First report of *Alaria* spp. in domestic feline in southern Brazil

ABSTRACT

Alaria spp. are trematodes that have a heteroxenous life cycle, requiring two intermediate hosts and several paratenic and definitive hosts. *Alaria alata* is considered a potential cause of disease in humans and is included among several emerging zoonotic parasites. It is the etiological agent of alariosis, which is associated with the consumption of raw or undercooked meat from intermediate (snails, frogs) or paratenic (mainly game) hosts of the parasite. This work aimed to report the first case of alariosis in a domestic feline in southern Brazil. The patient in this report was an adult male feline of no defined breed, who a few days after being adopted, began to present loose stools, which progressed to diarrhea, and some episodes of vomiting were also reported. The definitive diagnosis was obtained from coproparasitological examination, using the Hoffman, Pons, and Janer technique (spontaneous sedimentation), where *Alaria* spp. eggs were observed. Following the diagnosis, treatment with praziquantel (20mg/kg) was instituted for two consecutive days, as well as supportive therapy. At the end of the treatment, a new coproparasitological examination was carried out, which confirmed the effectiveness of the treatment. This reportsuggests, the importance of researching and reporting cases involving the trematode *Alaria* spp. becomes evident, as it represents not only a health problem for domestic animals but also a public health problem due to its zoonotic potential.

Keywords: Trematode; alariosis; zoonosis; cats.

1. INTRODUCTION

Parasites of the*Alaria* genus are trematodes with worldwide distribution, domestic and wild carnivores are the definitive hosts(1).The main recognized species are: *Alaria alata*, *Alaria mustelae*, *Alaria canis*, *Alaria arisaemoides*, *Alaria intermedia*, *Alaria taxidae* and *Alaria marcianae* (2). The life cycle of this trematode involves two intermediate hosts and several paratenic and definitive hosts(3). The adult form of the parasite is located in the small intestine of the definitive host, and after oviposition, the eggs are eliminated through feces into the environment, where they embryonate and hatch in fresh water.The newly hatched miracidia penetrate the first intermediate host, freshwater snails such as *Helistoma*, *Planorbis*, *Lymnea* and *Anisus* spp., where the cercariae emerge from the sporocysts. Cercariae penetrate the skin of the second intermediate host, such as tadpoles, frogs, or other amphibians, and become mesocercariae (4). Several species of birds, reptiles, and mammals that ingest infected amphibians can serve as paratenic hosts.

Definitive hosts become infected when they ingest infected amphibians or paratenic hosts. *Alaria marcianae*, a species that affects cats, has a similar life cycle, but can also be transmitted to kittens by lactogenic transmission (5). After ingestion of the intermediate or paratenic host by the definitive host, mesocercariae pass into the metacercariae stage, which migrates through the trachea, are swallowed, and reach the small intestine, where they transform into adult worms (6).

The species that causes infection in humans is *Alaria alata* which occurs through eating raw or undercooked meat of animals infected by the intermediate or paratenic host. Furthermore, *A. alata* was recently classified as an emerging zoonotic parasite by the Federal Office for the Environment (FOEN) and the Federal Office for Public Health (FOPH) in Bern, Switzerland (7). Infections are generally subclinical, however in cases with a high parasite load, enteritis may occur and the migration of the immature parasite through the lungs may result in pulmonary hemorrhage and subsequent involvement of lesions.

Therefore, the aim of this work was to report the first case of alariosis in a domestic feline in southern Brazil.

2. PRESENTATION OF CASE

An adult male feline andmixed breed was treated at a private clinic in the city of Pelotas, in southern Brazil. In the anamnesis, the owners reported that the feline had been adopted about a month ago, and a few days later it began to present loose stools, which evolved into diarrhea, and some episodes of vomiting were also reported. On clinical examination, all parameters were within physiological limits for the feline species. As complementary tests, blood was collected for blood count and biochemical analysis and a stool sample was collected for coproparasitological examination.

In the biochemical examination, all analyzed parameters (urea, creatinine, aspartate aminotransferase(AST), alanine aminotransferase(ALT), and alkaline phosphatase(ALP)) were within the reference values for the feline species. In the complete blood count, only eosinophilia (2.380/μL) was observed. In the coproparasitological analysis using the spontaneous sedimentation technique (8), eggs of *Alaria* spp. were identified (Fig.1). These eggs measure approximately 108-116x64-76 μm, are operculated, and contain an undifferentiated embryo upon elimination. Following the definitive diagnosis, a parasiticidal treatment with Praziquantel (20mg/kg) was administered for two consecutive days, along with supportive care (antiemetic and probiotic).

Fig.1.Egg of *Alaria* spp. in a fecal sample from a domestic feline, Observed under optical microscopy, 400x magnification.

3. DISCUSSION

Despite being uncommon, Alariosis is considered an emerging zoonosis, with cases of the disease being recorded on several continents. *Alaria alata*, a species that mainly affects humans, is found mainly in Europe, while the other species are found on other continents (9). Humans become infected by ingesting raw or undercooked meat from intermediate hosts, such as frogs and toads, and also from paratenic hosts, such as birds and rodents and mammals, such as wild boars, containing mesocercariae in their muscles (10).

Cases of human Alariosis are reported by several authors, such as Mcdonald et al. (11) who found two cases of intraocular infection due to the presence of *Alaria* spp. In another study, Kramer et al. (12) reported the case of a man with bronchospasm, recurrent urticaria and a subcutaneous nodule, from which mesocercariae of *Alaria* spp. were isolated, and the possible source of infection was the consumption of undercooked wild goose meat (paratenic host). Deaths due to the disease are also described. Fernandez et al., (13), reported in Canada, the first case of widespread human infection by *Alaria* spp., where mesocercariae were present in the stomach wall, lymph nodes, liver, myocardium, pancreas, spleen, kidney, lungs, brain and spinal cord. The infection was possibly acquired by ingesting undercooked frogs and the patient died eight days after the onset of the disease. Freeman et al. (14) reported two fatal cases of Alariosis in humans after the consumption of frogs in Canada. Both died after a serious illness with multiple organ failure.

Some studies were also carried out to determine the presence of *Alaria* spp. in domestic felines, such as those by Castro et al., (15), who reported for the first time in the municipality of Colonia, Uruguay, the presence of *Alaria alata* parasitizing domestic stray felines, where they observed the trematode in one of the four necropsied felines. Johnson et al. (5), analyzing the prevalence of *Alaria* spp. in companion animals in Oklahoma from 2006 to 2015,foundthat of the 1246 cat fecal samples, 17 were positive for *Alaria* spp. (1.4%). In this same study, mesocercariae were

detected in the tissues of 26% (11/43) of the wild pigs tested, which may indicate a potential source of human Alariosis infection in the United States. In another study, carried out in Egypt, Abbas et al. (16), analyzing 143 fecal samples from stray cats, identified eggs of *Alaria* spp. in 1.4% (2/143) of the samples.

In the southern region of Brazil, the same location as this report, one study was carried out researching the presence of helminths in field dogs and wild dogs, where, through necropsy, *Alaria alata* was observed in 50% of wild dogs and 36.4% of field dogs (17). This result highlights the presence of the parasite in this region.

The symptoms of Alariosis can occur in two ways, through the larval phase of the parasite, which affects the respiratory system, with involvement of the lungs, pleura and lymphatic vessels of the bronchi, and Alariosis caused by adult parasites, which can cause intestinal inflammation (18). The patient in this report only presented gastrointestinal symptoms, such as diarrhea and vomiting, possibly due to the presence of the adult form of the parasite in the small intestine. Eosinophilia was observed in the blood count. Eosinophils are cells whose primary function is to defend the host against relatively large organisms, such as helminths (19). Eosinophilia occurs as a result of the evolutionary cycle of the parasite, that is, the more complex the cycle, the greater the number of circulating eosinophils.

The treatment of Alariosis in domestic animals consists of eliminating the parasite through the use of parasiticides, such as praziquantel, an antiparasitic medication effective against most trematodes (20). Its action is related to the induction of paralysis and immediate immobilization of the parasites (21). After parasiticide treatment, the patient showed clinical improvement, and a new coproparasitological examination was performed,confirming the success of the therapy prescribed.

4. CONCLUSION

It is concluded that *Alaria* spp., despite being uncommon, can eventually be found parasitizing felines in southern Brazil, requiring further clinical and epidemiological studies on the prevalence of this parasite, since it represents not only an animal health problem but also a public health concern due to its zoonotic potential.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ozoliņa Z,Bagrade G,Deksne G. First confirmed case of *Alaria alata* mesocercaria in Eurasian lynx (*Lynx lynx*) hunted in Latvia. Parasitol. Res. 2020;119:759-762

2. Strokowska N, Nowicki M, Klich D, Didkowska A., Filip-Hutsch K, Wiśniewski J, Bełkot Z, Anusz K. A comparison of detection methods of Alaria alata mesocercariae in wild boar (Sus scrofa) meat. Int. J. Parasitol. Parasites Wildl. 2021;16:1–4

3. Rentería-Solís Z, Kołodziej-Sobocińska M, Riehn K. *Alaria* spp. mesocercariae in Eurasian badger (Meles meles) and wild boar (Sus scrofa) from the Białowieża Forest, north-eastern Poland. Parasitol. Res. 2018;117:1297-1299.

4. Hannon ER, Calhoun DM, Chadalawada S, Johnson PTJ. Circadian rhythms of trematode parasites: Applying mixed models to test underlying patterns. Parasitology. 2017;145:783–7921.

5. Johnson EM, Nagamori Y, Duncan-Decocq RA, Whitley PN, Ramachandran A, Reichard MV. Prevalence of Alaria infection in companion animals in north central Oklahoma from 2006 through 2015 and detection in wildlife. J Am Vet Med Assoc. 2017;250(8):881-886.

6. Wasiluk A. *Alaria alata* infection-threatening yet rarely detected trematodiasis. Journal of Laboratory Diagnostics. 2013;49(1):33-37.

7. Bilska-Zajac E, Marucci G, Piróg-Komorowska A, Cichocka M, Różycki M, Karamon J, Sroka J, Bełcik A, Mizak I, Cencek T. Occurrence of *Alaria alata* in wild boars (Sus scrofa) in Poland and detection of genetic variability between isolates. Parasitol Res. 2021;120:83-91.

8. Hoffman WA, Pons JA, Janer JL. Sedimentation concentration method in *Schistosomiasis mansoni*. P R Health Sci J. 1934; 9:283-298.

9. Berger EM, Paulsen P. Findings of *Alaria alata* mesocercariae in wild boars (Sus scrofa, Linnaeus, 1758) in west Hungary (Transdanubia regions). Wiener Tierarztliche Monatsschrift. 2014;101:120-123.

10. Dollfus RP, Chabaud AG. Distomum musculorum suis, mesocercairia of *Alaria alata* in the wild boar Sus scrofa L. Ann Parasitol Hum Comp. 1953;28:354-364.

11. Macdonald H, Kazacos KR, Schatz H. Two Cases of Intraocular Infection With *Alaria mesocercaria* (Trematoda). Am J Ophthalmol.. 1994;117(4):447-455.

12. Kramer MH, Eberhard ML, Blankenberg TA. Respiratory symptoms and subcutaneous granuloma caused by mesocercariae: a case report. Am J Trop Med Hyg. 1996;55:447-448.

13. Fernandez BJ, Cooper JD, Cullen JB, Freeman RS, Ritchie AC, Scott AA, Stuart PE. Systemic infection with *Alaria americana*. Can Med Assoc J. 1976;115:1111-1114.

14. Freeman RS, Stuart PE, Cullen SJ, Ritchie AC, Mildon A, Fernandes BJ, Bonin R. Fatal human infection with mesocercariae of the trematode *Alaria*. Am J Trop Med Hyg.1976;25:803-807.

15. Castro O, Venzal JM, Felix ML. Two new records of helminth parasites of domestic cat from Uruguay: *Alaria alata* (Goeze, 1782) (Digenea, Diplostomidae) and *Lagochilascaris major* Leiper, 1910 (Nematoda, Ascarididae). Vet Parasitol. 2009;160:344-347.

16. Abbas I, Al- Araby M, Elmishmishy B, El- Alfy ES. Gastrointestinal parasites of cats in Egypt: high prevalence high zoonotic risk. BMC Vet Res.2022;18(1):1-12.

17. Ruas JL, Muller G, Farias NAR, Gallina T, Lucas AS, Pappen FG, Sinkoc AL, Brum JGW. helmintos do cachorro do campo, *Pseudalopex gymnocercus* (Fischer, 1814) e do cachorro do mato, *cerdocyon thous* (linnaeus, 1766) no sul do estado do Rio Grande do Sul, Brasil. Rev Bras Parasitol Vet.. 2008;17(2):87-92.

18. Odening K. The “Duncker’s muscle fluke” can be transmitted experimentally to monkeys. Monatsh Veterinarmed. 1961;16:395-399.

19. Mukai K, Tsai M, Starkl P, Marichal T, Galli SJ. IgE and mast cells in host defense against parasites and venoms. Semin Immunopathol. 2016;38:581-603.

20. Katzung BG, Trevor AJ. Farmacologia básica e clínica. 13 ed. Porto Alegre: McGraw-Hill, 2017. 1202 p.

21. Chai JY. Praziquantel treatment in trematode and cestode infections: an update. Infect Chemother. 2013;45(1):32-43.