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Successful treatment of pulmonary paragonimiasis in a German shepherd dog with fenbendazole

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Abstract Pulmonary paragonimiasis is an important zoonotic disease reported from many parts of the world. It is an endemic problem in human population in north-eastern states of India. There seems no report of pulmonary paragonimiasis in canine population from India. The present case describes first report of pulmonary paragonimiasis in a female dog suggesting possibility of this fluke becoming established in canine population in the country. The dog revealed mild coughing with serous nasal discharge. Faecal sample revealed eggs of *Paragonimus* spp. Treatment with fenbendazole resulted in marked improvement as revealed by clinical signs and chest radiography.

Keywords Dog · Fenbendazole · Paragonimiasis · *Paragonimus*

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Introduction

Pulmonary paragonimiasis in dogs is caused by lung fluke, *Paragonimus kellicotti* and is prevalent in many parts of North America, South Asia and South Africa (Pechman 2008). In many north-eastern hilly states of India including Manipur, Nagaland, and Arunachal Pradesh, pulmonary paragonimiasis is an endemic problem (Singh et al. 1982, 2009; Narain et al. 2003). In India, *P. westernmani* is reported to cause disease in many mammalian species including human beings (Singh et al. 1986). However, pulmonary paragonimiasis in dogs has not been reported so far from any part of India including Punjab. This is the first report of canine paragonimiasis caused by *Paragonimus* spp. and its successful treatment with fenbendazole in India, suggesting possibility of this fluke becoming established in canine population in the country.

Case description

A German shepherd, 8 year old female dog was presented to the Teaching Veterinary Hospital, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India with a month old history of intermittent coughing, vomiting, pica and tarry coloured faeces. No dose of deworming was given to the dog for the last more than 1 year, but the vaccination for common infectious diseases was up to date. Clinical examination revealed rectal temperature 101.6°F, heart rate 128 beats per minute and normal respiratory rate and pattern. However, serous nasal discharge was seen at the time of examination. Auscultation of lungs revealed increased lung sounds, on both inspiration and expiration. Evaluation of different haemato biochemical parameters (Table 1) revealed

Table 1 Levels of different haemato biochemical parameters

Parameters	Pre-treatment	Post-treatment	Reference range[a]
Haemoglobin (g%)	13.6	13.1	12–18
Total leukocyte count (per mm^3)	24,420	17,400	6,000–17,000
Differential leukocyte count (%)			
Neutrophils	60	64	60–70
Lymphocytes	38	34	12–30
Monocytes	02	0	3–10
Eosinophils	0	02	2–10
Basophils	0	0	Rare
Platelet count ($\times 10^5$ cells/μL)	2.52	2.93	2–9
Alanine aminotransferase U/L)	26	19	8.2–57.3
Aspartate aminotransferase (U/L)	24	12	8.9–48.5
Alkaline phosphatase (U/L)	242	213	10.6–100.7
Total proteins (g/dL)	7.7	7.8	5.5–7.5
Albumin (g/dL)	2.6	2.6	2.6–4.0
Blood urea nitrogen (mg/dL)	6	2	8.8–25.9
Creatinine (mg/dL)	1	0.8	0.5–1.6

[a] Adopted from Kahn CM, Line S (2005) The Merc veterinary manual, 9th edn. Merck and Co. INC, N.J, pp 2584–2589

Fig. 1 *Paragonimus* egg observed in faecal sample of the dog

leukocytosis and mild increase in alkaline phosphatase activity. Faecal sample examination revealed eggs of *Paragonimus* spp. The eggs were large in size (72–90 μm long by 44–60 μm wide), yellowish brown in colour, with an operculum at one pole and a thickened shell at the opposite end (Fig. 1). Lateral radiograph of the chest showed thickened bronchi in the cranial lung lobe, caudal heart and accessory lung lobes, along with presence of multiple cavitations suggesting peribronchial infiltration (Fig. 2). A radio opaque round density was present near the diaphragmatic line. Size and position of the heart appeared normal.

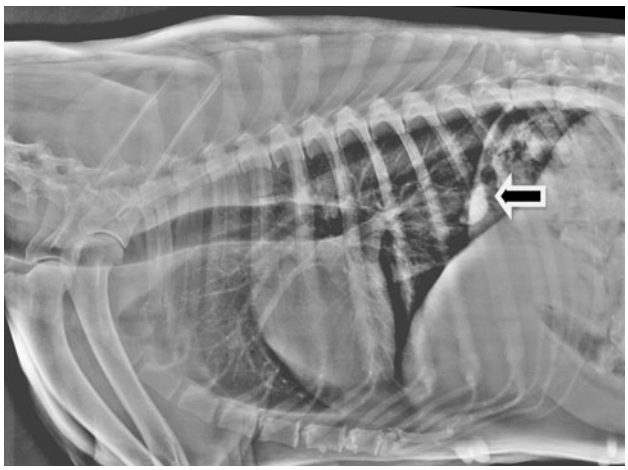

Fig. 2 Pre-treatment chest radiograph showing multiple cavitations in lung along with one large calcified nodule (*arrow*)

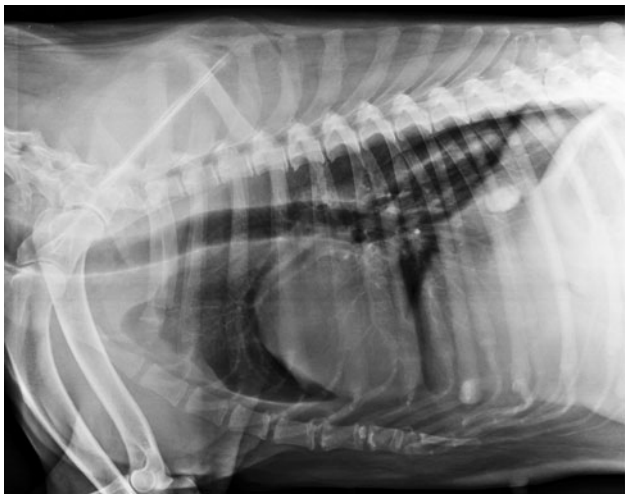

Fig. 3 Post-treatment chest radiograph showing marked improvement in bronchial pattern

Initially, the animal was treated symptomatically for gastric upsets with injectable antiemetics (metoclopramide) and H_2 blockers (ranitidine) for 2 days. Thereafter, fenbendazole was given at 25 mg/kg body weight (bw) twice daily for 14 days. Oral liver supplement was also prescribed as supportive treatment. After completion of the therapy, marked improvement in condition was reported by the owner, which was substantiated by disappearance of all the clinical symptoms observed previously. Post therapy lung radiograph also revealed marked improvement in bronchial pattern (Fig. 3), but calcified mass was still present. Haemato biochemical parameters were improved, as total leukocyte count and alkaline phosphatase activity came towards the normal range (Table 1). No *Paragonimus* spp. eggs could be detected in repeated faecal sample examination conducted after the treatment.

Discussion

Paragonimus spp. have complex life cycles that require two intermediate hosts, may be among snails, crustaceans and fish (Michael et al. 2009). The definitive host becomes infected by ingesting raw metacercariae contaminated shrimp or crayfish (Harrus et al. 1997). *Paragonimus* spp. can infect a variety of wild carnivores as well as dogs and cats (Michael et al. 2009) and is prevalent in North America, South Asia and South Africa (Harrus et al. 1997). Infection is more common in cats than in dogs (Nelson and Sellon 2005). The parasite has not been reported to cause disease in dogs so far from India. Humans are infected after eating fish containing metacercaria of the parasite (Mariano et al. 1986), where pulmonary lesions are caused by the penetration and growth of flukes (Dubey et al. 1979a). Clinical signs are often mild and hence frequently remain undiagnosed until severity of the disease increases. Clinical disease in humans is often confused with pulmonary tuberculosis (Singh et al. 1986). In human patients, chest radiographic findings include pneumothorax (Pachucki et al. 1984), pleural effusion (DeFrain and Hooker 2002; Madariaga et al. 2007) and consolidation (Castilla et al. 2003; Boe and Schwarz 2007). Leukocytosis and eosinophilia are common haematological changes in humans suffering from clinical disease (Singh et al. 1986; Shim et al. 1991). However, in present case, only leukocytosis with no increase in eosinophilia was observed in the dog.

Dogs also suffer from subclinical pulmonary infections where multiloculated cysts can be evident in chest radiograph (Pechman 2008). Radio opaque round density observed near the diaphragmatic line in the present case might be a focal granulomatous reaction caused by the lung fluke. Fenbendazole (Nelson and Sellon 2005) and praziquantel (Kirkpatrick and Shelly 1985) are reported to be effective against *Paragonimus* spp. Fenbendazole given at 25 mg/kg bw twice daily for 14 days showed good therapeutic response in the present case as evident from disappearance of clinical signs and improvement in chest radiographic findings. Fenbendazole in higher doses i.e., at 50–100 mg/kg bw for 3–8 days has been previously reported to be effective in canine paragonimiasis (Dubey et al. 1979b). Other drugs recommended for use in pulmonary paragonimiasis in man and animals include praziquantel, bithionol and albendazole (Pechman 2008; Michael et al. 2009).

This is the first report of *Paragonimus* spp. infection in a dog in India. Therefore, paragonimiasis may be added to the differential diagnosis whenever a dog is examined for chronic coughing and nasal discharges. Since overt clinical signs may be absent until the disease is in advanced stage, routine faecal and sputum examination should be performed, whenever nodular lung lesions are evident in lung radiograph. *Paragonimus* flukes do not have strong regional limitations and are increasingly being reported from many countries where snails of genus *Melania* and crabs of genus *Potamon* naturally occur (Harrus et al. 1997; Procop 2009). Both these two intermediate hosts are also found in aquatic habitat of Punjab (Khanna 1974), the state rich in water resources with many natural rivers and manmade canals, dams and ponds. Therefore, possibility of completing life cycle of this parasite in this region cannot be ruled out. In present case, it seems possible because the dog was born in Punjab and was never taken abroad or any other state of India. But since there is no report of *Paragonimus* spp. infection in dog or humans so far from Punjab, it may also be possible that this parasite was recently introduced from a geographically distinct area, where it is endemic. In view of the zoonotic potential of this parasite, there is an urgent need to create awareness among medical practitioners working in the Punjab state and other states of India regarding possible presence of lung flukes in human population. Fenbendazole is effective drug that can be used for treatment and control of lung worm infection in dogs.

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