Echinostoma hortense Infection with Enteritis Diagnosed by Upper Gastrointestinal Endoscopy in a Dog

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ABSTRACT. An 8-year-old male Shiba dog presented with chronic vomiting and diarrhea. Upper gastrointestinal endoscopy revealed severe enteritis and infection of the duodenal mucosa with *Echinostoma hortense*. We performed therapy for parasites and enteritis. The therapy was successful for deworming and temporarily improved the symptoms, but the dog died soon thereafter. To the authors' knowledge, this is the first case report of an antemortem diagnosis of *E. hortense* infection in a dog.

KEY WORDS: *Echinostoma hortense*, gastrointestinal endoscopy.

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Echinostoma hortense is a member of the *Echinostomidae* family, and its characteristics include a large elongated body, a head crown with collar spines and a large oral sucker [1, 5]. The fluke is zoonotic and inhabits the small intestines of birds and mammals, such as humans and mice [16]. Human echinostomiasis has been identified in China [12], Japan [7, 9] and Korea [16, 18]. Infection with *E. hortense* was found for the first time after autopsy of a stray dog in an epidemiological study in 1927 [2] and was found again in 1981 [6]. However, antemortem diagnosis and clinical data including those pertaining to therapy for *E. hortense* infection in dogs have not been described. This report describes a dog with *E. hortense* infection that was diagnosed by upper gastrointestinal endoscopy.

An 8-year-old neutered, domestic, male Shiba dog weighing 6.55 kg (body condition score, 1) was referred to the Animal Medical Center at Nihon University, Japan. The dog had symptoms of chronic diarrhea, vomiting and weight loss over a period of 4 years. The dog had been kept at the foot of a mountain in Kanagawa, Japan, near a brook and had never been taken outside Japan. At a local animal hospital, the dog received an elimination diet (Sensitivity Control Blue Whiting and Tapioca, Royal Canin, Japan) and antibiotics, but no improvement in symptoms was observed. Prednisolone therapy (1 mg/kg/day) temporarily improved excretion from watery diarrhea to loose stool. However, watery diarrhea and vomiting returned soon thereafter, occurring once or twice per week, and the dog was then referred to us. Se-

vere weight loss and wambling were evident during the first medical examination, but abdominal tenderness was absent. A blood test revealed (values with reference ranges) albumin (ALB), 1.8 g/dl (2.3-4.0 g/dl); total cholesterol (T. chol), 54 mg/dl (110-320 mg/dl); blood urea nitrogen (BUN), 5 mg/dl (7-27 mg/dl); hematocrit (Ht), 27.5% (37-55%); and C-reactive protein (CRP), 0.05 mg/dl (<1.00 mg/dl). There was no eosinophilia; the dog had an eosinophil count of 56/ μ l (100-1,250/ μ l). No significant abnormalities were observed in a general fecal examination (direct and flotation method), urinalysis, X-ray examination or abdominal ultrasound. Gastrointestinal endoscopy was performed to identify the cause of the anemia, hypoalbuminemia and gastrointestinal symptoms. During gastroduodenal endoscopy, motile flukes were found attached to the edematous duodenal mucosa (Fig. 1). The flukes, which looked slender and elongated, were ex-

Fig. 1. Endoscopic findings. A parasitic *Echinostoma hortense* worm is attached to the duodenal mucosa.

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Fig. 2. A; Two flukes obtained using endoscopic biopsy forceps are slender and elongated. B; Features of *Echinostoma hortense* worms (1). A characteristic head crown of *Echinostoma hortense* is collared by 28 spines. C; Features of *Echinostoma hortense* worms (2). The posterior body of *Echinostoma hortense* has rich vitelline glands.

Fig. 3. *Echinostoma hortense* egg. The bright yellow, elliptical, thin-shelled egg has a shallow operculum.

tracted with endoscopic biopsy forceps and transported to the Laboratory of Medical Zoology at Nihon University. They measured approximately 8×1 mm in size and had a characteristic head crown with 28 collar spines around the subterminal oral sucker. Tandem testes were observed in

the anterior body, and rich vitelline glands were seen in the posterior body (Fig. 2A, B and C). Stool examination using the formol-ether concentration technique (MGL method) revealed echinostome eggs. The eggs were 120.2×74.1 µm in size and were bright yellow, elliptical and thin-shelled with

a shallow operculum (Fig. 3). The worms were identified as *E. hortense* based on their morphological characteristics and measurements. A histopathological examination of the duodenum revealed severe lymphocytic plasmacytic enteritis (LPE) with lymphangiectasia. The dog was administered 20 mg/kg of praziquantel (Droncit; Bayer, Germany) for 3 days to treat the *E. hortense* infection, and the food elimination diet was continued. In addition, the dog was administered a daily antibiotic treatment of 15 mg/kg/day, b.i.d., metronidazole (Fragyl; Shionogi & Co., Ltd., Osaka, Japan) and steroid treatment of 1 mg/kg/day prednisolone (Predonine; Shionogi & Co., Ltd.) to treat the enteritis, as done at the local animal hospital. Eggs were absent in fecal samples after this therapy. The dog's stool became normal, and vomiting stopped. Blood chemistry parameters also improved somewhat at 33 days after the initial visit (ALB, 2.0 g/dl; T. chol, 91 mg/dl; BUN, 13 mg/dl; Ht, 34%; CRP, 0.25 mg/dl). However, weight loss, diarrhea and increased CRP levels (11 mg/dl) were observed at 83 days after initial presentation. Fecal examinations were again performed using the MGL method, but eggs were not found. Endoscopy of the duodenum and colon was then performed. Edema, erosion and flare were observed in the intestinal mucosa, but no flukes were found. Histopathological findings indicated severe LPE in the duodenum and mild inflammation in the colon. The steroid dose was increased to 2 mg/kg/day, and 5 mg/kg/day cyclosporine (Neoral; Novartis, NY, U.S.A.) and 10 mg/kg/day b.i.d. mesalazine (Pentasa; Kyorin Pharmaceutical Co., Ltd., Tokyo, Japan) were added to treat the chronic enteritis. However, the dog died following additional weight loss and exacerbated diarrhea at 171 days after the initial referral.

Epidemiological investigations in Japan have identified *E. hortense* infection in 4.9% (26/531) and 4.6% (4/87) of feral raccoons (*Procyon lotor*) collected from Wakayama and Shimane, respectively [10, 17]. Furthermore, *E. hortense* infection has been detected in 19.2% (10/52) and 5.2% (1/19) of Ezo red foxes (*Vulpes vulpes schrencki*) in Hokkaido and American mink (*Mustela vison*) in Nagano, respectively [11, 13]. There are no reports in dogs and cats; however, these previous findings indicate that the risk of *E. hortense* infection is quite prevalent in Japan. There are 54 reported cases of infection in humans, mostly in Akita (n=18), Okayama (n=14) and Osaka (n=7) [19]. All cases of infection in humans developed after consuming fish, such as loach in local dishes. Humans become infected with *E. hortense* mainly through the ingestion of raw freshwater fish or raw loach [5, 20]; one woman became infected after ingesting fresh water from a reservoir [20]. The route of infection in the Shiba dog described herein remains unknown, as it was fed a diet comprising only dry dog food. However, the dog could have ingested a secondary intermediate host or metacercaria from the brook located near where the dog lived.

The dog presented with anorexia, vomiting and diarrhea. These symptoms might have been due to mucosal irritation caused by *E. hortense*, as they disappeared temporarily after deworming. The hypoalbuminemia, hypocholesterolemia, low BUN and moderate anemia might have been caused by malabsorption and enteritis of the intestinal mucosa due to

the infection. The small intestine, particularly the duodenum, is the usual site of *E. hortense* infection in humans [3, 4, 8]. In the present case, the parasites were also found in the duodenum by endoscopy. However, as the jejunum and ileum were not investigated by endoscopy or autopsy, the parasitic status in these regions remains unknown.

Detailed observation of flukes in humans has been reported using indigo carmine staining [20]. In the present case, worms could be found by endoscopy without the use of indigo carmine staining. Eggs can be difficult to find by direct and flotation methods of fecal examination. In fact, fecal examinations at a local animal hospital and at our hospital did not identify any eggs. However, we identified *E. hortense* eggs using the MGL method, which is not the standard stool examination used in clinical practice. This method should be aggressively applied in animal hospitals. Praziquantel is generally recommended as an antiparasitic drug for the treatment of *E. hortense* in humans [5, 20] at doses ranging from 20 to 75 mg/kg for 1 to 3 days [7, 9, 19], but doses for dogs have not been established. This therapy eradicated flukes and eggs in the dog described herein and stopped the diarrhea and vomiting. However, enteritis worsened, eventually causing death. The enteritis might have been caused by a gastrointestinal disease other than parasitic infection. Shiba dogs with chronic enteropathy have a poor prognosis [14, 15]. Furthermore, a neoplastic disease, such as lymphoma, might also have been a cause of death. The precise cause of death in this dog remains unknown, because we could not perform an autopsy.

In summary, this is the first report of *E. hortense* infection diagnosed using endoscopy in a live dog. Our treatment strategy was as successful as in humans, and the dog's symptoms temporarily improved, although it subsequently died. Further studies of more cases are needed to clarify the effects of *E. hortense* infection in dogs.

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