Tension Pneumoperitoneum Due to Gastric Perforation in a Cat

Teruo ITOH\textsuperscript{1}, Kazumi NIBE\textsuperscript{1} and Kiyokazu NAGANOBU\textsuperscript{2}

\textsuperscript{1}Aoba Animal Hospital, 103–1 Aoba-cho, Miyazaki 880–0842 and \textsuperscript{2}Veterinary Teaching Hospital, Faculty of Agriculture, Miyazaki University, Miyazaki 889–2155, Japan

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\textbf{ABSTRACT.} A 14-year-old spayed female cat weighing 2.3 kg developed tension pneumoperitoneum that progressed for 6 hr. Abdominocectensis was performed and 1.3 L of gas was aspirated after which the cat’s respiratory condition improved. The next day, the cat’s abdomen redistended, and laparotomy was performed. A gastric perforation was noted and sutured after the margin was resection. The cat showed a good physical condition without any gastrointestinal signs at 6 months after surgery.

\textbf{KEY WORDS:} feline, gastric perforation, tension pneumoperitoneum.

Pneumoperitoneum refers to the presence of gas within the peritoneal cavity resulting from a ruptured hollow viscus, penetrating abdominal wounds or bacterial peritonitis [1]. Life-threatening, massive pneumoperitoneum necessitating immediate needle decompression to improve cardiopulmonary embarrassment, known as tension pneumoperitoneum, has been reported in humans [2, 4, 11, 13]. However, few reports have documented similar cases in veterinary fields. This study reports the case of a cat that developed tension pneumoperitoneum secondary to gastric perforation and was treated with abdominocectensis followed by laparotomy.

A 14-year-old spayed female, domestic shorthair cat weighing 2.3 kg presented with marked abdominal distension that had been progressing for 6 hr. For 1 week prior to admission, the cat had been anorexic after a transient episode of vomiting. The owner described 6 episodes of vomiting during a 4-month prior to admission, which had always been resolved with symptomatic therapy for gastritis. The cat had also been affected with chronic rhinitis for several years.

At the time of admission, the cat was collapsed in a recumbent position and was tachypneic with ballooned, tympanic abdominal distension. Heart rate was 180 beats per minute, and rectal temperature was 34.2°C. The mucus membrane was pale and purulent nasal discharge was noticed. Abdominal radiography revealed massive pneumoperitoneum with cranial displacement of the diaphragm, centralization of the abdominal organs, and a small amount of air within the contracted stomach (Fig. 1). Initial hematological abnormalities included a mildly low packed cell volume (32%), severe neutrophilia (42,240 cells/µL), and mild lymphopenia (880 cells/µL). Plasma biochemical analysis revealed high protein (9.6 g/dL), urea nitrogen (72 mg/dL), sodium (158 mEq/L) and chloride concentrations (121 mEq/L), and a low glucose concentration (63 mg/dL). The cat was seropositive for feline immunodeficiency virus antibody.

Since abdominal radiographs suggested high intra-abdominal pressure reducing diaphragmatic compliance, abdominocectensis was performed and 1.3 L of air was aspirated. The cat’s respiratory condition returned to almost normal. After administration of 5% glucose (20 mL, IV), cefazolin sodium (20 mg/kg, SC), and enrofloxacin (5 mg/kg, IM), the cat returned to the owner’s care at home because it was late at night. The next morning, the cat was roused with improved general conditions that allowed standing and walking. Rectal temperature was 36.8°C. Mild difficulty in breathing due to severe rhinitis remained. The owner requested hospitalization and fluid infusion was initiated (lactated Ringer’s solution, 5 mL/kg/hr, IV). Within 3 hr of treatment, the cat’s abdomen gradually redistended. Abdominal radiography showed pneumoperitoneum with gastric dilatation due to aerophagy (Fig. 2). Gastroenterography using 12 mL of diluted iohexol revealed leakage of the contrast medium into the abdominal cavity, therefore, gastrointestinal perforation was indicated.

After 9 hr of fluid infusion, a laparotomy was performed. Mild generalized peritonitis was found with a small amount of yellowish ascites. A gastric perforation 8 mm in diameter was confirmed at the dorsal site of the gastric fundus, where the omentum was mildly adhered. Other portions of the gastric wall were grossly or palpably normal. After blunt dissection of the adhered omentum, the perforated area was excised with a 1-cm margin of normal gastric tissue then sutured with 3–0 monofilament polyglyconate in a simple interrupted pattern. Other organs were grossly normal except for mild peritonitis. The abdominal cavity was flushed with 1 L of warm saline (0.9% NaCl) solution and closed in a routine manner. Cytology of the abdominal fluid revealed a number of neutrophils. Aerobic bacterial culture of the fluid yielded no bacterial growth.

Until 3 days after surgery, the cat’s status improved with its appetite returning and the resolution of rhinitis. The cat was discharged from hospital 6 days after surgery, and administration of antibiotics and an H2 blocker was continued for another 3 weeks. Two months after surgery, the cat developed ileocolic intussusception and was treated surgically. No abdominal abnormality except for the intussusception was noted at surgery, and histological examination...
of the excised intestinal tissue revealed no underlying disease. During 4-months follow-up after the second operation, the cat maintained a good condition without any gastrointestinal signs.

Reported common causes of pneumoperitoneum in small animals include abdominal surgery, a penetrating wound of the abdominal wall, gastrointestinal perforation, and bacterial peritonitis [1, 2, 9, 10]. In cats, pneumoperitoneum as a rare complication of endoscopic biopsy [14] or gastrostomy tube placement [7] has also been reported. Recent studies demonstrated that more than 70% of non-iatrogenic pneumoperitoneum in dogs and cats results from a perforated hollow viscus [9, 10]. However, most reported cases have not shown severe abdominal distension necessitating immediate abdominal decompression. Additional factors might play a role in the development of massive pneumoperitoneum.

In humans, tension pneumoperitoneum is a reportedly rare but life-threatening complication of gastric perforation [11]. Forceful ventilation is often associated with the progression of gas accumulation [4, 11, 13]. Tension pneumoperitoneum is characterized by acute, tympanic abdominal distention and respiratory or circulatory embarrassments resulting from elevated abdominal pressure [2, 4, 11, 13]. Radiographically, massive accumulation of intraperitoneal gas, an elevated diaphragm with cardiac compression, and centralization of abdominal organs has been observed [2]. Although cardiorespiratory embarrassments are potentially fatal, rapid improvements after abdominal decompression have been reported [2, 4, 11, 13]. These clinical or radiographic appearances were mostly consistent with those seen in the cat documented in this report.

In this particular cat, continuous aerophagy due to severe rhinitis likely contributed to the massive accumulation of free abdominal gas via the perforated site. With progression, increased abdominal pressure might have led to difficulty in breathing with tachypnea and aerophagy, resulting in acute tension pneumoperitoneum. The contracted stomach seen on radiographs before abdominocentesis suggested markedly elevated intra-abdominal pressure. Serious cardiorespiratory embarrassments with hypothermia at that time were likely due to pneumoperitoneum rather than peritonitis or sepsis because the condition improved after abdominocentesis as reported in humans [11, 13].

The exact cause of gastric perforation in this cat is still unknown. The cat had no evidence of neoplasia, hepatic disease, or recent drug treatments, all of which are reportedly common predisposing causes of gastric perforation in cats [3, 9]. Middle aged or older animals often develop spontaneous gastrointestinal perforation with no detectable underlying disease [5, 7, 8]. Age-related gastric atrophy [7], gastric ulcers [6], or gastric dilatation [5] are also thought to be possible predisposing causes of perforation in aged animals, some of which might have existed in our case.

Radiographical evidence of pneumoperitoneum usually
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indicates a ruptured hollow viscus or bacterial peritonitis, for which prompt surgical exploration is recommended [1, 9, 10]. Saunders et al. postulated that gastroenterography or abdominocentesis are not necessarily needed as diagnostic procedures prior to surgery in animals with pneumoperitoneum [9]. However, in an unusual dog case, acute-progressing pneumoperitoneum without any detectable cause even on necropsy was reported [8]. In addition, idiopathic cases that survived without surgery have been reported in both humans [2] and animals [10]. Therefore, gastroenterography to confirm the perforation might be useful in ruling out idiopathic cases, which in our case contributed to the owner’s consent to the surgery.

Necessity of therapeutic abdominocentesis as emergency care has not been emphasized in previous reports [9, 10]. In this report, immediate abdominocentesis followed by supportive therapies were indispensable for improving the fatal physical condition observed before surgery. Similar, but less severe pneumoperitoneum, secondary to a perforated gastric ulcer and treated with abdominocentesis and surgery, was recently reported in a cat [6]. Therefore, as in humans, prompt abdominal decompression prior to surgery might be necessary for animals with tension pneumoperitoneum, and exploratory surgery should be performed after stabilization of cardiopulmonary status has been obtained.

REFERENCES