

Case Report

First documented cases of *Pearsonema plica* (syn. *Capillaria plica*) infections in dogs from Western Slovakia

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Summary

Three clinical cases of dogs with *Pearsonema plica* infection were detected in the western part of Slovakia. All cases were detected within five months. Infections were confirmed after positive findings of capillariid eggs in the urine sediment in following breeds. The eight years old Jack Russell Terrier, one year old Italian Greyhound, and eleven years old Yorkshire terrier were examined and treated. In one case, the infection was found accidentally in clinically healthy dog. Two other patients had nonspecific clinical signs such as apathy, inappetence, vomiting, polydipsia and frequent urination. This paper describes three individual cases, including the case history, clinical signs, examinations, and therapies. All data were obtained by attending veterinarian as well as by dog owners.

Keywords: Urinary capillariasis; urine bladder; bladder worms; dogs

Introduction

Urinary capillariasis caused by *Pearsonema plica* nematode of family Capillariidae is often detected in wild canids. Especially in red foxes (*Vulpes vulpes*), where the *P. plica* infection was confirmed in many European countries. To be exact in Hungary (Sréter *et al.*, 2003), Denmark (Saeed *et al.*, 2006; Petersen *et al.*, 2018), Germany (Bork-Mimm & Rinder, 2011), Italy (Magi *et al.*, 2014), Norway (Davidson *et al.*, 2006), Estonia (Laurimaa *et al.*, 2016), Lithuania (Bruzinskaite-Schmidhalter *et al.*, 2011), Bosnia and Herzegovina (Alic *et al.*, 2015), and Belarus (Shimalov & Shimalov, 2003). In all these studies, the prevalence ranged from the lowest 21.3 % in Belarus and the highest in 93.3 % in Lithuania. Similarly Franssen *et al.* (2014) recorded *P. plica* in four out of four red foxes from Netherlands. Foxes as the hosts are considered to be the wild reservoirs of *P. plica* in the natural environment (Mariacher *et al.*, 2016) and their role in epidemiology of bladder worms seems to be very important (Petersen *et al.*, 2018). The

prevalence in domestic dog population is unknown. The occurrence of *P. plica* in domestic dogs was observed and described in quite a few case reports from Poland (Studzinska *et al.*, 2015), Italy (Callegari *et al.*, 2010; Mariacher *et al.*, 2016), and Switzerland (Basso *et al.*, 2014).

The life cycle of *P. plica* comprises of obligate intermediate hosts. The earthworms of the Lumbricidae family, such as *Lumbricus terrestris*, *L. rubellus*, and *Dendrodrilus rubidus*. A dog or fox will become infected after ingestion of earthworms containing infective first-stage larvae of *P. plica* (Moravec *et al.*, 1987). Petersen *et al.* (2018) considers also another way of transmission, which is typical by feeding on paratenic hosts, such as rodents and birds.

Case I: Jack Russell Terrier

Urinary capillariasis was diagnosed for the first time in eight years old Jack Russell Terrier female primarily presented with pronounced apathy. The animal owner also described the other

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Fig. 1. *Pearsonema plica* capillarid egg.

symptoms, such as inappetence, vomiting, and polydipsia. Clinical examination confirmed slight dehydration, pink sticky mucous membranes, and prolonged capillary refill time. The body temperature was 38 °C. Lymph nodes were not enlarged or changed and abdominal pain was not present. The urine obtained by cystocentesis was odorless, with pH 7, and of a yellowish color. The urine sample was centrifuged (2000 RPM/5 min). Microscopic examination of the urine sediment confirmed the presence of *Pearsonema plica* capillarid eggs (51 eggs in 0.1 mL) (Fig. 1) and bacterial infection associated with cystitis was also present. Ultrasonography revealed thickness of the urinary bladder wall and confirmed the presence of few very small uroliths. No history of a urinary tract disease was detected until this examination. Hematological examination confirmed eosinophilia, leukocytosis, and thrombocytosis. Biochemical examination indicated on increased level of urea concentration (15.8 mmol/L; normal range 2.5 – 9.6).

The dog has lived outdoors in the owner's garden in Bratislava and never went to the other places, except the veterinary clinic visits. Dog was not constantly under supervision. The owner did not exclude the possibility that the dog may have eaten intermediate hosts. Therapy applied therapy was Fenbendazole at the dose of 50 mg/kg for 4 days. The dog's condition improved within few days after the therapy initiation. The symptoms observed by dog owner have disappeared and dog became lively and active. Control examination was performed on day 13 and at that time the animal's condition was very good. However, the eggs of *P. plica* were still present in the urine sediment (39 eggs in 0.1 ml). The Fenbendazole therapy had to be repeated for another four days. Although a follow-up veterinary check-up examination was recommended the animal owner did not bring the patient for another examination. Therefore, the efficiency of the treatment could not be verified.

Case II: Italian Greyhound

Five months later, another case of urinary capillariasis was confirmed. The infection of *P. plica* was found in the one year old Italian Greyhound male from Šamorín (Western Slovakia) living indoors in its owner's flat. The dog had no clinical signs and capillarid eggs were found accidentally during the pre-operative assessment prior stomatological treatment. Beside the eggs, many struvite crystals were present in the urine sediment as well. Within two months five different biochemical blood examinations were performed. Each measurement confirmed an increased concentration of urea (ranging from 12.9 to 19.7; norm < 9.6). The other renal function parameters (CREAT, PHOS, and SDMA) were normal and the average number of capillarid eggs per 0.1 mL in urine sediment was 10. Four day Fenbendazole therapy was applied to treat parasitic infection. The treatment had to be repeated after 12 days due to reappearance of *P. plica* eggs (8t eggs in 0.1 ml of urine sediment). Following second treatment the egg production stopped and the urea level returned to normal. Two months later, control examinations confirmed the efficiency of the therapy. The dog was finally cured.

Case III: Yorkshire Terrier

During the treatment of previous case another case of *P. plica* infection emerged. The eleven years old Yorkshire Terrier female from Bratislava was examined due to the loss of appetite and frequent urination. The dog lived indoors and owner excluded any contact with intermediate hosts. Biochemical examination revealed slightly increased urea level in blood (9.35; norm <8.05). Together with capillarid eggs in the urine sediment (15 eggs in

0.1 ml), the transitional epithelial cells and erythrocytes were present and proteinuria was confirmed. The results of the X-ray examination and ultrasonography were normal. The dog was treated with Fenbendazole (50 mg/kg for 4 days). Unfortunately, 3 days after the therapy initiation she died due to the obstruction of esophagus with a chicken bone. The owner refused the autopsy. Therefore, the post-mortem examination of the urine bladder could not be performed.

Discussion

Since October 2018, three different clinical cases of *P. plica* infections were observed in the western part of Slovakia. Historically, only a little attention was paid to this helminth species and no such findings in our country have ever been published. In this paper, one veterinarian identified three naturally infected dogs within a relatively short time period (5 months). The urine sediment of all examined dogs contained typical thick wall and bipolar plugs capillarid eggs. The clinical signs in individual dogs ranged from none to quite serious. Inappetence was observed in two of three dogs. The bladder worm infection in Yorkshire Terrier was associated with pollakiuria, proteinuria, and the presence of erythrocytes as well as epithelial cells in the urine sediment. This was very similar to the clinical case in Switzerland where the same symptoms were observed (Basso *et al.*, 2014). Erythrocytes, leucocytes, and transitional epithelial cells were found in the urine sediment of an infected dog in Italy (Callegari *et al.*, 2010). This was similar to another case of canine urinary capillariasis in Poland in which the erythrocytes and leucocytes were detected along with bacteria and struvite crystals (Studzinska *et al.*, 2015). Large number of erythrocytes and leucocytes were also seen in urine of infected dog from Netherlands (van Veen, 2002). The cystitis confirmed in Jack Russel Terrier is one of the most common clinical signs associated with *P. plica* infection generally detected in dogs (Mariacher *et al.*, 2016), foxes (Alic *et al.*, 2015; Fernández-Aguilar *et al.*, 2010), wolves (Mariacher *et al.*, 2015), and cats (Rossi *et al.*, 2011). However, the pathologic effects of bladder worms in canids include also: reddish and thickened bladder mucosa (Alic *et al.*, 2015; Callegari *et al.*, 2010), inflammatory reactions and edema of submucosa of the bladder and ureter (Senior *et al.*, 1980), chronic inflammation of the urine bladder and renal pelvis, nephritis (Callegari *et al.*, 2010), and glomerular amyloidosis (Callegari *et al.*, 2010; Mariacher *et al.*, 2016). Additionally the renal failure and urethral obstruction was observed in cats (Rossi *et al.*, 2011). Regarding diagnostic methods the urine sedimentation technique usually detects the presence of *P. plica* eggs. Maurelli *et al.* (2014) used FLOTAC and Mini-FLOTAC quantitative techniques for diagnosis of capillarid eggs in dog urine. Both above mentioned methods are considered more sensitive than standard sedimentation technique.

In our study, biochemical blood examinations revealed elevated urea in all three dogs. This might be associated with the *P. plica*

infection. In an Italian Greyhound case we had the opportunity to compare urea values during and after the Fenbendazole treatment. When the parasitic infection was completely cured the urea level returned back to normal. Callegari *et al.* (2010) also measured the level of urea in a dog with the *P. plica* infection and found the same elevated urea concentration. The two other dogs from our study could not be examined repeatedly. As a consequence we do not know if the urea decreased after the Fenbendazole therapy. The thickness of the urinary bladder wall confirmed in Jack Russell Terrier might also be related to the urinary capillariasis. The same finding was described by Basso *et al.* (2014).

The data regarding the treatment of bladder worms are inconsistent and the experiences with particular drugs vary. In some cases Fenbendazole seemed to be efficient (van Veen, 2002; Mariacher *et al.*, 2016), and according to the other authors this therapy has failed. Instead of Fenbendazole, Kirkpatrick & Nelson (1987) and Studzinska *et al.* (2015) used Ivermectin to treat dog successfully. Del Angel Caraza *et al.* (2018) eliminated the infection with Fenbendazole in a dog and Ivermectin in a cat. On contrary, Basso *et al.* (2014) considered Ivermectin, Fenbendazole and Moxidectin-ime-dacloprid as inefficient. Based on their experience and due to high excretion of metabolites via urine Levamisole is the most appropriate drug for the treatment of the urinary bladder capillariasis. In our study, the Italian Greyhound was successfully treated with Fenbendazole. At the beginning of therapy the dose 50 mg/kg for 4 days was used for each dog. The veterinarian counted number of eggs in 0.1 ml of urine sediment at each examination. Although the urine sedimentation technique is considered as qualitative method with low sensitivity (Maurelli *et al.*, 2014) the vet found out that the number of eggs decreased as the patient's health condition was improving. The information whether the infection in Jack Russel Terrier has been definitely eliminated is missing, but the clinical signs observed at the first examination such as apathy, inappetence, vomiting, and polydipsia were not present during second vet checkup. The Yorkshire Terrier died shortly after initiation of treatment. Therefore it was impossible to monitor treatment efficacy. In general, Fenbendazole was efficient, or partially efficient, in all these cases.

The transmission of *P. plica* by earthworms is well known where intermediate hosts are essential for the development of this parasite. Many authors suggest that the ingestion of earthworms by dogs is the main source for the bladder worm infection (Fernández-Aguilar *et al.*, 2010; Bork-Mimm & Rinder, 2011; Mariacher *et al.*, 2016; Petersen *et al.*, 2018). The importance of paratenic hosts is also under consideration, but there is a lack of relevant information. No direct life cycle has been experimentally demonstrated (Senior *et al.*, 1980).

With regard to our study, it is not clear how dogs acquired the infection. Two dogs lived indoors and one outdoors and all of them in urban areas in the Western Slovakia. The owner of the Yorkshire Terrier excluded the consumption of earthworms. A contact between the Jack Russel Terrier and the Italian Greyhound and an

intermediate host could not be absolutely ruled out. According to Petersen *et al.* (2019), foxes can acquire the infection by feeding on rodents and birds as a paratenic hosts. This way of transmission might be possible in dogs and cats as well. The consumption of earthworms by cats is not unusual while rodents and birds are common preys of felids. For that reason, it is necessary we should to consider also another ways of transmission.

This study shows that dogs living exclusively in urban areas are also at the risk of worm bladder infection. It means that infected intermediate hosts could be present not only in rural areas, but also in big cities, such as Bratislava. Similar results were found in urban areas in Mexico where domestic animals (dogs and cats) were infected, but no wild animal as a definitive host of *P. plica* did occurred in the area (Del Angel Caraza *et al.*, 2018).

Based on our findings, more attention should be paid to the parasitological examination of urine sediments in dogs and cats. This may reveal more other cases of *P. plica* infection and also provide more information about urinary capillariasis. Additional data will help to clarify how domestic dogs and cats acquire this infection.

Ethical Approval and Informed Consent

No animals were killed for the purpose of this study.

Conflict of interest

Authors state no conflict of interest.

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