Figure 2**). Also, a midabdominal mass effect immediately caudal to the stomach is suspected, although a well-defined mass is not identified. In the ventrodorsal projection, an approximately 5-cm-diameter homogeneously soft tissue opaque mass is evident; this mass is possibly associated with the dorsal extremity of the spleen. There is extension of the hepatic silhouette caudal to the right 13th rib. Incidental findings include a transitional eighth lumbosacral vertebra and moderate spondylosis of the midlumbar portion of the vertebral column.

Initially, the prioritized list of differential diagnoses for the small mineral opaque bodies throughout the abdomen consisted of a neoplastic process (diffuse peritoneal metastatic neoplasia or nontypical manifestation of extraskeletal osteosarcoma, possibly arising from the spleen or liver) and non-neoplastic processes, such as schistosomiasis (or other parasitic disease) or fungal granulomatous disease. After further consultation with additional veterinary radiologists, additional differentials included possible barium extravasation following a previous positive-contrast study and peritoneal lar-

val cestodiasis (caused by *Mesocestoides* spp). Differential diagnoses for the midabdominal mass effect included neoplasia (possibly arising from the spleen), granuloma, or an inflammatory peritoneal mass-like lesion (such as sclerosing peritonitis).

Abdominal ultrasonography was performed to further evaluate the radiographic findings. Generalized hyperechoic hepatomegaly was observed with heterogeneous hepatic parenchymal architecture. A small (approx 1 X 2 X 3-cm), hyperechoic mass was present in the caudate liver lobe. Within the midportion and ventral extremity of the spleen was a heterogeneous, mildly irregularly marginated, mixed echogenic mass measuring 5.1 X 7.3 X 9.5 cm. Adjacent to this mass was an anechoic cystic and cavitated region within the spleen measuring up to 2.3 X 2.1 cm with surrounding hyperechoic mesentery. There was mild lymphadenopathy. Encapsulated anechoic effusion was observed along the ventral portion of the peritoneal cavity with large amounts of echogenic (possibly cellular) material within the fluid (**Figure 3**). Differential diagnoses for the splenic changes included extramedullary hematopoiesis, lymphoid hyperplasia, hemangioma, hemangiosarcoma, or hematoma. Differential diagnoses for the encapsulated fluid included idiopathic encapsulating sclerosing peritonitis, neoplasia (ie, lymphoma or carcinoma), or an infectious loculated effusion. Differential diagnoses for the hepatomegaly and hepatic mass included vacuolar hepatopathy, nodular hyperplasia, hepatic adenoma, and less likely hepatic adenocarcinoma.



**Figure 3**—Sagittal ultrasonographic image of the abdomen of the dog in Figure 1. The patient was scanned while in dorsal recumbency. The left kidney is to the left of the image (white asterisk). Notice the encapsulated highly echogenic material within the fluid on the right of the image in the near field (white arrow). This fluid is located in a non-gravity-dependent position overlying the omentum and gas-filled intestinal structures. Image was obtained with a 6- to 7-MHz curvilinear transducer.

## Treatment and Outcome

Ultrasound-guided abdominocentesis was performed to obtain fluid samples from the area of encapsulated fluid. Cytologic evaluation of the fluid revealed a neutrophilic exudate with parasite fragments. This was consistent with peritoneal larval cestodiasis, likely caused by an infection with *Mesocestoides* spp. Treatment with fenbendazole (145 mg/kg [66 mg/lb], PO, q 24 h) was initiated. The clinical condition of the dog continued to decline, and the dog became anorexic after 3 weeks of treatment. The dog was readmitted to the hospital because of a depressed appearance and tense abdomen. Given the dog's poor quality of life and lack of response to treatment, the owner elected to have the dog euthanized. A necropsy was not performed.

## Comments

Canine peritoneal larval cestodiasis is a rare and occasionally fatal parasitic infection caused by cestodes of the *Mesocestoides* genus. This genus of tapeworms has an indirect life cycle requiring 2 or more intermediate hosts and 1 definitive host. Larvae of the tapeworms are capable of penetrating the intestinal tracts of both intermediate and definitive hosts, which can include both dogs and cats.<sup>1-5</sup> Most infections in veterinary patients occur in pets that scavenge small animals, therefore ingesting the second intermediate host.<sup>1</sup> Canine peritoneal larval cestodiasis has been reported in multiple countries; within the United States, it is most prevalent in California and other northwestern states.<sup>1-4</sup> Many affected patients have progressive, insidious, nonspecific clinical signs including anorexia, vomiting, diarrhea, dyspnea, weight loss, ascites, and abdominal distension; however, subclinical infections can be an incidental finding during exploratory laparotomy.<sup>1-4</sup>

Imaging characteristics of peritoneal larval cestodiasis highlight the diagnostic benefit of radiography and ultrasonography to evaluate affected dogs. Radiographically, a

generalized loss of serosal detail is most common, supporting the finding of ascites.<sup>2,3</sup> In the dog of the present report, mineralized bodies in the abdomen were visible on radiographs. Dystrophic peritoneal mineralization is an uncommon manifestation of peritoneal larval cestodiasis in dogs and, to our knowledge, has only been reported once previously.<sup>5</sup> Ultrasonographically, the most common findings of peritoneal larval cestodiasis include ascites, occasionally with hyperechoic flecks of material, and cyst-like structures filled with anechoic fluid, which can vary in size and complexity.<sup>1-3</sup> These cysts may appear on the surface or within the parenchyma of the abdominal organs.<sup>2,3</sup> In the case described in the current report, the finding of encapsulated anechoic effusion with echogenic cellular material was consistent with previous reports of peritoneal larval cestodiasis in dogs. Because cytologic evaluation of the splenic and hepatic masses was not performed for the dog of the present report, it is unclear whether these masses were related to the peritoneal larval cestodiasis or a result of a separate process.

For the diagnosis of canine peritoneal larval cestodiasis, parasites must be recovered from the abdominal cavity.<sup>1,4</sup> Although findings on cytologic evaluation of abdominal fluid samples can often be enough for the diagnosis of peritoneal larval cestodiasis, molecular identification can aid in speciation of the parasites.<sup>1,2</sup> Serial abdominal ultrasonography can also be used to assess treatment progress and to aid in determination of when to discontinue treatment.<sup>2,3</sup> The most successful treatment recommendations for dogs with peritoneal larval cestodiasis include a combination of surgery or lavage of the abdomen and the use of high daily doses of fenbendazole.<sup>4</sup> Surgery was not a consideration for the dog of the present report. Even after aggressive treatment, some patients may require daily, lifelong treatment with an antiparasitic drug, which is often fenbendazole.<sup>4</sup>

The prognosis for dogs with peritoneal larval cestodiasis is guarded; the survival rates at 6 months and 1 year after diagnosis are 72.3% and 60.5%, respectively.<sup>4</sup> The 2 factors significantly impacting survival time include clinical severity and type of treatment.<sup>4</sup> The clinical severity of disease of the dog of the present report was high on the basis of the presence of ascites (suggesting higher parasite burden), dystrophic mineralization, and weight loss. Although the dog was treated with high doses of fenbendazole, worsening of clinical signs ultimately led to euthanasia.

## References

1. Caruso KJ, James MP, Fisher D, et al. Cytologic diagnosis of peritoneal cestodiasis in dogs caused by *Mesocestoides* sp. *Vet Clin Pathol* 2003;32:50-60.
2. Crosbie PR, Boyce WM, Platzer EG, et al. Diagnostic procedures and treatment of eleven dogs with peritoneal infections caused by *Mesocestoides* spp. *J Am Vet Med Assoc* 1998;213:1578-1583.
3. Venco L, Kramer L, Pagliaro L, et al. Ultrasonographic features of peritoneal cestodiasis caused by *Mesocestoides* sp. in a dog and in a cat. *Vet Radiol Ultrasound* 2005;46:417-422.
4. Boyce W, Shender L, Schultz L, et al. Survival analysis of dogs diagnosed with canine peritoneal larval cestodiasis (*Mesocestoides* spp.). *Vet Parasitol* 2011;180:256-261.
5. Barsanti JA, Jones BD, Bailey WS, et al. Diagnosis and treatment of peritonitis caused by a larval cestode *Mesocestoides* spp., in a dog. *Cornell Vet* 1979;69:45-53.