

## The first report of the ante-mortem diagnosis of *Ollulanus tricuspis* infection in two dogs

Daiki KATO<sup>1)</sup>, Mariko OISHI<sup>1)</sup>, Koichi OHNO<sup>1)\*</sup>, Ko NAKASHIMA<sup>1)</sup>, Atsuhito WADA<sup>1)</sup>, Tatsushi MORITA<sup>2)</sup>, Soichi IMAI<sup>2)</sup>, Masaya TSUBOI<sup>3)</sup>, James K. CHAMBERS<sup>3)</sup>, Kazuyuki UCHIDA<sup>3)</sup> and Hajime TSUJIMOTO<sup>1)</sup>

<sup>1)</sup>Department of Veterinary Internal Medicine, Graduate School of Agricultural and Life Sciences, The University of Tokyo, 1-1-1 Yayoi, Bunkyo-ku, Tokyo 113-8657, Japan

<sup>2)</sup>Division of Veterinary Infectious Disease, Department of Veterinary Pathobiology, Nippon Veterinary and Life Science University, 1-7-1 Kyonanchyo Musashino, Tokyo 180-8602, Japan

<sup>3)</sup>Department of Veterinary Pathology, Graduate School of Agricultural and Life Sciences, The University of Tokyo, 1-1-1 Yayoi, Bunkyo-ku, Tokyo 113-8657, Japan

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**ABSTRACT.** *Ollulanus tricuspis* is a small nematode parasite of the stomach, and its infection has been reported worldwide in cats but only one report in dogs as post-mortem diagnosis. Two dogs, kept in the Tokyo area, were presented for chronic vomiting. Chronic gastritis was diagnosed histologically, and many nematodes were detected in endoscopically-biopsied gastric samples and in the mucus of vomitus in both dogs. The parasites were small (<1 mm), and their morphological characteristics were consistent with those previously reported for *O. tricuspis*. The symptoms in one dog completely disappeared after anthelmintic therapy. To our knowledge, this is the first report describing ante-mortem diagnosis of spontaneous gastric *O. tricuspis* infection in dogs in which infectivity and pathogenicity of the nematode are suggested.

**KEY WORDS:** canine, gastritis, nematode, *Ollulanus tricuspis*, vomiting

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*Ollulanus tricuspis* is a small nematode parasite of the stomach, and its infection in cats has been previously reported [10, 13, 18]. Its life cycle is direct, and transmission is thought to occur by the ingestion of vomitus from infected cats [10, 12]. Although there is a report of *O. tricuspis* detection by using fecal flotation [11], there is no evidence for fecal transmission [2, 10]. *O. tricuspis* is generally believed to be of low pathogenic potential to cats, causing gastric mucous production, weight loss, anorexia and intermittent vomiting [12, 13]. However, there are some reports of severe chronic gastritis and carcinogenesis in cats [8, 13]. *O. tricuspis* infection has also been reported in other species including tiger [16], red fox [15], lion [6], cheetah [7] and pig [19]. In 1968, only one report demonstrated *O. tricuspis* infection in the stomach of stray dogs at necropsy findings [14]. So far, there have been no reports of dog infection with *O. tricuspis*. Here, we report the ante-mortem findings of gastric *O. tricuspis* infection in two domestic dogs with chronic vomiting.

**Case 1:** An 11-year-old, castrated male Papillion dog, weighing 3.1 kg, was referred to the Veterinary Medical Center of the University of Tokyo (VMC-UT). The dog had

symptoms of chronic vomiting (1 episode/day) and weight loss over a period of 2 months. The dog was previously diagnosed with protein losing enteropathy and mitral regurgitation, and was medicated with prednisolone (0.4 mg/kg/day, for 4 years) and benazepril hydrochloride (0.4 mg/kg/day). A blood test revealed eosinophilia with an eosinophil count of 1,500/ $\mu$ l (reference range; 100–1,250/ $\mu$ l), and albumin and C-reactive protein levels of 2.6 g/dl (2.6–4.0 g/dl) and 3.0 mg/dl (<1.0 mg/dl), respectively. No significant abnormalities were observed in a general fecal examination (direct and flotation method using sodium chloride solution [specific gravity 1.18]), abdominal X-ray and ultrasound. As antibiotics, antacid, prokinetics and antiemetic did not improve symptoms, gastrointestinal endoscopy was performed on day 83. Irregular, erythematous gastric membrane was macroscopically observed, and endoscopic biopsies were performed. Stomach mucous smear using biopsied tissues revealed some nematodes, which were characterized less than 1 mm in length of adults and had conspicuously longitudinal ridges on surface, copulatory bursa on male and cusped tails on female (Fig. 1A–1C). The detailed characteristics of the nematodes that described later suggested adult *O. tricuspis* [3, 4]. Histopathological findings of plasma cell and neutrophil infiltration and fibrosis in the lamina propria indicated chronic gastritis presumably caused by many nematodes in the gastral cavity and lumen (Fig. 1D). Some nematodes infiltrated into the stomach wall, and a granuloma was formed around the lesion. Nematodes were not detected in the duodenum, ileum and colon tissue samples. The dog was treated by an anthelmintic, Drontal Plus (Bayer Yakuhin Ltd., Osaka, Japan), 1/2 tab (praziquantel 25 mg, pyrantel

\*CORRESPONDENCE TO: OHNO, K., Department of Veterinary Internal Medicine, Graduate School of Agricultural and Life Sciences, The University of Tokyo, 1-1-1 Yayoi, Bunkyo-ku, Tokyo 113-8657, Japan. e-mail: aohno@mail.ecc.u-tokyo.ac.jp

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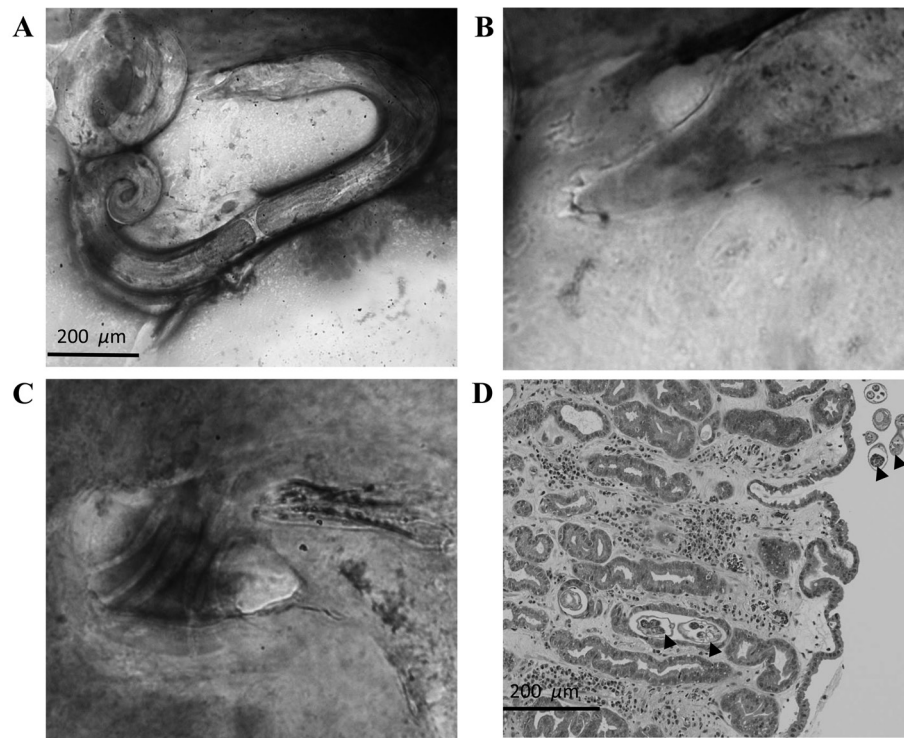


Fig. 1. Case 1 (A–C) Stomach mucous smear. Wright-Giemsa stain. (A) *O. tricuspis* body with conspicuously longitudinal ridges on surface was characterized less than 1 mm in length. (B) Cusped tails on female, (C) copulatory bursa on male. (D) Stomach histopathological examination revealed plasma cells, neutrophil infiltration and fibrosis in lamina propria with many nematodes (arrowheads) in the gastric cavity and lumen.

pamoate 72 mg and febantel 75 mg) once a day for 3 days. After 3 days medication, frequency of vomiting decreased significantly to 2 times/week. Ivermectin (Ivomec, Merial Japan, Tokyo, Japan) 150 µg/kg was subcutaneously injected once to kill the residual parasites, following which, no episode of vomiting was observed.

**Case 2:** A 7-year-old domestic, spayed female Beagle dog, weighing 8.6 kg, was referred to the VMC-UT. The dog had symptoms of chronic vomiting (almost 1 episode/day). Due to a previous history of immune-mediated neutropenia and hypothyroidism, the dog was medicated with prednisolone (1.3 mg/kg/day) and levothyroxine for a year. A blood test including eosinophil count (100/µl), general fecal examination, abdominal X-ray and ultrasound revealed no abnormalities. Antibiotics, prokinetics and antiemetic did not improve the symptoms, and gastrointestinal endoscopy was performed on day 64. There was no obvious gross finding in the stomach, but mucous smears using biopsied tissues revealed plenty of spirillum indicating *Helicobacter* spp. (data not shown). Hypotrophy of the gastric glands, plasma cell infiltration and fibrosis in lamina propria were seen on histopathology, and chronic gastritis was diagnosed. Some gastric glands were enlarged, and a number of nematodes were observed in the cavities (Fig. 2A). Nematode bodies were not detected in the duodenum, ileum and colon tissue

samples. The dog was started on *Helicobacter* spp. elimination therapy by administering metronidazole 15 mg/kg twice a day, clarithromycin 12 mg/kg twice a day and omeprazole 1.2 mg/kg once a day, for 15 days. After *Helicobacter* spp. elimination therapy, frequency of vomiting decreased markedly to only during fasting. On day 78, nematodes were still detected in the vomitus by microscopic examination. Observed characteristics of the nematodes were the same in case 1 and were compatible with *O. tricuspis* (Fig. 2B–2D). Anthelmintic therapy was started by administering Drontal Plus, 1 tab once a day for 3 days, after which, the dog did not show any vomiting.

To our knowledge, this is the first report demonstrating the details of gastric *O. tricuspis* infection as ante-mortem diagnosis in dogs. The nematodes in the stomach of the two dogs with chronic vomiting had clear characteristics of *O. tricuspis* as previously reported: a small buccal cavity with no teeth and conspicuously longitudinal ridges on surface with obvious cervical papillae, adult females possess distinctive 3–5 cusped tails and a vulva situated in posterior of the body with single uterus, and measure 0.8–1.0 × 0.04 mm, and adult males have a well-developed copulatory bursa supported by specific patterned rays (especially, the dorsal ray and the lateral rays) with equal spicules (40–50 µm length) and measure 0.7–0.8 × 0.035–0.04 mm [3, 4, 10, 13]. These

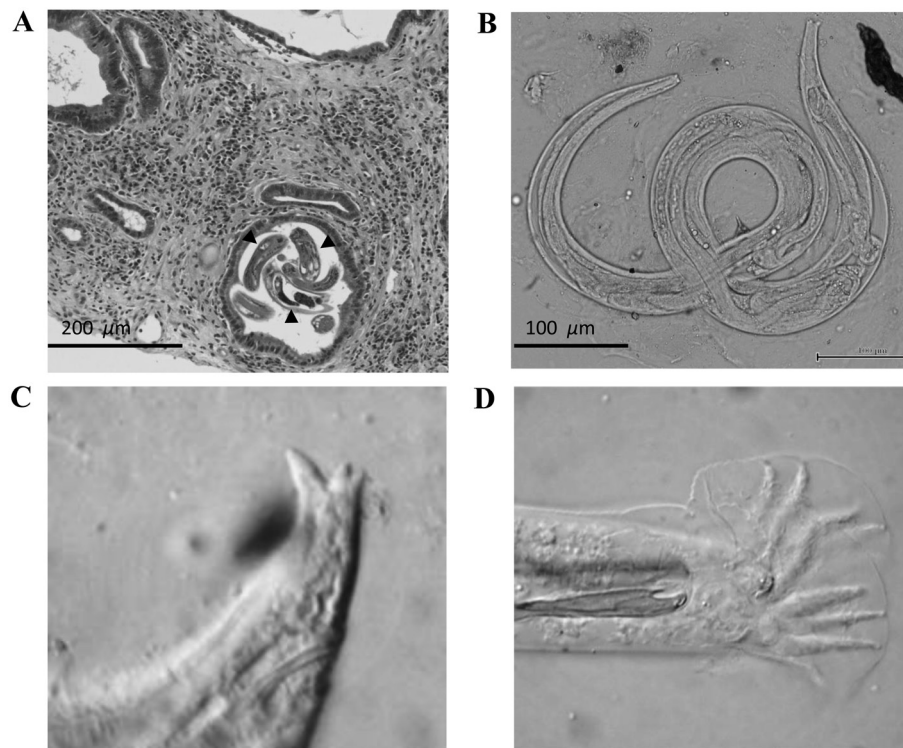


Fig. 2. Case 2 (A) Stomach histopathological examination revealed hypotrophy of gastric gland, plasma cell infiltration and fibrosis in lamina propria. Some gastric glands were enlarged, and a number of nematodes (arrowheads) were observed in the cavities. (B, C) Vomitus microscopic examination. No stain. (B) *O. tricuspis* body, (C) cusped tails on the female and (D) copulatory bursa on the male.

nematodes were apparently different from others including *Physaloptera* and *Gnathostoma spingerum* that could infect the stomach in dogs. The features of the parasitic bodies were more obvious by smear examination of the endoscopic biopsied sample and vomitus than by histological examination of the endoscopic biopsied sample. To diagnose *O. tricuspis* by fecal examination is difficult [9], and the fecal examination of the 2 dogs also could not detect *O. tricuspis* infection. However, it may be possible to detect *O. tricuspis* infection by fecal examination in rare occasions, because there is a report demonstrating detection of *O. tricuspis* infection by fecal flotation methods using modified Sheather's sugar flotation solution (specific gravity 1.27) [11]. Because *O. tricuspis* is ovoviviparous larvae, or adult bodies could be detectable by fecal examination. To detect latent infection of *O. tricuspis*, we believe that mucosal smears using endoscopic-biopsied samples and routine vomitus microscopic examination are important to diagnose *O. tricuspis* infection.

*O. tricuspis* has a worldwide distribution, and the prevalence of infection in cats was reported to be 0.2% to 42.9% [10]. Although there are no large epidemiological studies in Japan, Teshima *et al.* reported *O. tricuspis* infection in a cat in Tottori, Japan [20]. The 2 dogs in this report were kept indoors, but went walking in the Tokyo area. Case 1's owner realized that the dog ate vomitus from cats while walking. Although the infectious routes are unclear, both dogs had op-

portunities to eat vomitus from cats infected with *O. tricuspis* while walking. A large survey of the prevalence of *O. tricuspis* infection in dogs and cats in Japan could be important. As the 2 dogs in this report were given glucocorticoids for a long time, gastric mucosal injury and immunosuppression [17] might be risk factors of *O. tricuspis* infection in dogs.

As the vomiting seen in Case 1 was completely resolved by the anthelmintic therapy, it was suspected that the dog was vomiting due to chronic gastritis caused by *O. tricuspis* infection. On the other hand, the elimination therapy for *Helicobacter* spp. markedly decreased the frequency of vomiting in Case 2. This suggested that the gastritis seen in Case 2 could be related mainly to *Helicobacter* spp. infection and therefore, the pathogenicity of *O. tricuspis* in Case 2 was unknown.

Previous reports demonstrated that fenbendazole (50 mg/kg daily for 5 days) and oxyfendazole (10 mg/kg twice daily for 5 days) were effective in treating cats with *O. tricuspis* infection [1, 5]. In this study, praziquantel, pyrantel pamoate, febantel and ivermectin were used as an anti-nematode therapy. As post-treatment examinations were not performed, it is unclear whether these drugs could successfully deworm *O. tricuspis*.

In conclusion, this is the first report describing spontaneous gastric *O. tricuspis* infection as ante-mortem diagnosis in 2 dogs with chronic gastritis. *Ollulanus tricuspis* could

infect and might have pathogenicity in dogs. A further domestic epidemiological study of *O. tricuspis* is definitely needed in dogs and cats.

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