

Dioctophymosis in a free-ranging maned wolf (*Chrysocyon brachyurus*): clinical therapeutic, ultrasonographic and pathological aspects – case report

[*Dioctofimose em um lobo guará (Chrysocyon brachyurus) de vida livre: aspectos clínico-terapêuticos, ultrassonográficos e patológicos - relato de caso*]

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ABSTRACT

Dioctophymosis is the disease caused by *Dioctophyma renale*, a large nematode, popularly known as giant kidney worm, and whose definitive hosts are the domestic dog and many wild mammal species. There are some reports of maned wolf parasitism by *D. renale*, however, in most cases the reports are restricted to the finding of the parasite during necropsy, without clinical assessment. The present report aimed to describe the clinical-therapeutic, ultrasonographic and pathological aspects of *D. renale* parasitism in a free-ranging maned wolf, emphasizing the treatment with an association of doramectin, praziquantel, pyrantel pamoate, and febantel that resulted in complete elimination of the parasite.

Keywords: giant kidney worm, wildlife, wild canid

RESUMO

A dioctofimose é a doença causada pelo *Dioctophyma renale*, um nemátodo grande, popularmente chamado de verme gigante do rim e que tem como hospedeiro definitivo o cão doméstico e inúmeras espécies de mamíferos silvestres. Existem alguns relatos do parasitismo do lobo-guará por *D. renale*, contudo, na maioria das vezes, os relatos se restringem apenas ao achado do parasita durante a necropsia, sem a correlação clínica. O presente relato objetiva descrever os aspectos clínico-terapêuticos, ultrassonográficos e patológicos do parasitismo por *D. renale* em um lobo-guará de vida livre, enfatizando o tratamento com uma associação de doramectina, praziquantel, pamoato de pirantel e febantel, o que resultou na eliminação completa do parasita.

Palavras-chave: verme gigante, vida selvagem, canídeos selvagens

INTRODUCTION

Dioctophymosis is the disease caused by *Dioctophyma renale*, a large nematode parasite of the family Dioctophymatidae, popularly known as giant kidney worm. *D. renale* have a wide number of definitive hosts, being described especially in wild and domestic species of the order Carnivora. It parasites the kidney of these definitive hosts, but also requires an intermediate host (aquatic oligochoete or annelid) and a paratenic host (fishes and frogs) to complete its

cycle (Bowman, 2009). Transmission to the definitive host occurs by the ingestion of the paratenic hosts. Although it is not considered an important zoonosis, there are sporadic reports in humans (Ignjatovic *et al.*, 2003; Yang *et al.*, 2016).

The maned wolf (*Chrysocyon brachyurus*) is the larger wild canid of South America, classified as *near threatened* by International Union for Conservation of Nature and Natural Resources (IUCN) Red List. It is present in all Brazilian

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biomes, with the exception of the Amazon and Caatinga (Paula and Dematteo, 2015). There are a few reports of infection by *D. renale* in maned wolves (Dietz, 1984; Varzone et al., 2008; Cansi et al., 2012; Duarte et al., 2013). However, specific treatment protocols, clinical evolution, diagnostic tools, and post treatment anatomopathological findings have not been previously reported. Therefore, this report aimed to describe a case of diotrochymosis in a free-ranging maned wolf focusing on clinical-therapeutic, ultrasonographic and pathological aspects of the disease.

CASE REPORT

An adult, female, free-ranging maned wolf, weighting 23kg, was referred to the Veterinary Hospital of the Bauru Zoo (Bauru, São Paulo, Brazil) with a history of being run over. In order to perform physical examination, the animal was anesthetized with tiletamine and zolazepam

(8mg/kg I.M.). Ultrasound and radiological examinations were performed, while blood and urine samples were collected to perform hematological exam and urinalysis.

Radiographs revealed a complete fracture on the caudal region of the sacral bone and a complete oblique fracture in the vertebral body of L3 with cranioventral deviation. Through ultrasound, splenomegaly with a focal hematoma, characterized by mild local hypoechogenicity with irregular contours was observed. Unexpectedly, the right kidney was reduced in size (5.5cm x 3.3cm) with marked atrophy of the cortical region, loss of corticomedullary definition, and multiple anechoic tubular images with echogenic wall (ring-like structures) (Figure 1), which was interpreted as a chronic nephropathy with tubular parasites suggestive of nematodes. The left kidney had 6.2 x 3.6cm with a slightly thickened cortical region.

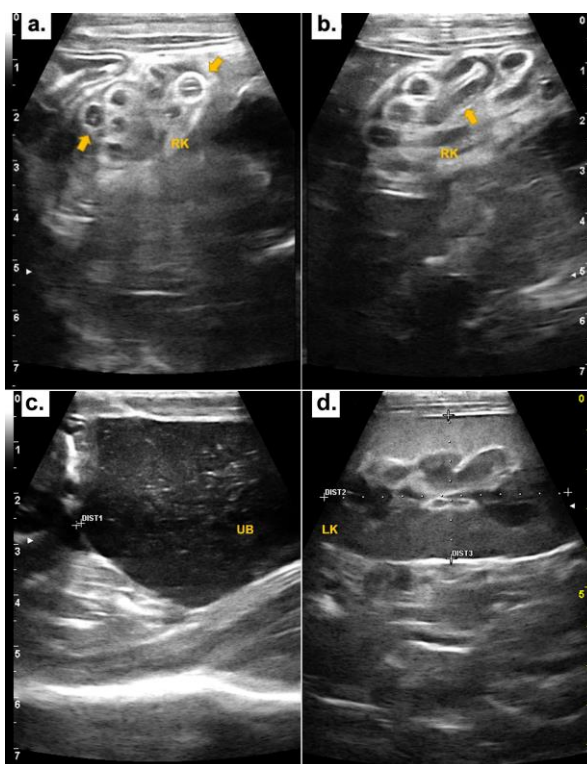


Figure 1. Ultrasound image of the right kidney (RK), left kidney (LK) and urinary bladder (UB) of a maned wolf (*Chrysocyon brachyurus*) parasitized by *Diotrochyma renale*. (a) Ring-like structures (arrow) characterized by anechoic tubular images with echogenic wall, compatible with transversal plan of the parasite. (b) Longitudinal image of the parasite (arrow). (c, d) ultrasonographical normal left kidney (LK) and urinary bladder (UB).

Urinalysis showed a cloudy and orange urine, with a foul odor, density of 1.045, pH 5.5, large amount of bilirubin (+++), occult blood (>15 per immersion power field), bacteria (+++), and moderate amounts of desquamated cells (+++), proteins (5 to 15 per immersion power field) and leukocytes (5 to 10 per immersion power field). The urine also contained nematode eggs with elliptical shape, symmetrical bipolar plugs and a thick rough shell, morphologically compatible with *D. renale* eggs.

Blood cell count revealed a slightly low packed cell volume (34.5%), lymphopenia (300/ μ L) and neutrophilia (12,300/ μ L). Blood biochemical examination indicated high levels of creatinine (2.05mg/dL) and alanine aminotransferase (311 U/L), and a slightly increased urea (81.6mg/dL). References values from Guimarães *et al.* (2013) were used to compare hematological data and ultrasound findings of this case.

During the course of treatment, in addition to antibiotic, anti-inflammatory, and analgesic therapy (tramadol 4mg/kg, subcutaneously, B.I.D.; ceftazidime 25mg/kg, subcutaneously, B.I.D.; carprofen 4.4mg/kg, oral, S.I.D.; metronidazole 15mg/kg, intravenous, B.I.D.; omeprazole 1mg/kg, oral, S.I.D.; pentoxifylline 20mg/kg, oral, B.I.D.) focused on the traumatic lesions, the animal received two doses of doramectin 0.5mg/kg, subcutaneously, with a 30-

day interval, and two anti-parasitic tablets composed of praziquantel (50mg), pyrantel pamoate (144mg), and febantel (150mg) (Drontal Plus, Bayer Pet, Brazil), with a 15-day interval, for ectoparasite and endoparasite control. Thirty days after initial treatment, leukometry, urea (57.1mg/dL), creatinine (1.11mg/dL), and alanine aminotransferase (57.3 U/L) were within the normal range. However, due to the deteriorated patient's general condition and poor prognosis of the traumatic injuries, euthanasia was performed followed by necropsy.

Macroscopically, there was a marked asymmetry of the kidneys, with the left kidney measuring approximately 9.0 x 5.0cm, and the right kidney with 3.0 x 1.5cm. The right kidney had a complete loss of the medullar region, with a distended pelvis and a markedly hypotrophic cortical region. Nevertheless, there were no parasites in the right kidney, as demonstrated by ultrasound and urinalysis performed *ante mortem* (Figure 2). In addition, the pancreas was diffusely dark red with a gelatinous consistency. Samples of the kidneys, lungs, liver, urinary bladder, heart, pancreas, superficial lymph nodes, small intestine, and large intestine were collected, fixed by immersion in 10% buffered formalin, processed according to the routine protocol for paraffin embedding, and stained with eosin and hematoxylin (HE).

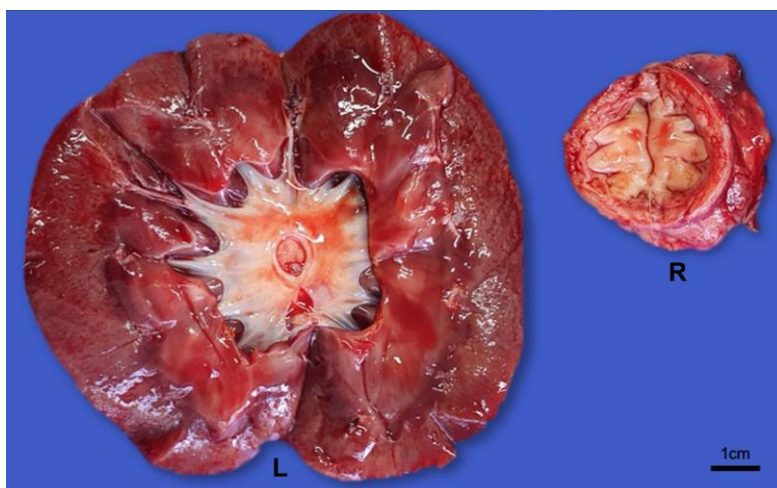


Figure 2. Macroscopic aspect of both kidneys of a maned wolf (*Chrysocyon brachyurus*) parasitized by *Dioctophyma renale*. Right kidney (R) is markedly smaller than the left kidney (L). The right kidney (R) had a complete loss of the medullar region, with a distended pelvis and a markedly hypotrophic cortical region. Nevertheless, there were no parasites in the right kidney.

Histopathology of the right kidney demonstrated a diffuse and severe hypotrophy of the medullar and cortical regions with complete loss of tubular structure, intense fibrosis, and diffuse and severe glomerulosclerosis, confirmed by PAS and Masson trichrome stain, characterizing a severe

chronic renal disease (Figure 3). There was no significant lesion in the left kidney. Additionally, there was a moderate multifocal to coalescing lympho-histioplasmacytic and neutrophilic interstitial pancreatitis.

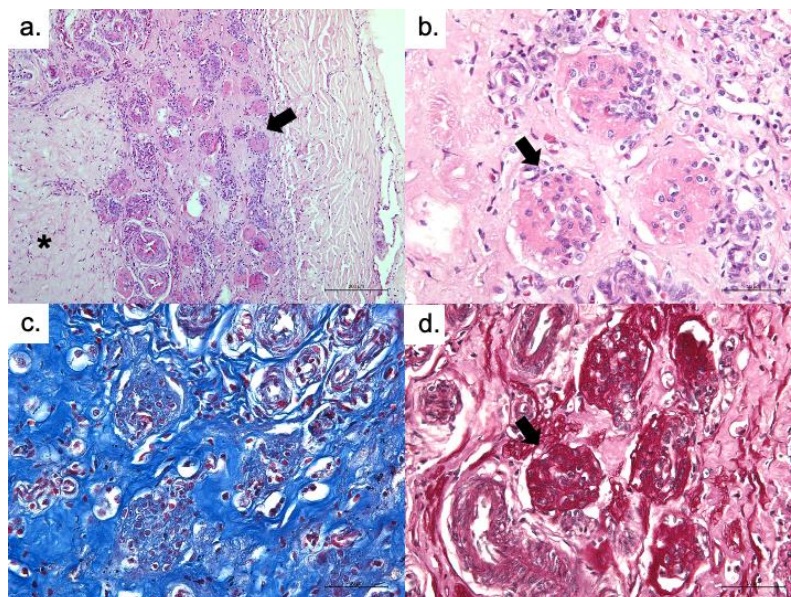


Figure 3. Histopathology of the right kidney from a maned wolf (*Chrysocyon brachyurus*) parasitized by *Dioctophyma renale*. (a) Severe fibrosis, with hypotrophy of the medullar (*) and cortical (arrow) regions with absence of tubular structures, HE, scale bar = 200 µm. (b) Glomeruli (arrow) are atrophic and sclerotic, HE, scale bar = 50 µm. (c) Intense fibrosis with accumulation of large amounts of collagen in blue, Masson trichrome stain, scale bar = 50 µm. (d) Severe thickening of the mesangium (arrow), PAS, scale bar = 50 µm.

DISCUSSION

This report describes in detail the clinical-therapeutic, ultrasonographic and pathological aspects of *D. renale* infection in the right kidney of a free-ranging maned wolf, with successful treatment protocol based in anti-parasitic drugs. In captive maned wolf *D. renale* has already been described as an important cause of death and it was also associated with poor reproductive performance (Dietz, 1984). However, there are no previous studies on the impact of this parasite on free-ranging populations of maned wolves (Maia and Gouveia, 2002). Importantly, this report describes clinical findings and diagnosis of diotophymosis, clearly demonstrating the irreversible nature of the renal lesions in spite of a successful parasitological treatment. Therefore, if bilateral, this parasitism may lead to renal failure and death.

Kidney interstitial fibrosis with hypotrophy of cortical and medullar region were compatible with the lesions observed in parasitized domestic dogs (Ferreira et al., 2010; Mesquita et al., 2014; Silveira et al., 2015) as well as with previously reported lesions in a maned wolf (Cansi et al., 2012). In the definitive host the ingested larva penetrates the duodenal wall and migrates through abdominal cavity to the kidney (Bowman, 2009). Interestingly, most of the previous reports of *D. renale* in maned wolves or other definitive hosts describes the presence of the parasite in the right kidney (Mace and Anderson, 1975; Varzone et al., 2008; Cansi et al., 2012; Duarte et al., 2013; Silveira et al., 2015), evidencing a side predisposition to the parasite migration, possible due to its anatomic proximity to the duodenum (Ferreira et al., 2010). Abdominal cavity is another common

place to find this parasite, where it may cause peritonitis (Bowman, 2009).

Some infected animals may remain asymptomatic, especially when only one kidney is affected, which highlights the importance of developing efficient diagnostic tools to identify the parasite (Ferreira *et al.*, 2010; Silveira *et al.*, 2015). Ultrasonography, as well as urinalysis, is particularly useful to identify renal parasitism. In this study, renal ultrasonographic changes, particularly the ring-like structures, lead to a presumptive diagnosis of renal parasitism, which was confirmed by demonstrating parasite eggs in the urine. Hematuria is a common clinical manifestation in *D. renale* infection even in asymptomatic animals (Ferreira *et al.*, 2010; Mesquita *et al.*, 2014; Silveira *et al.*, 2015). In this case, although only one kidney was affected, biochemical examination demonstrated increased levels of creatinine and urea, indicating azotemia that normalized after treatment. Therefore, the transient azotemia in this case might not be due to renal lesion, but likely due to other systemic conditions such as dehydration.

Treatment of *D. renale* is often based on nephrectomy, especially when only one kidney is affected (Ferreira *et al.*, 2010; Mesquita *et al.*, 2014; Silveira *et al.*, 2015), with no successful reports of anti-parasitic treatment alone. However, in humans there are a few reports of medical therapy using ivermectin and albendazole with satisfactory results (Ignjatovic *et al.*, 2003; Yang *et al.*, 2016, 2019). In these previous reports, treatment protocols were poorly described. However, two of them opted for a two times oral administration of the chosen anti-helminthic drug (Ignjatovic *et al.*, 2003; Yang *et al.*, 2016). Also, in these two cases the patients were monitored for 6-months (Yang *et al.*, 2016) to 6-years (Ignjatovic *et al.*, 2003) by serial urinalysis, with absence of *Diocetophyme* eggs in both cases after treatment. Yang *et al.* (2019) describe a case of a human patient that expelled a whole worm and fragments at urine after treatment, suggesting that this is the possible route of elimination. Importantly, in these reports urinalysis appears to be a good tool to follow up patients and to ensure the elimination of the parasite.

In the present case, treatment with doramectin associated with praziquantel, pyrantel pamoate,

and febantel was sufficient to eliminate the parasite, since it was not observed at necropsy. Importantly, most of the maned wolves diagnosed with *D. renale* came from the wild (Maia and Gouveia, 2002), when an effective anti-parasitic therapy is a better option when compared to nephrectomy. This highlights the importance to establishing an effective anthelmintic protocol for eliminating *D. renale* when the affected renal parenchyma is still preserved, particularly in wild animals.

CONCLUSION

D. renale parasitism in a maned wolf had clinical evolution and anatomopathological changes similar to those previously described in domestic canines. Ultrasound and urinalysis are important diagnostic tools for the identification of the parasite so these methods should be considered as screening tests for maned wolves coming from the wild, even in asymptomatic cases. Finally, a therapeutic protocol with the association of doramectin, praziquantel, pyrantel pamoate, and febantel was sufficient for a complete elimination of the parasite.

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