What Is Your Diagnosis?

History

A 2.5-year-old spayed female Jack Russell Terrier was referred for surgical attenuation of a single congenital extrahepatic portosystemic shunt that had been detected via abdominal ultrasonography. The dog had a history of intermittent vomiting, pacing, and destructive behavior with acute exacerbation immediately prior to initial evaluation by the referring veterinarian. Preprandial (180 µmol/L; reference range, 0 to 12 µmol/L) and postprandial (240 µmol/L; reference range, 0 to 16 µmol/L) serum bile acids concentrations were high, and serum biochemical analysis revealed hypoproteinemia (5.3 g/dL; reference range, 5.4 to 7.6 g/dL) and hypocholesterolemia (77 mg/dL; reference range, 135 to 361 mg/dL). The dog was started on medical treatment, including lactulose (2.5 mL, PO, q 8 h), amoxicillin (15 mg/kg [6.8 mg/lb], PO, q 12 h), and famotidine (0.4 mg/kg [0.18 mg/lb], PO, q 12 h), and a prescription diet to aid in hepatic health. The dog had no further clinical signs after the initiation of treatment and was returned for surgical intervention 4 weeks later. Prior to surgery, CT of the abdomen was performed with a helical scanner before and after IV administration of a nonionic, low-osmolar iodinated contrast agent (iopamidol) to further characterize the shunt anatomy (Figure 1).

Determine whether additional imaging studies are required, or make your diagnosis from Figure 1—then turn the page →
tablet medications has been tested and demonstrated in surgery to become clinically normal. The apparent gastric foreign body had actually been an amoxicillin tablet. The dog fully recovered from the mineral foreign body. On the basis of CT findings, the gastrointestinal tract was examined to remove the densities of the amoxicillin tablets were between 1,000 and 1,100 HU, and the density of lactulose was approximately 300 HU. The density of the ingested amoxicillin on CT images of the dog of the present report was lower than that obtained with in vitro CT imaging. This was most likely the result of partial dissolution of the tablet at the time of CT imaging in this patient.

The mnemonic BET A CHIP has been devised to help clinicians remember the most common radiopaque substances: barium; enteric-coated tablets; tricyclic antidepressants; antihistamines; chloral hydrate, cocaine, condoms, and calcium; heavy metals; iodides; and potassium-phenothiazines. The complete formulation of some medications is not listed in the consumer medicine information leaflet. Often the radiopacity and density of the medication in question are related to components other than the active ingredient. Calcium or potassium salts are frequently used, with potassium being one of the most radiopaque preparations. Bro-mine-containing compounds may also be detected on diagnostic imaging. In a study of amoxicillin from 2 manufacturers, one brand was moderately radiopaque and the other was minimally radiopaque. The exact formulation of the amoxicillin product used in the dog of the present report was not revealed on the medicine information leaflet and was not released by the manufacturer. This report documents the importance of a thorough history and knowledge of recent medications prior to diagnostic imaging to prevent misinterpreting medications as foreign material.

Diagnostic Imaging Findings and Interpretation

A large, tortuous anomalous vessel is evident originating from the portal vein and coursing left over the lesser curvature of the stomach into the left hepatic vein before merging with the caudal vena cava (Figure 2). The liver is subjectively normal in size. The stomach is fluid filled and contains a well-defined foreign body (diameter, 1 cm) with a bone (mineral) density of 470 Hounsfield units (HU).

Treatment and Outcome

An exploratory celiotomy was performed immediately following the CT scan to locate and attenuate the congenital portosystemic shunt. Prior to shunt attenuation, the gastrointestinal tract was examined to remove the foreign body. An orogastric tube was passed to ensure the foreign body had not passed cranially into the esophagus. Gastrotomy revealed a white sludge within the stomach, consistent with partial dissolution of an amoxicillin tablet given approximately 3 hours prior to anesthesia. The gastrotomy was closed routinely, and the portosystemic shunt was attenuated with a 3.5-mm ameroid ring constrictor at the entrance of the shunt into the left hepatic vein on the peritoneal surface of the diaphragm. The remainder of surgery and anesthetic recovery were uneventful. Postoperative radiography failed to reveal any residual radiopaque material within the gastrointestinal tract. The apparent gastric foreign body had actually been an amoxicillin tablet. The dog fully recovered from surgery to become clinically normal.

Comments

The radiopaque nature of various orally administered tablet medications has been tested and demonstrated in vitro by use of standard and digital radiography. The densities of some orally administered nonliquid medications have also been quantified in vitro by CT. In a report of a human patient with abdominal pain, tablet fragments were identifiable and incidentally discovered on abdominal CT. In previous studies, amoxicillin was shown to be moderately radiopaque. In an in vitro study to evaluate imaging properties of various medications, tablets with a density between 900 and 1,300 HU on CT images had variable visibility on radiographs, and tablets with a density > 1,300 HU on CT images were seen consistently on radiographs. However, these in vitro findings do not directly apply to veterinary patients because patient size influences radiographic visibility. Out of interest, we also evaluated the in vitro CT appearance (images not shown) of the same medications given to the dog of the present report, which included a 100-mg amoxicillin tablet and lactulose; additional amoxicillin tablets of different concentrations (50 and 200 mg) were also evaluated. On CT, the densities of the amoxicillin tablets were between 1,000 and 1,100 HU, and the density of lactulose was approximately 300 HU. The density of the ingested amoxicillin on CT images of the dog of the present report was lower than that obtained with in vitro CT imaging. This was most likely the result of partial dissolution of the tablet at the time of CT imaging in this patient.