Endoscopically diagnosed hookworm infestation in an adult with chronic iron deficiency anaemia

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ABSTRACT

Despite advances in hookworm control and prevention campaigns, the prevalence remains high in sub-Saharan Africa. Iron deficiency anaemia is a major complication in those with prolonged infection, a high hookworm burden, and undernutrition, though most infected people are asymptomatic. While infected patients are commonly diagnosed by the presence of ova or cysts in the stool, gastrointestinal (GI) endoscopy is required for those with negative stool tests and chronic iron deficiency anaemia. A 48-year-old female with symptoms of anaemia for nearly two years presented to Mbarara Regional Referral Hospital with worsening palpitations, easy fatigability, and dizziness over a period of one month. She was given blood transfusions on two occasions. She lives near the lake where she also gets water for drinking and domestic use. We advise GI endoscopy for all patients with chronic iron deficiency anaemia of unexplained aetiology on standard non-invasive testing. Hookworm's mass empirical treatment policy in endemic areas should be further emphasised.

Keywords: hookworms, endoscopy, iron deficiency anaemia, Uganda

Introduction

Globally, approximately 740 million individuals are infected by hookworm[1] and about 34% of these are in sub-Saharan Africa.[2] In Uganda, the hookworm prevalence ranges between 40 and 51%.[3,4] Most are asymptomatic. However, iron deficiency anaemia (IDA) may occur with prolonged infection, poor nutrition, and heavy worm burden.[5] *Ancylostoma duodenale* and *Necator americanus* are the most frequent hookworm infestations in humans.[6] In our setting, hookworms are commonly diagnosed by the presence of their eggs in the stool. However, we

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present a case of a 48-year-old adult with clinical features of anaemia for over a year but had tested twice negative for hookworms by stool microscopy. She was subsequently diagnosed through an oesophagogastroduodenoscopy (OGD). We are not aware of a previous report of endoscopically diagnosed hookworm infestation in south-western Uganda.

Case Report

A 48-year-old Ugandan woman, a peasant farmer, was admitted to Mbarara Regional Referral Hospital complaining of worsening palpitations, easy fatigability, and dizziness over the previous month. She had been well until about eighteen months ago when she developed intermittent palpitations associated with exercise and later at rest. Four weeks before this admission, the palpitations became constant, with easy fatigability and dizziness. She did not report syncope, breathlessness, cough, chest pain, or lower limb swelling but had gradually lost weight unassociated with heat or cold intolerance. She had been admitted five times for this illness, was investigated (Table 1) and transfused with blood and/or given haematinic medications.

During two of the previous admissions, she reported being given proton pump inhibitors. Her social history included drinking water (only occasionally boiled), washing, and bathing from the nearby lake and swamps. Her diet was mainly posho, matooke (cooked banana), beans, groundnut paste, vegetables, and potatoes with chicken, fish, beef, or goat meat, at least once a week. She had no significant past medical history besides a Caesarean Section 18 years ago. She drank 1-3 x 350 millilitre bottles of local alcohol every 2-4 weeks and had smoked 1-4 pipes of local tobacco weekly for the last 35 years. She was menopausal with an uneventful gynaecological history.

Examination on this admission revealed severe pallor of the mucus membranes but no jaundice. She had no koilonychia, leukonychia, cyanosis, or finger clubbing. She had no Muehrcke's lines, blue lanule, palmer erythema, Dupuytren's contracture, or metabolic flap. Orally she had angular stomatitis and glossitis but no ulcers or thrush. Skin and lymphatic systems were unremarkable. A cardiovascular examination revealed systolic murmurs at the left sternal border and apical areas possibly anaemic murmurs. The rest of the systemic examination was normal. Investigations showed features of IDA (Table 2). A stool analysis revealed no ova or cysts, and negative for the *Helicobacter pylori* antigen. Her rapid tests for human immunodeficiency and hepatitis B viruses were negative.

Table 1. Investigations done during one of the previous admissions

Investigation	Finding	Lab reference range
CBC	**RBCs:** 3.81*106/uL	4-5.2*106/uL
	WBCs: 9* 103 /uL	4-11*103/uL
	Hb: 4.6 g/dl	11.5-14 g/dl
	MCV: 68 fl	80-100 fl
	MCHC: 26.67 g/dl	32-36 g/dl
	MCH: 25 pg	28-32 pg
	RDW: 18 %	11.5-14.5 %
	PLT: 260* 103/uL	150-450* 103/uL
Stool analysis	Negative for ova and cysts	
***H. pylori* stool antigen**	Negative	

Note: Lab: Laboratory, **CBC:** Complete Blood Count, **RBCs:** Red Blood Cells, **WBCs:** White Blood Cells, **Hb:** Haemoglobin, **MCV:** Mean Corpuscular Volume, **RDW:** Red Cell Distribution Width, **PLT:** Platelets, **H. pylori:** *Helicobacter Pylori*

Other tests conducted are shown in Table 2.

Due to the evidence of IDA and the negative stool test results for worms or *Helicobacter pylori* antigen, an OGD was organized after obtaining informed consent from the patient. Two thread-like moving organisms were seen in the pyloric antrum (Figure 1) and a huge number of those organisms of different shapes and sizes were seen in the duodenum (Figure 2, Panel A). Also, features of acute and chronic inflammation were noted on the mucosal background of the duodenum (Figure 2, Panel B).

Mucosal biopsies were taken from the duodenum where the organisms were dense. After a thorough examination by both compound (Figure 3, Panel A) and dissecting (Figure 3, Panel B) light microscopes, an adult hookworm worm with characteristic features of *Ancylostoma duodenale* was observed.

Furthermore, a tissue sample examined confirmed *Ancylostoma duodenale* (Figure 4) with chronic mixed eosinophilic inflammation. Accordingly, the patient was transfused with three units of packed red blood cells and given haematinic and albendazole tablets. She was then discharged after demonstrating great improvement. On her review a month later, all the clinical signs of anaemia and the cellular parameters including haemoglobin of her complete blood count were within normal limits.

Table 2. Investigation done during this admission

Investigation	Finding	Lab reference range
CBC	**RBCs:** 2.41*106/uL	3.81*106/uL
	WBCs: 3.5*103 /uL	3.50-9.50* 103/uL
	Hb: 2.8 g/dl	11-15.8 g/dl
	MCV: 60 fl	80-100 fl
	MCH: 18 pg	27-34 pg
	RDW-SD: 60.2	(37-54)
	PLT: 212*103 /uL	150- 438* 103 /uL
Peripheral Blood Film	**RBC:** Anisocytosis with marked microcytic hypochromic anaemia, no inclusions	
	WBC: Mature cells, no toxic granulation.	
	PLT: Adequate with normal morphology and normal distribution with maturity	
	Conclusion: Features suggestive of iron deficiency anaemia	
Iron studies	**Serum iron level:** 7.0 umol/l	9-30.4 umol/l
	Serum transferrin: 50 umol/l	26-47 umol/l
	Transferrin saturation: 9.6%	20-55.0%
	Serum ferritin: 26.96 pmol/l	33.70-359.5 pmol/l
RFTs	**Creatinine:** 70.74 umol/l	53.05- 106.1 umol/l
	Urea: 4162.5 umol/l	1165.5- 4995 umol/l
	K+: 4.0 mmol/l	3.5-5.5 mmol/l
	Na+: 136 mmol/l	135-145 mmol/l
	Cl- : 98 mmol/l	95-105 mmol/l
Stool analysis	No ova or cyst was seen (was done twice before and after endoscopy)	
Abdominal ultrasound scan	Normal findings	
OGD	**Comments:** Multiple squirming red worms swimming in the duodenum and a few in the pylorus. A worm sample biopsy was taken for microscopic and histology. See figs. 1 and 2.	

Note: OGD: Oesophagogastroduodenoscopy, **RFTs:** Renal Function Tests

Discussion

Hookworms are among the commonest intestinal worms in humans, and infections are often caused by the nematode parasites *Ancylostoma duodenale* and *Necator americanus.*[6] The greatest number of hookworm cases occurs in Asia, then sub-Saharan Africa.[7] In Uganda, the prevalence is about 45% and 40% in Entebbe and Kisoro districts, respectively.[3,4] According to the Centers for Disease Control and Prevention (CDC), hookworm infections are common in places where defecation on soil is a practice including areas that use human stools as fertilisers.

As in our case, individuals with unhygienic habits, who have direct contact with infected water or soil are also at high risk of infection.[1] A high burden of infection was

found in people who walk barefoot outside their homes, the elderly, and those previously treated for worms. Also, illiterate households and those with a primary school education are at a high risk of hookworm infection.[8]

As with both *Ancylostoma duodenale* and *Necator americanus*, humans become infected when third-stage infective larvae in soil penetrate the skin. However, *Ancylostoma duodenale* can also cause infection after ingestion of contaminated food or water.[9] The third-stage larvae only grow into adult hookworms in the small intestine and depend on the host blood.[10]

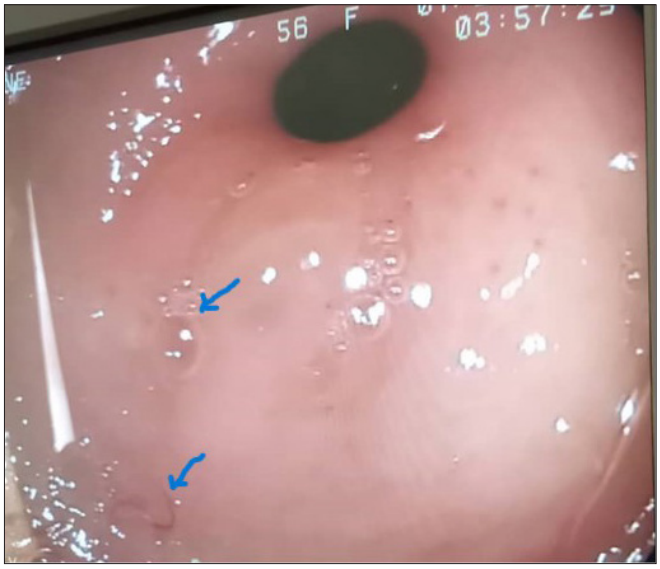

Figure 1. The pyloric antrum of the stomach with two hookworms as indicated by the arrows (Credit: Dr. Boniface Amanee Elias Lumori)

While individuals with a light worm burden are usually asymptomatic, individuals with a heavy worm burden often present with recurrent fatigue, epigastric pain, nausea, and exertional breathlessness as well as palpitations, headaches, and fatigue.[6] In addition, some individuals may develop Wakana Syndrome with heavy *Ancylostoma duodenale* ingestion.[11]

Hookworms attached firmly to the mucosa and submucosa of the intestine cause blood loss. They suck blood by creating negative pressure by contraction of its muscular oesophagus. Additionally, hookworms secrete hydrolytic enzymes that break the arterioles and capillaries in the intestinal mucosa and release anticoagulant factors.[6]

An inverse relationship between the hookworm egg burden in the intestine and the haemoglobin and serum ferritin has been drawn.[1] It has been estimated that each adult hookworm imbibes 0.01–0.04 mL and 0.05-0.3 mL per day for *Ancylostoma duodenale* and *Necator americanus*, respectively.[10] Our patient presented with many features associated with severe anaemia suggesting the presence of a heavy worm burden. While our case had flow murmurs on the cardiovascular examination, signs of heart failure were absent. In 1959, amongst hospitalised patients in Uganda, K. Somers described cases of reversible acute heart failure due to severe anaemia caused by heavy hookworm infestations.[12]

Hookworm infection is commonly diagnosed by the detection of eggs in faeces. There are several case reports of

Figure 2. Panel A. The duodenal mucosa with several hookworms as indicated by the arrows (Credit: Dr. Boniface Amanee Elias Lumori)

Figure 2. Panel B. The duodenal mucosa with mixed acute and chronic erythematous lesions (Credit: Dr. Boniface Amanee Elias Lumori)

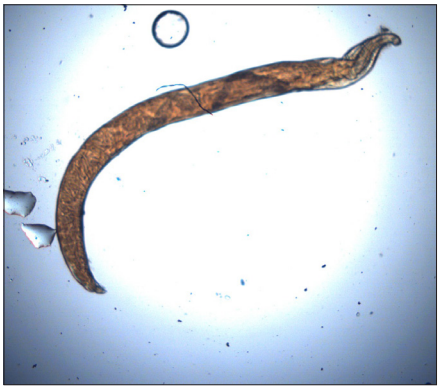

Figure 3. Panel A. A section of an adult hookworm on the compound microscope (Credit: Robert Wagubi)

Figure 3. Panel B. A section of an adult hookworm on the dissecting microscope (Credit: Robert Wagubi)

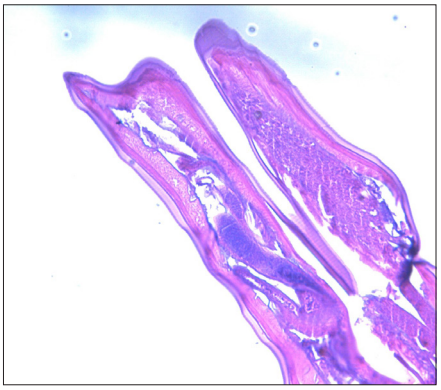

Figure 4. A histopathological analysis showing Ancylostoma duodenale (Credit: Dr. Raymond Atwine)

findings on upper GI endoscopy and capsule endoscopy,[5,13,14] but these are limited to areas where such facilities are available. A definitive diagnosis is usually made by repeated examination of the patient's faeces to find the eggs. However, in our case, we could not find ova or cysts in faecal examination twice, and the IDA did not improve despite prior treatment of a proton pump inhibitor and haematinic. Hence, it is recommended to assess the distal duodenum thoroughly during a routine OGD, especially in developing countries where the burden of hookworms is high.[15] Moreover, ruling out causes of bleeding of lower GI origin such as colorectal cancer, polyps, haemorrhoid, and diverticular disease by a colonoscopy is necessary in such cases.

Conclusion

We present a patient whom we diagnosed endoscopically with gastrointestinal hookworm infestation after nearly two years of symptoms of anaemia and absence of hookworm ova or cysts in the stool. We advise both upper and lower GI endoscopy for patients in hookworm endemic areas with chronic iron deficiency anaemia of unexplained aetiology on standard non-invasive testing. Hookworm's mass empirical treatment policy in endemic areas should be emphasised.

Conflicts of Interest: None

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