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CASE REPORT

FIRST REPORT OF PSEUDOPARASITISM BY *Capillaria hepatica* IN THE STATE OF PARÁ, BRAZIL

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ABSTRACT

The nematode *Capillaria hepatica* (syn. *Calodium hepaticum*) is the etiological agent of hepatic capillariasis, a serious and uncommon disease in humans. The manifestations of this disease are persistent high fever, hepatomegaly, leukocytosis with eosinophilia, and elevated serum transaminases; the final diagnosis is confirmed with liver biopsy. Due to the biological cycle of *C. hepatica*, adult worms reach the liver parenchyma of the host, and the eggs are also restricted there, so they are not found in the feces. Therefore, the presence of *C. hepatica* eggs in human stool indicates a spurious infection or pseudoparasitism. In these cases, the probable source of contamination is the ingestion of meat, especially the liver, from infected game animals. The eggs contained in the liver of these animals are accidentally ingested and pass through the gastrointestinal tract until they are eliminated in the feces. Although likely underestimated, several spurious cases of *C. hepatica* have been reported in Brazil and worldwide, as subsistence hunting is still the primary food source for many rural and indigenous populations. Here, we present the first report of pseudoparasitism by *C. hepatica* in the State of Pará, Brazil. Considering the concept of "One Health", where there is an intimate relationship between human, animal, and environmental health, reporting cases of pseudoparasitism is relevant for epidemiological surveillance.

KEY WORDS: Pseudoparasitism; *Capillaria hepatica*; capillariasis; one health.

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INTRODUCTION

Capillaria hepatica (syn. *Calodium hepaticum* (Bancroft, 1893. Moravec, 1982), *Capillaria philippinensis*, and *Eucoleus aerophilus* are the three species of parasites from the Capillariidae family known to infect humans (Klisiowicz et al., 2014). *C. hepatica* is a globally distributed nematode that causes hepatic capillariasis in various mammals, especially rats (Bolukbas et al., 2020). Hepatic capillariasis is rare in humans, underdiagnosed, and neglected, with approximately 200 published cases worldwide, despite being a common zoonosis in over 180 mammal species (Manor et al., 2021).

Mammalian hosts, including humans, become infected by ingesting food, soil, and/ or water contaminated with embryonated eggs of *C. hepatica*. After ingesting eggs that remained in the environment for 28 to 30 days, exposed to adequate humidity and temperature conditions to become infective (embryonated), the larvae that hatch from these eggs penetrate the host's intestinal mucosa. In 3 or 4 days, they reach the portal circulation and evolve into adult worms within 3 to 4 weeks, which settle deeply in the host's liver tissue. Approximately four weeks after infection, adult worms disintegrate, releasing eggs into the liver parenchyma; these eggs cannot be eliminated in the host's feces. The eggs will only reach the environment again with the death of the infected animal, whose infected carcass will contaminate soil, water, and food. Alternatively, infected animals may be ingested by other animals or humans, causing the non-embryonated eggs present in their livers to pass through the digestive tract and be eliminated in the feces, leading to spurious infection or pseudoparasitism (Carvalho-Costa et al., 2009).

In the life cycle of *C. hepatica*, humans participate in two ways: the first is by developing true infection or hepatic capillariasis, diagnosed by the presence of eggs and occasionally adult worms in the liver parenchyma through biopsy. The second is through spurious infection, also known as pseudoparasitism. The ingestion of non-embryonated eggs of *C. hepatica* present in the poorly cooked liver of wild mammals is the possible cause of pseudoparasitism, as the ingested eggs pass through the gastrointestinal tract and are eliminated in the feces without causing disease (Fuehrer et al., 2011; Gonçalves et al., 2012; Oliveira et al., 2022).

Herein, we report the first case of *C. hepatica* eggs found in human feces in the State of Pará, Brazil, indicating pseudoparasitism. The data presented here have epidemiological relevance as spurious cases can contribute to environmental contamination with *C. hepatica* eggs and favour the parasite's transmission cycle.

CASE REPORT

A 62-year-old female patient sought medical care at a Basic Health Unit, complaining of weakness, abdominal pain, cramps, diarrhoea, and back pain, which started five months ago. The patient had a previous diagnosis of hypertension, treated with losartan 50 mg every 12 hours, and acetylsalicylic acid 100 mg once daily. She had no other comorbidities. The patient resides in a rural area of Almeirim-PA, without basic sanitation; she reports consuming water from a natural source and eating game meat, such as paca and wild pig, including the viscera of these animals. The study was approved by the Research Ethics Committee of the Pontifical Catholic University of Paraná (CAAE nº 77709624.3.0000.0020). The patient agreed to participate in the survey through a free informed consent form.

An abdominal ultrasound revealed a renal cyst on the left side, with no other particularities. Laboratory tests showed the following results: erythrocytes 4.05 million/mm³, hemoglobin 12.4 g/dL, RDW 13.4%, total leukocytes 5,400/mm³, segmented neutrophils 2,538/mm³, eosinophils 162/mm³, platelets 295,000/mm³, erythrocyte sedimentation rate 21 mm/hour, C-reactive protein < 6 mg/L, fasting blood glucose 87 mg/dL, AST 14 IU/L, ALT 20 IU/L, total cholesterol 207 mg/dL, triglycerides 168 mg/dL, urea 25 mg/dL, creatinine 0.70 mg/dL, and urine test without abnormalities.

Parasitological stool examination (spontaneous sedimentation in water, Lutz or Hoffmann-Pons-Jener (HPJ) method) revealed the presence of non-embryonated eggs similar to *Trichuris trichiura* eggs, by their barrel shape and two flat polar prominences (bipolar plugs), but with striated shells, characteristic of *Capillaria* spp. (Figure). The eggs found were approximately 60-65 x 35-40 μm in size, with morphological characteristics compatible with *C. hepatica*. The patient had no notable abnormalities in previous laboratory tests (2 months before the finding).

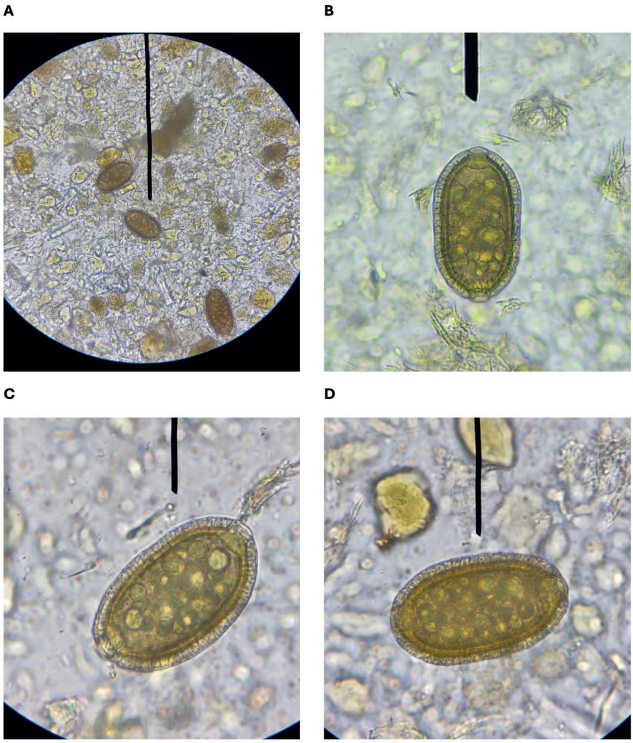

Figure. Preparation of fecal sample sedimented by the spontaneous sedimentation in water, Lutz or Hoffmann-Pons-Jener (HPJ) method, stained with Lugol. A) Non-embryonated *Capillaria hepatica* eggs. Magnification 400×. B - D) Non-embryonated *C. hepatica* egg, with opercula at the ends and striated shell. Magnification 400× plus cell phone zoom.

DISCUSSION

Hepatic capillariasis is a severe and uncommon disease with nonspecific symptoms. It may manifest as acute hepatitis. Clinical findings include prolonged fever, anemia, nausea, vomiting, abdominal pain, diarrhea, hepatomegaly, and respiratory disorders due to pneumonitis. Laboratory investigation usually reveals leukocytosis with eosinophilia and elevated serum transaminase levels. The most common manifestations are persistent high fever, hepatomegaly, and leukocytosis with eosinophilia (Fuehrer et al., 2011; Wang et al., 2019; Antoons et al., 2022). Adult worms and *C. hepatica* eggs in liver tissue produce an intense local inflammatory reaction with

eosinophils, macrophages, granulomas, and fibrosis around the eggs (Mowat et al., 2009; Hong et al., 2017).

Clinical manifestations of hepatic capillariasis are nonspecific, and there is no commercial serological test for detecting antibodies or antigens. Moreover, antibodies against *C. hepatica* may cross-react in serological tests for *Toxocara*, *Schistosoma*, and *Dirofilaria immitis* (Antoons et al., 2022). Thus, the definitive diagnosis is a liver biopsy with the observation of eggs and occasionally adult worms of *C. hepatica* in histological sections (Juncker-Voss et al., 2000; Assis et al., 2004; Wang et al., 2019).

The patient in this case presented with nonspecific gastrointestinal symptoms such as abdominal pain, cramps, and diarrhea, but no fever. Liver markers were normal, and the blood count did not show anemia, leukocytosis, and/ or eosinophilia, which are common changes in confirmed *C. hepatica* infection. Ultrasound did not indicate visceromegalies or liver abnormalities. For these reasons, liver capillariosis in the patient is very unlikely.

The patient resides in a rural area without basic sanitation and reports consuming water from a natural source and game meat, including the liver of these animals. The finding of eggs in her feces reflects only the passage of eggs in the consumed infected liver through her gastrointestinal tract, characterizing a typical case of pseudoparasitism.

The terms pseudoparasitism, spurious infection, or false parasitism describe episodes of accidental ingestion of some parasitic evolutionary form (Ferreira, 1973). Spurious infection or pseudoparasitism by *C. hepatica* is not uncommon in humans, with several reports worldwide, and in various regions of Brazil (Fan et al., 2000; Machado et al., 2008; Carvalho-Costa et al., 2009; Camargo et al., 2010; Fuehrer et al., 2011; Gonçalves et al., 2012; Cabada et al., 2013; Klisiowicz et al., 2014; Oliveira et al., 2022). This is the first report on the State of Pará in the North of Brazil. The number of pseudoparasitism cases is likely underestimated, mainly because *Capillaria* spp. eggs may be confused with *T. trichiura* eggs in parasitological stool examinations (Fan et al., 2000). Spurious cases do not require treatment, as all ingested eggs are eliminated in the feces within a few days after ingestion without causing infection.

The release of *C. hepatica* eggs in the feces of individuals with pseudoparasitism leads to environmental contamination. Animals and humans who ingest soil, food, and/ or water contaminated with *C. hepatica* eggs can become definitive hosts of the parasite, with the possibility of developing hepatic capillariasis.

The main difference between the eggs from *C. hepatica* and *T. trichiura* is that the outer shell of *T. trichiura* eggs is not striated as those from *C. hepatica* (Gonçalves et al., 2012). Additionally, *C. hepatica* and *C. philippinensis* eggs have similar morphology, though the latter is smaller and thinner (Cross, 1992; El-Dib & Ali, 2020; Kasher et al., 2022). Correct morphological identification of the eggs is crucial in differentiating suspected cases of intestinal capillariasis,

caused by *C. philippinensis*, from cases of pseudoparasitism by *C. hepatica*. In this sense, the continuous training of analysts is essential.

Although pseudoparasitism does not put the affected individual at direct risk of developing the disease, reporting spurious or pseudoparasitism cases is relevant as it identifies areas where the parasite is present and indicates the need for epidemiological surveillance. The close relationship between human health, animal health, and the environment, known as "One Health," underscores the importance of disseminating parasitological findings in specific geographic regions (Otranto et al., 2021).

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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