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<Case Report>

Natural infection of *Crenosoma vulpis* (Nematoda: Crenosomatidae) in an urban Korean dog

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Abstract : A male, 3.5 month old Pomeranian dog was diagnosed with a natural infection of *Crenosoma* (*C.*) *vulpis* in Daejeon, Korea. First stage larvae of *C. vulpis* were detected by fecal examination using the Baermann technique. Thoracic radiographs revealed mild, pervasive bronchial infiltration of the lung. Enumeration of larvae via the McMaster technique revealed 1,600 larvae per gram of feces. The dog was treated with mebendazole, and clinical symptoms were resolved 2 weeks post-treatment, as indicated by the subject presenting fecal tests negative for *C. vulpis*.

Keywords : *Crenosoma vulpis,* lungworm, natural infection, Pomeranian dog

Pulmonary nematodes of dogs cause parasitic diseases of central relevance in current veterinary practice. Parasites that infect the respiratory tract of dog include *Filaroides* (*F.*) *osleri, F. hirthi, F. milksi, Aelurostrongylus* (*A.*) *abstrusus, Angiostongylus* (*An.*) *vasorum* and *Crenosoma vulpis* belonging the family Metastrongylidae [7, 13, 14]. *Crenosoma* (*C.*) *vulpis* is a nematode lungworm that infects the bronchi, bronchioles and trachea of various carnivores, including wild and domestic canids. Among canids, *C. vulpis* infections are especially prevalent in foxes, while infections in domestic dogs have been rare [2, 4]. Barutzki and Schaper [1] reported that *C. vulpis* was only accidentally found in feces of dogs in Germany. However, recent studies have shown that prevalence rates in dogs may have increased in recent years [13]. Nonetheless, there have been few reports of dog metastrongylosis in Korea. This record describes an urban dog infected with *C. vulpis*.

A 3.5-month-old male pomeranian dog from Daejeon in Korea was referred to the Veterinary Medical Teaching Hospital of Chungnam National University with emaciation (body weight 350 g), a body temperature of 38.0°C, a respiration rate 42 breaths/min, and a pulse of 120 beats/min. The main clinical symptoms presented were coughing and diarrhea. The results of complete blood counts and serum chemistry profiles were decreased remarkably except for white blood cell and sodium profiles in normal ranges (Table 1).

Table 1. Results of complete blood counts and serum chemistry of dog for the diagnosis

Item	Result	Reference range
WBC ($\times10^3/\mu L$)	5.04	6.0-17.0
RBC ($\times10^6/\mu L$)	2.80	5.5-8.5
PCV (%)	17.9	33-55
Hb ($\times10^3/\mu L$)	0.04	6.0-17.0
Alb (g/dL)	2.2	2.6-3.9
TP (g/dL)	3.7	5.0-7.1
Na (mEq/L)	136	137-150

First-stage larvae in the feces were recovered via the Baermann technique and were counted by the McMaster technique. At that time, the larvae were active and motile. There were 1,600 larvae per gram of feces (LPG), and the larvae ranged from 275~335 μm in length. The oral ends were bluntly conical and the terminus of the tail had slightly deflected, but there were absent the kink and spine seen in other nematode lungworms (Fig. 1). The esophagus of the larvae were about one-third of the total body length, 105~115 μm long, and the tail between 33-35 μm.

Thoracic radiographs revealed mild bronchial infiltration across the entirety of the field of the lung (Fig. 2A). The patient exhibited stomach and colon bloating due to gas (Fig. 2B), and abdominal radiography detailed weight loss in comparison to the norm consistent with the patient breed and age.

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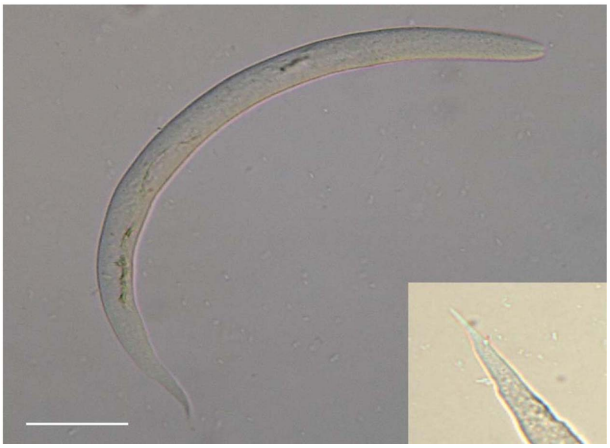

Fig. 1. Light microscopy finding of a first stage larva of *Crenosoma vulpis* recovered from feces of dog *via* Baermann technique. The insert shows the larval tail at a higher magnification. The terminus of the tail has a slight deflection. Scale Bar = 50 μm.

The dog was treated with mebendazole (25 mg/dog, p.o. q24 h for 7 days), and clinical symptoms subsided and fecal samples tested negative for *C. vulpis* 2 weeks post-treatment.

Sporadic cases of metastrongylosis have been reported in USA. and Canada, but these cases have involved dogs that had traveled from Europe [8]. Spontaneous infections of *C. vulpis* in dogs are quite rare, but a few cases have been recently reported from the UK, Ireland and Switzerland. The infected dogs typically present respiratory disease caused by the metastrongyloid lungworms [4, 9, 15]. The role of the *C. vulpis* infection in the clinical symptoms is unknown, but nonfatal chronic respiratory disease characterized primarily by a cough has been reported in dogs with lungworm infection [2].

In fact, the diagnosis of *C. vulpis* infection is based on the detecting first stage larvae in feces using the Baermann technique [2]. This technique remains the standard for the diagnosis of the infections caused by *An. vasorum, C. vulpis* and *A. abstrusus*, due to the positive hydro-/thermo-tropism exhibited by the live first stage larvae [5]. Because the larvae are not generally detected using the standard fecal floatation examination techniques utilized at most veterinary clinics. The dogs infected with *C. vulpis* infections could be misdiagnosed allergic respiratory disease [2]. Rinaldi *et al.* [10] reported that the FLOTAC technique produced mean LPG of feces greater than that produced by the McMaster, Baermann, flotation and Wisconsin technique. The mean LPGs were FLOTAC 91.3, McMaster 36.7, Baermann 0.7, flotation 11.1 and Wisconsin 36.7. Using the Baermann and the McMaster technique we observed high fecal counts. This study also presented a large number of *C. vulpis* larvae from the dog presenting symptoms typical of respiratory infection. We surmise that the high LPG is a result of the patient lack of appetite.

In canine feces, larvae of the lungworm *Filaroides* spp. and those of the intestinal parasite *Strongyloides* (*S.*) *stercoralis* may also be detected and need to be differentiated from *An. vasorum* and *C. vulpis* [5]. The caudal end of the first stage larvae found in the fecal sample had different features from other parasites; the end of *A. abstrusus* is notched and S-shaped, *An. vasorum* has a tip with a dorsal spine and a sinus wave curve, *Oslerus osleri* and *Filaroides* spp. are absent dorsal spine and are S-shaped end with a slight kink, while *S. stercoralis* and *C. vulpis* have pointed and straight tails [7, 14]. *S. stercoralis* could be identified by their typical esophageal structure with a club-shaped anterior portion, a postmedian constriction, and a posterior bulbus [12]. In our study, the oral ends of the larvae are bluntly conical and the tips of the tails taper smoothly to the end without any kink, undulation, or spine.

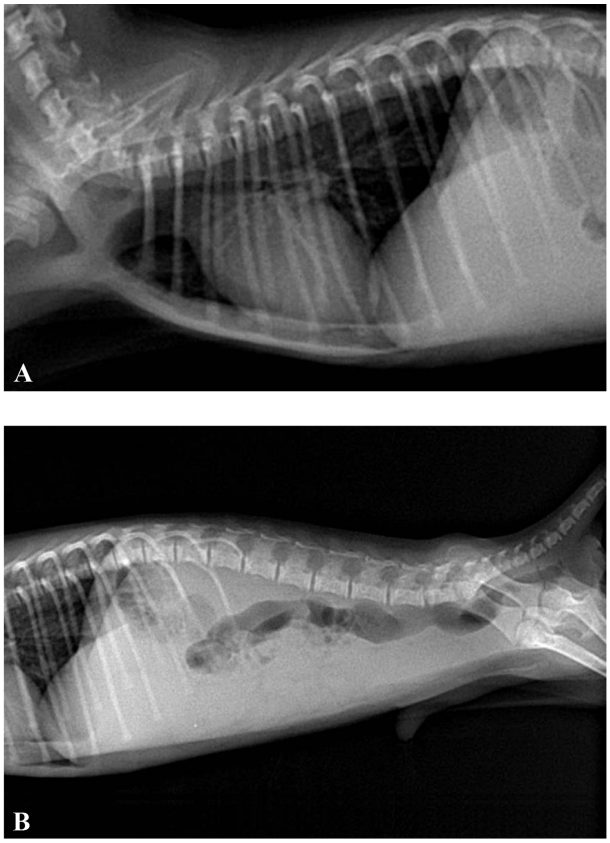

Fig. 2. Thoracic radiograph of dog showed mild bronchial pattern (A) and an abdominal radiograph showed a gas filled stomach and colon (B).

It was reported that mild bronchial patterns were shown on thoracic radiographs of three dogs infected by *C. vulpis* [11]. Bronchial infiltration might be caused by eosinophilic pneumonitis, even though it is not a pathognommonic symptom of *C. vulpis* infection.

Metastrongylosis can be treated with fenbendazole 50 mg/kg daily for 3~7 days or with mebendazole at a dose 50~100 mg/kg orally two times daily over 5 to 10 days [2, 3]. Ivermectin at a dose 200 μg/kg subcutaneous injection resolves clinical symptoms, and fecal exams were negative at 3 and 6

wks post-treatment [6]. Previous studies have shown the clinical symptoms are resolved and shedding of larvae in feces ceased in *Crenosoma*-infected dogs given a single oral dose of 0.5 mg/kg milbemycin oxime [5]. In our study, the infected dog was treated with mebendazole (25 mg/dog, p.o. q24 h for 7 days) and fecal sample was negative 2 weeks post-treatment.

In the recent past the distribution of canine lungworms has increased in various geographical areas. This is true especially for the metastrongyloids *A. abstrusus*, *An. vasorum* and *C. vulpis.* The reasons of this emergence are unknown but many factors such as global warming, changes in vector epidemiology and movements in animal populations, may provide insight into dynamics of these populations [14].

In this case, how the parasite was introduced to the urban dog in Korea remains unknown, but it has been that it was spread by the importation of infected dogs from other countries. This is the first documentation of an infection of an urban dog with *C. vulpis* in Korea.

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