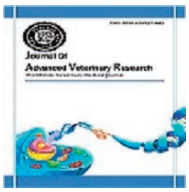
Journal of Advanced Veterinary Research

https://advetresearch.com



Dioctophymiasis as an Emerging Disease in Palotina and Western Region of Paraná – Brazil

Laura Zanella Souza[1*], Fernanda de Lima Correa[2], Camila Francisca Batschke[2], Solimar Dutra da Silveira[2], Tainá Minuzzo[2], Ana Paula Smirdele[2], Ana Paula Molinari Candeias[2], André Luis Vriesman Beninca[2], Nelson Luis Mello Fernandes[2]

[1]*Parasitic Diseases of Domestic Animals, Veterinary Teaching Hospital, Universidade Federal do Paraná – Palotina, Brazil.*
[2]*Universidade Federal do Paraná – Palotina, Brazil.*

ARTICLE INFO

Case Report

Received:
20 August 2020

Accepted:
30 September 2020

Keywords:

Dioctophymosis,
Fish farm,
Roaming dogs

ABSTRACT

Dioctophyma renale is a nematode known as giant red kidney worm and parasites kidneys of domestic and wild animals. For its life cycle to be complete, the parasite needs an aquatic environment to develop inside the intermediate and paratenic hosts (annelid oligochaete, fishes and frogs). Subsequently these hosts may be ingested by domestic and wild carnivores. In this report, we reviewed cases of roaming dogs which, probably due to their poor feeding habits and proximity to fish farming areas, have been infected by this parasite and attended at the Veterinary Hospital of Federal University of Paraná, in the municipality of Palotina. A progressive exploitation of aquaculture in local properties is observed within the region, which might provide favorable conditions for the occurrence of the disease in local roaming dogs.

J. Adv. Vet. Res. (2020), 10 (4),257-260

Introduction

Dioctophyma renale, belongs to Enoplida order and Dioctophymatidae family. It is the largest ever described nematode to parasitize animals; adult males can reach up to 45 cm of length by 3 to 4 mm of diameter and females, up to 100 cm of length by 5 to 12 mm of diameter. They are red-colored, cylindrically-shaped and usually affect carnivore animals but have also been reported in humans (Barriga, 2002; Alves *et al*., 2007; Monteiro, 2011; Chauhan *et al*., 2016).

Definitive hosts contract the parasite by ingesting annelids, frogs or fishes infected with larvae. Inside these hosts kidneys, the adults mate and eliminate their eggs through urine (Kommers *et al*., 1999; Varzone *et al*., 2008; Pedrassani *et al*., 2009).

Once in aquatic environment, the offspring in its first larval stage develops itself inside the eggs, which are then ingested by intermediate host, an aquatic oligochaete annelid, Lumbriculus variegatus, in which the larvae undergo morphological changes and reaches infectant stage. The paratenic hosts, fishes and amphibians are infected by ingesting the larvae and the cycle completes when these are ingested by dogs or other carnivores. (Kommers *et al*., 1999; Nakagawa *et al*., 2007; Pedrassani *et al*., 2009; Verocai *et al*. 2009). In its third stage, the larvae penetrate the animal stomach and duodenum walls, migrating then through the liver and peritoneal cavity until it reaches the kidney, where it remains for 6 months, until reaching its adult stage.

In dogs the parasite usually affects the right kidney due to its anatomical proximity to duodenum, however there are reports of it free floating in the abdominal cavity, normally as accidental findings (Zabott *et al*., 2012). Erratically wandering, the nematode can still reach tissues such as urethra, uterus, ovaries, mammary glands and lymph nodes (Maxie *et al*., 1993).

Presence of this parasite in the kidney entails the progressive destruction of cortical and medullary layer, reducing the organ to a fibrous capsule (Ferreira *et al*., 2010). Consumption of the renal parenchyma occurs through action of proteolytic and lypolytic enzymes produced by glands located in the parasite esophagus. However, much of the parenchyma's loss may be attributed to hydronephrosis caused by obstruction of the urethral ostium (Nakagawa *et al*., 2007). Clinical signs, although unspecific, usually include dysuria, hematuria and

*Corresponding author: Laura Zanella Souza
E-mail address: laura.zanella@ufpr.br

ISSN: 2090-6277/2090-6269/

lower back pain (Pedrassani *et al*., 2009; Silveira *et al*., 2015).

Diagnosis is made through observation of ellipsoid, amber-colored, thick walled eggs with bipolar protuberances and measuring 60-80 x 39-46 mm, in the urinary sediment (Barriga *et al*. 2002). Occasionally, it is possible to visualize these parasites with help of diagnostic imaging techniques, thus placing this kind of tool between ones capable of diagnosing dioctophymiasis (Pedrassani *et al*., 2009; Zardo *et al*., 2012).

The most efficient proven therapeutic approach is nephrectomy of the affected kidney, especially in early diagnosed cases and cases in which one of the kidneys does not display any functional abnormality (Kommers *et al*., 1999; Alves, 2007; Sousa *et al*., 2011).

Preventive measures consist of avoiding consumption of raw fish or frog, since they are potential paratenic hosts, as well as avoid ingestion of water that may contain the intermediate host. Presence of factors such as abundant hydric resources, a diverse wild fauna and a high population of free roaming dogs makes this helminthiasis control quite challenging, since the majority of the infections are associated to them (Dyer, 1998; Ferreira *et al*. 2010).

Western region of Paraná state, southern Brazil has a wide range of rural areas dedicated to aquaculture that is still increasing. Most of these areas border with forestlands and wild animals may cohabit with domesticated animals, in addition many roaming dogs usually move between rural and urban areas.

Dioctophymiasis zoonotic potential and insidious traits combined with local geographic characteristics render evident that the recognition and research of this disease are of utmost relevance to the western region of Paraná.

Materials and methods

Most of the dogs attended with dioctophymiasis were accidentally diagnosed and the parasites were found during necropsy and surgical procedures. Two specific cases drew attention for its correlation with accidental finding and presence of nearby fish farming areas. Both dogs were attended at the Veterinary Hospital of UFPR in Palotina, Brazil.

All the collected parasite specimens were forwarded to the Parasitic Diseases Laboratory in the same institution that the dogs were attended and treated.

In order to identify the parasite, its morphological features such as color and size and the anatomical localization were considered. In order to differentiate the specimen gender, the shapes of the copulatory organs were observed through a stereo microscope. The females were told apart by the presence of terminal anus, blunt posterior extremity and vulva localized 7 cm towards the end of the anterior extremity (Barriga, 1982).

Results

One interesting finding consisted in a 12 months old male pit bull that was attended presenting symptoms such as dysuria and hematuria, in addition to primary myiasis on outer face of both pinnae and infestation by *Tunga penetrans* in all of the patient's paws. This patient was used to swim in fish ponds of its owner's property, which was dedicated to aquafarming. Upon clinical examination, it was possible to ascertain bladder repletion and moderate to severe pain in the inguinal region which led to imaging exams requesting.

Abdominal radiography revealed calculus presence in penile urethra and therefore urinary catheterization was performed. In the course procedure, there was a rupture to the bladder and a surgical intervention became imperative. After performing the ventral midline celiotomy through a retro-umbilical incision, a female *Dioctophyma renale* was found attached to the omentum (Fig. 1). Afterwards, during peritoneal lavage procedure another female of the same species was detected (Fig. 2).

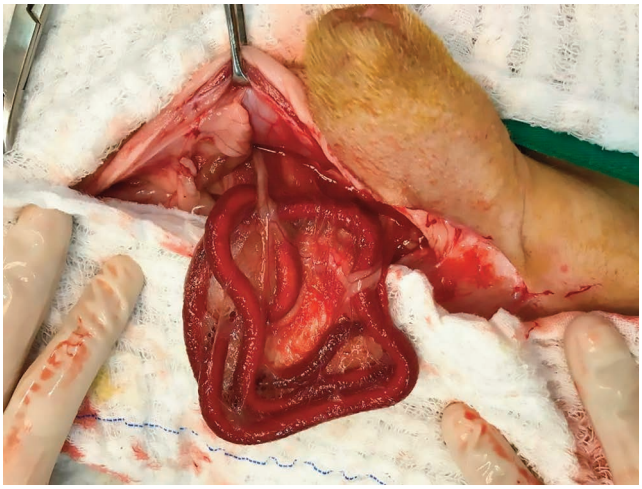


Fig. 1. *Dioctophyma renale* female specimen attached to dog's omentum. Source: Hospital Veterinário, UFPR - Palotina.

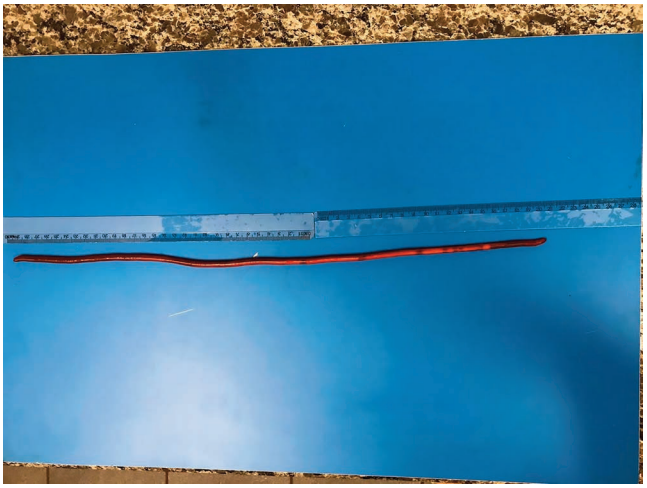


Fig. 2. *Dioctophyma renale* female specimen, in the dog's abdominal cavity, measuring approximately 51 cm of lengthwise. Source: Laboratório de Doenças Parasitárias. Hospital Veterinário, UFPR - Palotina.

Another case observed was an 8 years old male mongrel dog, which was admitted to the hospital under suspicion of an ophidic accident. In accordance with protocol, several exams were performed, including urinalysis, through which was detected a high rate of red cells, leukocytes and squamous epithelial cells.

An ultrasonography was then requested and revealed that the right kidney had suffered a swelling although it had its shape, outline and echogenicity preserved, as well as its corticomedullary relation and differentiation. The renal pelvis was distended due to anechogenic content. Through this same examination was also possible to notice that the right kidney measured 3.37 cm and presented with a thickened renal capsule and, within it, cylindrical and rounded structures. In addition, it was also noticed the presence of anechogenic content and complete destruction of the renal parenchyma (Fig. 3).

Subsequently, the patient was then submitted to a surgery through which was verified the consumption of renal parenchyma in the right kidney due to the action of an endoparasite, later identified as a female *Dioctophyma renale* specimen. A total nephrectomy of the kidney was performed, since it is the only efficient treatment in such cases.

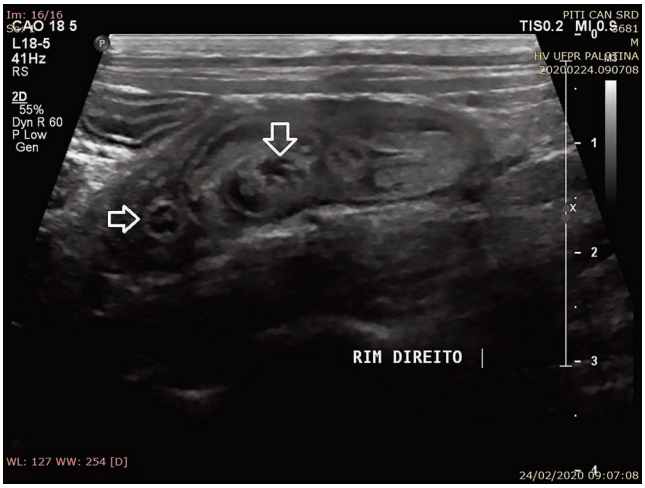


Fig. 3. Dog's right kidney (longitudinal section) with rounded and cylindrical echogenic shapes (arrows) consistent with the presence of an adult *Dioctophyma renale*. Source: Diagnostic imaging -- Hospital Veterinário, UFPR -- Palotina.

Discussion

In one of the reported cases, the dog presented signs of polyuria, polydipsia, apathy and painful response to abdominal palpation, additionally to presence of blood underneath the foreskin, which is in accordance with what is described in the literature (Alves *et al*., 2007; Sousa *et al*., 2011; Silveira *et al*., 2015). Signs of hematuria and painful response to abdominal palpation could result from damage of the renal parenchyma (Birchard and Sherding, 2003; Thrall *et al*., 2015). As reported in the first case, despite tender age of the patient, only 12 months, the parasite specimens found were adults with more than 50cm of length, which may indicate that the infection might have occurred already in early months of the patient's life, further jeopardizing its health.

In dogs *Dioctophyma renale* is usually spotted in the right kidney as observed in one of the cases. This may be attributed to the proximity of this kidney to the duodenum, which allows the larvae, that are penetrating the duodenum, to more easily reach its organ of predilection (Zabott *et al*. 2012). If the larvae penetrate the lesser curvature of the stomach, they may develop to adult form while between renal lobes, either free or encapsulated in cavities. As observed in the first case reported, in which two nematode specimens were free floating in the abdominal cavity. Presence of *Dioctophyma renale* in body cavities may result in peritonitis and adhesion between several organs. The macroscopic injuries therefore depend of the parasite localization in the host's organism.

In cases of renal parasitism, as observed in the second case, the right kidney is frequently found with severe loss of parenchyma and the therapeutic approach consists in nephrectomy. This technique is also prescribed when one kidney presents hydronephrosis and the opposite is functioning properly. Otherwise recommended approach for early diagnosed cases is surgical removal of nematode through nephrectomy (Kommers *et al*., 1999; Ferreira *et al*., 2010; Sousa *et al*., 2011; Gómez *et al*., 2017), which may provide the patient greater likelihood of recovery.

The main diagnostic methods described in literature include diagnostic imaging tests, through which is possible to spot adult parasites, and the urinalysis, through which is possible to find eggs upon a sediment examination (Monteiro, 2011). In both of the cases described, patients presented abnormalities in urine, such as presence of red cells, leukocytes and squamous epithelial cells, (Birchard and Sherding, 2003; Thrall *et al*., 2015) although a *Dioctophyma renale* infection was overlooked in favor of other possibility of diagnosis. Diagnostic imaging tests of abdominal region are a diagnostic approach that may sometimes result in accidental finding as reported in the second case, in which an ultrasonography revealed tubular structures with hyperechoic outer layers and hypoechoic core, consistent with presence of *Dioctophyma renale*. The suspicion was later confirmed upon realization of surgical procedure (Soler *et al*., 2008; Pedrassani *et al*., 2009; Ferreira *et al*., 2010; Zardo *et al*., 2012).

As dioctophymiasis is considered a silent pathology due to the lack of noticeable symptoms, its occurrence in the host might easily go undetected (Monteiro *et al*., 2002; Alves *et al*., 2007). Thus, it is worth noticing the relevance of urinalysis diagnostic imaging tests, that should be performed with highest possible accuracy, always taking into the possibility of parasitism by *Dioctophyma renale*, especially in regions where factors relevant to the parasite's life cycle are present, such as the western region of Paraná state, homeland to the researched cases.

Paraná western region is considered one of the main centers to Brazilian aquaculture, produces more than 60 tons of fish fillet on a daily basis, which represents more than 22% of Paraná state's output. Within the region, municipalities of Toledo and Palotina stand out, for they occupy the top of the national rank of fish production (Feiden *et al*., 2018). Aspects of the production chain combined with geographic attributes, such as abundance of its drainage basin, are major factors in the microregion potential of disseminating dioctophymiasis, taking into consideration that the main form of infection is the ingestion of fishes hosting the parasite in its larval stage (Kommers *et al*., 1999; Varzone *et al*., 2008; Pedrassani *et al*., 2009). The environment could be intrinsically related to lowly selective dietary habits of the researched animals, which may favor ingestion of fish, due to unrestricted access to fish ponds dedicated to aquafarming.

There are reports of this parasitosis in humans of different continents associated to ingestion of undercooked fishes or frogs. Although fishes destined to human consumption are usually eviscerated, the parasite's stage three larvae can be found in the host's flesh, a factor that, one more time, should highlight the importance of this parasitosis being treated as a public health concern (Urano *et al*., 2001; Ignjatovic *et al*., 2003; Pedrassani *et al*., 2009; Katafigiotis *et al*., 2013; Tokiwa *et al*., 2014; Norouzi *et al*., 2017). Preventive measures that must be taken to prevent infection of humans and animals consist in avoiding the ingestion of undercooked fishes or water of rivers that may contain the intermediate host (oligochaete) (Measures *et al*., 2001; Varzone *et al*., 2008; De Lima *et al*., 2016).

Conclusion

Based in the observation of dioctophymiasis cases, it is possible to notice a considerable association between the presence of parasites to the development of aquaculture, diversified wild fauna and large population of roaming dogs. Thus, it is important to consider dioctophymiasis as a potential diagnosis in cases where there is a suspicion that renal functioning is compromised. Because of its zoonotic potential and absence of noticeable symptoms, dioctophymiasis should receive its due attention as a highly relevant disease to the concern of public health, in order to prevent it from going overlook by veterinarians of Paraná state's western microregion.

References

Alves, G.C., Silva, D.T., Neves, M. F., 2007. *Dioctophyma renale*: O parasita gigante do rim. Rev. Cient. Eletrônica. Med. Vet. 8, 1-10.

Barriga O., 2002. Las enfermedades Parasitarias de los animales domésticos en la América Latina. First Ed. Santiago: Editorial Germinal. p. 247.

Birchard, S.J., Sherding, R.G., 2003. Manual Saunders: Clínica de Pequenos Animais, Second Ed. Roca, BR, pp. 1001-1028.

Chauhan, S., Kaval, S., Tewari, S., 2016. Dioctophymiasis: A rare case report. J. Clin. Diagn. Res. 10, 1-2.

De Lima, C.S., Murakami, V., Nakasu, C.C.T., Milech, V., Durante, L.H., Perera, S.C., Cleff, M.B., Rappeti, J.C., Crivellenti, L.Z., 2016. Dioctophyme renale o verme gigante do rim: revisão de literatura. Rev. Investigação. 15,80-85.

Dyer NW., 1998. *Dioctophyma renale* in ranch mink. J. Vet. Diagn. Invest. 10,111-113.

Feiden, A., Ramos, M.J, Chidichima, F.C., Schmidt, C.M., Fiorese, M.L., Coldebella, A., 2018. A cadeia produtiva da tilápia no oeste do Paraná: uma análise sobre a formação de um arranjo produtivo local. Redes. 23, 238-263.

Ferreira, V.L., Medeiros, F.P., July, J.R., Raso, T.F., 2010. *Dioctophyma renale* in dog: clinical diagnosis and surgical treatament. Vet. Parasitol. 168,151-155.

Gómez, J.R., Sanudo, M.J.M., Morales, J.G., 2017. Cirurgia na Clínica de Pequenos Animais, a Cirurgia em Imagens Passo a Passo: Abdome Caudal, First Ed. MedVet, BR, p.

Hodesson, D.L., Daniels, R.B., Richards, B., 1980. *Dioctophyma renale* in a dog (a case report). Vet. Med. Small. Anim. Clin. 75,825.

Ignjatovic, I., Stojkovic, I., Kutlesic, C., Tasic, S., 2003. Infestation of the human kidney with *Dioctophyma renale*. Urol. Int. 70,70-73.

Katafigiotis, I., Fragkiadis, E., Pournaras, C., Nonni, A., Stravodimos, K., 2013. Rare case of a 39-year-old male with a parasite called *Dioctophyma renale* mimicking renal cancer at the computed tomography of the right kidney. Parasitol. Int. 62,459-460.

Kommers, D.G., Ilha, M.R.S., Barros, C.S.L., 1999. Dioctofimose em cães: 16 casos. Cienc. Rural. 29,517–522.

Maxie, M.G., The Kidney. In: Jubb, K.V.F., Kennedy, P.C., Palmer, N., 1993. The Pathology of Domestic Animals. Fourth Ed. Vol. 2. Academic Press. 5,447–538.

Measures, L.N. Dioctophymatosis. In: Samuel, W.M., Pybus, M.J., Kocan, A.A., 2001. Parasitic diseases of wild mammals. 2nd ed. Iowa State University Press.

Monteiro S.G., 2011. Parasitologia na medicina veterinária. Vol. 1. Roca. BR.

Monteiro, S.G., Sallis, E.S.V., Stainki, D.R., 2002. Infecção natural por trinta e quatro helmintos da espécie *Dioctophyma renale* (Goeze, 1782) em um cão. Revista da FZVA 9, 9.

Nakagawa, T.L.D.R., Bracarense, A.P.F.R.L., Reis, A.C.F., Yamamura, M.H., Headley, S.A., 2007. Giant kidney worm (*Dioctophyma renale*) infections in dogs from Northern Paraná, Brazil. Vet. Parasitol. 145,366-370.

Norouzi R., Manochehri A., Hanifi M.A., 2017. Case report of human infection with *Dioctophyma renale* from Iran. Urol. J. 14, 3043-3045.

Pedrassani, D., Hoppe, E. G.L., Avancini, N., Nascimento, A.A., 2009. Morphology of eggs of Dioctophyme renale, Goeze, 1782 (Nematoda: Dioctophymatidae) and influences of temperature on development of first-stage larvae in the eggs. Rev. Bras. Parasitol. Vet. 18,15-19.

Silveira, C.S., Diefenbach, A., Mistieri, M.L., Machado, I.R.L., Anjos, B.L., 2015. *Dioctophyma renale* em 28 cães: aspectos clinicopatológicos e ultrossonográficos. Pesqui. Vet. Bras. 5, 899-905.

Soler, M., Cardoso, L., Teixeira, M., Agut, A., 2008. Imaging diagnosis-*Dioctophyma renale* in a dog. Vet. Radiol. Ultrasound. 49,307-308.

Sousa, A.A.R., Sousa, A.A.S., Coelho, M.C.O.C., Quessada, A.M., Freitas, M.V.M., Moraes, R.F.N., 2011. Dioctofimose em cães. [dioctophymiasis in dogs] Acta Scientiae Veterinariae. 39, 1-4.

Thrall, M.A., Weiser, G., Allison, R.W., Campbell, T.W., 2015. Hematologia e Bioquímica Clínica Veterinária. 2nd ed. Guanabara Koogan, BR.

Tokiwa, T., Ueda, W., Takatsuka, S., Okawa, K., Onodera, M., Ohta, N., 2014. The first genetically confirmed case of Dioctophyme renale (Nematoda: Dioctophymatida) in a patient with a subcutaneous nodule. Parasitol. Int. 63,143-147.

Urano, Z., Hasegawa, H., Katsumatat, Toriyama, K., Aoki, Y., 2001. Dioctophymatid nematode larva found from human skin with creeping eruption. J. Parasitol. 87, 462-465.

Varzone, J.R.M., Aquino, L.P.C.T., Rodovalho, M.V.T., 2008. Achados macroscópicos de lesões resultantes do parasitismo por *Dioctophyma renale* em lobo-guará (Chrysocyon brachyurus) – Relato de Caso. Ens. e Ciên. 12,171-178.

Verocai, G.G., Measures, L.N., Azevedo, F.D., Correia, T.R., Fernandes, J.I., Scotty, F.B., 2009. *Dioctophyma renale* (Goeze, 1782) in the abdominal cavity of a domestic cat from Brazil. Vet. Parasitol. 161, 342-344.

Zabott, M.V., Pinto, S.B., Viott, A.M., Tostes, R.A., Bittencourt, L.H.F.B., Konell, A.L., Gruchouskei, L., 2012. Occurrence of *Dioctophyma renale* in Galictis cuja. Pesq. Vet. Bras. 32, 786-788.

Zardo, K.M., Santos, D.R., Babicsak, V.R., Belotta, A.F., Oliveira, H.S., Estanislau, C.A., Brandão, C.V.S., 2012. Aspecto ultrassonográfico da dioctofimose renal canina. [Ultrassonografic aspect of renal canine dioctophymiasis]. Vet. Zootec. 19, 57-60.