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Belt Loop and Circumcostal Gastropexy Techniques of Canine Gastric Dilatation-Volvulus: 4 Cases

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Abstract : Four dogs were presented with the history of progressive abdominal distension and regurgitation. Survey abdominal radiographs revealed gastric dilatation-volvulus (GDV) with a distended, gas-filled stomach and double bubbles. The mean time from onset of clinical signs to presentation to a clinic was 3.25 hours. In three dogs, orogastric tubes were inserted and their stomachs were decompressed. However, we failed to insert the tube in the remaining one dog. Among these four dogs, gastrotomy was performed in two dogs to remove the gastric contents and to decompress the stomach additionally during surgery. The dogs with GDV were treated with belt-loop gastropexy (n=3) or circumcostal gastropexy (n=1) to prevent recurrence. Necrosis of gastric or splenic tissues was not observed during surgical intervention. All four dogs recovered uneventfully, and no recurrence was found in long term follow-up during 1~3 years.

Key words **:** Gastric dilatation volvulus, belt loop gastropexy, circumcostal gastropexy, dog.

Introduction

Gastric dilatataion-vovulus (GDV) is an acute, life-threatening condition of dogs that need immediate medical and surgical management. Breeds at highest risk include the Great Dane, Golden Setter, Irish Setter, Weimaraner, Saint Bernard, Standard Poodle, and Bassett Hound (1,6). GDV is characterized by a rapid accumulation of gas in the stomach, distention and malposition of the stomach, increased intragastric pressure which in turn lead to decreased venous return, portal hypertension and often cardiogenic shock (10,12). Aggressive therapy is required for dogs showing signs of GDV. Initial treatment consists of gastric decompression and therapy for shock to increase venous return to the heart (10,11). Surgical intervention is necessary for correction of visceral displacement and to prevent recurrence of GDV. Despite appropriate surgical intervention and intensive postoperative care, case-fatality rates as high as 15~18% have been reported (2). Thus, it is clear that shock therapy and gastric decompression should be considered only as first aid for dogs with GDV, and some forms of gastropexy is needed to prevent a recurrence and reduce mortality (10,11).

Surgical goals of treatment for GDV are to decompress the stomach, to correct the malposition and to fix the stomach that prevents recurrence of the GDV (10). Fixation methods for the stomach include tube gastropexy, belt-loop gastropexy, circumcostal gastropexy, gastrocolopexy and incisional gastropexy (4,10,15). Belt-loop gastropexy and circumcostal gastropexy, in which a flap of the pyloric antrum sutured around gastric wall or a rib, are used frequently. Although circumcostal gastropexy has several advantages compared with other techniques and has a stronger adhesion than other techniques, this technique is difficult to perform and the rib fracture can occur during the treatment (10). However, the belt-loop gastropexy is much easier and quicker to perform compared to the circumcostal gastropexy (14,15). In the present report, we described 4 cases of GDV in dogs treated with belt-loop or circumcostal gastropexy. We also described the influence of these two procedures on postoperative recovery and recurrence.

Case Study

Four dogs with GDV were referred to the Konkuk University Veterinary Teaching Hospital. The range of body weight of the dogs was between 22 kg and 60 kg. The age of dogs varied from 7 to 10 years, with a mean age of 7.75 years. The history of clinical signs included a progressive abdominal distension (n=4) and regurgitation (n=3) (Table 1).

On physical examination, the dogs revealed abdominal enlargement, hypersalivation, prolonged capillary refill time, pale mucous membranes, and weak femoral pulse. CBC showed decreased PCV in two dogs (cases 1,3) and mild leu-

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Table 1. Signalment, surgical methods of gastropexy and prognosis of four dogs with GDV.

Case No	Breed	Age (yrs)	Time from onset of clinical signs to surgery (hrs)	Body weight (kg)	Sex	Gastropexy	Follow-up (yrs)
1	Old English Sheep	7	3	33	Female	Belt-loop	3
2	Golden Retriever	10	3	30	Male	Belt-loop	1
3	Shepherd	7	5	33	Female	Belt-loop	3
4	Great Dane	7	2	60	Male	Circumcostal	1

Table 2. Hematologic and serum chemistry profile of 4 dogs with GDV.

Parameter	Reference range	Case 1	Case 2	Case 3	Case 4
RBC count × 10^6/μl	5.5~8.5	3.96	7.26	4.10	7.08
Hemoglobin (g/dl)	12~18	7.7	16.9	8.2	17.1
Hematocrit (%)	37~55	24.9	53	23.5	44
MCV (fl)	60~74	62.9	73.3	56.6	62.9
MCH (pg)	19.5~24.5	19.4	23.3	20.0	24.2
MCHC (g/dl)	31~36	30.9	31.8	35.3	38.4
WBC count × 10^3/μl	6~17	9.88	21.4	33.12	10.74
Platelet × 10^3/μl	200~500	185	53	212	185
BUN (mg/dl)	9.2~29.2	40.4	30.2	20.8	18.3
Creatinine (mg/dl)	0.4~1.4	1.1	1.4	0.6	0.9
ALT (U/L)	17~78	37	466	61	49
AST (U/L)	17~44	49	509	55	58
ALP (U/L)	47~254	147	154	443	185
CK (U/L)	49~166	303	169	754	194
GLU (mg/dl)	75~128	141	133	114	125
TP (g/dl)	5.0~7.2	5.4	6.4	6.5	7.5
ALB (g/dl)	2.6~4.0	2.5	2.8	3.1	3.0
Potassium, (mmol/L)	3.8~5.0	4.0	3.6	3.5	4.1
Sodium (mmol/L)	141~152	144	146	139	151
Chloride (mmol/L)	102~117	105	114	98	116

RBC, red blood cell; MCV, mean corpuscular volume; MCH, mean corpuscular hemoglobin; MCHC, Mean corpuscular hemoglobin concentration; WBC, white blood cell.

kemia in two dogs (cases 2, 3). In serum biochemistry, elevations were found in CK (n=4), ALP (n=1), AST (n=4), ALT (n=1), BUN (n=2), TP (n=1) and glucose (n=2). The details of CBC and the serum biochemistry are shown in table 2.

Abdominal survey radiographs revealed a distended, gas-filled stomach. The reverse C sign (case 2 and 3) and double bubbles caused by the shelf of tissue were observed on right later view (Fig 1).

All four dogs were received fluid therapy with dopamine (Tropin®, Hanlim Pharm. Co. Ltd., 5 μg/kg/min), and were premedicated with midazolam (Dormicum®, F. Hoffmann-La Roche Ltd, Switzerland, 2 mg/kg, IV). Anesthesia were induced with propofol (Anepol®, Hana Pharam Co., Ltd., Korea, 6 mg/kg, IV, cases 1~3) or etomidate (Etomidate-Lipuro®, B. Braun Melsungen AG, Germany, 2 mg/kg, IV, case 4) and maintained with isoflurane (Forane®, Rhodia Orgranique Fine Ltd., Korea) in oxygen. An orogastric tube was inserted in three dogs (cases 1~3), the stomach was decompressed of gas, but in a dog we failed to insert tube and decompress stomach.

Surgical treatments were performed as soon as the animal's conditions have been stabilized. The mean time from onset of clinical signs to surgery was 3.25 hours. A midline cranial celiotomy were performed. Clockwise GDV were apparent. In two dogs (cases 2 and 4), a small gastrotomy was performed to remove the gastric contents and to decompress the stomach. Once the stomach had been decompressed, malposition of the stomach was corrected. Necrotic gastric tissues or splenic necrosis was not observed during surgical intervention. To prevent recurrence of GDV, belt-loop were performed in three dogs (case 1~3), circumcostal gastropexy was performed in one dog (case 4).

For belt-loop gastropexy, a seromuscular flap was elevated from the gastric antrum. And two transverse incisions were made in the ventrolateral abdominal wall and a tunnel under abdominal musculature was made with forceps (Fig 3A). The

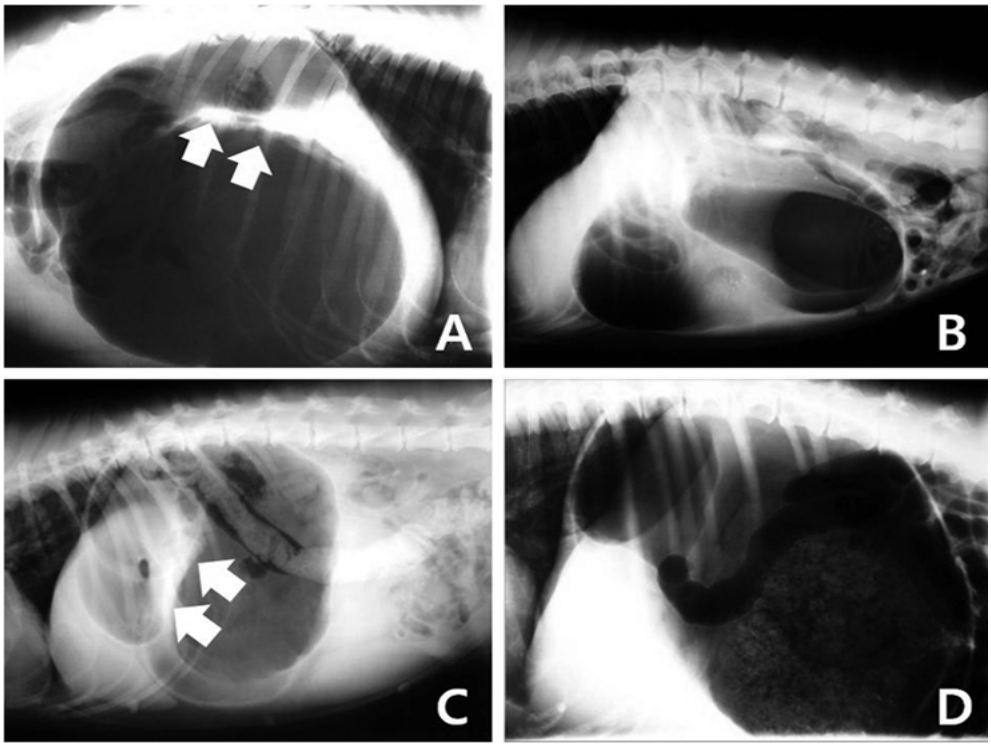

Fig 1. Right lateral radiographs of the four dogs ((A) case 1; (B) case 2; (C) case 3; (D) case 4) with GDV showing a distended, gas-filled stomach. The pylori were separated from the rest of the stomach by soft tissue (arrows).

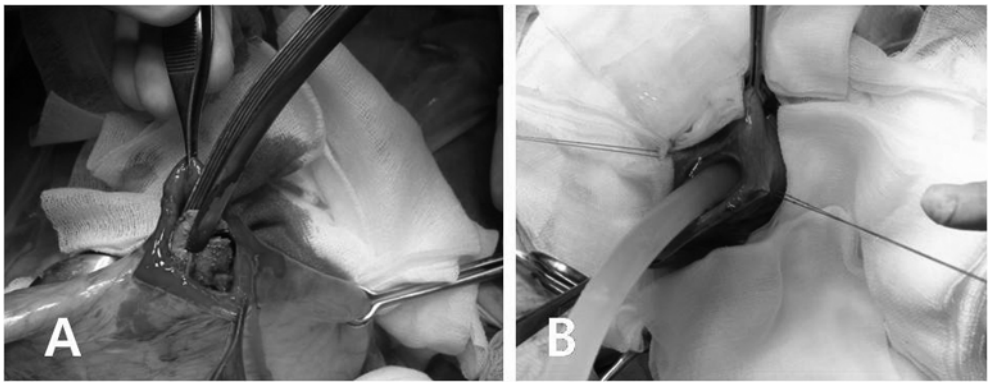

Fig 2. Gastrotomy in case (A) 2 and (B) 4. Gastrotomy performed to remove the gastric contents and to decompress the stomach.

gastric antral flap passed from cranial to caudal under the muscular flap. And the gastric antral flap was sutured to its original gastric margin with simple interrupted suture pattern using 2-0 absorbable suture (Fig 3B).

For circumcostal gastropexy, one layer hinged flap was made from the gastric antrum. And a 5~6 cm incision was made over the eleventh rib at the level of the costrochondral junction. A tunnel under the rib was made using forceps (Fig 4A). The gastric antral flap passed craniodorsal under the rib and was sutured with 2-0 absorbable suture (Fig 4B).

The peritoneum was closed with 2-0 absorbable suture in a simple interrupted suture pattern, the subcutaneous tissues were closed with 2-0 absorbable in a simple continuous suture pattern, and the skin was apposed with staples. Post-operative analgesia (buprenorphine, Renolpan®, Hanlim, Korea, 10~20 μg/kg, IM) and fluid therapy were applied, and all dogs recovered uneventfully. At telephone contact 1~3 years following surgery, the owners reported the dogs had a normal appetite, attitude, activity, and no recurrence of GDV (Table 1).

Discussion

In a previous study, dogs with clinical signs for > 6 hours prior to examination had a significantly higher risk of having gastric necrosis (1). Gastric necrosis was found to be a pre-

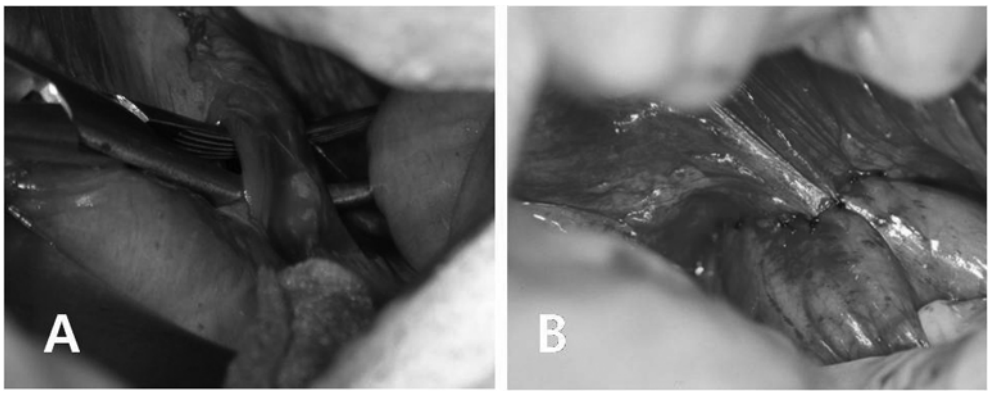

Fig 3. The belt loop gastropexy in case 2. (A) Two transverse incisions were made in the ventrolateral abdominal wall and a tunnel under abdominal musculature was made with forceps. (B) The gastric antral flap was sutured to its original gastric margin.

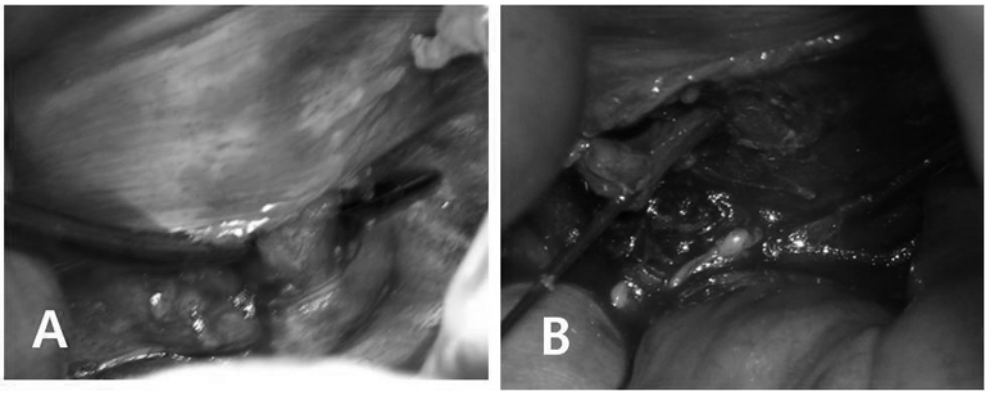

Fig 4. Circumcostal gastropexy in case 4. (A) Incision made over the rib at the level of the costrochondral junction. A tunnel under the rib made using forceps. (B) The gastric antral flap passed craniodorsal under the rib and sutured.

dictor of postoperative complication and death in GDV indicating the important role of ischemic hypoperfusion in the progression (1,2,15). In contrast, another study that examined the duration of clinical signs has not found a significant effect on risk of death (7). In the four cases of GDV described in this report, the time from onset of clinical signs to presentation to a clinic was below 6 hours. Because decompression with an orogastric stomach tube was not achieved completely in case 2 and 4, a gastrotomy was needed to decompression additionally and to remove the gastric contents (Fig 2). Necrotic gastric tissues and splenic necrosis were not observed during surgical intervention. All four dogs recovered uneventfully after surgical intervention. Considering all these factors, we suggest that the time factor and the viability of gastric tissue were associated a good outcome in present report.

In this study, two surgical techniques were advocated to prevent recurrence of GDV. Circumcostal gastropexy forms a stronger adhesion and a more proper anatomic placement of the stomach (10). However, there are possible complications including pneumothorax and rib fracture, when the operation is performed by surgeons who are inexperienced with the technique.

Belt loop gastropexy is a modification of the circumcostal gastropexy. The technique differs from the circumcostal gastropexy in that the seromuscular stomach flap is passed around a belt loop of transverse abdominal muscle located just caudal to the last rib rather than around the rib itself (11,12).

The recurrence rate of GDV is 42% to 77.8% in dogs that have survived an acute episode of GDV, without a gastropexy (3,13). Various surgical techniques to reduce the likelihood of recurrence of GDV have been advocated, and most of these techniques involve fixation of the stomach to the body wall. One study reported a 92% reduction in the risk of recurrence of GDV following gastropexy when compared with the dogs that were treated by conservative treatments (7). However, the strength and extent of adhesions created by these techniques differ, and some recurrence of GDV are reported in each gastropexy techniques; reported recurrence rates are 3.3 ~ 9% for circumcostal gastropexy (4,20,21), and 5.6% for belt-loop gastropexy (13). A high rate of recurrence must be expected after conservative decompression of the stomach with a gastric tube. In the studies of Fox et al (5), 17.6% of the dogs had a relapse after tube gastrotomy. Recently, Hammel et al (9) reported a case with recurrence of GDV at 4 months after incisional gastropexy. They suggested that chronic stress on the site after some healing had

taken place in the case, rather than an acute failure where hemorrhage and evidence of tearing might be expected (9). The multiple attachments made to the body wall might interfere with normal distension and collapse of the stomach after a meal. However, bilateral incisional gastropexy has been reported to eliminate gastric migration after intermittent gastro-esophageal intussusception in an 8-week-old Siberian husky, with good results (8).

Though the choice of a particular gastropexy technique is largely dependent upon a personal preference, the surgeon should consider either belt-loop or circumcostal gastropexy to reduce recurrence rate of GDV. Further studies with large number of cases and long term follow-up may help identify the advantages and disadvantages of belt-loop and circumcostal gastropexy in the treatment of GDV.

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