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

Laura Zanella Souza1*, Fernanda de Lima Correa2, Camila Francisca Batschke2, Solimar Dutra da Silveira2, Tatiana Minuzzo2, Ana Paula Smirdele2, Ana Paula Molinari Candeias2, André Luis Vriesman Beninca2, Nelson Luis Mello Fernandes2

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

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ABSTRACT

Dioctophyema 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.

Introduction

Dioctophyema 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, Lumbricus 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
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 located 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).

Another case observed was an 8 years old male mongrel dog, which was admitted to the hospital under suspicion of an ophidian 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.
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 hydropnephrosis 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 et al., 2012). 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 slowly 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; Katagfitios 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 on 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
