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CASE REPORT

Hookworm infection in a healthy adult that manifested as severe eosinophilia and diarrhea

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KEYWORDS

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A 54-year-old male was admitted because of having suffered from progressive watery diarrhea for 12 days. He had no history of diabetes mellitus, hypertension, heart disease, organ transplantation, or malignancy. After admission, he still complained of diarrhea despite medical treatment. The laboratory examination showed leukocytosis with eosinophilia and a stool examination by the concentration method was negative four times. When a sigmoidoscopy was performed as a part of an explorative survey, a single protruding mass consisting of a moving adult hookworm was found. The fifth stool examination by the concentration method identified hookworm ova. The patient was treated with oral mebendazole 100 mg twice a day for 3 days. The diarrhea and eosinophilia subsided after this treatment.

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Introduction

Hookworm infections are common in the tropics and subtropics.^{1,2} *Ancylostoma duodenale* and *Necator americanus* are the major species of hookworms that infect humans. Furthermore, while *Ancylostoma ceylanicum* is able to reach maturity in man, *Ancylostoma braziliense* and *Ancylostoma caninum* generally cause cutaneous

larvamigrans or creeping eruption.^{3,4} The gastrointestinal symptoms caused by hookworm infection include nausea, diarrhea, vomiting, abdominal pain, and abdominal fullness. A definitive diagnosis of hookworm infection depends on discovery of eggs in the stool; however, samples may be negative during the early stage of hookworm infection. A parasitic infection may induce eosinophilia; however, the absence of eosinophilia does not mean that the patient does not suffer parasite infection. Furthermore to parasitic infection, fungal diseases as well as HIV and other retroviral infections also cause eosinophilia. We report here a case of hookworm infection in a healthy adult with the unusual manifestations of severe eosinophilia and diarrhea.

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Case report

A 54-year-old male complained of progressive watery diarrhea that had started 12 days ago. He had no history of diabetes mellitus, hypertension, heart disease, organ transplantation, or malignancy. The patient had been healthy previously. Twelve days before admission, watery diarrhea had begun and the frequency of the diarrhea had increased from 3 times per day to 10 times per day. Fever and general weakness had developed after 3 days. He did not have headaches, nausea, vomiting, nasal discharge, productive cough, neck stiffness, sore throat, chest pain, palpitation, abdominal pain, dysuria, or any abnormal skin lesion. He had no recent history of travel or animal contact. At the emergency department, leukocytosis with eosinophilia were noted and he was admitted for further management.

After admission, we performed stool culture for the presence of various bacteria, specifically *Vibrio*, *Salmonella* and *Shigella*, as well as a stool examination for ova by the concentrated method; however the result were all negative. Empirical oral levofloxacin was prescribed initially to treat the suspected bacterial enteritis. However, the diarrhea persisted and we repeated the stool examination four times with negative results. As a part of an extended investigation, we arranged a sigmoidoscopy. A single protruding mass consisting of an adult hookworm was found moving on the surface at 80 cm from the anal verge (Fig. 1). A biopsy was conducted and this confirmed hookworm infection by histopathological examination (Figs. 2 and 3). We repeated the stool examination a fifth time and hookworm ova were seen. Based on these findings, oral mebendazole 100 mg twice a day for 3 days was prescribed.



Figure 1. Endoscopy: a single protruding mass, 2.5 cm wide, which consisted of a moving adult hookworm. The hookworm was found on the gastrointestinal surface at 80 cm from the anal verge.

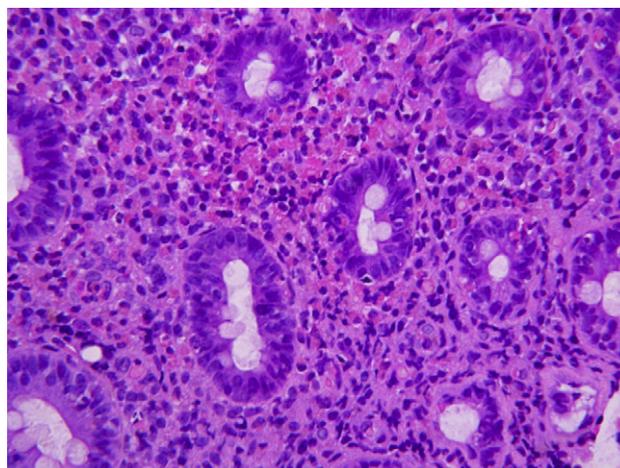


Figure 2. A colon section shows the presence of cecal mucosa with chronic inflammatory cell infiltration that is rich in eosinophils (haematoxylin and eosin staining, 400 \times).

The diarrhea and eosinophilia subsided after this treatment. Five days after treatment with mebendazole, the patient was discharged from hospital. No further diarrhea occurred and no stool ova was found at subsequent outpatient visits.

Discussion

N. americanus and *A. duodenale* are transmitted through contact with contaminated soil.⁵ After the infective hookworm larvae enter the host by skin penetration, the larvae receive a host-derived signal that causes them to resume development.⁶ At this point, the larvae are carried first by the venules to the right heart and then to the lungs. In the lung, the larvae rupture and enter the alveoli, migrating to the bronchioles, bronchi, and trachea. After being swallowed, the larvae enter the gastrointestinal tract, where they develop to the adult stage. It requires approximately 6–8 weeks from the larvae infecting humans to the



Figure 3. The parasite segments are suggestive of hookworm (original magnification, 200 \times).

development of sexual maturity and mating. How did the hookworm infect this patient? Tracing this patient's history, it was found that he had drunk spring water from the Yangmingshan National Park area for many years. Furthermore, the patient is a businessman who had sold fruit for 17 years at a wholesale market. In this context, he often forgot to wash his hands during work. He might have contracted the infective hookworm larvae either while drinking the spring water or during his work. Repeated exposure to hookworm larvae may result in a local pruritic, erythematous, papular rash known as "ground itch". However, this patient denied that he had suffered from any ground itch of the feet or hands in the past. Therefore, although the common infection route is through the skin, we need to explore whether there was another route of infection with this patient. *A duodenale* may also be transmitted through ingestion of larvae. They can develop into mature worms in the intestine without migrating through the lung to the intestine. This disease, named Wakana disease,⁷ is characterized by nausea, vomiting, dyspnea, pharyngeal irritation, cough, and hoarseness. This disease occurs after the oral ingestion of a large number of infective *A duodenale* larvae. This patient did not have any of the above symptoms more than his 2 weeks hospitalization and there was only a single hookworm identified. In this context, the possible infection route for this patient remains through the skin.

Patients with acute infections involving many worms may experience fatigue, vomiting, nausea, abdominal pain, diarrhea with black to red stools, weakness, and pallor.^{8–11} In chronic infections, patients may suffer from iron deficiency anemia,^{12,13} edema of the face and feet, listlessness, cardiomegaly, mental retardation, and physical retardation. This patient was admitted because of watery diarrhea and his bacterial stool culture was negative for *Vibrio*, *Salmonella*, and *Shigella*. Detection of parasite ova by the concentration method was negative four times and only positive when conducted a fifth time. This case report indicates that stool examinations for ova may be negative during the early stage of hookworm. However, according to the literature, we should be able to detect ova about two months after dermal acquisition of a *N americanus* infection and at up to 38 weeks after *A duodenale* infection.¹⁴ Therefore it was important that stool examination are repeated, with at a total of five times being needed to make the diagnosis with this case.

Eventually we found the worms by endoscopy. There have been a number of previous cases, where endoscopy was used to detect worms in patients with gastrointestinal symptoms (abdominal pain, epigastric discomfort, and intestinal bleeding) in the literature.^{15–26} In most of these cases, worms were identified in the small intestine and only one study reported finding hookworms by colonoscopy.²⁶ Incidentally, the patient in that study had also suffered from watery diarrhea up to 10 times a day for 2 weeks before expelling a bloody stool later. The worms in the previously published case were identified as *A ceylanicum* by their morphological characteristics. It would have been interesting to know if the worm from our patient was also *A ceylanicum*²⁶; unfortunately we did not perform further morphological observations on the living hookworm that were detailed enough to allow species identification. Hookworm species are mainly differentiated by their buccal

capsule. The buccal capsule of *A duodenale* has two pairs of curved teeth on the ventral wall of the capsule. In contrast, *N americanus* has a conspicuous pair of semilunar cutting plates on the dorsal wall. If the worm in Fig. 3 was not a section but a whole mount of the worm, it would be possible to know the answer by rehydrating the specimen with 70% alcohol then turn the worm around so that the buccal cavity is able to be viewed from the front side rather than side ways. Nonetheless, judging from the tooth morphology, this hookworm is highly likely to be an *Ancylostoma* sp.

Five to nine weeks after the onset of infection, an eosinophilia peak has been noted that coincides with the appearance of adult hookworms in the intestine.²⁷ According to previous reports, the peak eosinophil counts ranged from 1,350 cells/ μ L to 3,828 cells/ μ L.^{27,28} It is well known that the allergic, infectious, neoplastic, and idiopathic diseases are associated with eosinophilia.²⁹ The important infectious causes of eosinophilia include parasitic and fungal diseases as well as HIV and other retroviral infections. One report showed that of 128 Indochinese with unknown factors causing eosinophilia, 122 patients had intestinal parasitism caused by one or organisms; overall, hookworms were the most common organisms identified at 55%.³⁰ This patient had persistent eosinophilia after admission; however there was no finding of parasitic infection during the initial investigations. Based on the present case, it is therefore important to keep in mind the possibility that a parasite infection is present in the patients and causing the eosinophilia. However, the absence of eosinophilia does not mean the patient does not suffer from a parasite infection. Therefore, it is important to note that eosinophilia cannot be used as a diagnostic criterion for parasite infection.

The hookworm infection was treated with mebendazole (100 mg orally BID for 3 days or 500 mg once) as a first choice. It would also be possible to use either pyrantel pamoate (11 mg/kg per day for 3 days) or albendazole (400 mg once) as alternative agents.^{31,32} The drugs usually reduce the hookworm burden to a level below the threshold that causes disease. After treating this patient with mebendazole for the hookworm infection, his diarrhea disappeared. This case report should also remind endoscopists and physicians to keep living hookworms as specimens to conduct further detailed examinations so that they can attempt to confirm accurately the species of the hookworm that is infecting their patient.

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