

## ADULT *TOXOCARA CATI* INFECTIONS IN U.S. CHILDREN: REPORT OF FOUR CASES

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**Abstract.** We report four cases of passage of subadult or adult *Toxocara cati* worms by young children ages 20 months to seven years. Worms were expelled rectally in two cases and in two cases they were vomited. A single worm was passed in two cases, three worms in one case, and 15 worms in the fourth case. All worms that were available for study were identified as *T. cati* by morphologic criteria, including the arrow-shaped cervical alae and the digitiform shape of the male tail. None of the four children exhibited clinical signs of ocular or visceral larva migrans, and in two cases where serum samples were available, neither child had a titer to *Toxocara*. These results further the argument that these children acquired the worms through the ingestion of immature worms passed by infected cats, not through the ingestion of infective eggs. Although the children were generally not ill as a result of these unusual infections, it does serve to reinforce the public health issue that potential serious consequences can occur where children have exposure to an environment that has been contaminated with cat feces, or, more specifically, infective eggs, and could become infected with larval forms of *Toxocara*.

Human infection with the dog or cat ascarids *Toxocara canis* or *T. cati* is typically a result of accidental ingestion of embryonated eggs.<sup>1</sup> It is generally believed that these roundworms are not able to complete their life cycle in humans, but that tissue migrating larvae can result in serious complications, including visceral larva migrans (VLM) or ocular larva migrans (OLM). Children are most often infected through the ingestion of eggs in soil or via hands contaminated with eggs.<sup>1</sup>

Reports of human intestinal infection with subadult or adult worms number about 20, but many of these are believed to be spurious or erroneous observations.<sup>2</sup> Furthermore, these cases of adult toxocariasis have all been attributed to *T. cati*, and it has been suggested that human infection with adult worms probably cannot be acquired in the usual manner of ingesting infective eggs or larvae in paratenic hosts.<sup>2</sup> It is possible that children, handling worms that have been passed by an infected kitten or cat, could ingest the worm(s) and subsequently vomit or expel the worm from the anus. This was believed to be the case in an eight-month-old child in Vermont.<sup>3</sup>

We report here four cases of children who passed from one to 15 adult *T. cati* worms.

### CASE REPORTS

**Case 1.** A 20-month-old boy, a resident of Selwickley, Pennsylvania, had been sick for several weeks with vomiting and diarrhea. In early October 1995, at the end of a bath, as his mother lifted the child out of the tub, he passed 15 moderately large roundworms. Further clinical evaluation included pertinent history, hematologic evaluation, and serologic testing. The parents stated that the child had a history of playing with a stray kitten, and that they had another cat in the household and had a cat litter box in the house, which was also used on occasion by the stray kitten.

The child's blood work-up results were unremarkable; there was no eosinophilia, liver function enzymes were not elevated, and the serologic tests result for toxocariasis was negative (titer = 1:4 with positive being  $\geq$  1:32).

One week after passing the worms (but before a definite

diagnosis of the parasite had been made) the child was treated with Vermox® (mebendazole) (Janssen Pharmaceutica, Inc., Titusville, NJ), 100 mg twice a day for three days, and again one month later at the same dose. The child has been asymptomatic and there has been no further passage of additional worms.

One female and four male worms were available for detailed study. The males ranged from 4.0 to 4.8 cm in length by 0.8 to 1.0 mm in diameter, while the one female measured 6.1 cm in length by 1.2 mm in diameter. The most striking feature was the very pronounced arrowhead-like anterior end of both sexes, and the digitiform shape of the male tail (Figure 1). Three characteristic lips, the presence of a ventriculus, and typical caudal papillae and spicules and the shape of the tail in the males were all noted and characteristic of ascarids in the genus *Toxocara*. The shape of the prominent cervical alae allowed an identification as *T. cati*.

**Case 2.** A six-year-old boy, a resident of Willimantic, Connecticut, passed three worms as part of a bout of bloody, mucous diarrhea in July 1996. The worms were found in the child's underpants following the diarrhea; however, the mother could not state with certainty that the child had passed the worms. Further evaluation included a more detailed history and serologic testing. The family had a young kitten, which the child played with extensively. The result of serologic testing was negative (titer = 1:4).

At the time that the child passed the worms, he was treated with Vermox®, 100 mg twice a day for three days. The kitten was also dewormed at the same time. Following expulsion of the worms, the child was asymptomatic and reported in good health.

The three worms passed were all available for study, and consisted of one female and two males. The female worm measured 5 cm in length by 1.2 mm in diameter; the male worms were each 2.5 cm in length by 0.7 mm in diameter. The worms had the same physical features as seen in those from case one, and were identified as *T. cati*.

**Case 3.** In August 1996, a seven-year-old boy from Stillville, Missouri experienced an episode of vomiting during the night, and a single worm was recovered from the vomitus. There was a history of a cat living with the family. The

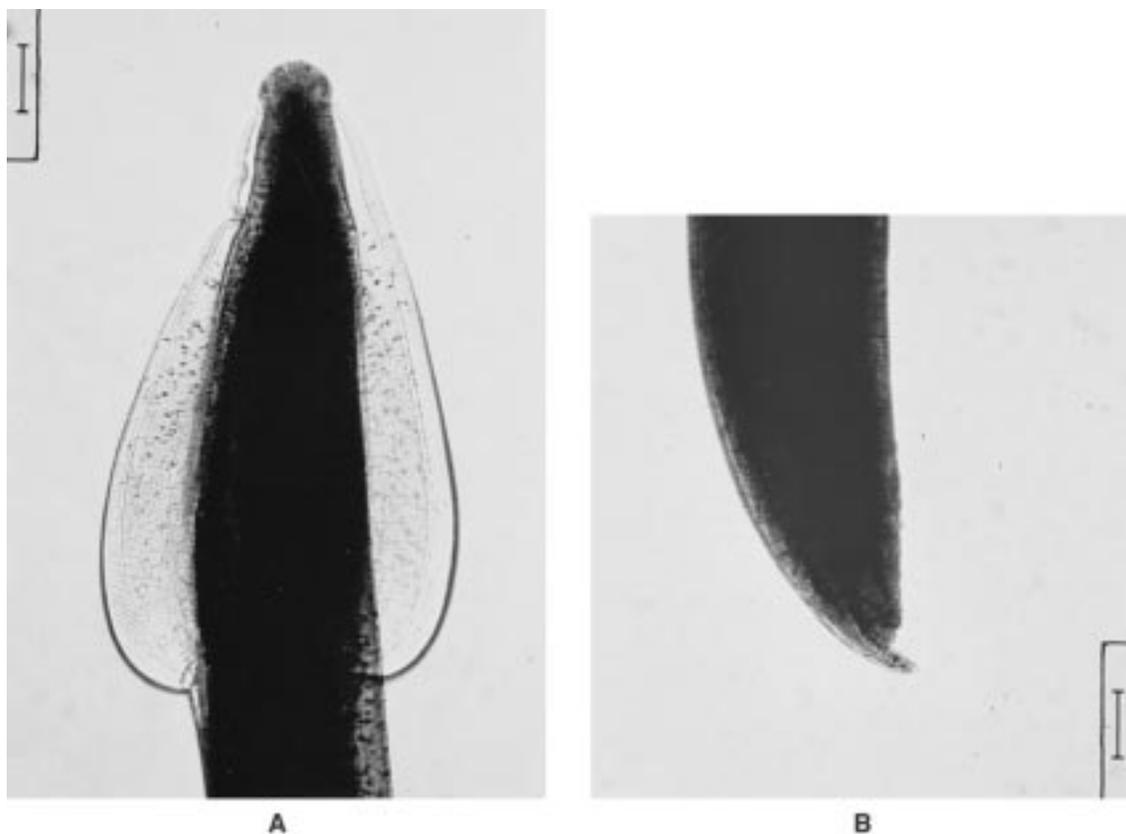


FIGURE 1. Photomicrographs of adult male *Toxocara cati* passed by a 20-month-old boy in Pennsylvania. **A**, anterior end illustrating the very prominent cervical alae. **B**, posterior end portraying the digitiform shape of the tip of the tail. Scale bars = 200  $\mu$ m.

child received no medication, and, other than the vomiting episode, was asymptomatic and in good health. No serum was obtained for testing.

The single worm was a female and measured 3.5 cm in length by 1.5 mm in diameter. The worm exhibited the same morphologic features as those obtained in cases 1 and 2, and was identified as *T. cati*. Of note was the fact that a few typical fertile *T. cati* eggs were present in the formalin fluid in which the worm was received, indicating that the worm was gravid.

**Case 4.** In May 1996, a 31-month-old girl in Kansas had an episode of vomiting. A parent collected a single worm from the vomitus. The physical examination at this time was unremarkable, but the child was treated with Vermox® twice a day for three days. No serologic testing was done, and no history was obtained that indicated whether or not a kitten or cat was present in the household.

The single worm was a female and measured 7 cm in length by 2 mm in diameter. Eggs and sperm were noted in the uterus of the worm.

#### DISCUSSION

Human infection with the larval stages of the dog and cat ascarid, *T. canis* and *T. cati*, are well-recognized clinical entities.<sup>1</sup> A much rarer event is the passage of subadult or adult worms either in vomit or feces. Based on experimental infections in animals, it is generally regarded that neither species is able to complete development from ingestion of

infective eggs to adult worm.<sup>4</sup> This suggests that children swallow immature (but advanced-stage larvae) or adult worms, which may either then be regurgitated or slowly pass through the digestive system and are expelled in a still living state. The negative antibody response in the toxocarasis assay and the absence of a typical VLM syndrome in the present cases, and as previously noted by von Reyn and others,<sup>3</sup> further suggests that passage of adult *Toxocara* worms did not result from successful development of larval stages. However, it should be noted that Sprent documented that adult *T. cati* could develop in the intestinal tract of cats without undergoing a liver-lung migration.<sup>5</sup> Thus, it may be possible that *T. cati* could develop in children without undergoing tissue migration; thus, we cannot state unequivocally that children cannot become infected through ingestion of eggs. Under such a scenario, it is likely that production of circulating antibodies would be minimal.

Passage of moderate-sized nematodes has on several occasions been attributed to *Toxocara* infections. However, upon further examination of the worms, they were found to be young *Ascaris* and not *Toxocara*.<sup>6</sup> Only one well-documented case of adult *T. cati* infection has been reported in the literature, that being the report of von Reyn and others in 1978.<sup>3</sup> In that case, a single female worm was passed by an eight-month-old girl in Vermont, and there was clear documentation of cats living in the household, a litter box in the kitchen, and recovery of an adult *T. cati* from the litter box. The present cases bear many similarities to that previous report, with the exception of the unusually large number

of worms passed in case one. In three of the cases, there was good evidence that the worms were passed by the children, the worms were all readily identified as *T. cati*, the patients had no symptoms compatible with VLM or OLM, the serologic test results in two cases were negative, there were cats in the household of at least three of the cases, and adult worms had been noted in the cat litter box in two cases. In all four cases, the worms were alive when passed, and none showed signs of decomposition.

In at least one instance (case one), based on the history of vomiting and diarrhea during the 2–3 weeks preceding the passage of the worms, it would suggest that the child had ingested the worms several weeks prior. This also suggests that the worms were able to slow their transit time considerably, although not totally preventing an eventual expulsion. In two of the other cases (no. 3 and 4), there was little or no history of physical discomfort and it may be that the worms were vomited shortly after being ingested.

The serologic test results for cases 1 and 2 further strengthen the argument that individuals who pass adult *Toxocara* are unlikely to have acquired the infection through ingestion of embryonated eggs with subsequent larval migration. However, we were concerned about potential exposure to infective eggs to warrant serologically screening as many of these children as possible. This was based on the clear evidence in all but one case that there was household exposure to infected cats, *Toxocara* worms, and quite possibly embryonated eggs. The negative serologic status of both children was valuable to the clinical decisions regarding further need for medical attention as well as in discussion with the children's parents.

This report represents a well-documented occurrence of expulsion of *T. cati* adult worms by four children with a history of exposure to cats and cat litter boxes. The observation by parents in one instance of adult worms in the litter box, the absence of clinical symptoms of larval migrans, and negative serologic test results would all suggest that these cases were acquired by ingestion of subadult or adult worms. The morphologic features allowed ready identification as *Toxocara cati*. Although all the children became asymptomatic upon passing the worms, and do not appear to have residual damage from their experiences, these cases provide continued evidence that people, especially children, are at increased risk of acquiring toxocariasis, the larval stages of which can result in serious medical conditions. The need for appropriate treatment of pets to reduce or eliminate their parasite infections and as consequence, reduce the risk of human infection is again demonstrated. Veterinary and public health professionals recommend that cats and dogs, particularly kittens and pups, be periodically dewormed. Stra-

tegic preventive treatments of dogs and cats are aimed at preventing illness in the animal and excretion of eggs and larvae into the environment where they may serve as a source of infection for children. Emphasis must be placed on young animals because they are most often and most heavily infected. The Centers for Disease Control and Prevention/American Association of Veterinary Parasitologists recommendations<sup>7</sup> for veterinarians on how to prevent transmission of intestinal roundworms from pets to people discuss these issues and outline preventive strategies that apply to different situations.

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