

# What Is Your Diagnosis?

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Figure 1—Left lateral (A) and ventrodorsal (B) radiographic views of the thorax of a 5-year-old spayed female Yorkshire Terrier evaluated because of anorexia and intermittent vomiting.



## History

A 5-year-old spayed female Yorkshire Terrier was referred for evaluation because of anorexia and intermittent vomiting. Three weeks earlier, the patient was attacked by a pit bull-type dog, which resulted in a laceration wound in the neck and a few puncture wounds in the right side of the thorax. Findings on physical examination were unremarkable except for icteric mucous membranes. Serum biochemical analysis revealed high total bilirubin concentration (18.3 mg/dL; reference interval, 0 to 0.4 mg/dL) and high alkaline phosphatase (2,878 U/L; reference interval, 20 to 130 U/L) and alanine aminotransferase (385 U/L; reference interval, 15 to 110 U/L) activities. Pancreas-specific lipase activity was mildly increased at 254  $\mu$ g/L (reference limit < 200  $\mu$ g/L). Radiographs of the thorax were obtained (Figure 1).

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

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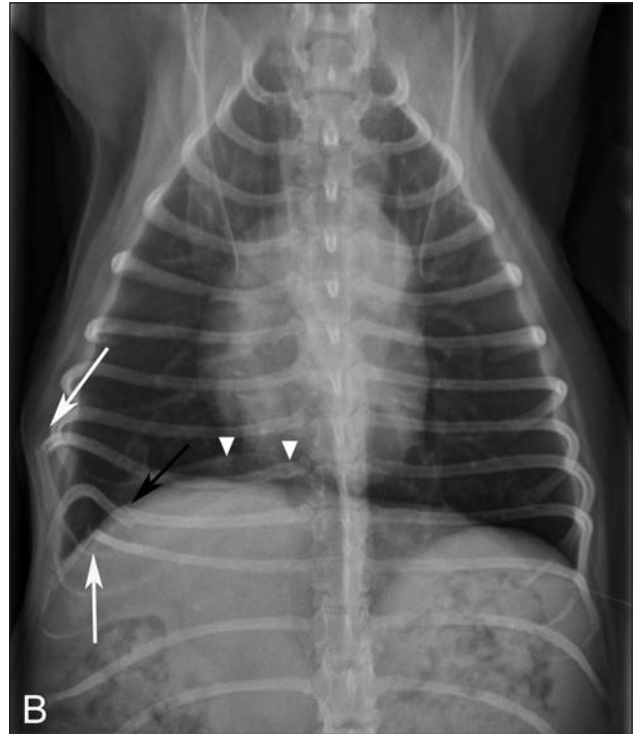


Figure 2—The same radiographic images as in Figure 1. A—A soft tissue bulge of the dorsal aspect of the right crus of the diaphragm suggestive of diaphragmatic or hiatal hernia, hematoma, or diaphragmatic eventration is evident (arrows). The cardiac silhouette, pulmonary vasculature, and pulmonary parenchyma are unremarkable. B—Transverse fractures of the right ninth and eleventh ribs with cranial displacement (white arrows) and an oblique fracture of the right tenth rib with caudal displacement (black arrow) are evident. A subtle bulge of the diaphragm is also noticeable (arrowheads).

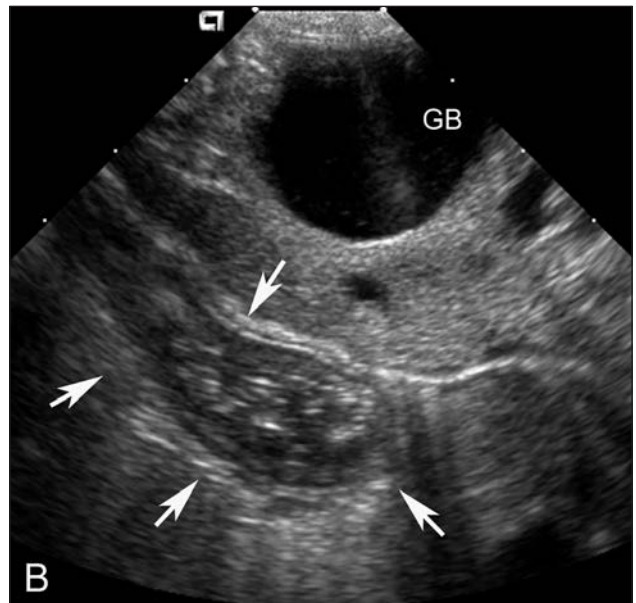


Figure 3—Ultrasonographic images of the area of the liver and diaphragm of the dog in Figure 1. A—On a sagittal image, notice the distended gallbladder (large white arrow), dilated (arrowhead) and tortuous (small white arrows) common bile duct measuring 3.5 to 9.8 mm in width, and enlarged intrahepatic bile ducts (black arrow), likely due to biliary obstruction or severe cholecystitis. B—On a transverse image, notice the 2 small intestinal segments cranial to the liver and adjacent to the diaphragm (arrows), highly suggestive of diaphragmatic hernia. Images were obtained via a transabdominal and transthoracic approach with a 14-MHz linear transducer (A) and 8.5-MHz phased array transducer (B). Scale markers indicate depth in centimeters. GB = Gallbladder.

### Diagnostic Imaging Findings and Interpretation

A soft tissue bulge of the dorsal aspect of the right crus of the diaphragm suggestive of diaphragmatic or hiatal hernia, hematoma, or diaphragmatic eventration (Figure 2) is evident. Radiographic appearance of the

cardiac silhouette, pulmonary vasculature, and pulmonary parenchyma is unremarkable. Transverse fractures with cranial displacement of the right ninth and eleventh ribs and an oblique fracture with caudal displacement of the right tenth rib are evident.

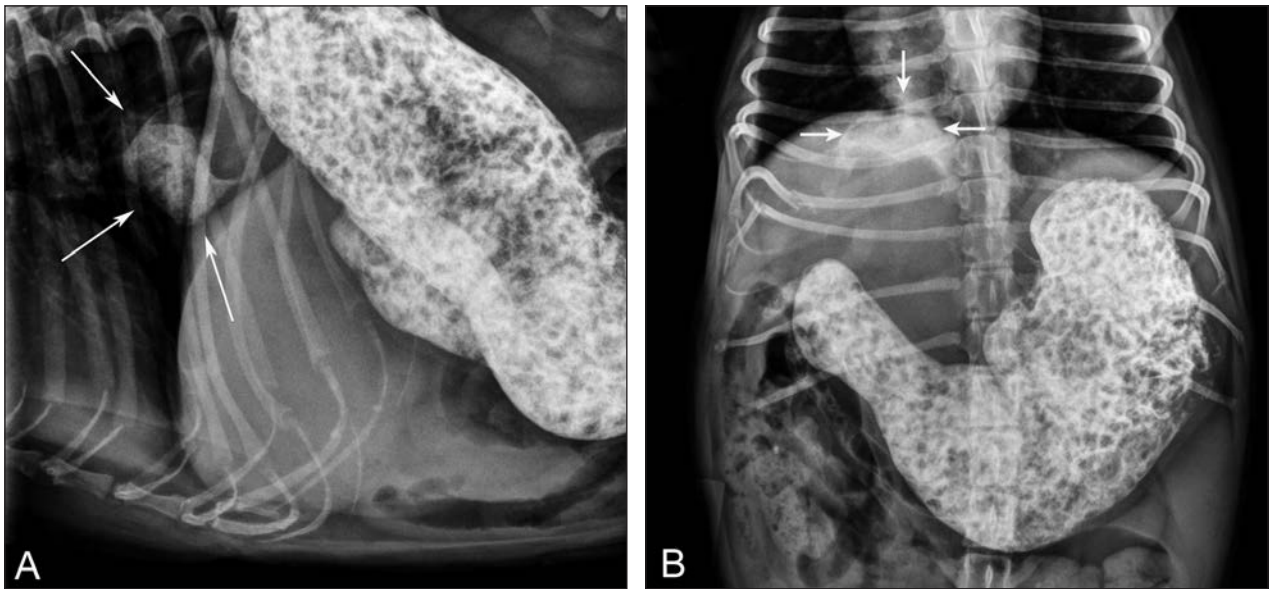


Figure 4—Radiographic positive-contrast images of the upper gastrointestinal tract of the dog in Figure 1. A—On the lateral view, the segmentally dilated lumen of the duodenum (arrows) is positioned cranial to the stomach, liver, and crus of the diaphragm. B—On the ventrodorsal view, outpouching of the right crus of the diaphragm (arrows) is evident, confirming diaphragmatic hernia with entrapment of the proximal portion of the duodenum.

Abdominal ultrasonography revealed a distended gallbladder, dilated and tortuous common bile duct measuring 3.5 to 9.8 mm in width, and enlarged intrahepatic bile ducts likely due to biliary obstruction or severe cholecystitis (Figure 3). An unexpected finding was the presence of 2 small intestinal segments cranial to the liver and adjacent to the diaphragm, highly suggestive of diaphragmatic hernia. One of the segments could be followed toward the pylorus. A scant amount of anechoic fluid was present within the thorax. A portion of the pancreas imaged in the abdomen was enlarged and hypoechoic with an adjacent hyperechoic mesentery consistent with pancreatitis and focal peritonitis.

On radiographic positive-contrast imaging of the upper gastrointestinal tract, contrast material was identified within a segmentally dilated portion of the duodenum, cranial to the stomach and liver, within the outpouching of the right crus of the diaphragm, confirming diaphragmatic hernia with entrapment of the proximal portion of the duodenum (Figure 4). This finding was confirmed on fluoroscopy along with functional ileus of the small intestines.

### Treatment and Outcome

A diagnosis of biliary tract obstruction was made on the basis of imaging findings and later confirmed by exploratory laparotomy. A rent was identified in the right ventrolateral portion of the diaphragm, with the proximal portion of the duodenum and pancreas entrapped within the thoracic cavity. The common bile duct was markedly distended, and the gallbladder was severely enlarged. Multiple adhesions between the right caudal lung lobe, pancreas, duodenum, and right thoracic wall at the level of the rib fractures were identified. A partial right lung lobectomy and partial pancreatectomy were performed to retract herniated structures into the abdomen and close the diaphragmatic rent. The gallbladder was then easily expressible, and a chest tube was placed. There were no postsurgical complications, the thoracic

tube was removed after 36 hours, and the dog was discharged from the hospital the following day.

### Comments

Extrahepatic biliary obstructions in dogs and cats are most commonly caused by pancreatitis (42.2%) or pancreatic, hepatic, or gastrointestinal neoplasia (24.4%).<sup>1</sup> Other, less commonly encountered causes include cholangitis, inspissated bile, cholelithiasis, stricture, parasites, or blood clots. Diaphragmatic hernia in dogs and cats is a frequent sequela to blunt trauma, and the liver is the organ most commonly displaced into the thoracic cavity. Icterus is reported infrequently in cats.<sup>2</sup> To our knowledge, diaphragmatic herniation of the pancreas and proximal portion of the duodenum resulting in biliary obstruction has not been reported before in dogs. One similar case has been reported in a cat.<sup>2</sup>

The most common clinical signs of chronic diaphragmatic hernia are dyspnea and vomiting, and many dogs and cats have nonspecific signs such as anorexia, lethargy, and weight loss.<sup>3</sup> Diagnosis of chronic diaphragmatic hernia requires diagnostic imaging, but these modalities often yield false-negative results. In a series of 50 dogs and cats, one-third of the hernias could not be conclusively demonstrated with thoracic radiography.<sup>3</sup> In the dog of the present report, the presence of only a small portion of intestine within the thoracic cavity resulted in difficulty identifying the herniated structures as a definitive cause of biliary obstruction. Because any diagnostic imaging technique can be inconclusive, more than 1 modality may be needed to reach a recommendation to proceed to exploratory surgery.

1. Fahie MA, Martin RA. Extrahepatic biliary tract obstruction: a retrospective study of 45 cases. *J Am Anim Hosp Assoc* 1995;31:478–482.
2. Cornell KK, Jakovljevic S, Waters DJ, et al. Extrahepatic biliary obstruction secondary to diaphragmatic hernia in two cats. *J Am Anim Hosp Assoc* 1993;29:502–507.
3. Minihan AC, Berg J, Evans KL. Chronic diaphragmatic hernia in 34 dogs and 16 cats. *J Am Hosp Assoc* 2004;40:51–63.