

Pneumoperitoneum secondary to a perforated gastric ulcer in a cat

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- ▶ Common causes of pneumoperitoneum include recent abdominal surgery, ruptured gastrointestinal viscus, and abdominal infection by gas-producing bacteria.
- ▶ Exploratory laparotomy is indicated in cats with pneumoperitoneum.
- ▶ Perforated gastric ulceration should not be ruled out as a cause of pneumoperitoneum in cats with mild clinical signs.

A 7-year-old female spayed domestic longhair cat was referred to the Ontario Veterinary College Veterinary Teaching Hospital (OVC-VTH) at the University of Guelph for evaluation of pneumoperitoneum. The cat had a 6-month history of weight loss, intermittent diarrhea, and anorexia. A cystotomy to remove calcium oxalate calculi had been performed 5 weeks prior to referral. Orbifloxacin^a (3 mg/kg [1.4 mg/lb], PO, q 24 h) was administered perioperatively; treatment was changed to amoxicillin-clavulanic acid^b (62.5 mg, PO, q 12 h, for 4 weeks) after surgery on the basis of results of bacteriologic culture and antimicrobial susceptibility testing of urine.

Four days prior to evaluation at the OVC-VTH, the referring veterinarian examined the cat because of abdominal distension of 24 hours' duration. At that time, physical examination findings were normal, except for marked abdominal distension. Results of a CBC and serum biochemical analyses were unremarkable. Marked pneumoperitoneum was observed on lateral and ventrodorsal abdominal radiographs. Abdominocentesis was performed, and 640 mL of air was aspirated. Referral to the OVC-VTH was recommended, but the owners declined and elected conservative medical management. Treatment with orbifloxacin (3 mg/kg, PO, q 24 h) was begun, and the cat was discharged; 3 days later, the cat was reevaluated at the referring clinic, and the owners reported that the abdominal distension had recurred 1 day after abdominocentesis. Physical examination revealed no abnormalities except for marked abdominal distension, and abdominal radiography confirmed recurrence of pneumoperitoneum (Fig 1). Other radiographic findings included moderate gas distension of the small intestinal tract, which suggested generalized ileus; renal mineralization was also observed, which was

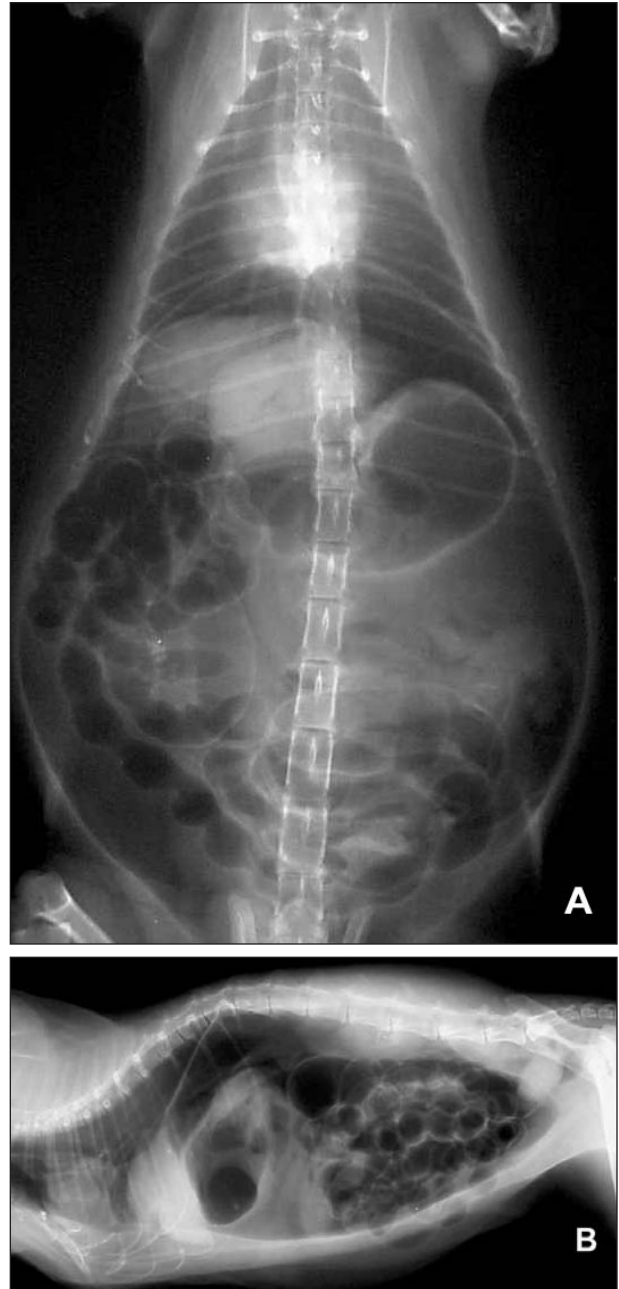


Figure 1—Ventrodorsal (A) and lateral (B) abdominal radiographs of a 7-year-old spayed female domestic longhair cat with pneumoperitoneum.

consistent with nephrocalcinosis and possible concurrent nephrolithiasis. The cat was referred to the OVC-VTH for further evaluation and treatment.

On physical examination, the cat was bright and

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alert, with temperature, pulse, and respiratory rates within reference ranges; no abnormalities were found, except that the mucous membranes were pale, and the abdomen was moderately distended. Results of a CBC revealed that Hct was low but within reference range (0.31 L/L; reference range, 0.28 to 0.49 L/L) and a mature neutrophilia (18.45×10^9 neutrophils/L; reference range, 2.1 to 8.3×10^9 neutrophils/L). Serum biochemical analyses were not repeated because of financial considerations. A presumptive diagnosis of pneumoperitoneum secondary to a perforated viscus was made, and an exploratory laparotomy was performed.

On incision of the linea alba, the escape of free gas from the abdominal cavity was heard. A small quantity of fluid was present in the peritoneal cavity, and swab samples were obtained for aerobic and anaerobic bacteriologic culture. The omentum was inflamed and adhered focally to the gastric wall. The gastric wall was thickened and hyperemic, and there was a focal adhesion between the greater curvature of the stomach and the pancreas. A gastrotomy was performed in a grossly normal area and revealed a gastric perforation 4.0 mm in diameter through the greater curvature of the stomach at the site where the surrounding tissues were adhered (Fig 2). Blunt dissection was performed to detach the stomach from the pancreas. Diffuse capillary hemorrhage from the dissected pancreatic area persisted throughout the surgery. Because neoplasia was the main differential diagnosis, the ulcerated area with a 1.5-cm margin of grossly normal gastric tissue was resected. The resection involved approximately 30% of the greater curvature of the stomach. The defect was sutured with 3-0 polydioxanone^c suture in a simple continuous pattern and oversewn with the same suture material in a Lembert pattern. Impression smears of the cut surface of the ulcer and adjacent tissues were made for cytologic examination, and the resected tissue was submitted for histologic evaluation. Further examination of the abdominal cavity revealed

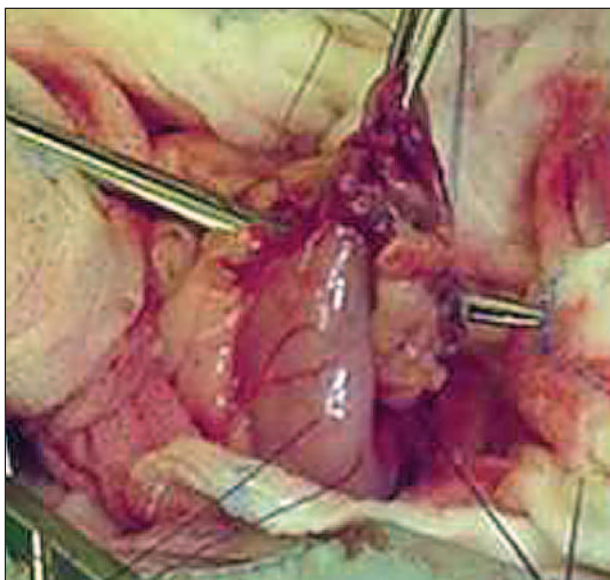


Figure 2—Photograph obtained during surgery of the abdomen of a cat with pneumoperitoneum. Notice the Metzenbaum scissors placed through the ulcer via the gastrotomy incision.

that the mesenteric lymph nodes were firm and enlarged, and the colonic serosa and mesocolon adjacent to the urinary bladder had a granular appearance. In the urinary bladder wall, sutures placed during the cystotomy were visible, but the site appeared otherwise normal. The liver, gall bladder, kidneys, ureters, small intestine, spleen, and adrenal glands appeared grossly normal. Biopsy specimens of the liver and mesenteric lymph nodes and a sample of the mesocolon were obtained for histologic examination. The abdominal cavity was lavaged thoroughly with warm physiological saline (0.9% NaCl) solution and closed in a routine manner. The cat received a 30-mL transfusion of packed RBCs during surgery because of low blood pressure and anemia (PCV decreased to 11% during surgery). After the transfusion, PCV was 35%, and the plasma total solids concentration was 5.0 g/dL. Cefoxitin sodium^d (30 mg/kg [13.6 mg/lb], IV) was administered at the time of induction of anesthesia, and treatment was repeated every 6 hours during the postoperative period until discharge from the hospital. Treatment with ranitidine^e (0.5 mg/kg [0.23 mg/lb], IV, q 12 h) was also started. Analgesia was provided by the administration of oxymorphone^f (0.05 mg/kg [0.02 mg/lb], IV), as needed.

The cat recovered from anesthesia without complication and was initially bright and alert. Eighteen hours after surgery, the cat had signs of depression, and low blood pressure was recorded. The PCV decreased to 20%, and the plasma total solids concentration decreased to 4.4 g/dL. It seemed probable that these changes were the result of continued blood loss from the pancreas or stomach. Sixty milliliters of whole blood was administered IV to the cat. Food and water were withheld for the first 48 hours after surgery until pancreatitis could be excluded; because clinical signs and hematologic and serum biochemical abnormalities consistent with pancreatitis were not detected after 48 hours, the cat was provided frequently with small meals of a low fat diet.^g

Cytologic examination of the impression smears from the resected gastric tissue revealed septic, suppurative inflammation that was consistent with a necrotic or septic ulcer. This was confirmed by histologic examination, which revealed a severe perforating ulcer filled with fibrin and surrounded by granulation tissue. On the serosal surface of the gastric wall, focal acute and chronic peritonitis was also evident, which had probably developed secondary to perforation. The gastric wall adjacent to the ulcer appeared normal histologically. Examinations of the mesenteric lymph node and mesocolon biopsy samples revealed reactive lymph node tissue and mild chronic peritonitis, respectively; on the basis of chronicity and location, the changes in the mesocolon were likely secondary to the previous urinary bladder surgery. Liver biopsy specimens had been obtained to rule out metastasis, and these appeared normal histologically. Aerobic and anaerobic bacteriologic cultures of the abdominal fluid yielded no bacterial growth. Bacterial contamination of the abdominal cavity may have been prevented via sealing of the ulcer by the omentum and pancreas or eliminated by the antimicrobial treatment adminis-

tered by the referring veterinarian. Four days after surgery, the cat was discharged to the owners, who were instructed to administer ranitidine (4 mg/kg [1.8 mg/lb], PO, q 12 h) and cefaclor^b (15 mg/kg [6.8 mg/lb], PO, q 8 h) for 14 days. At suture removal, the owners reported to the referring veterinarian that the cat was clinically normal. However, occasional vomiting began 4 months after surgery and gradually increased in frequency. Physical examinations performed by the referring veterinarian at that time and later during reevaluations revealed no abnormalities, and the owners declined further diagnostic procedures. To control vomiting, ranitidine (0.5 mg/kg, SQ, q 12 h) was administered by the owners for a few months. Seventeen months after surgery, ranitidine treatments had been discontinued, and the cat appeared to be clinically normal, except for occasional vomiting of hairballs.

The most common cause of pneumoperitoneum in small animals is recent abdominal surgery. Other commonly reported causes include ruptured gastrointestinal viscus,^{1,4} infection by gas-producing bacteria within the abdominal cavity,^{1,5} and necrosis of the spleen.^{1,5} Rarely reported causes include pneumoperitoneum as a sequela to alveolar leakage of air secondary to high pressures created during positive end-expiratory pressure ventilation of abnormal lungs,⁶ leakage of air into the abdominal cavity from abdominal drain sites,⁷ and idiopathic pneumoperitoneum.⁸ The mean duration of pneumoperitoneum that develops after surgery ranges from 14 to 25 days, although it has been reported to last as long as 34 days in a dog.^{9,10} The duration of pneumoperitoneum is most dependent on the amount of air trapped in the abdomen at the time of surgery,¹⁰ because the air is gradually absorbed by the peritoneum during the postoperative period. Although the cat of this report had undergone abdominal surgery 5 weeks previously, pneumoperitoneum associated with surgery was not considered, because abdominal radiographs performed immediately after cystotomy had revealed only trace amounts of free air in the abdominal cavity.

Histologic evaluation of the stomach wall lesion was consistent with chronic ulceration of unknown etiology. Commonly reported causes of ulceration of the gastrointestinal tract in dogs and cats include administration of nonsteroidal¹¹⁻¹³ and corticosteroid^{12,14-16} anti-inflammatory drugs, mast cell neoplasia,^{12,17,18} canine gastrinoma,¹⁹ malignant gastric tumors,²⁰ severe hepatic disease,¹² uremia,^{12,21} and inflammatory bowel disease.^{12,22} The cat of this report was not receiving any anti-inflammatory drugs and had no evidence of renal, hepatic, or neoplastic disease at the time of the laparotomy. Inflammatory cell infiltrates were not evident in the tissue sections of stomach that were examined histologically.

The development of pneumoperitoneum suggests that gastric perforation allowed swallowed air to enter the abdominal cavity. In the cat of this report, gastric fluid may have been excluded from the abdominal cavity via sealing of the gastric ulcer by the omentum and pancreas, which thereby prevented the development of severe generalized peritonitis. The phenomenon of a

perforating gastric ulcer becoming sealed via tissue response to local peritonitis on the serosal surface of the stomach and the subsequent prevention of generalized peritonitis has been reported in a cat.⁴

Pneumoperitoneum caused by a ruptured viscus has been reported in 2 dogs^{2,3} and 1 cat⁴; diagnosis of pneumoperitoneum was made post mortem in 2 of these animals.^{3,4} In another cat,²³ septic peritonitis and pneumoperitoneum was suspected to be secondary to a ruptured viscus, but this was not confirmed. In the cat of this report, it was unusual that clinical signs were limited to the recurring abdominal distension, despite the duration (5 days) and severity of the pneumoperitoneum. This cat recovered without complications after partial gastrectomy to resect the ulcerated area. Ruptured gastric ulcers should be considered a differential diagnosis for cats with pneumoperitoneum, despite the absence of other clinical signs.

^aOrbax, Schering-Plough Animal Health, Union, NJ.

^bClavamox, Pfizer Animal Health, Exton, Pa.

^cPDS, Ethicon Inc, Somerville, NJ.

^dCefoxitin, Novopharm Ltd, Toronto, Canada.

^eZantac, Glaxo Wellcome, Research Triangle Park, NC.

^fNumorphan, DuPont Co, Wilmington, Del.

^gPurina E/N, Ralston-Purina, St Louis, Mo.

^hNovo-cefaclor, Novopharm Ltd, Toronto, Canada.

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