



## CASE REPORT

### Giant Duodenal Diverticulum Associated with Lymphoma in a Dog

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#### ABSTRACT

A 2-year old, 14-kg intact female Jindo dog was referred with a 1-month history of anorexia, weight loss, lethargy, and melena. On physical examination, the patient had pale mucous membranes and a low body condition score. Radiographic and ultrasonographic examinations revealed a large mass containing mineral density materials and peritoneal free fluid within the abdominal cavity. Fine-needle aspiration of the mass-like lesion was performed and the cytologic interpretation was gastrointestinal lymphoma. The diagnosis was gastrointestinal lymphoma with septic peritonitis. The decision was taken to resect the mass. Abdominal exploration revealed a large amount of septic fluid and a hollow structural mass adherent to the omentum on the antimesenteric duodenal border. Duodenal resection and anastomosis was performed. Histopathologic examination noted largely effaced tissue architecture and confirmed lymphoma. Immunohistochemical staining indicated that the mass was a high-grade B-cell lymphoma. This is the first description of canine duodenal diverticulum with malignancy.

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#### INTRODUCTION

Malignant lymphoma or lymphosarcoma is one of the most commonly diagnosed neoplasms in dogs. The prevalence of lymphoma has been estimated to be in the range of 13-114 per 100,000 dogs at risk (Zandvliet, 2016) and to account for approximately 8.5-9% of all canine tumors (Ettinger, 2003). Lymphoma can occur in almost any organ, so can be associated with a wide variety of histories and clinical signs. Four anatomic variations of canine lymphoma have been described, including multicentric, gastrointestinal, mediastinal, and extranodal forms (Ettinger, 2003).

Approximately 80% of dogs with lymphoma develop the multicentric form of the disease, which is usually characterized by superficial lymphadenopathy. The gastrointestinal form of lymphoma is much less common, accounting for 5-7% of all canine lymphomas (Zandvliet, 2016). Vomiting, diarrhea, anorexia, weight loss, and malabsorption are commonly associated with gastrointestinal lymphoma, in which malignant lymphocytes proliferate in a multifocal and diffuse manner in the submucosa and lamina propria of the small intestines

(Zandvliet, 2016). Primary gastrointestinal lymphoma in dogs may occur focally but usually involves multiple segments, with thickening of the intestinal wall, narrowing of the lumen, and frequently mucosal ulceration. Ulcers of the intestinal mucosa, sometimes with necrotic centers, have been reported in association with lymphoma. And secondary association of the gastrointestinal diverticulum with duodenal ulcer have been reported (Knoefel and Rattner, 1994). This complication, however, is extremely uncommon in veterinary medicine.

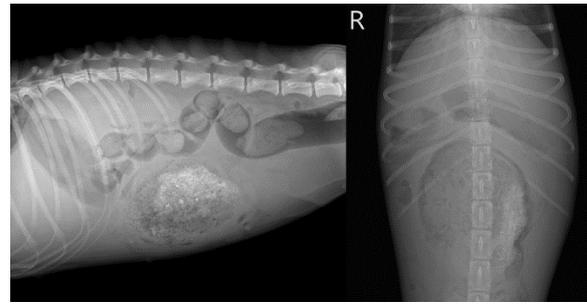
This present report describes the clinical findings in a dog with a giant duodenal diverticulum and a concomitant gastrointestinal lymphoma.

**Case history and surgical intervention:** A 2-year-old, 14-kg intact female Jindo dog was referred with a 1-month history of anorexia, weight loss, lethargy, and melena. On physical examination, the patient was depressed and had fever (39.2°C), pale mucous membranes, and a low body condition score (3/9). Vital signs were within normal limits. Laboratory investigations revealed severe anemia (7%), severe systemic inflammation (C-reactive protein 45 µg/mL, reference range [RR] 10-20 µg/mL), elevated liver

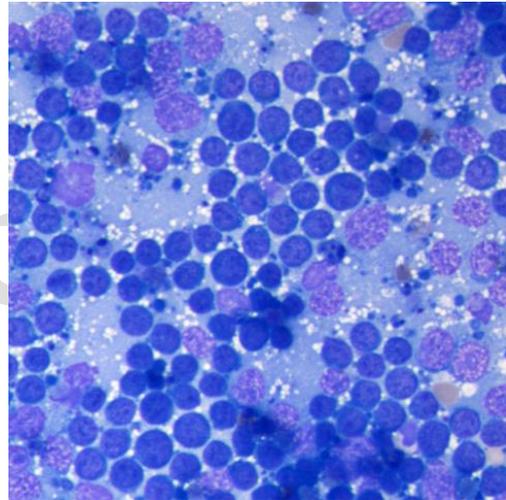
enzymes (alkaline phosphatase 825 U/L [RR 23–212 U/L], alanine aminotransferase 441 U/L [RR 10–100 U/L]), hypoalbuminemia (albumin 1.6 g/dL [RR 2.3–4.0 g/dL]), and hypoproteinemia (total protein 4.3 mg/dL [RR 5.2–8.2 mg/dL]). Radiographic examination revealed a cavitory mass-like lesion measuring 18 cm in diameter in the mid-line of the ventral abdomen (Fig. 1). Abdominal ultrasonography revealed that the wall of the mass-like lesion was irregularly thickened (up to 1 cm) and extended from the hyperechoic luminal surface to inside the wall with loss of normal wall layering. A small quantity of peritoneal free fluid was noted in the abdominal cavity. Ultrasound-guided fine-needle aspiration of the mass-like lesion was performed, and the cytologic interpretation was gastrointestinal lymphoma (Fig. 2). Analysis of the aspirated fluid indicated septic peritonitis. The diagnosis was gastrointestinal lymphoma with septic peritonitis. The decision was taken to resect the mass and perform an intestinal anastomosis. Prior to surgery, the patient was premedicated with tramadol (3 mg/kg; Toranzin, Shinpoong Pharm, Seoul, Korea) and butorphanol (0.2 mg/kg; Butorphan, Myungmoon Pharm, Seoul, Korea) for analgesia and with metronidazole (15 mg/kg; Flasinyl, CJ Pharm, Seoul, Korea), amoxicillin-clavulanate (13.75 mg/kg; Clavamox, Pfizer Animal Health, New York, NY, USA), and enrofloxacin (10 mg/kg; Baytril, Bayer Korea, Seoul, Korea) as antibiotic cover. Propofol (6 mg/kg; Provive, Myungmoon Pharm) was used for induction of anesthesia. Anesthesia was maintained with 2–3% isoflurane (Hana Pharm, Hwasung, Korea) and oxygen. On abdominal exploration, a large amount of septic fluid was identified, along with a hollow structural mass adherent to the omentum on the duodenal antimesenteric border and leakage of ingesta through the ruptured site (Fig. 3A, B). Intestinal resection and anastomosis of the duodenal diverticulum with a serosal patch were performed. The submitted specimen comprised a 5-cm length of duodenum containing a diverticular lesion (15 cm × 15 cm) accompanied by perforation with surrounding edematous change and mucosal ulceration (Fig. 3C, D).

Histologically, the transmural structure was obliterated by neoplastic lymphocytes. These cells have a small amounts of basophilic cytoplasm with round nuclei (1.5–2.5 times the diameter of normal red blood cells). Histopathology was consistent with lymphoma, high-grade (Fig. 4). Immunohistochemical staining was performed to characterize the neoplastic round cells further. These cells were diffusely positive for CD79a and negative for CD3, consistent with a diagnosis of high-grade B-cell lymphoma.

After removal of the stitches 10 days after surgery, the patient was started on the traditional CHOP (doxorubicin-cyclophosphamide-vincristine-prednisone) protocol for lymphoma. From the second day of the CHOP cycle onwards, there was a gradual improvement in the patient's vitality and an increase in body weight to 16 kg. The owner reported a positive clinical response, including improved clinical signs and quality of life. Unfortunately, 2 months after chemotherapy, the patient died suddenly after an abrupt deterioration in clinical status.



**Fig. 1:** Abdominal radiographic images showing a cavitory mass-like lesion in the mid-line of the ventral abdomen. (A) Lateral view. (B) Ventrodorsal view. The lesion measured 18 cm in diameter.

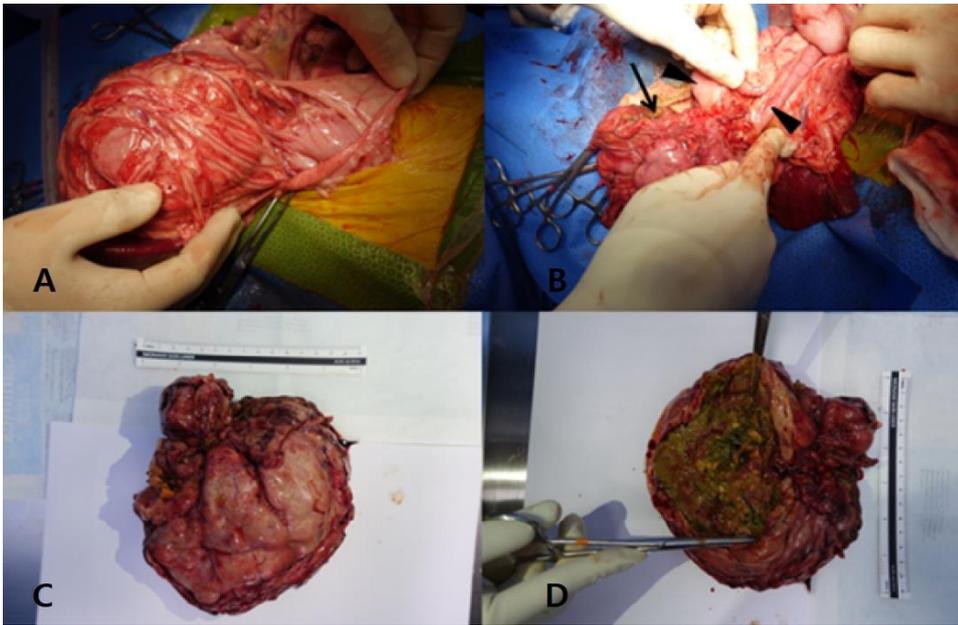


**Fig. 2:** Cytologic photograph of the abdominal mass. The biopsy specimen was highly cellular, with intermediate to large-sized lymphocytes. These cells had high N:C ratios with basophilic cytoplasm. The nuclei are round to oval with fine chromatic patterns and 1–3 prominent nucleoli. The cytologic interpretation was lymphoma. Diff-Quik stain. x100 objective.

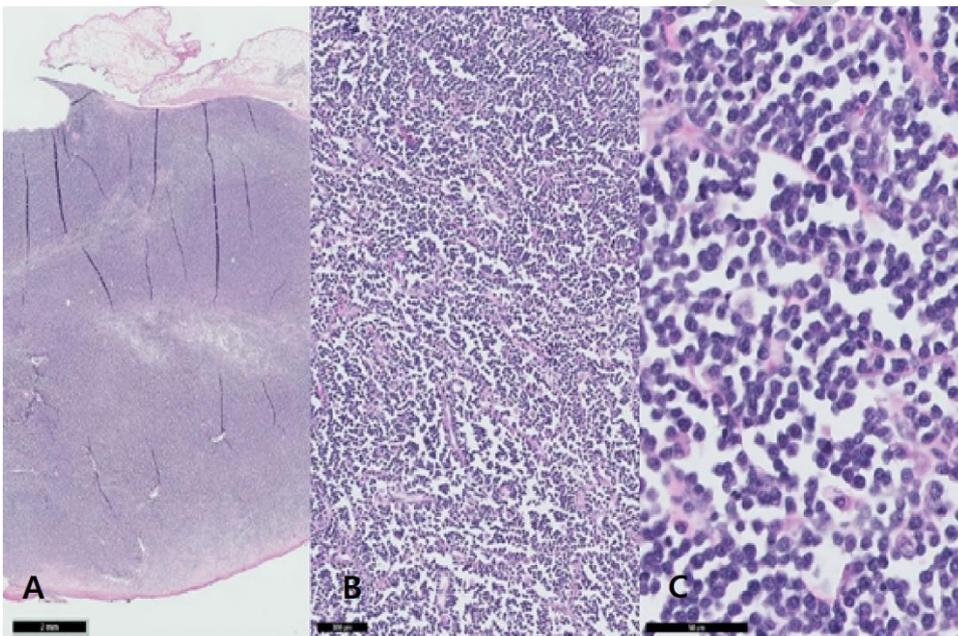
## DISCUSSION

Reports of canine duodenal diverticulum are rare in the veterinary literature. In a previous report, only one dog with duodenal diverticulum identified in a series of 13 dogs with intestinal diverticulum admitted between 1962 and 1988 (Ablin, 1991). Two case reports in the recent literature have mentioned intestinal diverticulum occurring in the duodenum in young boxers (Polf and Poteet, 2010; Van Klaveren *et al.*, 2008). Duodenal diverticulum accounts for about 5% of all gastrointestinal diverticula in humans (Knoefel and Rattner, 1994).

The etiology of intestinal diverticulum is not clear. True congenital diverticulum is a slight bulge in the small intestine that is present at birth and a vestigial remnant of the omphalomesenteric duct that connects the embryonic midgut to the yolk sac and normally atrophies when placental nutrition replaces the yolk sac (Nael *et al.*, 2014). Two other possible etiologies are mentioned in the human literature. The first is an embryologic pseudodiverticulum that does not include all layers of the bowel wall and arises because of a local weakening of the musculature. The second type is a true diverticulum caused by adhesion or extraluminal scarring related to peptic ulceration and is often located in the duodenum (Knoefel and Rattner, 1994).



**Fig. 3:** (A, B) Clinical photographs showing that the mass was adherent to the omentum on the antimesenteric duodenal border with leakage of ingesta through the ruptured site. The dilated portion of duodenum (arrow) is connected by two normal loops (arrowheads). (C, D) The submitted specimen comprised a 5-cm length of duodenum containing a diverticular lesion (15 cm × 15 cm) accompanied by perforation with surrounding edematous change and mucosal ulceration.



**Fig. 4:** Histologic photographs of the intra-abdominal mass. Transmural structure was obliterated by neoplastic lymphocytes showing cord-like arrangement. Neoplastic cells are intermediate to large-sized lymphocytes with small accounts of basophilic cytoplasm and round nuclei (1.5-2.5 RBC in diameter). H&E stain. (A) ×0.5 objective, (B) ×10 objective, (C) ×40 objective.

The initiating factor for the unusual development of duodenal diverticulum in the patient described in this report is unknown. However, it is possible that the bleeding in the duodenal wall was caused by lymphoma that may have weakened the duodenal musculature and led to a secondary diverticulum and melena. Diverticulum with malignancy is often reported in the human medical literature. Although the primary malignancy has been reported to occur in diverticulum of the ileum (Ablin *et al.*, 1991), a diverticulum found in other segments is presumed to be secondary to malignancy (Nael *et al.*, 2014). In the veterinary literature, there have been two reports of diverticula with malignancy in the jejunum in 4 horses (Mair *et al.*, 2011; Sherlock *et al.*, 2017). According to the report by Mair *et al.*, in 2011, a diverticulum measuring about 10 cm was found at autopsy after euthanasia in a horse that had previously undergone surgical exploration of the abdomen at which time no evidence of lymphoma or diverticulum had been found; the diagnosis was T-cell lymphoma by immunohisto-

chemistry following full-thickness biopsy to investigate malabsorption in the small intestine. That case, which had a clear posterior process, is believed to have reinforced the hypothesis that a diverticulum can occur secondary to malignancy.

Two major surgical approaches are recommended for the treatment of diverticula, i.e., diverticulectomy or full-thickness resection of the involved intestinal segment. Since the mid-1970s, diverticulectomy has not been recommended in humans because of the surrounding inflammation and possibility of a wide diverticular neck. However, full-thickness resection is reported to have a good surgical prognosis with fewer side effects (Custer *et al.*, 1999). In the patient described here, full-thickness resection was possible because the diverticulum was distant from the pancreas.

To conclude, this is the first description of canine duodenal diverticulum with malignancy. Although rare, this diagnosis should not be ruled out in patients with lymphoma accompanied by chronic anemia and melena.

**Authors contribution:** MK, YK, JC, YK, JK, HC performed the surgery and postoperative care. MK and NK held consultation, initial supportive and postoperative care. CJ and SK analyzed the pathologic figure and revised the manuscript. YK and MK wrote the manuscript. All authors read and approved the final manuscript.

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