Macracanthorhynchus ingens Infection in an 18-Month-Old Child in Florida: A Case Report and Review of Acanthocephalasis in Humans

Blaine A. Mathison,1,2 Henry S. Bishop,1 Chad R. Sanborn,3 Samaly dos Santos Souza,1,2 and Richard Bradbury1

1Division of Parasitic Diseases and Malaria, Center for Global Health, Centers for Disease Control and Prevention, and 2IHRC, Inc, Atlanta, Georgia; and 3Pediatric Infectious Diseases, Palm Beach Children's Hospital, West Palm Beach, Florida

A case of acanthocephalasis in an 18-month-old child caused by Macracanthorhynchus ingens is reported from Florida. This represents only the third documented case of this species in a human host. An overview of human cases of acanthocephalasis in the literature is presented, along with a review of the biology, clinical manifestations and pathology in the human host, morphology, and diagnosis.

Keywords. Macracanthorhynchus; acanthocephalasis; pediatrics; zoonotic; Moniliformis.

Acanthocephalasis is a zoonotic infection caused by members of the phylum Acanthocephala, referred to as “thorny-headed worms.” Superficially similar to nematodes, acanthocephalans are more closely related to the rotifers, possibly nested within the phylum Rotifera [1]. Most acanthocephalans are intestinal parasites of marine vertebrates; however, members of the genera Macracanthorhynchus and Moniliformis are parasites of terrestrial mammals and are responsible for the vast majority of human infections [2].

Human infection with Macracanthorhynchus hirudinaceus has been documented from Thailand, Bulgaria, the Czech Republic, Russia, China, Vietnam, Papua New Guinea, Australia, Brazil, and Madagascar, and from the United States in Louisiana [2, 3]. Macracanthorhynchus ingens has been reported from humans twice in Texas [4, 5]. In addition, 2 of the authors (B. A. M., H. S. B.) have identified other cases of Macracanthorhynchus in the United States from Florida (unpublished data).

Moniliformis moniliformis in humans has been documented from Iran, Iraq, Israel, Bangladesh, Russia, Italy, Nigeria, Egypt, Sudan, Zambia, Zimbabwe, Australia, Belize, Colombia, Saudi Arabia, and the United States [2, 6]. In addition, 2 of the authors (B. A. M., H. S. B.) have identified additional cases from Connecticut, Florida, Indiana, and Texas (unpublished data).

Other rare cases of acanthocephalans in humans include Bolbosoma species from Japan, Acanthocephalus bufonis from Indonesia, Acanthocephalus rauschi from Alaska, and Corynosoma stumosum from Alaska [2].

CASE REPORT

An 18-month-old girl presented with worm-like objects in her stool. The child first had previously shed a worm 5 months earlier; follow-up stool ova and parasite (O&P) examinations were negative. Three months later, 2 worms were observed 2 days apart in the child’s stool. The worms were sent to a local hospital microbiology laboratory and a commercial reference laboratory for analysis. Both specimens were reported as “segmented worm, not consistent with human parasite.” Three additional 3 O&P exams were again negative. The patient was prescribed albendazole but was unable to tolerate the medication. The girl was then referred to a pediatric infectious disease physician.

Upon inspection, the patient appeared well nourished, with a normal physical exam. She was found to be in the 25th–50th percentile of weight and height for her age. The girl’s mother reported that she had been asymptomatic for the last 5 months. She had no rashes, fevers, abdominal complaints, vomiting, or diarrhea. There was no international travel, and the patient had resided her whole life in Palm Beach County, Florida. There was no animal contact, and although millipedes (a possible intermediate host of the parasite) were reported around the outside of the home, ingestion was never witnessed. The child spent limited amounts of time outdoors and had no history of pica.

Three additional O&P examinations by a reference laboratory were all negative. Laboratory tests revealed a white blood cell count of $8.3 \times 10^6$ cells/µL and eosinophils of 8% (normal < 3%); the hemoglobin level was 12.3 g/dL, and the platelet count was 321 000 cells/µL. Immunoglobulin E level was 13 kU/L (normal < 93). Strongyloides and Toxocara antibody tests were both negative. Abdominal ultrasound was negative for any intestinal occlusion/obstruction. One month later, she had passed another worm in the stool. Photos of 2 worms were taken and sent to the Centers for Disease Control and Prevention’s Division of Parasitic Diseases and Malaria for telediagnostic assistance and reported as suspicious for an acanthocephalan. Follow-up material was requested for further testing.

One worm, measuring approximately 14 cm in length (Figure 1A), was received and initially identified as M. hirudinaceus based on generalized characteristics of the adult. Dissection of the specimen also revealed eggs characteristic of the genus...
BIOLOGY OF ACANTHOCEPHALANS

Acanthocephalans have a complex life cycle involving multiple hosts. *Macracanthorhynchus* species and *M. moniliformis* have both a terrestrial arthropod intermediate host and a terrestrial mammalian definitive host, although amphibians and reptiles may serve as paratenic hosts. Adult *M. hirudinaceus, M. ingens,* and *M. moniliformis* reside in the small intestine of pigs, raccoons, and rodents, respectively, although a wide variety of mammals may serve as definitive hosts. Eggs containing an infective first-stage larva (acanthor) are shed in feces and ingested by appropriate intermediate hosts. Common intermediate hosts for *M. hirudinaceus* and *M. moniliformis* are beetles and cockroaches [2]. Prokopić and Bílý [8] reported 52 species of beetles that can serve as intermediate hosts for *M. hirudinaceus* and 23 species of beetles that may serve as intermediate hosts for *M. moniliformis*. Millipedes are the primary intermediate host for *M. ingens*, although beetles and cockroaches may also serve as intermediate hosts [7, 8]. Within the hemocoel of the arthropod host, the acanthor molts into the second larval stage (acanthella). After several weeks to months, the acanthella becomes an infective cystacanth, which remains dormant. The definitive host becomes infected after ingesting arthropods containing cystacanths. Within the intestinal tract of suitable definitive hosts, acanthocephalans develop to sexual maturity [2]. In humans, acanthocephaliasis is commonly seen in children, due to their habit of ingesting objects (including insects). The condition can also be seen in people ingesting insects for dietary or medicinal purposes [2]. In the rare cases of infection with *Bobosoma* species, *A. bufonis, A. rauschi,* and *C. strumosum,* it is speculated that humans become infected by ingesting infected fish serving as paratenic hosts [2].

PATHOLOGY IN THE HUMAN HOST

Clinical manifestations of acanthocephaliasis range from asymptomatic to severe, including abdominal pain, distension, intestinal perforation, loss of appetite, nausea, vomiting, weight loss, constipation, bloody stools, and eosinophilia [2, 9–11]. Infections are largely confined to the intestinal mucosa, although *A. rauschi* and *Bobosoma* have been found in the peritoneum [2]. A case was reported (possibly incidental following contamination from the environment) of an immature, unidentified acanthocephalan in the eye of a groundskeeper from the United Kingdom [12].

Pathologically, the intestinal mucosa is ulcerated, the edge showing heavy infiltration of neutrophils and eosinophils, with edema in the submucosa and containing necrotic tissue and serofibrinopurulent exudates. Lacteals in the lamina propria are dilated, and hemorrhagic areas may resemble necrotizing enteritis. Mesenteric lymph nodes show follicular hyperplasia, and eosinophils entering the lymph nodes can cause dilatation. Intestinal perforation, leading to acute peritonitis and secondary bacterial infections, may occur [2, 11].

Treatment regiments are not well understood. Three oral doses of pyrantel pamoate (11 mg/kg per dose) separated by 2-week intervals is one option [2]. *Macracanthorhynchus ingens* has also been successfully treated with mebendazole [5]. With heavy infections, surgical procedures may be necessary to repair damaged tissues.

DIAGNOSIS AND MORPHOLOGY

Diagnosis of acanthocephaliasis is usually made by the finding of adult worms in stool specimens. In cases of *M. moniliformis,* eggs are frequently detected in stool on O&P; however,
Macracanthorhynchus species less frequently shed eggs in feces of the human host [2]. O&P examinations of stool of infected individuals may not reveal eggs. Eggs of Macracanthorhynchus species in human stool might represent spurious passage, especially in the absence of an adult worm or clinical manifestations, and repeat testing in such cases is advised.

Adults are large pseudocoelomate worms, usually cream to pale pink in color, and often have constrictions, giving the false impression of segmentation, but lacking defined demarcations. In the human host, female Macracanthorhynchus species are thick-bodied, measuring 12–32 cm in length; males are smaller (7–8 cm). Separation of Macracanthorhynchus species is done by morphometric analysis of the proboscis and its hooks. Moniliformis moniliformis is smaller and has more prominent pseudosegmentation, with females measuring 10–27 cm and males 4–10 cm. Members of both genera have a retractable proboscis (Figure 1, inset) armed with recurved hooks; it is this proboscis that is used for attachment to the host’s intestinal mucosa [2, 11]. There are no serologic or molecular tests available for routine diagnosis of acanthocephalans in human clinical specimens.

CONCLUSIONS

A human infection with M. ingens is reported from an 18-month-old child from Florida. This is the third documented case of a human host, the other 2 being from Texas [4, 5]. Although most cases of Macracanthorhynchus are attributed to M. hirudinaceus, M. ingens is a possibility in the eastern United States, where the raccoon definitive host is common. Identification to the species level requires morphometric analysis of the proboscis and the hooks on the proboscis [8]. Analysis of the specimen submitted demonstrated that it was morphometrically consistent with M. ingens. Treatment is the same for both species, but a species-level identification may be desired for epidemiologic purposes.

Note

Potential conflicts of interest. All authors: No potential conflicts of interest. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

References