What Is Your Diagnosis?

**History**
A 7-year-old 33.2-kg (73.0-lb) neutered male mixed-breed dog was evaluated because of vomiting and abdominal distension of 5 hours’ duration. The vomitus contained a white, foamy substance and rapidly progressed to non-productive retching. On physical examination, the patient had evidence of hypovolemic shock. The patient was obtunded, tachycardic (200 beats/min), and hypothermic (35.5°C [96.0°F]) and had pale mucous membranes with a prolonged capillary refill time. Severe abdominal distension was also noted.

At hospital admission, the patient was immediately stabilized. Intravenous catheters were placed in both cephalic veins, and the patient underwent fluid resuscitation with IV administration of hypertonic saline solution and lactated Ringer solution. Percutaneous gastric trocarization was performed to relieve abdominal distension. General anesthesia was induced with propofol, and an orogastric tube was passed. Venous blood gas analysis revealed a mild metabolic acidosis (pH, 7.30; reference range, 7.32 to 7.44), severe hyperlactatemia (8.5 mmol/L; reference range, < 2.5 mmol/L), and mild azotemia (BUN, 31 mg/dL [reference range, 6 to 25 mg/dL]; creatinine, 2.2 mg/dL [reference range, 0.5 to 1.6 mg/dL]). Abdominal and thoracic radiography were 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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Radiographic Findings and Interpretation

The stomach is severely distended as evident by gas and soft tissue opacities and extends to the level of L6. The pylorus is seen as a tubular, narrow, gas-filled structure on the right lateral view (Figure 2). The pylorus is not identifiable on the dorsoventral view. The fundus and body of the stomach are gas filled on the right lateral view and located on the right side of the abdomen on the dorsoventral view. The small intestines are displaced cranially and to the left and diffusely gas filled but normal in size. The splenic head is not seen in its normal location in the left cranial quadrant of the abdomen on the dorsoventral view. Multiple, streaky, gas opaque regions are present focally within the liver and ventrally along the abdominal wall not associated with any gastrointestinal organ. The margins of the liver are mildly rounded and extend past the costochondral arch. There is generalized decreased peritoneal detail as a result of the mass effect.

Considering these radiographic findings, a diagnosis of severe gastric dilation with suspect displacement was made without definitive evidence of volvulus. There was concurrent pneumoperitoneum, small intestinal functional ileus, and mild generalized hepatomegaly. Differentials for the pneumoperitoneum included gastric wall necrosis, prior percutaneous gastric trocarization, or liver torsion. Differentials for the hepatomegaly included torsion or nonspecific causes such as metabolic or inflammatory hepatopathy. The lack of visualization of the splenic head in the left cranial aspect of the abdomen was likely the result of displacement of the fundus of the stomach to the right, causing the spleen to move with it because of the gastrosplenic ligament.

Treatment and Outcome

Following radiography, gastric trocarization was performed a second time and an orogastric tube was passed, removing a large amount of gastric fluid and food. Given the patient’s clinical signs and radiographic findings, an exploratory laparotomy was performed. A severely dilated stomach was found in the cranial aspect of the abdomen, with the pylorus located on the right side of the abdomen somewhat caudal to its normal anatomical position. The esophagus was palpated at the level of the esophageal hiatus for evidence of torsion, which was not present. A gastrotomy was performed, and the stomach was decompressed. The remainder of the abdomen was explored, and the left lateral and left medial liver lobes were found to be dark and firm, consistent with liver lobe torsion. These liver lobes were exteriorized, and torsion was confirmed at the hilus and ligated by use of a surgical staple. The liver lobes were excised and submitted for histologic evaluation. The remainder of the exploratory laparotomy did not reveal additional abnormalities, and the source of free gas was not identified. An incisional gastropexy was performed just caudal to the 13th rib. The abdomen was checked for hemorrhage and closed routinely. The patient did not experience any intraoperative complica-
tions and recovered uneventfully from general anesthesia. Postoperative serum biochemical analysis revealed a normal lactate concentration (1.4 mmol/L) and resolved azotemia (BUN, 15 mg/dL; creatinine, 0.8 mg/dL). The patient was discharged from the hospital the next day.

Histologic findings were consistent with marked passive congestion and ischemia of the left lateral liver lobe and mild congestion of the medial lobe associated with hepatocellular necrosis. There were also multifocal hepatic granulomas with rare intralobular fat and cross sections that were most consistent with *Heterobothriurus americanum*. The clinical importance of the parasite was not evident histologically. The widespread necrosis secondary to the torsion was not considered to be directly associated with the multifocal granulomatous inflammation secondary to the parasite migration, because ischemic necrosis secondary to parasite migration would be multifocal to locally extensive. The necrosis described here was a change that affected all of the hepatic lobes in the liver lobes with vascular compromise as a result of the torsion. The patient received fenbendazole for 7 days and praziquantel for 2 days as treatment for the *H americanum* infection. The patient was reported to be doing well as of 1 year after surgery.

**Comments**

Liver lobe torsion is a relatively rare disease in dogs, with few cases reported in the literature. The causes of liver lobe torsion are not known, but hypotheses include stretching of the supporting structures of the liver, neoplasia, trauma, and congenital anomalies. Intermittent gastric distension has been proposed as a predisposing factor in dogs, but no studies have been performed to confirm this. Torsion of the left lateral liver lobe is reported to occur most commonly and is suspected to be a result of its large size, mobility, and separated anatomy, compared with the rest of the liver. Furthermore, the potential for laxity of the associated hepatic gastrographic ligament can also result in a predisposition for torsion of this lobe. Clinical signs are relatively nonspecific and most commonly include signs of abdominal pain, vomiting, anorexia, lethargy, and collapse. The most common physical examination findings include tachycardia, hypothermia, dehydration, signs of abdominal pain, abdominal fluid wave, weak femoral pulses, and cardiac arrhythmias. Reported radiographic findings include an abdominal mass effect, gas distension of the stomach and small intestines, peritoneal effusion, and pneumoperitoneum.

In the dog of the present report, liver lobe torsion or necrosis was considered to be one of the differentials for the pneumoperitoneum; however, gas introduced by prior percutaneous gastric trocarization or secondary to gastric wall necrosis was also a consideration. No mass effect was present in the region of the liver, although the liver was mildly enlarged. On the basis of the patient’s clinical signs and physical examination findings, gastric dilatation-volvulus was the primary differential. Radiographic findings confirmed gastric distension and displacement, which in conjunction with pneumoperitoneum and the patient’s clinical signs prompted an exploratory laparotomy, despite the lack of radiographic signs of gastric volvulus. Characteristic radiographic findings of volvulus include distension of the stomach by gas and soft tissue opacity, with craniodorsal and leftward displacement of the pylorus and caudoventral and rightward displacement of the fundus. Compartmentalization, the presence of soft tissue bands that project into the gas filled lumen of the rotated stomach, can also be present. In the dog of the present report, the pylorus was not craniodorsally displaced and no compartmentalization was present radiographically; therefore gastric volvulus was not confirmed; however, gastric displacement, with the fundus located on the right side of the abdomen and the pylorus located on the left side of the abdomen, was suspected on the basis of shifting of the expected gas pattern on the lateral views and gastric position on the dorsolateral view. During surgery, neither volvulus nor gastric displacement was present; therefore, it is possible that the stomach returned to its normal position after the second trocarization, after the passage of the orogastric tube, or on induction of general anesthesia or that the shifting of the expected gas pattern on the lateral views was secondary to severe gastric dilation alone.

In instances of suspected liver lobe torsion, ultrasonography may be performed to confirm the mass effect of the liver, and color Doppler ultrasonography may be used to identify hepatic vessels with decreased or absent blood flow. Computed tomography can also be performed, demonstrating a hepatic mass or enlargement of a single lobe with decreased or absent blood flow on postcontrast images and the presence of peritoneal effusion. In a large number of patients with liver lobe torsion, additional imaging is not pursued because of the emergent nature of this condition necessitating immediate exploratory laparotomy. Treatment involves excision of the affected liver lobes. Postoperative complications include anemia secondary to intraoperative blood loss, hypoalbuminemia, and aspiration pneumonia. The prognosis for dogs undergoing liver lobectomy is generally excellent if there is not an underlying cause.

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**References**