Case Report

Surgical treatment for tubular colonic duplication communicating to retroperitoneal space in an adult dog

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Abstract

Canine colonic duplication is a rare congenital anomaly, usually symptomatic in the first year of life, with the common signs of bowel obstruction. Most importantly, colonic duplication in an adult dog has not been reported. This case document reports a non-communicating tubular colonic duplication with concurrent retroperitoneal mass in a 3-year-old female crossbred dog, presented for further diagnosis and treatment of the abdominal mass. Without any remarkable clinical signs, physical examination noted only abdominal distension with mild discomfort. Ultrasonography demonstrated a large mass in the mid-caudal abdomen, a tubular mass appearance on the colonic wall and the presence of peritoneal effusion. An exploratory laparotomy revealed a colonic tubular mass without communication with the true lumen. An opening tract from the tubular mass to a massive distended retroperitoneal sac was identified with a ruptured area. Surgical removal of the retroperitoneal sac and partial colectomy of the conjoined part were accomplished with full recovery and normal defecation within 12 months of the follow-up processes. The diagnosis of a non-communicating tubular colonic duplication was confirmed by the histopathological result. In consideration of the abdominal mass, colonic duplication should be listed as a differential diagnosis in any age of dog. Other associated abnormalities should be included in the investigation, in order to prevent any complications. Surgery is recommended to achieve a final diagnosis and an applicable treatment for successful outcomes.

Keywords: colonic duplication, dog, partial colectomy, retroperitoneal space

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Introduction

Colonic duplication is a remarkably rare congenital malformation in veterinary medicine, and there have been only eight publicly reported single cases in dogs (Jakowski, 1977; Longhofer et al., 1991; Lorinson and Lorin, 1995; Shinozaki et al., 2000; Arthur et al., 2003; Landon et al., 2007; de Battisti et al., 2013; Fernandez et al., 2017), one in a horse (Bassage et al., 2000) and one in a cat (Kramer et al., 2007). Other concurrent congenital abnormalities, including cecal malformations, urogenital duplications and spinal column abnormalities were noted in the first three canine cases, which were untreated and euthanized (Jakowski, 1977; Longhofer et al., 1991; Lorinson and Lorin, 1995). All of the previous canine reported cases were young patients. Clinical signs of colonic duplication are nonspecific, varying from asymptomatic to severe progressive signs, depending on location and the association of the duplicated segment with other abdominal organs. The varieties of symptoms often include defecation problems such as rectal prolapse, dyschezia, tenesmus and constipation; and other signs of gastrointestinal occlusion, abdominal distention and pain. A number of imaging techniques e.g. barium enema, colonoscopy, abdominal ultrasonography and negative contrast computed tomography have been used for diagnosis in veterinary medicine. Moreover, exploratory laparotomy, gross examination and histopathological evaluation are considered procedures for final diagnosis and type identification. Treatment of this condition depends on type, location, shape, and size of the duplication (Fernandez et al., 2017). Previously in dogs, five of eight cases had surgical correction performed with various procedures (Shinozaki et al., 2000; Arthur et al., 2003; Landon et al., 2007; de Battisti et al., 2013; Fernandez et al., 2017) and all of them were single colonic duplication without other concurrent problems.

This case document is the first to describe the concomitant conditions of tubular non-communicated colonic duplication with a connecting tract to form a retroperitoneal mass in an adult dog. Surgical excision of the retroperitoneal sac and partial colectomy were performed as treatments with successful outcomes.

Case description

A 3-year-old 12-kg intact female crossbred dog was presented with a week history of abdominal distension at the Kasetsart University Veterinary Teaching Hospital (KUVTH), Bangkaen campus. Referral radiography noted the presence of a large, soft opacity tissue extending from the mid- to caudal abdomen, whereas ultrasonography revealed a dilated colon with hyperechoic content. Abdominal mass with megacolon, severe constipation, colonic obstruction and intestinal mass were suspected primarily.

On physical examination, abdominal distention and firmness were noted. On palpation, mild discomfort was elicited without any remarkable abnormalities. A complete blood count and serum biochemistry results were within normal limits. Abdominal ultrasonography at KUVTH identified a large pear-shaped structure in the retroperitoneal space filled with mix echogenic content located near the right kidney (Figure 1). One part of the colon showed a thickened wall with the focal tubular mass effect on it. An amount of mix echogenic peritoneal effusion was detected in the caudal part of the abdomen. Intestinal mass with severe obstruction and intestinal leakage were suspected. Exploratory surgery was performed for diagnosis and treatment on the same day of referral.

Prior to surgery, the dog was given a systemic antibiotic of marbofloxacin (4 mg/kg, IV; Marbocyl®, Vetoquinol, France) at the outpatient department. Premedication of midazolam (0.15 mg/kg, IV; Midazolam Sandoz®; EVER Pharma Jena GmbH, Germany) and morphine (0.5 mg/kg, IM; Morphine Sulfate Injection; M & H Manufacturing, Co., Ltd. For Food and Drug Administration, Thailand) were administered. Anesthesia was induced with propofol (2 mg/kg, IV; Troypofol®; Troikaa Pharm., Ltd., India) and maintained with isoflurane (Attane™; Piramal Critical Care, Inc., USA) in 100% oxygen. A loading dose of ketamine (0.5 mg/kg, IV; Ketamine-Hameln, Hameln Pharm. Gmbh, Germany) and lidocaine (1 mg/kg, slow IV; Locana, L.B.S. Laboratory, Ltd., Thailand) was administered followed by intravenous constant rate infusions of a mixture of morphine (0.3 mg/kg/h), lidocaine (50 µg/kg/min) and ketamine (10 µg/kg/min) (MLK) in isotonic crystalloid fluid at 10 ml/kg/h.

On abdominal exploration, a single tubular (10 x 3 cm)-cavitary mass was grossly found attached to the right side of the descending colon and extended in parallel from the cranial part to approximately 4 cm. cranial to the pelvic inlet (Figure 2). The mass was equal in size of a diameter to the colonic tube and adhered with both mesenteric- and antimesenteric borders. A shallow depression was detected as a septal wall on both borders between them with multiple branches of vessels presented on the grooves. There was blood supply sharing on attachments along the length of the segment. Functionally, the true colon had a normal outflow without obstructive evidence. At the distal end of the mass, there was an opening tract communicating with the retroperitoneal space, which was distended massively to be a large sac was approximately 10 x 15 cm in size. The retroperitoneal sac located in the right mid- to the caudal abdomen and contained a large volume of light, brown, mixed mucous fluid with a dark brown substance. The ruptured opening hole of the sac was found at the distal end near the level of the bladder, where the fluid was leaking into the caudal abdominal cavity. The fluid was collected for cytological evaluation and bacteriologic culture. To identified the communication on the adhered site of the colonic tube, the retroperitoneal sac was incised adjacent to the opening distal end of tubular mass and a finger was inserted into the tubular lumen to investigate. There was a complete septal wall along the length and the cranial end of the tubular mass terminated in a blind pouch limited to the descending colon. Other abdominal organs were examined and appeared to be normal. The retroperitoneal mass was excised by undermining it free from the other retroperitoneal structures. The right

kidney, ureter and other retroperitoneal structures were examined and abnormalities were not detected. A partial colectomy was performed to remove the conjoined segment. The lumen of the descending colon was occluded at 4 cm from both ends of the adhered site after the fecal content had been milked away from the lumen. The vasa recta vessels were ligated at the point of transection and the major colic vessels were preserved intact. The descending colon was excised unreservedly approximately 3 cm cranially and caudally to the conjoined part. The tissues were submitted for histopathological evaluation. End-to-end anastomosis was performed by full thickness one-layer closure with 4-0 polydioxanone suture in a simple interrupted pattern. The leakage was checked thoroughly and the mesenteric defect was closed. The abdomen was irrigated with warm isotonic saline solution. A closed active suction drain (MILA International Inc., USA) was placed into the abdomen to establish peritoneal drainage and the abdomen was closed routinely.

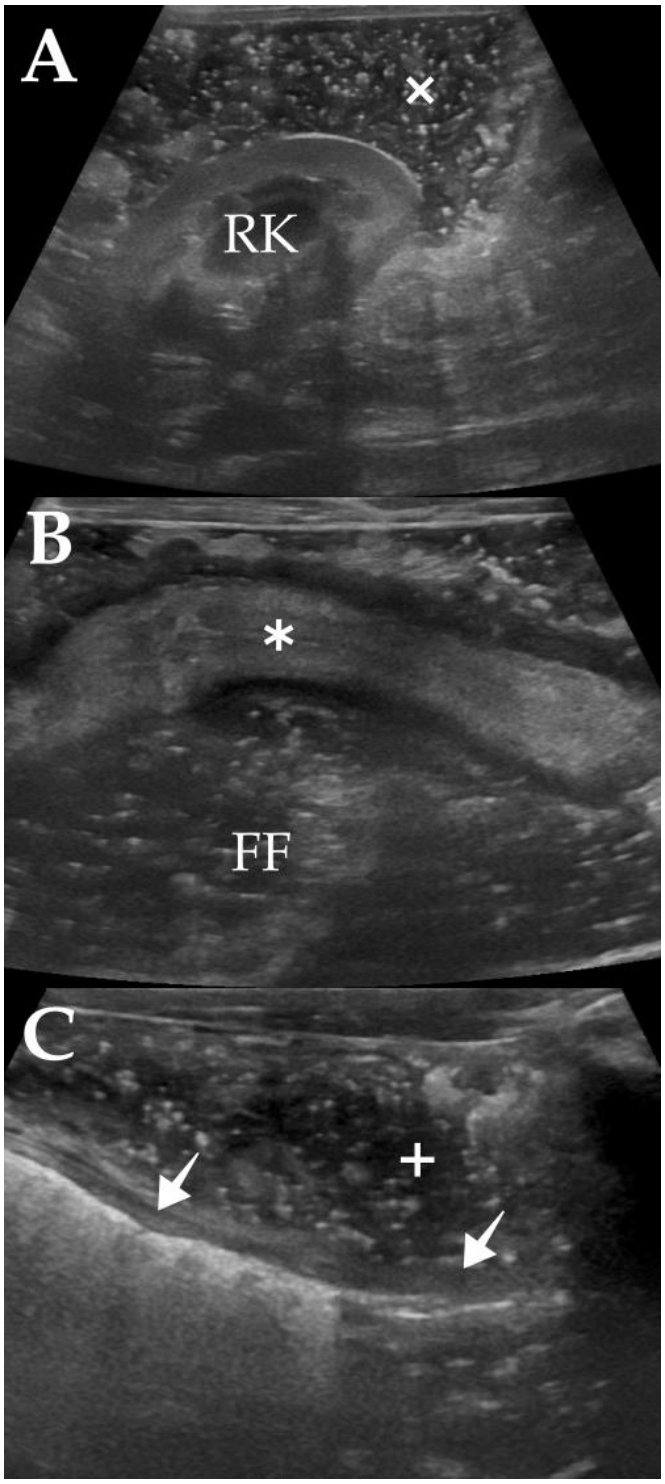

Figure 1 **Sagittal ultrasonographic images of mid-(A) and caudal abdomen (B) (C):** Notice a large fluid-filled area with a mixture of echogenic cellular components located in the retroperitoneal space (X marker) near the right kidney (RK). The peritoneal free fluid (FF) is visible near the descending colon (asterisk). Focal fluid-filled tubular mass effect (cross) is evident on some part of the colonic wall (arrows).

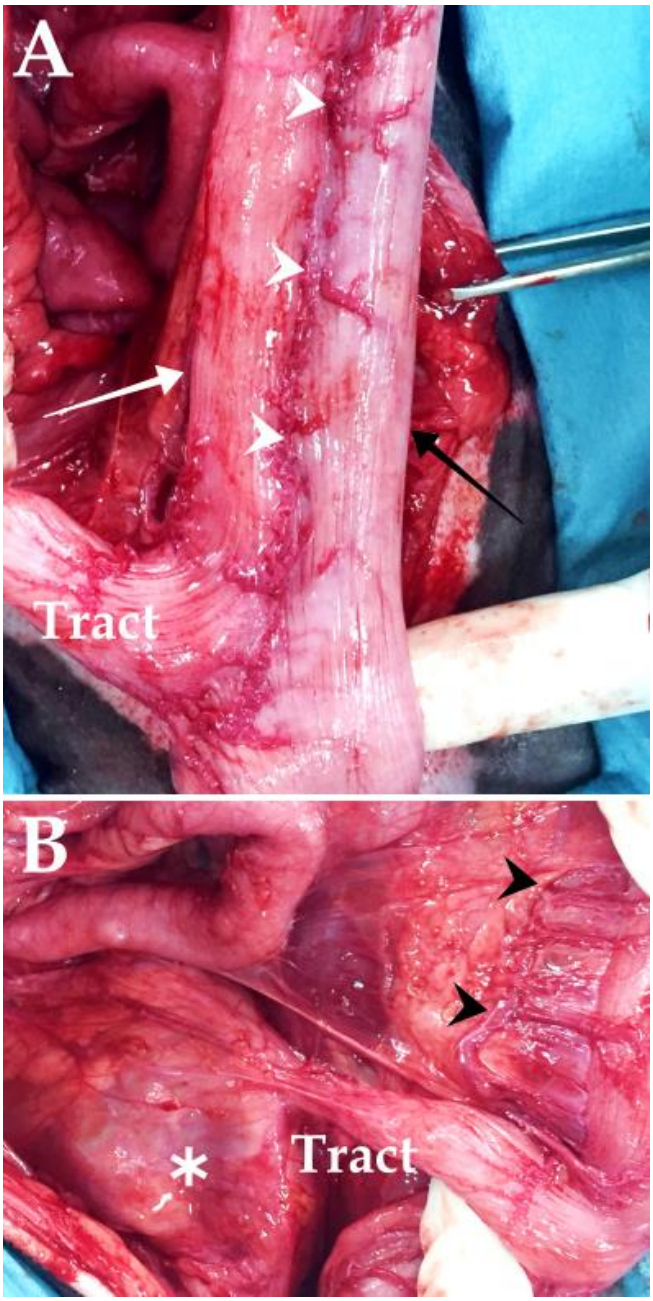

Figure 2 **Intraoperative photographs of mid-to caudal abdomen:** (A) An equal-sized duplicated colon (white arrow) is present on the right border of the descending colon (black arrow), the branches of vessel are visible along the groove on the antimesenteric conjoined area (white arrowheads) and the tract is shown at the distal end of the duplicated lumen (Tract). (B) The right lateral view of the descending colon shows the sharing blood supply on the mesenteric border (black arrowheads), the connecting tract (Tract) communicating to the retroperitoneal space and the accumulated fluid-filled retroperitoneal sac (asterisk).

Recovery from surgery happened uneventfully. The dog was treated postoperatively after admission in the KUVTH critical care unit. Defecation was noted as normal initially. One week after surgery diarrhea and tenesmus were presented but then resolved gradually over a week. The close active suction drain was removed after 12 days postoperatively. The dog had normal defecation and improved in appetite leading to a gain in weight up to 15 kg (6 months after surgery). During the 12 months of the postoperative follow-up, the condition was good and there were no other abnormal findings on physical examination.

No growth occurred on the bacterial culture of the peritoneal effusion that leaked from the retroperitoneal mass. The cytology result was mucinous non-septic suppurative inflammation. Histopathologic examination of the tubular lesion found two lumens separated by a septum. The walls of these tubular structures were composed of mucosa, submucosa and both circular and longitudinal muscular layers which were similar to the normal colon. The mucosa was lined with mostly goblet cells. Lymphocytes and plasma cell infiltration were presented throughout this layer. There were multiple foci of mucosal ulceration. Moreover, some part of the septum were composed of loose connective tissue as

the serosal layer with blood vessels (Figure 3). The diagnosis of non-communicating tubular colonic duplication was made as a conclusion from the gross lesion and histopathological pattern in this dog.

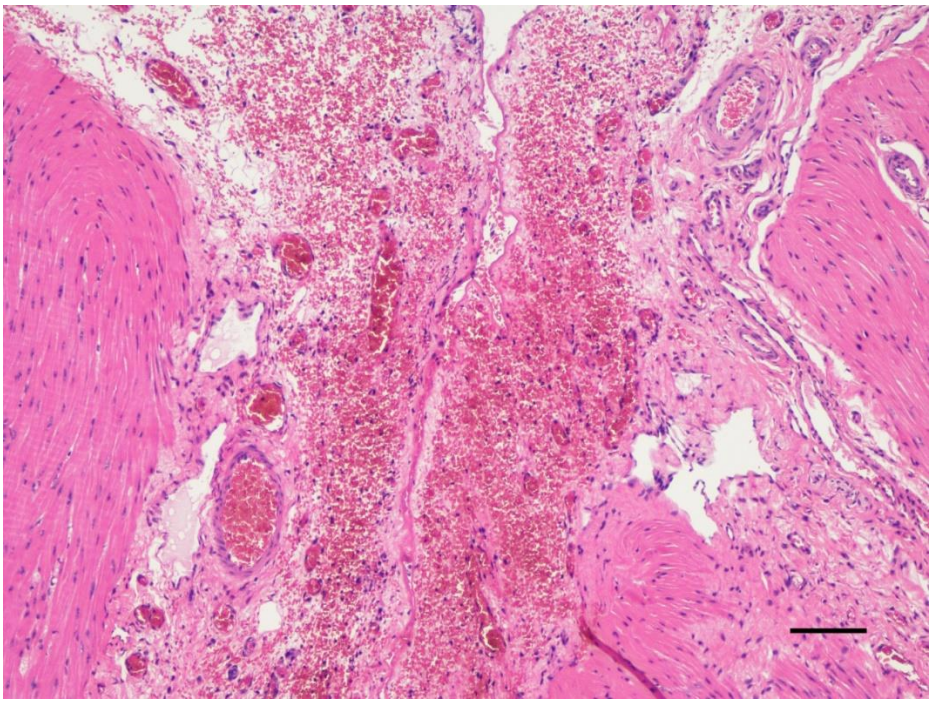

Figure 3 **Photomicrograph of a section of the conjoined septum of the duplicated colon:** Loose connective tissue with blood vessels as the serosal layer of the colon is present in some part of the septum and discontinuous. Moderate hemorrhage and edema of the septum is observed. H&E stain; bar = 100 μm

Discussion

Because of the rarity of canine colonic duplication, the classification system has to be referred from human medicine. Briefly, this congenital malformation can be categorized into two types as type I and II mean without and with other anomalies, respectively, while the duplication may or may not communicate with a true colon in both types. In type I, the shape of the duplicated form is defined as a. spherical, b. tubular, c. double-tubular with communications, d. loop duplication with separate blood supply and e. multiple duplications (mixing of a., b. and c.) (Kottra and Dodds, 1971) (Figure 4). In human type II hindgut duplication mostly occurs with urogenital and musculoskeletal malformation (Landon et al., 2007; Banchini et al., 2013). In previously reported canine cases, three of them were type II (Longhofer et al., 1991; Lorinson and Lorin, 1995; Jakowski, 1997) and four of them were type I with communications (Shinozaki et al., 2000; Landon et al., 2007; de Battisti et al., 2013; Fernandez et al., 2017). There was only one reported case of a type I non-communicating form without other abnormalities (Arthur et al., 2003). Moreover, other alimentary duplications have been reported in canine cases (Spaulding et al., 1990).

The duplication in this case was different. A type Ib colonic duplication was suspected by A gross appearances. However, the fistula from the non-communicating duplicated colon to retroperitoneal space make the classification in this case unclear. In a female child with long segment colonic duplication, a rectovaginal, rectovulvar, or rectoperineal fistula notably presented (Kaur et al., 2004) but a tract to retroperitoneal space is unseen in any record. In this dog, it is assumed that the fusion between the duplicated colon and retroperitoneal space may had been a result of the defect during embryogenesis like other defects that usually present together with alimentary duplication (Spaulding et al., 1990; Arthur et al., 2003). Conversely, this fusion also may happen after a burst of the over-distended lumen of type Ib duplicated colon after birth. Nevertheless, the etiologies of this congenital defect in the canine case should be investigated more in future.

Colonic duplication generally is detected in juveniles especially when the patient shows clinical signs of gastrointestinal obstruction, defecation problems or other abnormal organ systems; including urogenital and skeletal abnormalities (Landon et al., 2007). However, signs can be hidden continuously for years until clinical problems show up (Fotiadis et al., 2005; Banchini et al., 2013). In dogs, this is the first report of colonic duplication in an adult (3 years old). In consequence of the connection of the duplicated colon with retroperitoneal space, duplicated lumen was able to constantly drain self-produced content out and did not distend to compress the true lumen or other organs nearby. The fecal movement in the true colon was not diminished and the dog could urinate normally. With this incidence, the common clinical sign of duplication defect was unidentified and the dog could endure suffering from colonic duplication until its maturity. This case shows that the onset of clinical signs depends on type, location and organ association. Additionally, colonic duplication cases may not show the signs of gastrointestinal or defecation problem and can be presented in the young adult case.

Radiography and ultrasonography have been used as prior diagnostic procedures in cases of these abnormalities but some imaging results can lead to misdiagnosis (Banchini et al., 2013). Even computed tomography confirmedly reported more precisely in canine colonic duplication investigation (de Battisti et al., 2013; Fernandez et al., 2017), exploratory laparotomy still has to be performed for final evaluation and treatment. Because of the limited detail on the source of peritoneal effusion and the colonic abnormalities ultrasonographically in the dog of this report, the exploratory laparotomy was most appropriate.

The first three cases, which were type II colonic duplication, were untreated and euthanized. The other five cases had surgical treatments performed. Three of them were communicating types and the surgical procedures included incision of the common septum (Shinozaki et al., 2000) mucosal stripping (Landon et al., 2007) and excision of the common septum (de Battisti et al., 2013). The fourth case was a non-communicating colonic duplication with lack of shared blood supply, excision of the duplicated tube was performed and the colonic wall was reinforced and repaired with porcine small intestinal submucosa (Arthur et al., 2003). According to our case's detail, there was the complete common septal wall and the equal-sized duplicated tubular adhered to both mesenteric- and antimesenteric borders of the true lumen. Similar to the recent publicity (Fernandez et al., 2017), there was fully shared blood supply on the adherent site, thus, the partial colectomy was preferred for treatment, in this case, to prevent vessel damage complication postoperatively. In addition, excision of the common septum in our case may obtain the double sized diameter of the new colonic tube with the questionable function of half part of the lumen that was the duplicated lumen, in which the intestinal content had never been passed through before. Moreover, there have been incidences of malignant transformation associated with the alimentary duplication in human cases (Orr and Edwards, 1975; Hickey and Corson, 1981; Horie et al., 1986) the incidence in the veterinary literature, until now, have not been reported. For all of these reasons to prevent future complications, partial colectomy tended to be the recommended choice of surgical procedure in this case.

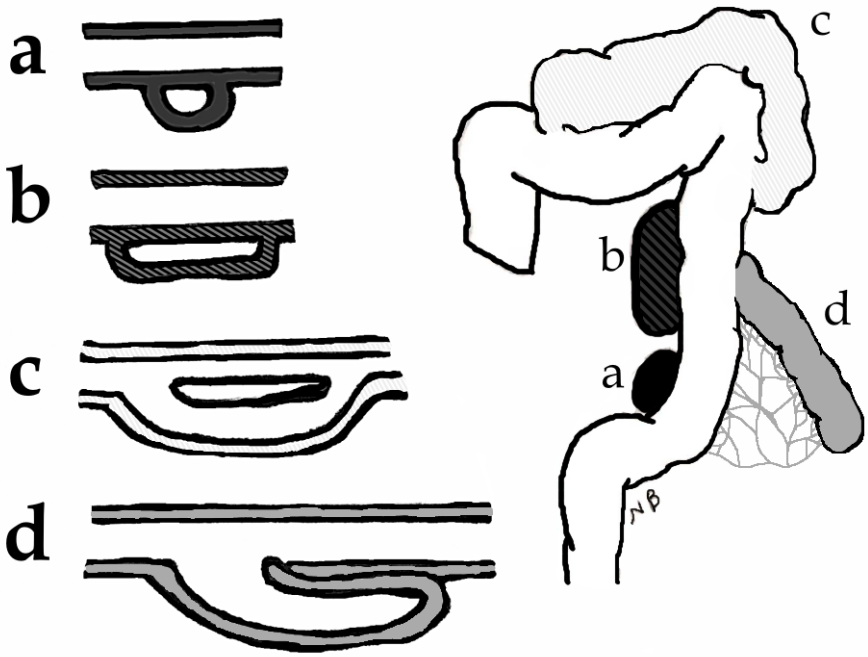

Figure 4 **Type I colonic duplications:** (a) spherical, (b) tubular, (c) double-tubular with communication(s) and (d) loop duplication with separate mesentery and blood supply.

The previous case report relating to retroperitoneal abscess in dogs demonstrated that clinical signs commonly presented of nonspecific, chronic, fever and abdominal and/or back pain with progressive deterioration (Marvel and MacPhail, 2013). The most common etiologies were a foreign body from ingestion, migrating plant material, infection from a bite wound, reaction from suture material and unknown causes. Ultrasonography is the first basic line and preferable diagnostic tool for retroperitoneal space disease. Nevertheless, advanced imaging such as computed tomography may be used to provide specific information (Hylands, 2006; Marvel and MacPhail, 2013). In our report, only mild abdominal discomfort was presented on attempted abdominal palpation on the visiting day without the history of other remarkable signs. The retroperitoneal mass effect was noted and the dog had evidence of peritoneal effusion on ultrasonographic views, which influenced our decision to perform emergency abdominal exploration on the referring day. Surgical removal with abdominal lavage and the closed active suction drain placement

were elected to eliminate the retroperitoneal mass and provide postoperative drainage. Because of the complete septum on duplication and the result of cytology with bacterial culture, the leakage content in the abdomen was not contaminated with feces. Moreover, it is believed that the leakage had happened recently prior to the visiting day. As a consequence, the dog did not show clinical signs of severe peritonitis on presentation.

So far this is the first report of partial colectomy as a treatment of type I tubular non-communicating colonic duplication in an adult dog with a concurrent tract connecting to retroperitoneal space, in which the removal was performed with a good outcome.

Conclusively, colonic duplication should be investigated as a differential diagnosis in both symptomatic and asymptomatic cases with unknown large intestinal mass in any age of dog. Laparotomy with histopathology is necessary for final diagnosis and surgical treatment is required. Alignment and condition of all abdominal organs must be seriously investigated perioperatively to be aware of other complications.

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บทคัดย่อ

การผ่าตัดรักษาภาวะลำไส้ใหญ่ซ้ำซ้อนชนิดท่อที่เชื่อมต่อกับช่องหลังช่องท้องในสุนัขโต

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ภาวะลำไส้ใหญ่ซ้ำซ้อนในสุนัข เป็นความผิดปกติแต่กำเนิดที่พบได้ยาก โดยมักแสดงอาการในช่วงขวบปีแรกด้วยภาวะลำไส้อุดตัน ที่สำคัญยังไม่เคยมีรายงานในสุนัขโตมาก่อน รายงานสัตว์ป่วยนี้อธิบายถึงภาวะลำไส้ใหญ่ซ้ำซ้อนชนิดท่อที่เชื่อมต่อกับช่องหลังช่องท้องในสุนัขพันธ์ผสมอายุ 3 ปี ซึ่งถูกส่งตัวเพื่อเข้ารับการวินิจฉัยเพิ่มเติมและทำการรักษาเนื้องอกในช่องท้อง การตรวจร่างกายพบเพียงช่องท้องโตและไม่สบายตัว จากการตรวจคลื่นเสียงสะท้อนความถี่สูงพบก้อนเนื้อขนาดใหญ่บริเวณช่วงกลางถึงท้ายของช่องท้อง ก้อนเนื้อที่ผนังลำไส้ใหญ่ และของเหลวในช่องท้อง การผ่าตัดเปิดช่องท้องพบก้อนเนื้อที่ลำไส้ใหญ่มีลักษณะเป็นท่อยาวและไม่มีรูเชื่อมต่อกับช่องภายในลำไส้ บริเวณปลายก้อนเนื้อพบทางเชื่อมไปยังถุงขนาดใหญ่ในช่องหลังช่องท้องซึ่งมีรูรั่ว การรักษาโดยการตัดลำไส้ใหญ่บางส่วนในตำแหน่งซ้ำซ้อนและส่วนที่อยู่ติดกันออก ร่วมกับ การเลาะถุงในช่องหลังช่องท้องประสบผลสำเร็จ สุนัขฟื้นตัวดีและอุจจาระได้เป็นปกติตลอดระยะเวลา 12 เดือนของการติดตามอาการ ผลพยาธิวิทยายืนยันภาวะลำไส้ใหญ่ซ้ำซ้อนชนิดท่อที่ไม่เชื่อมต่อกับลำไส้จริง ดังนั้นภาวะลำไส้ใหญ่ซ้ำซ้อนควรถูกนำมาพิจารณาในการวินิจฉัยแยกโรคกรณีก้อนเนื้อช่องท้องในสุนัขทุกช่วงวัย รวมทั้งควรวินิจฉัยความผิดปกติที่เกี่ยวข้องอื่น ๆ เพื่อป้องกันภาวะแทรกซ้อนที่อาจเกิดขึ้น สำหรับการผ่าตัดนั้นสามารถช่วยในการวินิจฉัยโรคขั้นสุดท้าย ร่วมกับให้การรักษาที่เหมาะสมและประสบผลสำเร็จ

คำสำคัญ: ภาวะลำไส้ใหญ่ซ้ำซ้อน สุนัข การตัดลำไส้ใหญ่บางส่วน ช่องหลังช่องท้อง

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