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Source: Journal of Wildlife Diseases, 30(4) : 548-551

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-30.4.548

Journal of Wildlife Diseases, 30(4), 1994, pp. 548–551

Pathogenicity of the Hookworm, *Ancylostoma pluridentatum*, in a Florida Panther (*Felis concolor coryi*) Kitten

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ABSTRACT: We evaluated clinical signs and administered anthelmintic treatment to a wild-caught, captive Florida panther (*Felis concolor coryi*) kitten from Big Cypress National Preserve, Florida (USA) infected with the hookworm, *Ancylostoma pluridentatum*. Clinical signs observed included poor body condition, lethargy, and below normal red blood cell numbers, hemoglobin concentration, and packed cell volume, and elevated eosinophil numbers. In addition, a maximum of 936 *Ancylostoma* sp. eggs/g of feces were found on Day 11 of captivity. Following oral administration of 20 mg/kg pyrantel pamoate on Day 11, 26 *A. pluridentatum* were collected from the feces. Based on the resolution of clinical signs, cessation of egg shedding, and a return to normal hematologic values following anthelmintic treatment, we believe that infection with *A. pluridentatum* was the primary cause of the stressed conditions in the panther kitten.

Key words: *Ancylostoma pluridentatum*, hookworm, *Felis concolor coryi*, Florida panther, hematology.

The Florida panther (*Felis concolor coryi*) presently consists of a single free-ranging population of 30 to 50 adults (Belden, 1986) found in and around the Big Cypress National Preserve (BCNP) of southern Florida (USA) (25°30′ to 26°30′N, 80°40′ to 81°40′W). O'Brien et al. (1990) believe that the hookworm, *Ancylostoma pluridentatum*, was introduced into the Florida panther population with the inadvertent release of infected South American puma intergrades (*F. concolor* ssp.) in southern Florida between 1956 and 1966. *Ancylostoma pluridentatum* is now one of the most prevalent and abundant parasites found in Florida panthers (Forrester et al., 1985).

Some *Ancylostoma* spp. can be highly pathogenic in domestic dogs and cats, especially in young animals (Kalkofen, 1987). Roelke et al. (1985) reported that two, 3-wk-old captive cougar (*F. concolor stanleyana*) kittens had clinical signs, including anemia and poor weight gain, due to infections with *Ancylostoma* sp. with 150,000 eggs/g (EPG) of feces. They speculated that the animals probably would have died if they had not been treated with anthelmintics. The only information available on the pathogenicity of *A. pluridentatum* is from a preliminary study on domestic cats in which clinical signs were noted in infections with fewer than 250 hookworms (Forrester, 1992).

We evaluated clinical signs and hematological values of a wild-caught, captive Florida panther kitten naturally infected with *A. pluridentatum*. Our objective was to evaluate the pathogenicity of *A. pluridentatum* and the efficacy of anthelmintic treatment in a panther kitten.

A wild-born female Florida panther (208), approximately 12 to 14 days old, was hand-caught in the BCNP on 6 June 1992. The kitten was held in isolation at the Lowry Park Zoo, Tampa, Florida, and fed a mild replacer (KMR®, Peg-Ag, Incorporated, Hampshire, Illinois, USA) until Day 18 of captivity when KMR® was mixed with a moist feline diet (Nebraska Feline Brand®, Central Nebraska Packing, Incorporated, North Platte, Nebraska, USA).

Whole blood was collected from the jugular vein, at capture and while in captivity, and stored in EDTA Vacutainers® (Becton Dickinson, Rutherford, New Jersey, USA) until analyzed. A Coulter Counter Model S + IV (Coulter Corporation, Hialeah, Florida) was used to perform leucocyte and erythrocyte counts (RBC), hemoglobin concentration (Hb), and packed cell volume (PCV). Mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglo-

bin concentration (MCHC) were calculated from measured RBC, Hb, and PCV values using the methods of Coles (1986). Hematological evaluations were performed at the Veterinary Medical Teaching Hospital (VMTH), College of Veterinary Medicine, University of Florida, Gainesville, Florida.

Lowered hematological values such as RBC, Hb and PCV are recognized features of hookworm and related nematode infections (Ross and Armour, 1960; Anosa, 1977). These values were used to assess possible hookworm-induced anemia in Kitten 208. Mean corpuscular volume, MCH, and MCHC were evaluated to classify any anemia. And, since eosinophilia may be present in ancylostomiasis (Duncan and Prasse, 1982), eosinophil numbers were used to approximate relative degree of hookworm infection.

Fresh fecal samples were collected at capture and during captivity. Nematode eggs were counted using a fecal flotation technique (Thienpont et al., 1979) at VMTH.

Kitten 208 was treated orally with pyrantel pamoate (Strongid-T®, Pfizer Incorporated, New York, New York, USA) at a dose of 20 mg/kg on two occasions, 12 hr apart, on Day 11 of captivity. Feces were collected intermittently from 2 to 30 hr from time of first anthelmintic treatment and preserved in 10% formalin fixative solution (Fekal®, Meridian Diagnostics, Incorporated, Cincinnati, Ohio, USA) for identifying and counting nematodes. *Ancylostoma pluridentatum* was identified according to characteristics described by Schwartz (1927). A single dose of ivermectin (Ivomec®, Merck & Company, Incorporated, Rahway, New Jersey) was given orally on Day 17 at a dose of 0.20 mg/kg.

On 7 April 1992, a male Florida panther (54), approximately 12 to 14 days old, was hand-caught in the same area as Kitten 208. Blood and fecal samples were collected at the capture site prior to his release.

Kitten 208 was moderately thin (body weight, 0.6 kg) and lethargic as compared to Kitten 54 (weight 1.4 kg); Kitten 54 was in excellent physical condition. No parasite eggs were found in the feces collected at time of capture (Day 1) of either kitten, nor on Day 3 or 6 from Kitten 208. Eggs of *A. pluridentatum* were found first in the feces of Kitten 208 on Day 7 (19 to 21 days of age). A maximum of 936 *A. pluridentatum* EPG were found on Day 11 from Kitten 208, and the kitten was treated with pyrantel pamoate the same day. Twenty-six immature and adult *A. pluridentatum*, including seven gravid and five non-gravid females, were found in the feces between 2 to 29 hr post-treatment. No *A. pluridentatum* or other helminth eggs were found between Day 16 and 45, the last day of the study.

Representative specimens of *A. pluridentatum* have been deposited in the U.S. National Parasite Collection, USDA, Beltsville, Maryland 20705, USA (USNM Helminth Collection Number 83977).

Body weight of Kitten 208 increased from 0.6 kg (Day 1) to 1.1 kg (Day 9) to 2.4 kg (Day 23) for an average gain of 0.06 kg/day pre-treatment, compared to 0.09 kg/day post-treatment. Clinical signs of thinness and lethargy resolved within 7 days post-treatment.

We compared pre-treatment and post-treatment hematological values for Kitten 208, with values from Kitten 54, and apparently normal values from captive cougars, and wild-caught bobcats (*Felis rufus*) (Table 1). Below-normal values for RBC, Hb, and PCV, and normal values for MCV, MCH, and MCHC for Kitten 208 on pre-treatment Days 1 and 9 of captivity are consistent with normocytic, normochromic anemia. Values for RBC, Hb, and PCV increased to near normal at 12 days post-treatment (Table 1). Eosinophil numbers increased from Day 1 of captivity (4%, 284/μl) to a high on Day 9 (24%; 1656/μl) before treatment, then declined to near normal (6%, 880/μl) 12 days post-treatment; we believe these changes correspond

TABLE 1. Hematological values for a Florida panther kitten (FP 208), before and after anthelmintic treatment (on Day 11) for infection with *Ancylostoma pluridentatum*. Values for another clinically normal panther kitten (FP 54) and felids of other types are included for comparison.

Blood value	FP 208			FP 54	Adult captive cougars[b]	Wild caught bobcats[c]
	Pre-Treatment		Post-Treatment			
	Day 1[a]	Day 9	Day 23			
Red blood cells ($\times 10^6$/ul)	5.54	5.04	6.52	6.74	7.9 ± 1.1[d] (6.0–9.7)[e]	7.11 ± 0.48[d]
Hemoglobin (g/dl)	13.4	10.6	12.1	12.7	13.8 ± 2.1 (10.5–17.8)	12.28 ± 0.59
Packed cell volume (%)	32.8	27.8	34.8	31.3	38 ± 6 (27–48)	36.47 ± 2.24
Mean corpuscular volume (fl)	59.5	56.0	58.1	46.0	49 ± 2 (46–54)	53.68 ± 2.83
Mean corpuscular hemoglobin (pg)	24.1	21.2	18.6	18.8	17.6 ± 0.8 (15.6–19.0)	—
Mean corpuscular hemoglobin concentration (%)	45.4	38.1	31.9	40.6	35.8 ± 1.4 (32.0–38.2)	—
Eosinophils (% total leucocytes)	4	24	6	5	(0–6)	—
Eosinophils (number/μl)	284	1,656	880	230	100 ± 100 (0–400)	278 ± 392

[a] Number of days in captivity.
[b] From Hawkey and Hart (1986).
[c] From Heidt et al. (1988).
[d] Mean ± SD.
[e] Range.

to the relative degree of hookworm infection.

Signs of hookworm disease in domestic dogs and cats include progressive anemia, emaciation, and lethargy. In heavy infections, there may be acute normocytic, normochromic anemia followed by microcytic, hypochromic anemia with circulatory collapse culminating in shock and death (Kalkofen, 1987). Based on the resolution of clinical signs, cessation of egg shedding, and a return to normal hematologic values after anthelmintic treatment, we believe that infection with *A. pluridentatum* was the primary cause of the stressed conditions in the panther kitten. The clinical signs and hematological value in Kitten 208 were consistent with signs of a light to mild hookworm disease.

We suspect that Florida panther kittens <2 mo of age, infected with low numbers of *A. pluridentatum*, may show signs of anemia suggestive of hookworm disease. It is possible that infection of very young kittens may be indicative of perinatal infection, either transuterine or transmammary. Kittens infected by either route may be more susceptible to developing hookworm disease than older kittens infected by the oral route. We believe that the anthelmintics pyrantel pamoate and ivermectin are a safe and effective treatment for hookworm infections in Florida panther kittens. Information on routes of infection of neonates may allow the development of more appropriate treatments in pregnant females. Consequently, further research is needed to document the effects and routes of infection of *A. pluridentatum* in Florida panthers.

The authors thank personnel of the Florida Game and Fresh Water Fish Commission, including Dr. Melody E. Roelke, Dr. Carolyn M. Glass, David S. Maehr, J. Walter McCown, Jayde C. Roof, E. Darrell Land, and Marnie G. Lamm for their efforts in the capture and handling of animals used in this study, and Dr. James A.

Rodgers and James R. Brady for their reviews of the manuscript. We also express our appreciation to Drs. Donald J. Forrester and Ellis C. Greiner for their critical reviews of the manuscript and Dr. Greiner for his assistance with parasite egg counts. This project was funded in part by the Florida Game and Fresh Water Fish Commission federal grant-in-aid funds administered through the U.S. Fish and Wildlife Service under section 6 of the Endangered Species Act of 1973 (PL No. 93-205) and The Florida Nongame Trust Fund. This publication is dedicated to the memory of Dr. Carolyn M. Glass.

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Received for publication 22 March 1994.