

Cecocolic Intussusception Caused by *Ancylostoma caninum* Infection in a Dog

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Abstract : An eight-month-old, outdoor, intact male English Pointer dog weighing 23.5 kg presented to the hospital with signs of hematochezia, soft stools, and weight-loss. There were no remarkable findings on physical examination, complete blood count, serum biochemistry, electrolyte and gas analysis, and radiography. The serologic and Polymerase Chain Reaction (PCR) tests for canine parvovirus were negative. A fecal smear examination showed rod-shaped, spore-forming bacteria. Additionally, a fecal flotation test showed ova of *Ancylostoma* spp. The size of ova was 60 × 40 μm, and it was identified as *Ancylostoma caninum* using light microscopy. The PCR test indicated a *Clostridium perfringens* infection and the presence of *C. perfringens* alpha toxin. The diagnosis given was *C. perfringens* enterotoxigenosis with ancylostomiasis. Treatment included antibiotics (metronidazole, trimethoprim-sulfamethoxazole) and anthelmintics (afoxolaner, milbemycin oxime). After two weeks, the clostridial infection resolved, but ancylostomiasis persisted for six weeks. The anthelmintic was changed to Drontal[®] plus (praziquantel/pyrantel pamoate/febantel). After four weeks, there were no remarkable findings in the fecal samples, but the patient still presented with watery stools and hematochezia. Survey of abdominal ultrasound had performed, and a target-like sign with multiple rings was seen in the cecocolic region. The patient was diagnosed with *A. caninum*-induced cecocolic intussusception from the history and clinical signs. After a surgery, he recovered fully. This is the first clinical case report of *Ancylostoma caninum* parasitizing from the small intestine and causing an intussusception in the large intestine.

Key words : intestinal intussusception, *Ancylostoma caninum* infection, parasite, hookworm, chronic parasite infection, dog.

Introduction

Intussusception is defined as the invagination of one segment of the intestine into the lumen of the adjacent segment, and may occur in any area of the gastrointestinal tract (1). Intestinal intussusception is the most common form of intussusception seen in dogs, and may occur as single or multiple and normograde or retrograde (12,16). Although the most common cause of intestinal intussusception reported in dogs is idiopathic, many conditions predispose dogs to this condition, including intestinal parasitism, viral enteritis, intestinal foreign bodies, intestinal mass, and abdominal surgery (1-3,8-10). The most common presenting clinical signs in dogs with intestinal intussusceptions are vomiting, diarrhea with hematochezia or melena, anorexia, and weight-loss (16).

The hookworms belonging to family Ancylostomatidae, of superfamily Ancylostomatoidea, are important among the nematode parasites infecting dogs, because of their blood sucking habit (14). *Ancylostoma caninum* (Ercolani, 1859) parasitizes the small intestine in felines and domestic and wild canines (4). This parasite has a monoxenic life cycle, and can accidentally infect humans, causing cutaneous larva migrans associated with clinical appearances of anemia; it is known to cause intestinal lesions in dogs (13). However, an

association with intestinal mechanical complications such as intussusception has not been reported. This case report describes intestinal intussusception caused by *A. caninum* infection in a dog.

Case Report

An eight-month-old, outdoor, intact male English Pointer dog weighing 23.5 kg presented to the hospital with signs of hematochezia, soft stools, and weight-loss. There were no remarkable findings on physical examination and cardiac auscultation except low body condition score. Complete blood count, serum biochemistry, and electrolyte and gas analysis were within normal limits. Plain radiography showed mild enlargement of the main pulmonary artery and spleen.

The serologic test for canine parvovirus (CPV) using the CPV Antigen test Kit (Bionote, Hwaseong, Korea) was negative. A fecal smear examination with Diff-Quik staining showed numerous rod-shaped and spore-forming bacteria (Fig 1A). A fecal flotation test showed ova of *Ancylostoma* spp. (Fig 1B). The size of the ova was 60 × 40 μm, and it was identified as *Ancylostoma caninum* using light microscopy. A fecal sample was submitted to IDEXX Reference Laboratories for Polymerase Chain Reaction (PCR) analysis (Canine Diarrhea RealPCR™ panel, IDEXX Laboratories, Westbrook, Maine, USA). The results demonstrated the DNA and alpha toxin of *Clostridium perfringens*. The diagnosis given was clostridial enterotoxigenosis with ancylostomiasis.

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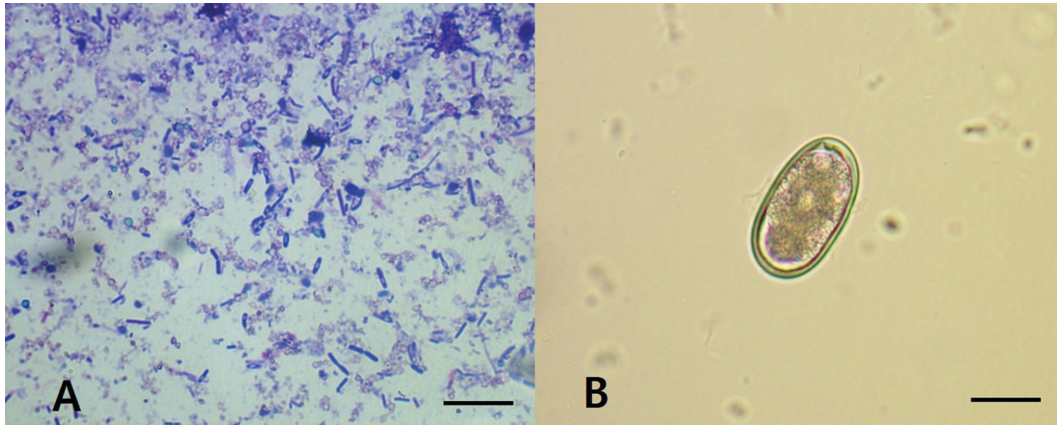


Fig 1. Microscopic findings of fecal examination. (A) A fecal smear examination with Diff-Quik staining, showing numerous rod-shaped and spore-forming bacteria. H&E. (B) The egg of *Ancylostoma caninum* collected from the stool of the patient, $60 \times 40 \mu\text{m}$ in average size. Bar = $40 \mu\text{m}$.

The patient was treated with metronidazole (Flasinyl tab; CJ, 15 mg/kg, p.o., q 12 hr), trimethoprim-sulfamethoxazole (Septrin; Samil, 20 mg/kg, p.o., q 12 hr) and afoxolaner plus milbemycin oxime (NexGard Spectra[®]; Merial, once a month). After two weeks, the clostridial infection resolved, but the ancylostomiasis persisted. However, the owner stopped administering the drugs because the patient did not show any clinical signs of the infection. After four weeks, the patient presented to the hospital again with signs of hematochezia and diarrhea. Fecal smear examination and fecal flotation test indicated clostridial infection and ancylostomiasis. The previous anthelmintic drugs were replaced with an praziquantel/pyrantel pamoate/febantel (Drontal[®] plus; Bayer Animal Health GmbH, Germany, once a week for four weeks) as an anti-parasitic. After four weeks, the patient gained weight, but still presented with watery stools and hematochezia. However, there were no remarkable findings in the fecal samples anymore. For accurate examination, survey of abdominal ultrasonography was performed. In the transverse ultrasonographic view, a target-like sign with multiple rings was seen in the cecocolic region (Fig 2A). The patient was suspected to have an intestinal intussusception, and was finally diagnosed with a cecocolic intussusception through exploratory laparotomy (Fig 2B). He underwent surgery and recovered fully.

Discussion

In this case, an intestinal intussusception associated with *Ancylostoma caninum* infection was diagnosed. The patient showed continuous mucoid bloody stools and weight-loss. There are many causes for soft hematochezia and weight-loss in young dogs. All viral infections were ruled out using PCR analysis. Chronic *A. caninum* infection causes repeated clostridial infections and probably a change in the intestinal motility, resulting in an intestinal intussusception.

Veterinary clinics typically diagnose *A. caninum* infection through the detection of eggs in the fecal examination. The morphology of the egg and adult forms of the organism is already known (11). Although we could not obtain an adult worm, we could identify eggs from fecal samples using light microscopy. *Ancylostoma caninum*, *Ancylostoma braziliense*,

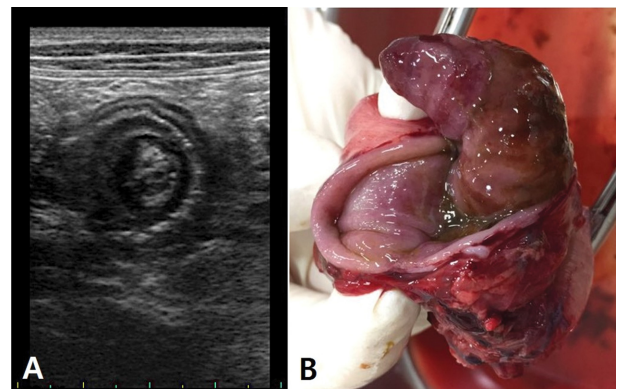


Fig 2. Transverse sonogram of cecocolic intussusception and gross findings on exploratory laparotomy. (A) Alternating hyperechoic and hypoechoic concentric rings are present within the lumen of a bowel segment. (B) The observed intussusception of the cecum and colon with red mucosa in the dog.

and *Uncinaria stenocephala* are common hookworm infections in dogs (15). The eggs of *A. braziliense* are significantly smaller than the eggs of *A. caninum* (11). The eggs of *Uncinaria stenocephala* are approximately 70 to 90 μm long by 40 to 50 μm wide and are especially easy to differentiate from the eggs of *Ancylostoma* when present in mixed infections (5). Thus, the eggs seemed to be readily distinguishable using light microscopy, aiding in species-identification from the fecal samples (11). Only *A. caninum* infestation typically results in clinical illness (6). Dogs with hookworm infections may present with anemia with bloody diarrhea or melena. Other clinical signs include lethargy, anorexia, dehydration, vomiting, and poor weight gain due to the worm's consumption of blood and body fluids (6). To identify the parasitic species exactly, PCR for genotyping is needed.

There are two mechanisms of formation of an intestinal intussusception: one is the result of lack of homogeneity of the bowel wall caused by any abnormality like an inflammation, and the other is a mechanical linkage between nonadjacent segments of the bowel caused by altered intestinal motility or pliability (16). The clostridial infection was treated, but ancylostomiasis was not resolved over 10 weeks in the pres-

ent case. We concluded that the intestinal intussusception observed in the patient originated from *A. caninum* chronic infection. However, the exact mechanism of intussusception by ancylostomiasis is unknown. *Ancylostoma caninum* parasitizes the small intestine (4), but the intussusception occurred in the large intestine in this case. Some gastrointestinal parasites are known to cause disease by altering the gastrointestinal motility (7). Parasitic infections have been found to alter the enteric nervous system via three main mechanisms: (i) modification in the nerve distribution; (ii) alterations of neurochemical levels; and (iii) altered neuronal functions (7). It is hypothesized that the infection by *A. caninum*-induced inflammation with consequent dysfunction in intestinal motility leading to cecocolic intussusception. The cecocolic intussusception possibly occurred as a result of the changes in peristalsis promoted by the injured intestine. To determine the cause of formation of intussusception, histopathological examination is needed.

Conclusions

This is the first case report describing chronic *A. caninum* infection that caused intestinal intussusception by possibly altering the gastrointestinal motility in a dog.

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Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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