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Case report

A worm in the toilet bowl! What does it tell us about the challenges in the identification of supposed human parasites in practical parasitology?

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ABSTRACT. Non-parasitic vermiform organisms can circumstantially be associated with humans and their identification can be challenging for medical professionals. The present report describes the finding of a vermiform organism in the toilet bowl by a patient from Brazil, who thought he had expelled it in his faeces. The gross analyses in a clinical laboratory reveal the worm was different from other macroscopic organisms routinely identified, and the laboratory staff requested assistance in an academic laboratory specialized in helminthology. After preliminary analysis in a stereomicroscope, the supposed human worm was identified as an oligochaete annelid (earthworm). The patient was contacted to investigate a possible case of pseudoparasitism. However, we were informed that the organism had been collected in a toilet bowl from a rural environment where the untreated water comes from a cistern indicating our finding was circumstantial. The methodology revisited herein allowed a quick microscopic analysis of easy-to-view morphological structures, which are useful to separate oligochaete annelids from helminths and can prevent misdiagnosis in similar situations. We discuss the overly restricted view on human parasites by health professionals in collecting clinical history and laboratory analysis, providing some epistemological insights on the necessary interdisciplinarity between parasitology and other basic knowledge with health practice.

Keywords: annelid, diagnosis, epistemology, helminths, misidentification, pseudoparasitism

Introduction

Despite the fundamental importance of the coproparasitological tests for the identification of eggs and larval stages of human helminths, the analysis of worms expelled through of orifices (ear, nostrils, mouth and more frequently anus), or found in the vomiting or faeces, can also be considered valuable samples for diagnosis of helminthosis [1]. Patients themselves or their parents (in the case of children) can find and deliver macroscopic organisms to the practitioner during consultation or clinical laboratory, mainly in rural areas. These situations are not uncommon in practice and may be related to psychosocial impacts, including concern, distress and stigma for the patient and family. Moreover, human worm specimens have also been obtained during diagnostic image tests and surgical procedures [2–5].

In these cases, the worms can be processed and analyzed for correct identification using morphological techniques. Although not always performed, this morphological approach is a procedure well established for several parasites with medical importance, such as *Enterobius vermicularis*, *Ascaris lumbricoides*, *Taenia* spp. and fish-borne trematodes [6,7]. In many cases, this type of analysis is mandatory to achieve the specific parasitological identification [7–10]. However, in addition to human parasites, a miscellaneous of macroscopic organisms that can be found or thought to be associated with human faeces can complicate this scenario. There are many cases of accidental human infections with zoonotic helminths from wild animals [11,12]. Another complicating factor is the pseudoparasitism observed when developmental stages of organisms (parasites or not) that were ingested and passed through the human gastrointestinal tract without causing an actual infection are found in faeces. Lastly, there is cases described as supposed parasites, in which non-parasitic organisms found or incorrectly associated with the faeces are at first interpreted as human parasites [1,13].

This type of confusion may be more common than thought among the macroscopic helminths known since antiquity (e.g., tapeworms, pinworms, and roundworms). For instance, the identification of the roundworm *Ascaris lumbricoides*, possibly the worm from humans earliest recognized due to its large size and high prevalence, is historically linked to controversies. *Ascaris* reports are present in texts from ancient China, Mesopotamia, Greece and Rome, and this nematode was likely mistaken for earthworms by the Greeks and Romans [14]. In fact, the Latin word "Lumbricus" was used to designate both intestinal worms and earthworms. Even after the Renaissance and the advent of Modern Science, the confusion between these zoological groups remained and can be exemplified by the first scientific description (as *Lumbricus teres*) of the species currently known as *A. lumbricoides*, then as belonging to the common earthworm genus *Lumbricus*, by the English scientist Edward Tayson, in the 17th century [15].

Since then, although reports of *A. lumbricoides* expelled through orifices of infected individuals are not uncommon among the population of endemic areas [2,3,16], formal studies and discussion on this situation of supposed parasitism (especially concerning annelids) are virtually nonexistent. This fact can contribute to keeping the confusion between true parasites and other zoological groups in some situations and communities. In this case, a supposed human worm found in a toilet bowl by a patient from a rural area from Brazil was sent for identification in a reference clinical laboratory. This event was a starting point for reflections on the erroneous diagnostic of non-parasitic organisms found circumstantially associated with humans. We addressed some epistemological issues related to the necessary interdisciplinarity between parasitology and other basic subjects for an adequate health practice, since some professionals are not always adequately prepared for parasitological practice.

Case report

A 68-year-old male (AJS), previously healthy, sought medical attention distressed about a vermiform organism he thought he had expelled in faeces. The organism was found in the toilet bowl from a vacation farm located in the rural region of the small municipality of Lamim, state of Minas Gerais, Brazil, in October 2020. The patient collected the ”worm”, transferred to a glass container containing water and sent it for identification in a clinical laboratory from the state capital Belo Horizonte. This procedure was recommended by a doctor, who first monitored the case and was unable to recognize the organism. The only information initially presented to the laboratory was that the worm-like organism had been expelled in patient faeces. A faecal sample was also processed by the spontaneous sedimentation technique, and the result was negative for developmental stages of helminths. The worm was delivered still alive for identification. As it was different from macroscopic elements that are routinely evaluated, the laboratory staff sought assistance for identifying the worm-like organism in an academic laboratory specialized in helminthology. After guidance was given by one of us (HAP), the organism was killed in hot water and fixed in 95% ethanol.

In the academic laboratory, the organism was initially visualized in a stereomicroscope and differentiated from the human helminths. The worm measured about 5 cm in length, had a reddish color and serpentiform movement (Fig. 1A). The general morphological analysis revealed we are dealing with an earthworm, a free-living organism belonging to the phylum Annelida, class Oligochaeta. The presence of segments containing hooks (chitinous spiniform setae) was visualized under a stereomicroscope and under a light microscope in a low magnification (Fig. 1B). The organism was then cleared in Amman's lactophenol and mounted in a non-permanent preparation between a slide and coverslip for more precise visualization of diagnostic traits under an optical microscope (Fig. 1C). A transverse cut of the organism mounted as described above revealed four pairs of these chitinous setae in each body segment (Figs 1D, 1E), a structural arrangement typical to most oligochaete groups but absent in helminths.

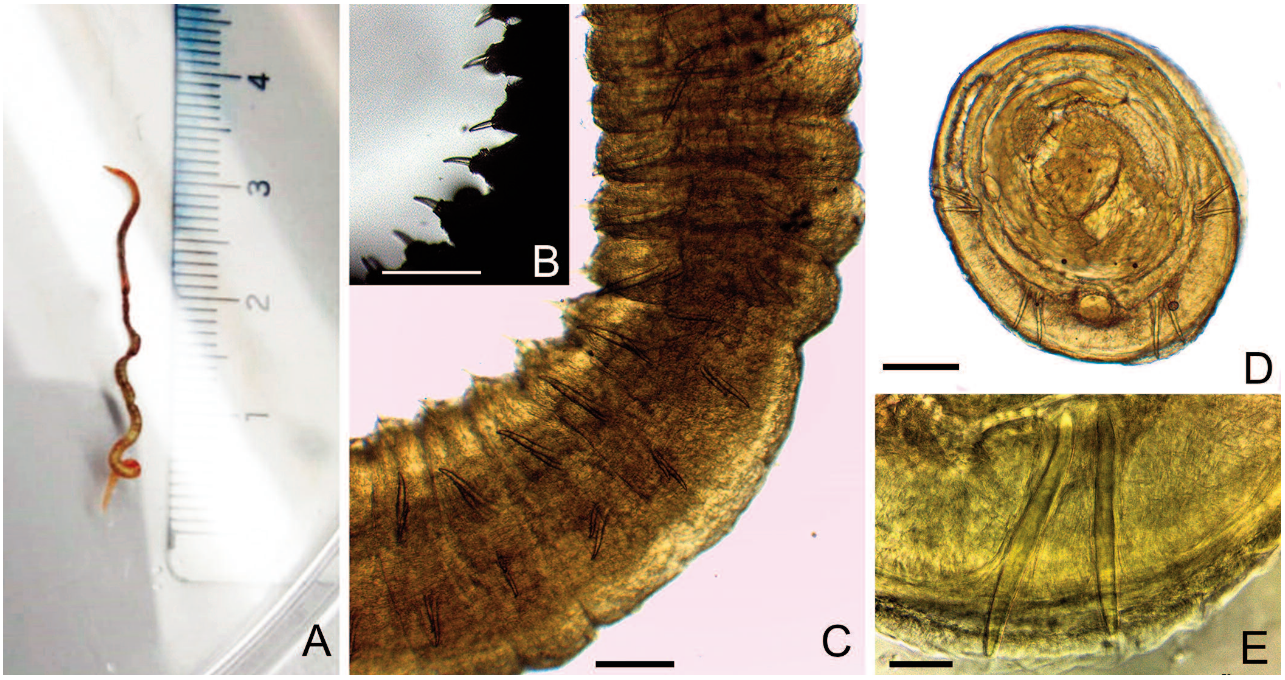

Figure 1. Worm-like organism found in the toilet bowl and sent for identification to a clinical laboratory from Brazil. At first, it was thought to be an expelled human parasite. (A) Whole view of the worm; (B) Microscopic view evidencing spines, a characteristic common in oligochaete annelids (earthworms); (C) Evidence of segmented body after clarification with Amman's lactophenol; (D) A transversal cut showing the presence of four pairs of spines (arrows); (E) Detail of a pair of spines. Scales bars: (A) a centimeter ruler is shown in the left; B–D: 250 µm; E: 50 µm

The general appearance revealed similarities with members of the family Ocnerodrilidae, which includes freshwater annelids [17]. For the specific identification of earthworms, a detailed and specialized study of the specimen is mandatory. However, this task is outside the scope of the clinical laboratory and from the present study.

Considering these initial results and the lack of detailed information on the clinical history, we first hypothesize the finding as a case of pseudoparasitism. The patient was contacted to obtain additional information about the episode. He was still very concerned about the situation, despite the absence of acute or chronic symptoms, including gastrointestinal manifestations. There was no history of changes on physical examination and routine laboratory tests. The patient confirmed that the worm-like organism was found in the toilet bowl and added that the water used in the farm was untreated and came from a cistern. Moreover, when explicitly asked, he did not report the finding of worms on his faeces or episodes of anal elimination of such structures. This hidden information obtained led us to reinterpret the case as a circumstantial finding, and the possibility of human pseudoparasitism by earthworm was ruled out.

Discussion

This report documents a case of a vermiform organism retrieved from a toilet bowl and initially mistaken by the patient for a parasite, as well as the subsequent steps to identify it correctly. The case demonstrated the practical challenges of distinguishing parasitic worms from free-living organisms, such as earthworms. In order to resolve doubts about whether or not the organism is a true parasite, adequate clinical and laboratory anamnesis is essential, as well as the careful analysis in the diagnostic laboratory, whose professionals, outside the academic environment, may not be adequately prepared to do it.

Interestingly, there are on the internet some reports of the finding of earthworms in bathrooms and toilet bowls in several parts of the globe, and the concern about the possibility of being a human helminth. This fact indicates that this type of circumstantial association is likely more common than supposed and it may be occurring in other clinical analysis laboratories worldwide. The annelid encounter in a rural environment, where the untreated water comes from a cistern, strongly points to external contamination suggesting that the patient did not expel the earthworm. Some reports of human parasitism by annelids are available in medical literature, including the accidental vaginal [18], nasal [19] and intestinal [20] finding of oligochaetes in humans. In the latter case, several reports were revised over time, but all considered circumstantial, given the internal passage through the human gastrointestinal tract has not been unequivocally demonstrated [20]. Also in this context, the semi-digested earthworm in a vomit of a child was reported [1].

The parasitological diagnoses of human helminthosis can be suitable to the interference of the finding of artifacts, including pseudoparasites, a phenomenon more widely discussed in relation to coproparasitological tests [1,6]. There are several reports of the finding of macroscopic objects indeed eliminated or thought to be associate with humans, including cases of pseudoparasitism with turbellarian (e.g., terrestrial planarians), nematomorphs (gordian worms), larval stages of different groups of insects and earthworms [11,21–24]. The last group belongs to the phylum Annelida, class Clitellata and subclass Oligochaeta. They are represented by speciose free-living organisms found in aquatic and terrestrial environments [25]. Nematoda and Annelida are phyla that contain invertebrates with elongated bodies. However, unlike nematodes, oligochaetes annelids are coelomates and segmented worms, present clitellum and usually four bundles of chaetae (several to more than a dozen chaetae) in the segments [24,26].

Among the different groups of human nematodes, the roundworms are without doubt the most prone to be confused with earthworms. In fact, the migration and spontaneous elimination of the human species *A. lumbricoides* through the mouth or anus under certain conditions considered unfavorable to parasites (e.g., fever, alcohol intake, inhalation of anesthetics and drugs, including anthelmintics) can contribute to this confusion [3,14,16,27–29]. Furthermore, many cases of ascariosis remain undiagnosed, and worms are many times spontaneously expelled with the feces after the comparatively short time of life of the parasite (about one year) [29]. Mature *A. lumbricoides* are usually larger (up to 30cm in length in adult females; males with 15–20 cm) than an earthworm. However, the elimination of juvenile specimens with smaller size and more like earthworms can occur [30].

Annelids as supposed parasites seem to be an underestimated event. The review by Mathison and Pritt [24], which focused on laboratory identification of ectoparasites, is, to the best of our knowledge, the only formal report that mentioned the fact of earthworms and other organisms not of public health concern be routinely submitted to laboratories for identification. Although the zoological knowledge for differentiation of these organisms can be considered trivial, this insight is not part of the training of health professionals involved in the parasitological diagnosis. The knowledge production has been substantiated by the division of contents and creation of disciplines with recognized benefits for education and science, a reflection point already addressed in biomedical epistemology. Although there is no better and feasible alternative in the short term, the traditional and consolidated knowledge division into disciplines presents problems, which are related to the excessive specialization [31–33] that can negatively affect health practice, research, and even teaching in the helminthology field. This fact can also be illustrated by lacking the subject discussed in this manuscript, including aspects of the differential diagnosis of helminths and earthworms, in basic parasitological books, which indicates that more integration between parasitology and other areas of knowledge, such as zoology, should be encouraged.

An unequivocal separation between annelids and parasitic nematodes can be easily performed after a microscopic study. However, the zoological knowledge required to differentiate these organisms, while basic, is usually out of training for health professionals. Thus, the analysis by non-specialists of easy-to-view structures (body segmentation and chitinous setae) herein revisited can be applied to quickly perform the differential diagnosis between free-living and parasitic vermiform specimens and thus avoid erroneous identification of parasites, as well as unnecessary procedures and treatment.

Considering that the difficulty in the separation between earthworms and human worms dates back to the first civilizations and it is still a possibility in the 21st century, we reinforce the need for effective integration of knowledge and the incentive to translational science so that the basic knowledge produced reaches society and even health professionals in a more effective way. We consider the clinic doctors and other professionals involved in the diagnosis of helminthosis need to have more proper training and an interdisciplinary view to analyze macroscopic material received for identification. Some processes as sample contamination, pseudoparasitism, and artifacts should not be neglected and need to be part of continuing education and technical improvement. We hope that the present case report and highlighted issues contribute to preventing iatrogenic risk by avoiding misidentifications of organisms as supposed parasites due to circumstantial reasons.

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