Case Report: Management of Dead Intraocular Helminth Parasites in Asymptomatic Patients

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Abstract. We report four asymptomatic patients from Nepal with an incidental finding of a dead intraocular helminth parasite on ophthalmological routine examination. Because the patients were asymptomatic and the intraocular helminth parasites dead without noted pathology present, it was decided to abstain from surgical removal and pursue a watch-and-wait strategy. The clinical follow-up of the four patients over two years was uneventful and showed no complications. We conclude that dead intraocular helminth parasites in asymptomatic patients without apparent pathology do not require surgical removal.

CASE REPORTS

Four asymptomatic patients diagnosed with dead intraocular helminth parasites on ophthalmological routine examination were referred to our tertiary care hospital in Kathmandu, Nepal, between February 2016 and March 2018. Table 1 summarizes the four patients' characteristics, and Figure 1 shows the photo documentation of the patients' intraocular helminth parasites.

In the absence of pathology requiring intervention (i.e., inflammatory or mechanical), it was decided to abstain from surgical resection of the helminth parasites and to pursue a watch-and-wait strategy with a close follow-up of the patients.

Because the helminth parasites in our four patients were not surgically removed, no definite species diagnosis can be provided. Nevertheless, the photo documentation was sent to the DPDx team at the Division of Parasitic Diseases and Malaria at the Centers for Disease Control and Prevention in Atlanta, GA and to the Swiss Diagnostic Reference Laboratory for Human Parasitic Diseases at the Swiss Tropical and Public Health Institute in Basel, Switzerland for review. Experts from both institutions concluded that according to the identifiable morphological features, the helminth parasites of cases 1, 2, and 3 are most likely plerocercoid larvae (spargana) of the genus *Spirometra* belonging to the class of Cestodes (tapeworms). The putative genus of the helminth parasite in case 4 was initially also determined as *Spirometra* but later revised to *Angiostrongylus cantonensis*, belonging to the class of nematodes (roundworms), following external peer review.

Because serological testing for tissue-invasive parasites is currently not available in Nepal and because the result would not have changed the clinical management of the patients, serological testing was omitted. The clinical follow-up of the four patients over 2 years was uneventful and showed no complications.

DISCUSSION

A broad range of anthroponotic and zoonotic helminth parasites are capable of coinfecting the human eye (Table 2). Although ocular affection is classically seen with some anthroponotic helminth parasites (e.g., subconjunctival migration of *Loa loa* macrofilariae or intraocular detection of microfilariae in onchocerciasis), invasion of the eye is not a mandatory part of any parasite's life cycle. Therefore, the finding of intraocular helminth parasites is a rare encounter and a result of parasites' aberrant tissue migration. Ocular pathology may be caused directly by tissue invasion and migration of parasite larvae or adults, or indirectly by toxic reactions and/or immune-mediated reactions.¹

Three treatment options for intraocular helminth parasites are available: surgery, laser photocoagulation, and treatment with antiparasitic drugs. Which treatment option to choose primarily depends on the size and location of the parasite, the locally available resources, and the experience of the treating physician. Live intraocular helminth parasites are, if their size and location permit, surgically removed to prevent further damage. If surgical removal is not possible, because of the parasite's size and location, laser photocoagulation can be used to kill the parasite and prevent further migration-related damage. This method has proven to be very effective in treating "diffuse unilateral subacute neuroretinitis," a clinical entity caused by subretinal migration of various nematode larvae (including, e.g., *Toxocara canis*, *Ancylostoma caninum*, *Strongyloides stercoralis*, *Ascaris lumbricoides*, and *Baylisascaris procyonis*).² If surgery and laser photocoagulation are not indicated, available, or possible, treatment with antiparasitic drugs presents an alternative. Adjunctive corticosteroid treatment is used in the presence of an inflammatory reaction or to avert treatment-induced inflammatory reactions triggered by antigen liberation due to dying parasites.¹

Although there is broad consensus on the indication to treat live intraocular helminth parasites by surgery, the indication for surgical removal of dead intraocular helminth parasites found on routine examinations in asymptomatic patients is less clear, especially if no concomitant pathology (inflammatory reaction, etc.) is present.

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TABLE 1
Characteristics of the four patients

Patient number	Age (years)	Gender	Location of the dead helminth parasite	Vision	Intraocular pressure	Suspected parasite class/genus
1	44	Male	Behind the iris on the pupillary border at 5 o'clock position	Unaffected	Normal	Cestode/ <i>Spirometra</i>
2	45	Female	Anterior chamber: adherent to the ciliary border of the iris at 7 o'clock position	Unaffected	Normal	Cestode/ <i>Spirometra</i>
3	59	Male	Anterior chamber: pupillary border of the iris at 3 o'clock position	Unaffected	Normal	Cestode/ <i>Spirometra</i>
4	47	Female	Anterior chamber: pupillary border of the iris at 4 o'clock position	Unaffected	Normal	Nematode/ <i>Angiostrongylus cantonensis</i>

Sparganosis. *Spirometra* species are globally distributed intestinal parasites of dogs, cats, and other mammals with a complex life cycle. Humans may get infected by 1) drinking water containing infected copepods (first intermediate host), 2) ingesting raw or undercooked flesh of a second intermediate host (e.g., frogs and snakes), or 3) applying flesh of a second intermediate host to wounds or mucous membranes. In the accidental human dead-end host, the larvae are capable of tissue invasive migration and may end up in any organ, including the eye. Spargana larvae may measure from millimeters up to 50 cm and remain viable up to several years (possibly decades).³ Mostly human infections present as subcutaneous nodules, and the diagnosis is only made after surgical resection.⁴ Drug treatment of sparganosis is

restricted to cases where surgical removal of larvae is impossible, for example, in cerebral sparganosis. In such cases, antiparasitic treatment with praziquantel has shown to be effective.⁵ Ocular sparganosis is a rare entity primarily reported from Southeast Asia in the past, when applying poultice made of frog or snake meat on open wounds or sore eyes was a common practice in traditional medicine.⁶ This practice, allowing direct tissue invasion by migratory spargana larvae, has fortunately become rare. However, spargana larvae may also migrate to and invade the eye in patients who are orally infected.⁷ The source of infection in our patients is unclear. The prevalence and natural hosts of *Spirometra* species is currently not well described in Nepal. Because our patients did not report suggestive food habits or high-risk traditional medicine practices, we suspect that they acquired their parasites via unfiltered water containing copepods harboring infective proceroid larvae. Reviewing the literature on ocular sparganosis, we found only case reports describing symptomatic infections with considerable pathology requiring surgical intervention.

Angiostrongyliasis. The rat lungworm (*A. cantonensis*) is a parasite whose main host is the rat in whose pulmonary arteries it lives. After hatching from their eggs in the rat's lung, larvae are passed in the feces and infect slugs or snails which serve the parasite as intermediate hosts. Humans get infected by ingesting 1) raw or undercooked snails or slugs, 2) paratenic hosts (crabs, frogs, and freshwater shrimps), or 3) vegetables contaminated with infective larvae. In the accidental human dead-end host, the parasite's larvae have a strong tropism for the central nervous system and are a worldwide leading cause of eosinophilic meningitis. Ocular invasion by an *Angiostrongylus* larva (2.6–12.6 mm in length) is reported in 1.1% of diagnosed angiostrongyliasis cases.⁸ Interestingly, we found no description of an ocular infection where more than one larva was found. Within the eye, the larva is primarily found in the vitreous cavity (39%), subretinal space (33%), and anterior chamber (22%).⁹ Live larvae in the subretinal space are treated by laser photocoagulation, whereas live intra-cameral and intra-vitreous larvae are treated by laser photocoagulation followed by surgical removal.⁹ Reviewing the literature on ocular angiostrongyliasis, we found only case reports describing symptomatic infection with considerable pathology requiring intervention. The only case report we identified describing the finding of a dead intraocular *Angiostrongylus* larva was a 20-month-old child who had just received antiparasitic treatment for *Angiostrongylus*-related eosinophilic meningitis

FIGURE 1. Photo documentation of the intraocular helminth parasites detected in the four patients. This figure appears in color at www.ajtmh.org.

TABLE 2
Parasites reported to cause ocular human infection

Helminth parasite taxonomic group	Disease (name of the parasite)	Parasite's characteristic (natural definitive host)	Tissue-invasive parasite stage	Source of human infection
Nematodes (roundworms)	Ancylostomiasis (<i>Ancylostoma caninum</i>)	Zoonosis (dogs)	Larvae	Larvae present in soil contaminated with dog feces penetrate the intact skin
	Angiostrongyliasis (<i>Angiostrongylus cantonensis</i>)	Zoonosis (rats)	Larva	Ingestion of raw or undercooked infected molluscs, snails, crabs, frogs, or freshwater shrimps, or vegetables containing infective larvae
	Ascariasis (<i>Ascaris lumbricoides</i>)	Anthroponosis	Larva	Ingestion of eggs via food contaminated with human feces
	Baylisascariasis	Zoonosis (raccoons)	Larva	Ingestion of eggs via soil contaminated with raccoon feces
	Dirofilariasis (<i>Dirofilaria</i> spp.)	Zoonosis (dogs and cats)	Adult worm	Bite of bloodsucking mosquitoes (<i>Culex</i> , <i>Aedes</i> , <i>Ochlerotatus</i> , and <i>Anopheles</i>)
	Lymphatic filariasis (<i>Wuchereria bancrofti</i> and <i>Brugia</i> spp.)	Anthroponosis	Adult worm	Bite of bloodsucking mosquitoes (<i>Culex</i> , <i>Anopheles</i> , <i>Mansonia</i> , and <i>Aedes</i>)
	Loiasis (<i>Loa loa</i>)	Anthroponosis	Adult worm	Bite of bloodsucking deerfly (<i>Chrysops</i> spp.)
	Onchocerciasis (<i>Onchocerca volvulus</i>)	Anthroponosis	Larva/adult worm	Bite of bloodsucking blackfly (<i>Simulium</i> spp.)
	Gnathostomiasis (<i>Gnathostoma</i> spp.)	Zoonosis (dogs, cats, a.o.)	Larva	Ingestion of raw or undercooked flesh of fish, snakes, snails, or frogs containing infective larvae
	Strongyloidiasis (<i>Strongyloides stercoralis</i>)	Anthroponosis	Larva	Larvae present in soil contaminated with human feces penetrate the intact skin
	Thelaziasis (<i>Thelazia callipaeda</i>)	Zoonosis (dogs and cats)	Larva/adult worm	Conjunctival deposition of infective larvae via various secretophagus flies
Trematodes (flukes)	Alarisis (<i>Alaria alata</i>)	Zoonosis (frogs)	Larva/adult worm	Ingestion of undercooked frog flesh containing mesocercariae (infective larvae)
	Fascioliasis (<i>Fasciola hepatica</i>)	Zoonosis (sheep)	Larva/adult worm	Ingestion of contaminated water or water plants containing metacercarial cysts (infective larvae)
	Paragonimiasis (<i>Paragonimus</i> spp.)	Zoonosis (crabs, grayfish, a.o.)	Larva/adult worm	Consumption of raw or undercooked crabs or crayfish containing metacercariae (infective larvae)
	Philophthalmosis (<i>Philophthalmus palpebrarum</i>)	Zoonosis (birds)	Larva/adult worm	Contact with water or vegetables contaminated with metacercariae (infective larvae)
	Schistosomiasis (<i>Schistosoma</i> spp.)	Anthroponosis	Larva/adult worm	Skin contact with fresh water contaminated with cercariae (infective larval stage)
Cestodes (tape worms)	Coenuriasis (<i>Taenia</i> spp.)	Zoonosis (dogs, a.o.)	Metacestode (cyst)	Ingestion of parasite eggs via fecally contaminated food or water
	Cysticercosis (<i>Taenia solium</i>)	Anthroponosis	Metacestode (cyst)	Ingestion of parasite eggs via fecally contaminated food or water
	Echinococcosis (<i>Echinococcus granulosus</i> and <i>E. multilocularis</i>)	Zoonosis (dogs and foxes)	Metacestode (cyst)	Ingestion of parasite eggs via fecally contaminated food or water
	Sparganosis (<i>Spirometra</i> spp.)	Zoonosis (various mammals)	Larva/adult worm	Drinking water containing copepods (first intermediate host) harboring coraciidae (infective larvae), ingesting raw or undercooked flesh of a second intermediate host (e.g., frogs and snakes) harboring infective larvae, or applying flesh of a second intermediate host to wounds or mucous membranes

a.o. = and others.

when additionally unilateral retinal pathologies and a dead larva in the vitreous cavity were discovered.¹⁰

Why in our four cases no local signs of concomitant or past inflammation was present remains unclear. Considering that tissue invasive parasites will only be recognized and diagnosed once they have reached a detectable size (macroscopically or by imaging methods) and/or cause clinical apparent pathology, we speculate that infections with still small and prematurely dying parasites are more likely to remain asymptomatic or oligosymptomatic and thus undiagnosed. This assumption is supported by the small size of the plerocercoid larvae in our three cases when compared with the reported size of proceroid larvae resected from the periocular soft tissue.^{11–13} In addition, once inside the eye, parasites find themselves in a relatively protected site from the host immune response.¹⁴

A major limitation of our study is that we can neither provide definitive proof of the diagnosis nor a species identification. A positive serological test could have supported the morphological diagnosis. However, serologies for tissue-invasive parasites are currently not available in Nepal, and in our experience, a negative serological test would not have refuted the diagnosis because following treatment or the natural death of a parasite seroreversion is more the rule than the exception.

Our report is the first case series examining the role of observation, without intervention, in asymptomatic patients with reported dead intraocular helminth larvae not causing obvious pathology. We conclude that in asymptomatic patients, dead intraocular helminth larvae not causing apparent pathology do not require surgical removal and patients may be followed up under a watch-and-wait strategy.

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