Extra-Renal Lesion Caused by *Diectophyma renale* Eggs in an Erratic Cycle in a Dog

Lesión Extra Renal Causada por los Huevos de *Diectophyma renale*
en un Ciclo Errático en un Perro

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SUMMARY: A dog with multiple infection by *D. renale* in the abdominal cavity presented granular peritonitis with giant cells phagocytizing *D. renale* eggs. Hepatic and phrenic serositis associated to numerous eggs of the parasite immersed in fibrinous process were observed. Lungs presented *D. renale* eggs in the parenchyma, mononucleated cell infiltrates, edema, hemorrhage, congestion, atelectasia, emphysema, and thromboembolism. *D. renale* eggs were detected inside the center-lobular veins, auricular cavities, and superficial venous bed of the heart. These findings characterized an atypical dissemination pathway of eggs in erratic cycle.

KEY WORDS: Egg; *Diectophyma renale*; Erratic cycle; Extrarenal parasitism; Canine.

INTRODUCTION

Diectophyma renale is a cosmopolitan parasite known as giant kidney worm. The parasite infests several mammal species, even man (Acha & Szyfres, 2003; Fortes, 1997). *D. renale* is often described in dogs (Osborne *et al.*, 1969; Amato *et al.*, 1976; Kommers *et al.*, 1999; Leite *et al.*, 2005; Nakagawa *et al.*, 2007). The parasite is commonly diagnosed in the right kidney and in the abdominal cavity (Osborne *et al.*; Amato *et al.*; Kommers *et al.*; Leite *et al.*) but it may parasitize both kidneys (Augusto Filho *et al.*, 1999). Also, *D. renale* may be diagnosed only in the abdominal cavity. Other organs may also be affected, like the liver (Gargili *et al.*, 2002), stomach and mesenterium (Miranda *et al.*, 1992), causing perforations, hemorrhage and peritonitis (Osborne *et al.*; Monteiro *et al.*, 2003).

The lesions caused by *D. renale* depend on the location in the body where the parasite is diagnosed (Kommers *et al.*). More specifically, in the kidney one or more worms (Amato *et al.*; Kano *et al.*, 2003) cause the compressive destruction of the parenchyma (Leite *et al.*; Nakagawa *et al.*) and lead to the thickening of renal capsule due to the development of fibrosis (Leite *et al.*). The clinical

expression of the parasitosis by *D. renale* is unspecific (Osborne *et al.*; Kommers *et al.*; Kano *et al.*; Monteiro *et al.*), or may even be absent (Osborne *et al.*). If only one kidney is infected, the renal function is preserved by the contralateral kidney (Kano *et al.*; Leite *et al.*; Monteiro *et al.*). Anemia (Kano *et al.*), hematuria, progressive weight loss (Kommers *et al.*; Nakagawa *et al.*) and abdominal distension may be signs associated to *D. renale* parasitosis (Kano *et al.*).

The parasite's preference for renal sites favors its cycle, which is long and complex. The cycle involves several hosts; eggs are eliminated through urinary ways of the infected host and then ingested by intermediate hosts, aquatic oligochaetes, which are ingested by paratenic hosts (fish and frogs). Definitive hosts and/or terminal hosts are infected by ingestion of contaminated oligochaetes or paratenic hosts (Fortes). Characteristically, *D. renale* eggs are large, elliptical, brown, thick-shelled, wrinkled, and are roughly between 60 and 80mm in length and 39 and 46mm in diameter (Osborne *et al.*). *D. renale* diagnosis is normally reached with casual necropsy findings, during surgical

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procedures, in tests in urinary sediment and ascetic liquid (Kommers *et al.*; Leite *et al.*), and via radiographic and ultrasound investigation (Costa *et al.*, 2004). As anatomopathological findings of *D. renale* in dogs are restricted to renal lesions, the aim of this study was to describe extra-renal lesions in tissue samples collected from a dog with peritonitis caused by multiple *D. renale* infestation.

MATERIAL AND METHOD

The study material consisted of tissue samples from a young, 7-kg mixed-breed dog (*Canis familiaris*) gone astray in the vicinities of Muriaé River, municipality of Itaperuna, state of Rio de Janeiro, Brazil. The animal

presented cachexia, abdominal distension, anemia, hematuria.

The dog was treated with serum and antibiotics therapy and a blood transfusion, in a treatment period of 14 days, after which it died. A necropsy was conducted, after which the cardiorespiratory tract, mediastinic lymph nodes, liver and respective lymph nodes as well as part of the diaphragm were kept in formaldehyde 10% in totum. Viscera were inspected and sliced in several parts, including vascular coagula, and subsequently sectioned, mounted on slides and stained with hematoxylin/eosin (HE) for visualization in a light microscope. Egg morphometry was carried out using a digital morphometry software (Microimage Processing Software Dn-200M) with 20 eggs sectioned longitudinally.

Fig. 1. Hepatic serositis. Fibrinous reaction imputed to innumerable *D. renale* eggs. HE staining. Objective 20x.

Fig. 2. Phrenic serositis. Fibrinous reaction imputed to innumerable *D. renale* eggs. HE staining. Objective 20x.

Fig. 3. Peritoneal granuloma by multinucleated foreign body giant cells phagocytizing *D. renale* eggs. HE staining. Objective 40x.

Fig. 4. Liver. *D. renale* egg in the center-lobular vein. HE staining. Objective 40x.

Fig. 5. Lung. *D. renale* egg immersed in mononucleated inflammatory cell infiltrates and alveolar emphysema. HE staining. Objective 40x.

Fig. 6. Lung. Alveolar emphysema, edema, atelectasis and *D. renale* egg. HE staining. Objective 10x.

RESULTS

The incision in the abdominal cavity revealed a considerable amount of sanguinolent liquid, pale viscera, and signs of peritonitis, evinced by the accumulation of fibrin in the visceral and parietal peritoneum and by adhered areas in the mesenterium. Eleven adult nematodes identified as *D. renale* were found between intestinal loops. The right kidney was absent, indicating destruction by the worms. The inspection of the material by light microscopy confirmed the accumulation of fibrin in the liver and in the abdominal side of the diaphragm. Histopathological investigations revealed hepatic (Fig. 1) and phrenic serositis (Fig. 2). The eggs found were thick-shelled, irregularly shaped, chestnut brown in color and measured approximately 63x40mm. In several microscopy fields eggs were involved in phagocytosis process represented by multinucleated foreign body giant cells (Fig. 3). The hepatic parenchyma sections revealed congestion, the presence of eggs inside center-lobular veins (Fig. 4), and thickening of the portal connective tissue.

The microscopy of lung samples revealed *D. renale* eggs were surrounded by mononucleated cell infiltrates (Fig. 5), destructure of the histoarchitecture of lungs due to edema, hemorrhage, congestion, alveolar emphysema, thromboembolism, and *D. renale* eggs scattered in the parenchyma (Fig. 6), characterizing pneumonia. Eggs were observed in both auricular cavities and in the superficial venous bed of the heart. No eggs were found in the hepatic hilus or in mediastinic lymph nodes.

DISCUSSION

The anatomopathology of dogs infected with *D. renale* is commonly restricted to renal lesions (Amato *et al.*; Kommers *et al.*; Leite *et al.*; Nakagawa *et al.*), as the association with peritonitis and the effects on other organs are less frequently observed events (Amato *et al.*; Kano *et al.*; Monteiro *et al.*). Since the diagnosis of parasitosis is in most cases reached incidentally (Osborne *et al.*; Kommers *et al.*), the histopathological investigation of other organs as well as the physiopathology of peritonitis caused by *D. renale* has been the subject of limited research. This may be explained by the fact that the parasitosis by *D. renale* is symptomatically unspecific (Osborne *et al.*; Kommers *et al.*; Kano *et al.*; Monteiro *et al.*), and often occurs parenthetically to canine distemper, *Hepatozoon sp.*, *Ehrlichia sp.* (Porfirio *et al.*, 2004), and leptospirosis (Costa *et al.*).

The peritonitis diagnosed in the present study was

caused by worms and eggs, which led to irritation of the organ serous membrane and accumulation of fibrin, starting the inflammatory process in the peritoneum and the adherence of intestinal loops and mesenterium. The event may be explained by the fact that any noxious stimulus causing a lesion in the peritoneal mesothelium is enough to trigger an inflammatory response (Cotran *et al.*, 1989), similar to that occurring in any other part of the organism and characterized by hyperemia, exudation, concentration of phagocytes, and local accumulation of fibrin. The inflammation in the peritoneum may be classified as primary, secondary or tertiary in relation to its origin being peritonitis (Wittmann *et al.*, 1996; Zimmermann *et al.*, 2006). In the present study, peritonitis by *D. renale* was classed as primary, as the process was of diffuse appearance in the peritoneal cavity, no hollow viscera was perforated, and no signs of bacterial presence were observed. Multiple infection, with females in their egg-laying stages and abundance of eggs in the peritoneal cavity characterized an inflammatory response that evolved into granular process represented by the amount of phagocytes that united to form foreign body giant cells in an attempt to isolate *D. renale* eggs. These eggs are inert, insoluble structures, and difficult to digest — all of which are characteristics shared with *Schistosoma mansoni* eggs, also capable to induce granulomatous response (Atta *et al.*, 1981; Lambertucci *et al.*, 2005). Dogs are considered terminal hosts, uncommonly or accidentally infected (Acha & Szyfres), since they often host one single parasite in the right kidney (Amato *et al.*; Augusto Filho *et al.*; Kommers *et al.*; Monteiro *et al.*). In the natural cycle of *D. renale*, adult worms of both sexes are necessary in the kidneys to produce fertile eggs, whose dissemination pathway is the urinary tract (Osborne *et al.*).

In the animal studied in this case report, the erratic cycle was characterized by multiple infection in the abdominal cavity. Even though worms of both sexes and a large number of eggs were present, neither worm nor egg had the dissemination pathway clear to reach the environment. The records of *D. renale* in lung parenchyma and in the cardiac and hepatic vascular bed suggest that worms laid eggs in the circulatory system, an atypical dissemination pathway of eggs in their erratic cycle. The *D. renale* eggs are capable of inducing granular peritonitis and pneumonia, an observation so far unpublished in the literature reviewed. The findings of the present study emphasize the importance of more detailed anatomopathological investigations about the systemic involvement caused by the parasite.

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RESUMEN: Un perro con infección múltiple por *D. renale* en la cavidad abdominal presentó peritonitis granulomatosa con células gigantes fagocitando huevos de *D. renale*. Se pudo observar serositis hepática y frénica asociada a numerosos huevos del parásito inmersos en un proceso fibrinoso. Los pulmones presentaron huevos de *D. renale* en el parénquima, infiltrados de células mononucleares, edema, hemorragia, congestión, atelectasia, enfisema y tromboembolismo. Huevos de *D. renale* fueron detectados en el interior de la vena centro lobular, cavidades auriculares y lechos venosos superficiales del corazón. Estos hallazgos caracterizan una vía de diseminación atípica de los huevos en ciclo errático.

PALABRAS CLAVE: Huevo; *Diocetophyma renale*; Ciclo errático; Parasitismo extrarenal; Canino.

REFERENCES

- Acha, P. N. & Szyfres, B. *Zoonoses and communicable diseases common to man and animals*. Washington, OPAS, 2003.
- Amato, J. F. R.; Grisi, L. & Rosa, V. L. M. Reunión dos casos brasileiros de diocetofimose canina, com registro de mais alta intensidade de infecção por *Diocetophyma renale* (Goeze, 1782). *Rev. Brasil. Biol.*, 36:117-22, 1976.
- Atta, A. M.; Magalhães, L. A. & Alcântara, G. P. Esquistossomose Mansônica. I. evolução do quadro patológico: análise parasitológica, hematológica e histopatológica. *Rev. Saúde Pública*, 15:72-92, 1981.
- Augusto Filho, O.; Araújo, W. N.; Paes, A. C. & Mamprim, M. J. *Diocetofimíase canina bilateral com vários parasitas. Relato de caso*. Seminário Brasileiro de Parasitologia Veterinária, XI. Salvador, Colégio Brasileiro de Parasitologia Veterinária, 1999.
- Costa, P. R. S.; Neto, N. M. A.; Oliveira, D. M. C.; Vasconcelos, R. S. & Menezes, F. M. Diocetofimose e leptospirose em um cão. *Clínica Veterinária*, 51:48-50, 2004.
- Cotran, R. S.; Kumar, V. & Robbins, S. L. *Robbins Pathologic Basis of Disease*. 4th ed. Philadelphia, W. B. Saunders Company, 1989. pp.65-71.
- Fortes, E. *Parasitologia Veterinária*. 3rd ed. São Paulo, Ícone, 1997.
- Gargili, A.; Firat, I.; Toparlak, M. & Çetinkaya, H. First case report of *Diocetophyma renale* (Goeze, 1782) in a dog in Istanbul, Turkey. *Turk. J. Vet. Anim. Sci.*, 26:1189-91, 2002.
- Kano, F. S.; Shimada, M. T.; Suzuki, S. N.; Osaki, S. C.; Menarim, B. C.; Ruthes, F. R. V. & Laidane Filho, M. A. Ocorrência de diocetofimose em dois cães no município de Guarapuava-PR. *Ciências Agrárias*, 24:177-80, 2003.
- Kommers, D. G.; Ilha, M. R. S. & Barros, C. S. L. Diocetofimose em cães: 16 casos. *Ciência Rural*, 29:517-22, 1999.
- Lambertucci, J. R.; Moreira, R. F. & Barbosa, A. J. A. Nódulo pulmonar solitário causado pelo *Schistosoma mansoni* em paciente com carcinoma medular da tireóide. *Rev. Soc. Bras. Med. Trop.*, 38(6):536-7, 2005.
- Leite, L. C.; Círio, S. M.; Diniz, J. M. F.; Luz, E.; Navarro-Silva, M. A.; Silva, A. W. C.; Leite, S. C.; Zadorosnei, A. C.; Musiat, K. C.; Veronesi, E. M. & Pereira, C. C. Lesões anatomopatológicas presentes na infecção por *Diocetophyma renale* (Goeze, 1782) em cães domésticos (*Canis Familiares*, Linnaeus, 1758). *Arch. Vet. Sci.*, 10:95-101, 2005.
- Miranda, M. A.; Benigno, R. N. M.; Galvão, G. R. & Oliveira, S. A. L. Diocetophyme renale (Goeze, 1782): localização ectópica e alta intensidade parasitária em *Canis familiares* do Pará – Brasil. *Arq. Brás. Med. Vet. Zoot.*, 44:151-3, 1992.
- Monteiro, S. G.; Sallis, E. S. & Stainki, D. R. Infecção natural por trinta e quatro helmintos da espécie *Diocetophyma renale* (Goeze, 1782) em um cão. *Rev. Fac. Zootec. Vet. Agro. Uruguiana*, 9:29-32, 2003.
- Nakagawa, T. L. D. R.; Bracarense, A. P. F. R. L.; Reis, A. C. F.; Yamamura, M. H. & Headley, S. A. Giant kidney Worm (*Diocetophyma renale*) infections in dogs from Northern Paraná, Brazil. *Vet. Parasitol.*, 145:366-70, 2007.
- Osborne, C. A.; Stevens, J. B. & Hanlon, G. F. *Diocetophyma renale* in a dog. *J. Am. Vet. Med. Assoc.*, 155:605-20, 1969.
- Porfírio, L. C.; Carvalho, G. D.; Massariol, P. B.; Afonso, T. Z.; Machado, J. P. & Masseno, A. P. B. Infecção concomitante por *Diocetophyma renale*, *Hepatozoon sp.*, *Ehrlichia sp.* e cinomose em cão. *Veterinária Ser.*, 1:16-22, 2004.
- Wittmann, D. H.; Schein, M. & Condon, R. E. Management of secondary peritonitis. *Ann. Surg.*, 224:10-8, 1996.
- Zimmermann, M.; Raiser, A. G.; Mazzanti, A.; Lopes, S. T. A. & Salbego, F. Z. Peritonite em cães. *Ciência Rural*, 36:1655-63, 2006.

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