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ORIGINAL PAPER

Efficacy of eprinomectin against *Toxacara canis* in dogs

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Abstract This study was made to investigate efficacy of eprinomectin against to *Toxocara canis* in dogs. In the study, 20 stray dogs naturally infected with *T. canis* were divided into two groups as treatment (ten dogs) and control (ten dogs). Eprinomectin (100 μg/kg, Eprinex 250 ml) was given to treatment group dogs orally, and eggs per gram were determined in the faeces on the day of pre-treatment and the second, fourth, sixth, eighth and tenth days of post-treatment. No side effects associated with nervous, respiratory, gastrointestinal systems and some haemotological parameters were observed. In conclusion, eprinomectin was determined to be 100% effectual against *T. canis*.

Keywords Dog · Eprinomectin · *Toxocara canis* · Treatment

Introduction

Toxacara canis is a prevalent nematode in dogs all over the world. The infective period larvae of *T. canis* is quite important because it produces visceral larva migrans in humans (Soulsby 1982). *T. canis* causes death because of the reasons such as development anomaly, diarrhea, uneasiness, loose abdominal appearance, dehydration and intestinal obstruction or rupture at intervals in young dogs (Burrows et al. 1995). Different chemical compounds such as ivermectin, pyrantel pamoate, nitroscanate, mebendazole, selamectin and milbemycin have been used for the treatment of this parasite (Bowman et al. 1998; Genchi et al. 1990; Clark et al. 1991; McTier et al. 2000).

Eprinomectin is a semi-synthetic member of avermectins from the macro-cyclic lacton family and a chemical compound composed of a mixture of Eprinomectin B1a and Eprinomectin B1b, which differ by a methylene group in the C25 (EMA/MRL/114/96 1996). It has been reported that endocytocytes from the avermectin family may have neurotoxic effects together with mydriasis, salivation, emesis and ataxia in Collie dogs (Pronk and Schefferlie 1998). Use of ivermectins in dogs is not few in number (off-label treatments available). Ivermectins have been used for the treatment of demodicosis and flariasis in dogs (Shipstone 2000).

Almost all the studies about Eprinomectin, an ivermectin group, are at toxicological level, most of which is associated with toxications because of long-term use (Pronk and Schefferlie 1998). No study about the efficacy of Eprinomectin in dogs has been encountered yet.

Consequently, the efficacy of Eprinomectin against the adult periods of *T. canis* was investigated in this study.

Materials and methods

In this study, a total of 20 stray dogs of different sexes and ages between 15 and 30 kg weight, determined to be naturally infected with *T. canis* were divided in two groups

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Table 1 The efficacy of eprinomectin on live weight and against *T. canis* in dogs

Groups	Dog number	Age	Sex	Body weight, day 0	Body weight, day 21	EPG						Efficacy (%)
						Day 0	Day 2	Day 4	Day 6	Day 8	Day 10	
Eprinomectin (100 μg/kg body weight per day)	1	2	♀	20	18	900	–	–	–	–	–	100
	2	7	♂	30	28	500	–	–	–	–	–	100
	3	1	♀	17	17	200	–	–	–	–	–	100
	4	4	♂	23	25	400	–	–	–	–	–	100
	5	3	♀	15	17	450	–	–	–	–	–	100
	6	7	♂	20	20	200	–	–	–	–	–	100
	7	1	♀	14	16	200	–	–	–	–	–	100
	8	5	♂	21	23	250	–	–	–	–	–	100
	9	1	♀	15	17	300	–	–	–	–	–	100
	10	2	♂	18	17	600	–	–	–	–	–	100
Control	11	1	♀	19	21	200	150	200	150	150	250	–
	12	2	♀	18	16	100	150	200	250	200	200	–
	13	5	♀	29	30	4,550	4,550	4,650	4,600	4,650	4,500	–
	14	2	♂	29	30	200	350	350	400	300	400	–
	15	4	♀	21	20	700	650	600	700	700	650	–
	16	3	♀	17	18	300	350	350	300	400	300	–
	17	3	♀	23	21	600	550	550	600	550	550	–
	18	4	♂	26	27	700	700	550	600	600	700	–
	19	2	♂	20	20	200	150	250	200	250	250	–
	20	2	♀	15	17	800	700	700	800	800	700	–

as treatment (ten dogs) and control (ten dogs) by using Fulleborn's Floatation Method, and the severity of *T. canis* infection was determined by egg count per gram of dog faeces using the McMaster method. The dogs used in the study were put under veterinary supervision 2 months before the study. After obtaining samples three times from 180 dogs and examining the faeces from these 180 animals, only the ones which were diagnosed to have *T. canis* infection constituted the study groups.

Live weights of all dogs were weighted on pre-treatment day (day 0) and post-treatment day 21 (day 21). Each dog was weighted and kept hungry a day before received 100 μg/kg body weight per day Eprinomectin (Eprinex 250 ml) orally. The dose of 100 μg/kg was used because it is claimed to be without adverse effects and the used dose in the previous toxicological studies. Additionally, the medicine firm recommended that the dose of 100 μg/kg could be sufficient.

During the study, the dogs were followed with regard to temperature, pulse (number of heart beat), loss of appetite, vomiting, diarrhea and abnormal behaviour (lethargy, tremor, ataxia). Venous blood samples in the eprinomectin group were collected into vacutiner tubes with ethylenediamine tetraacetic acid–K3 in the treatment days (days 0, 7 and 15). White blood cell count (WBC), red blood cell (RBC) count and haematocrit (PCV) were analysed manually.

No medication was applied to the dogs in the control group. Faeces samples were collected from every dog in both groups on days 0, 2, 4, 6, 8 and 10 after the treatment and examined with regards to *T. canis*. Eggs per gram (EPG) were determined in the faeces. The efficacy level of eprinomectin was determined.

For the housing and feeding of animals, World Association for the Advancement of Veterinary Parasitology guidelines were considered where necessary (Jacobs et al. 1994). However, dogs were exposed to stress as minimally as possible. For 2 months before the study, feaces of dogs were examined. All dogs were kept in separate boxes (sized 2×3 m) but under the same conditions. Faeces analysis continued for a 3.5-month period after the treatment.

Table 2 Some hematological parameters in eprinomectin administered dogs

Hematological Parameters	Day 0	Day 7	Day 15	*p* value
WBC (10^3/mm^3)	12.15±4.9	10.725±4.1	10.65±3.5	>0.05
RBC (10^6/mm^3)	6.18±0.4	6.34±0.4	6.39±0.7	>0.05
PCV (%)	46.38±4.8	46±3.2	44.5±2.7	>0.05

Considering the life cycle of *T. canis*, the necropsy was not practiced because 5.5 months is enough to observe efficacy of the drug.

Results

The age, sex, weight, gram faeces egg numbers and percentage of the effect of the medicine of the dogs examined macroscopically using Fulleborn's Floatation Method pre- and post-treatment are displayed in Table 1.

No toxic effect was observed in dogs immediately after the medicine administration. No difference was also determined in body temperature, heartbeat number and appetite. Vomiting, diarrhea or abnormal behaviour was encountered in none of the dogs. No difference was established between treatment and control groups with regard to live weight.

Haematological parameters (WBC, RBC, PCV) were within reference ranges in the eprinomectin group in the treatment days of 0, 7 and 15, and no significant differences were observed (Table 2).

Discussion

Macrocyclic lactones such as avermectins and milbemycins, ascarids included as well, show a perfect anti-parasitic activity against nematodes. Various formulations of these compounds are used all over the world for many animal groups such as cattle, sheep, pig and horse (McKellar and Benchaoui 1996).

With some dogs (especially Collies, Sheepdogs, Australian Shepherds and Bobtails), the sensitive ones exhibit a mutation in the mdr1-Gen, which codes for the p-glykoprotein pump. p-Glycoproteins pump out Avermectine from central nervous system (CNS) cells, and animals with defective p-glycoprotein levels in the blood–brain barrier are susceptible to toxicity. Nervous signs including depression, muscle weakness, blindness, coma and death were observed, especially in Collies (Vercruysse 2005; ANON 2007).

The sensitive dogs enrich themselves the Avermectine in the CNS because an active return motion mechanism does not function. Mammalian safety appears to depend on p-glycoprotein activity in the blood–brain barrier. It is thought that p-glycoprotein deficiency in certain animals of this breed allows avermectins to penetrate and accumulate in the CNS more readily than would normally be expected, causing unusual signs at dose levels considerably below those required to produce toxicity in healthy animals (Vercruysse 2005; ANON 2007).

Eprinomectin was used in dogs only in toxicity studies, and more than one administration was applied. Eprinomectin applied several weeks was reported as "The No Observable Effect Level (NOEL) 0.8 mg/kg" in the brain. For the brain, 0.8 mg/kg body weight per day has been the NOEL (EMEA/MRL/114/96 1996). The dose we applied was lower than the above dose, and only one administration was applied.

Medicine combinations such as pyrantel pamoate (Clark et al. 1991), nitroscanate (Genchi et al. 1990; Sarımehmetoğlu et al. 2002), milbemycine (Bowman et al. 1998; Osamura et al. 1995), ivermectin (Pal et al. 1995), selamectin (McTier et al. 2000), moxidectin (Gargılı et al. 1999), praziquantel, pyrantel embonate and febantel (Lloyd and Gemmel 1992), ivermectin and pyrantel pamoate (Clark et al. 1992) have been used in dogs to treat gastrointestinal cestodes and nematodes in the recent years.

Clark et al. (1991) reported in their studies, where they investigated the efficacy of various doses of pyrantel pamoat against ascarid and hookworms in dogs, that this combination was effectual against *T. canis* by 76.1–94.2%. While Bowman et al. (1998) found that milbemycine applied at a dose of 0.27 mg/kg orally was 100% effective against *T. canis*, Sarımehmetoğlu et al. (2002) reported that seven of eight dogs infected with *T. canis* were treated with 50 mg/kg nitroscanate.

There are studies where macrocyclic lactones such as ivermectin, moxidectin and selamectin were used for the treatment of ascarid in dogs. A dose of 0.2 mg/kg ivermectin administered subcutaneously (Pal et al. 1995) and moxidectin (Gargılı et al. 1999) were reported to be 100% effectual against *T. canis.* Payne-Johnson et al. (2000) stated that selamectin administered topically at a dose of 6 mg/kg to dogs infected with *T. canis* decreased the faeces egg number by (EPG) 99.7%.

In this study eprinomectin applied orally at a dose of 100 μg/kg to dogs infected with *T. canis* was determined to decrease EPG by 100%.

In conclusion, eprinomectin administered to insensitive dogs at a dose of 100 μg/kg orally may be used in treating *T. canis* because no side effects were determined during study.

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