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What Is Your Diagnosis?

In collaboration with the American College of Veterinary Radiology

History

A 6-year-old spayed female Chesapeake Bay Retriever was presented to the authors' institution for a 1- to 2-month history of melanic diarrhea, intermittent vomiting, and weight loss, with 2 days of hyporexia. Prior to presentation, the dog had been treated symptomatically with metronidazole, maropitant, and sulfasalazine with no clear improvement and had tested negative for intestinal parasites by means of fecal flotation.

On presentation, the dog was quiet and alert with a distended abdomen and mildly increased respiratory effort. The dog had a mild neutrophilia (segmented neutrophils, 2.2 X 10^9 cells/μL; reference range, 3.5 X 10^9 to 14.2 X 10^9 cells/μL), elevated ALT (299 U/L; reference range, 10 to 90 U/L) and ALP (333 U/L; reference range, 11 to 140 U/L), and hypoalbuminemia (2.0 g/dL; reference range, 2.5 to 3.9 g/dL). The dog was also found to have mild bilateral pleural effusion on a preliminary thoracic point-of-care ultrasound examination. Thoracic and abdominal radiographs were pursued **(Figure 1)**.

Formulate differential diagnoses, then continue reading.

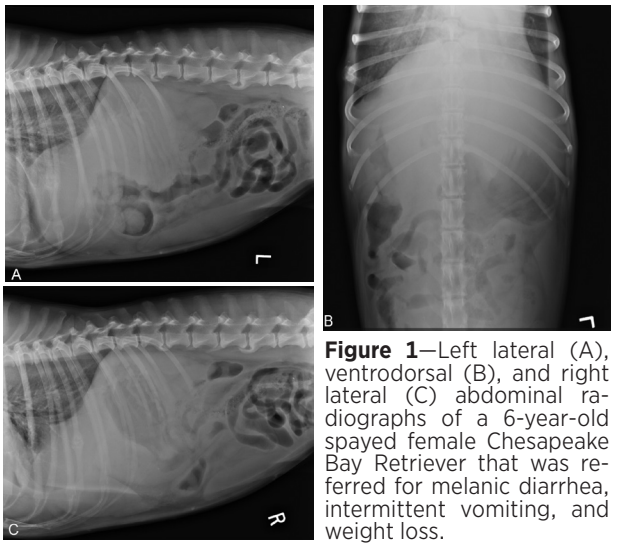

Figure 1—Left lateral (A), ventrodorsal (B), and right lateral (C) abdominal radiographs of a 6-year-old spayed female Chesapeake Bay Retriever that was referred for melanic diarrhea, intermittent vomiting, and weight loss.

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Diagnostic Imaging and Findings

Multiple broad-based, lobular, round to ovoid, homogenously soft tissue opaque structures continuous with the cranioventral pyloric and dorsal duodenal walls and extending into the lumen were present in the pylorus and proximal duodenum. No evidence of obstruction, such as a distended stomach, secondary to the masses was present. Visible within the included thorax was mild bilateral pleural effusion, a moderate unstructured interstitial pulmonary pattern in the right caudal lung lobe, and an aggressive osseous lesion of the right ninth rib **(Figure 2)**. Thoracic radiographs (not shown) displayed the same changes.

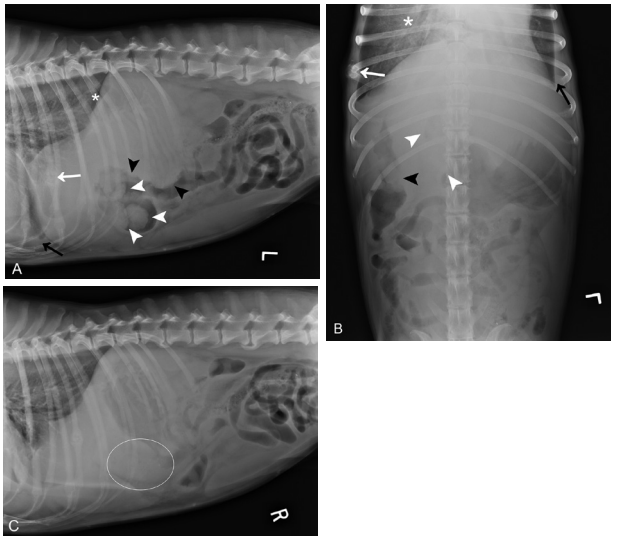

Figure 2—Same radiographic images as in Figure 1. There are round soft tissue opaque structures within the pylorus (white arrowheads) and duodenum (black arrowheads). There is a diffuse unstructured interstitial pulmonary pattern (asterisk) and pleural effusion (black arrow) within the visible portion of the thorax. There is an aggressive osseous lesion of the ninth right rib (white arrow) with irregular periosteal proliferation and cortical destruction. Note that in the right lateral projection there is complete effacement of the masses within the pylorus that were visible in the left lateral projection (white circle).

Abdominal ultrasonography was performed the next day, revealing an ill-defined, sessile, irregularly marginated and shaped mass of mixed echogenicity within the pylorus, moderate and diffuse thickening of the gastric wall (up to 0.95 cm; reference range,[1] 3 to 5 mm) and mild thickening of the proximal duodenum (up to 0.64 cm; reference range,[1] 5 to 6 mm) with loss of wall layering. Other findings (not shown)

included mild, diffuse thickening of the gastric wall, a small volume of anechoic free abdominal fluid and multiple moderately enlarged and hypoechoic lymph nodes throughout the abdomen. A small volume of anechoic free abdominal fluid and multiple enlarged and hypoechoic lymph nodes throughout the abdomen (up to 1.56 cm) were also noted (not shown). Fine-needle aspirates of the gastric mass were obtained with no complications.

Treatment and Outcome

A Pythium titer was negative, and the splenic cytology was consistent with lymphoid hyperplasia. The abdominal effusion was not sampled; however, analysis of the pleural effusion showed abnormal epithelial cells that were concerning for an epithelial neoplasm or carcinoma. Cytology of the gastric mass collected during abdominal ultrasonography was inconclusive, so a gastroduodenoscopy was pursued. The pyloric mass described during ultrasound was found to be multilobulated and erythematous; however, the scope could not be passed beyond this mass into the duodenum. Biopsies of the gastric mass were taken and submitted for histopathology. Prior to histopathology results being finalized and following thoracocentesis, the dog was discharged with a presumptive diagnosis of malignancy due to the multifocal lesions suggestive of infiltrative and aggressive disease. The dog was prescribed maropitant (2.6 mg/kg, PO, q 24 h), metronidazole (10.8 mg/kg, PO, q 12 h), omeprazole (0.87 mg/kg, PO, q 12 h), sucralfate (1 g, PO, q 8 h), and fenbendazole (52 mg/kg, PO, once; the patient received 4 previous doses during hospitalization). Finalized biopsy results following discharge revealed lymphoplasmacytic, eosinophilic enteritis with a suspected adenomatous polyp. The dog returned 2 days later due to increased vomiting, anorexia, and lethargy. By means of point-of-care ultrasound, the dog was found to have a recurrence of pleural effusion as well as increased peritoneal effusion. Due to the dog's declining status and increasing concern for neoplasia, euthanasia was elected.

A necropsy was performed and showed 2 firm nodules within the pylorus, with a gastric ulcer between them. There was circumferential, multinodular thickening of the duodenal wall, mostly within the mucosa, that affected approximately 15 cm of the proximal duodenum. There were disseminated firm, white nodules throughout the mesentery, diaphragm, and liver and around the pancreas. These nodules were also present throughout the parietal pleura, diaphragm, and ventral mediastinum. The final diagnosis was metastatic duodenal adenocarcinoma with pleural and peritoneal carcinomatosis, and nonmalignant gastric fibrosis of the lamina propria. Concurrently, the lungs and mediastinum were also found to contain trematode eggs from *Paragonimus kellicotti*.

Comments

Adenocarcinoma is one of the most common types of primary intestinal neoplasia in the dog, alongside leiomyosarcoma and lymphoma.[2] Clinical signs associated with primary intestinal neoplasia are often nonspecific and include vomiting, diarrhea, melena, anorexia, and weight loss. Owing to these nonspecific signs, many dogs diagnosed with intestinal adenocarcinoma are late in the disease process, with 43% having detectable metastasis to the lymph nodes, mesentery, or other structures at the time of diagnosis.[3] Gastrointestinal masses are often difficult to diagnose on survey radiographs due to effacement of the gastrointestinal walls with fluid and thus often require administration of contrast. In the present case, it was possible to identify these masses due to the natural contrast provided by means of positional gas accumulation within the pylorus and duodenum in the left lateral and ventrodorsal projections. The left lateral projection permitted examination of the pylorus, as gas moved into the non–gravity-dependent portion of the stomach. To better investigate the duodenum by use of gas contrast, starting a 3-view study (right lateral, left lateral, and ventrodorsal projection) with the patient in left lateral recumbency not only will allow examination of the pylorus as the gas moves to fill the nondependent portion of the stomach but has been shown to increase duodenal gas in subsequent views (with the ventrodorsal projection acquired after the left lateral projection and right lateral projection taken either before the left lateral and ventrodorsal or after both the left lateral and ventrodorsal projections).[4] If there is insufficient gas within the stomach, a pneumogastrogram may be performed.

Ultrasound findings of gastrointestinal adenocarcinoma include focal transmural wall thickening with loss of normal intestinal wall layering, and often > 4 cm of small intestine are affected.[5] While there are no pathognomonic imaging characteristics to differentiate intestinal adenocarcinoma from other neoplasms, the described case highlighted many of the features most often associated with this neoplasm. In this patient, the stomach and duodenum both displayed wall thickening and loss of layering, with the adenocarcinoma affecting 15 cm of the duodenum. While there is some overlap, loss of normal wall layering is typically associated with infiltrative disease, such as neoplasia or mycotic or oomycotic infection, rather than inflammation, which typically causes thickening of the bowel without loss of layering.[1] While both the gastric wall and duodenal wall had some degree of layering loss, it is notable that the duodenal wall was more severely affected, possibly due to the different etiologies affecting these 2 organs. Another important feature of this case due to prognostic implications was that metastasis was present and detectable at the time of diagnosis, as evidenced by neoplastic pleural effusion, as well as confirmed carcinomatosis at necropsy. Unexpectedly, no neoplastic tissue was present in the pyloric masses. While the exact cause of this patient's gastric ulceration and fibrosis is unknown, a few possibilities exist. It may have resulted from the migration of *P kellicotti* larvae from the upper gastrointestinal tract (with this theory possibly be-

ing supported by the apparent resolution of the eosinophilic component of the gastritis at the time of necropsy following anthelmintic treatment), from altered gastroduodenal function secondary to the primary tumor, or inflammation secondary to systemic disease. Regardless, while there remained clinical suspicion of gastrointestinal adenocarcinoma due to the above-mentioned characteristics and findings in this patient, this proliferative fibrosis ultimately hindered the clinician's ability to make a definitive antemortem diagnosis by means of endoscopy and biopsy. The difficulties encountered in passing the endoscope may have suggested that this mass was causing a partial obstruction, contributing to the patient's clinical signs.

This case highlighted the importance of using multiple imaging modalities for the diagnosis of gastrointestinal disease owing to the differing strengths and limitations of radiography and ultrasonography. Within the abdominal radiographs, the gastric and duodenal masses were made clearly visible due to intraluminal gas acting as a negative contrast agent. Without gas in these structures, soft tissue silhouetting would have obscured these masses from view. Ultrasound was better able to define the nature of these masses, with the loss of intestinal layering and extent of the disease being suggestive of an aggressive process. It has been suggested that ultrasound has higher diagnostic value in animals with weight loss and the presence of neoplastic disease due to chronicity and severity of the lesion.[6] Similarly, fine-needle aspirates have higher diagnostic yield in thicker lesions[7]; however, a diagnosis was not obtained by means of aspirates on this patient despite the large size of the lesions. It is also important to note that while radiographs suggested multiple mural masses extending into the intestinal lumens of the stomach and duodenum, not all were clearly identified on ultrasound. This could have been due to gas within the lumen of the stomach and duodenum obscuring full evaluation or the size or conformation of the patient making full evaluation difficult. It is also worth noting that the liver appeared normal on ultrasonographic exam but was found to have metastatic disease, thus serving as a reminder that not all structural abnormalities may be identifiable on abdominal ultrasonography.

Acknowledgments

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