

# Endoscopic diagnosis of Uncinariasis, presentation of a case with severe iron deficiency anemia

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## Abstract

We present the clinical case of a young man from a rural area who required transfusion of blood products due to severe iron deficiency anemia although there was no obvious bleeding. Multiple tests ruled out hemolytic, autoimmune causes and chronic disease as the cause of his anemia. Endoscopy found massive ancylostomiasis, a potentially curable cause of anemia in our environment. In this article we describe the clinical case, discuss differential diagnoses of iron deficiency anemia, and review the literature.

## Keywords

Anemia, ancylostomiasis, parasitic diseases, endoscopy, differential diagnosis.

## INTRODUCTION

Hookworm infections (also known as ancylostomiasis or hookworm infections) are caused by *Necator americanus* or *Ancylostoma duodenale* nematodes. They are transmitted by direct contact with soils containing these parasites. In humans, they primarily manifest in the digestive tract, and their most frequently found symptoms are chronic blood losses, secondary iron deficiency anemia and protein-losing enteropathy with secondary hypoalbuminemia.

Although hookworm infections are common in Colombia, they are usually underdiagnosed or underestimated in cases of severe anemia. (1, 2) Hookworm infections are endemic especially where physical and sociocultural environment favors fecal-oral contamination. Preschool and school children are most susceptible to infection, but the disease also occurs in adults. (2, 3) Several studies published in Latin America and Africa have confirmed the causal relationships of hookworm infections with poverty, poor environmental sanitation, and residence in rural areas. (4-6) Diagnosis is usually made by identifying the parasite or its eggs in fecal matter.

## CLINICAL CASE

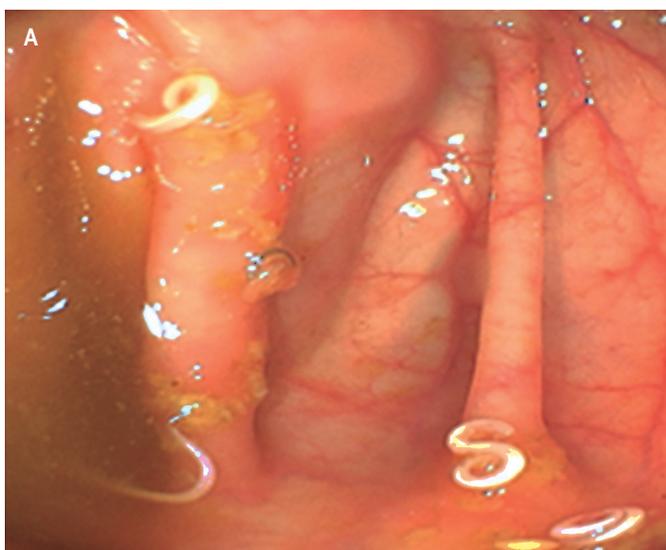
A 20-year-old farmer from a reservation of indigenous people in Cauca was evaluated at the municipal health center in February 2017. He had been suffering unquantified intermittent fevers, feelings of weakness, fatigue and diaphoresis. On physical examination, his overall physical condition was found to be poor. He had marked cutaneous and mucosal paleness and a fever of 38.5° C. Blood tests showed severe anemia with a hemoglobin (Hb) count of 3.6 g/dL. A thick smear was positive for malaria (*P. falciparum* with 1520 asexual forms). Treatment was initiated with 4 tablets of Coartem® (20 mg of artemether and 120 mg of lumefantrine) every 12 hours for 6 doses in total. He was referred to our medical center, where additional blood tests of ferrokinetics, hemolysis and other infections were performed (Table 1). In addition, the thick smear was repeated and found a significant decrease of parasitemia. He was treated for anemia with 3 units of packed red blood cells and antimalarial treatment continued. His fever disappeared and his Hb count increased to 7.8 g/dL, so he was discharged.

The was readmitted on October 5, 2017 due to marked asthenia, adynamia, fatigue, itching and pulsatile headache. He said he had not suffered any manifest gastrointestinal bleeding or jaundice. At admission, he required a blood transfusion due to severe anemia (hemoglobin: 4.9 g/dL). Upper digestive endoscopy found evidence of inflammatory changes and erosion in the duodenum where moving parasites were identified (Figure 1A). Colonoscopy identified at

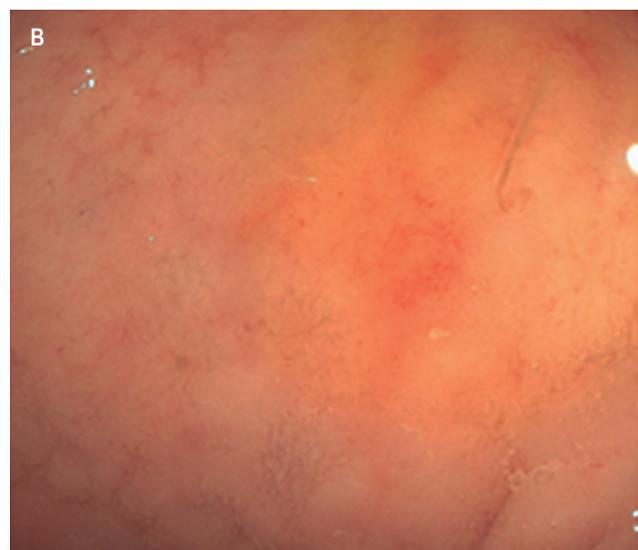
least 15 elongated whitish worms that were moving within the right colon and cecum (Figure 1B). Daily oral doses of iron salts for 6 months plus treatment with 10 mg/kg of pyrantel pamoate for 3 days every 6 months for 3 years was recommended for the patient and his close relatives. In addition, he was offered health education on basic hygiene. In telephone follow-up calls at 6 and 9 months, he reported complete improvement of his symptoms.

**Table 1.** Hospital blood test results

First hospital stay	
Blood chemistry	ALT 14, AST 21 Total bilirubin: 0.93, Direct bilirubin: 0.39, Alkaline phosphatase: 69, C-reactive protein: 0.93, Creatinine: 0.83, Blood urine nitrogen: 9.5, Na: 137, Cl: 104.5, Ca: 8.2, K: 4.21
Infectious diseases	Hemoparasites: 16 gametocytes of plasmodium falciparum per mm <sup>3</sup> HIV: Non-reactive
CBC Anemia study	Hb 3.7; Hematocrit 12.9; Mean corpuscular volume 68; Mean corpuscular hemoglobin 19.5, Red blood cell distribution width 20, leukocytes: 6,200, neutrophils: 3,700, eosinophils, 1,300, lymphocytes: 1400, platelets 222,000, Iron: 24, Transferrin: 330, Total iron binding capacity: 412, transferrin saturation: 6%, ferritin: 13 pmol/L
Second hospital stay	
Blood chemistry	ALT: 19, AST: 32, Creatinine: 0.81, Blood urine nitrogen: 8.5, Na: 139, Cl: 104.9, K: 4.86, Ca: 9.4, INR: 1.11, PT: 11.9 (10.79), PTT: 29.9 (30.6)
Infectious diseases	Hemoparasites: Negative HIV: Non-reactive
CBC Anemia study	Hb: 4.9, Hematocrit: 17.8, Mean corpuscular volume: 57, Mean corpuscular hemoglobin: 15.7, leukocytes: 6,200, Neutrophils: 2,542, Lymphocytes: 1,860, Eosinophils: 1,364 L 1,860, Platelets: 362,000, Reticulocytes: 31,000 (index 0.4 percentage 1.0), LDH: 212, Iron: 20, Ferritin 3.6 pmol/L



Multiple hookworms in right colon



Hookworm in duodenum with evidence of local erosion

**Figure 1.** Diagnostic images. Endoscopic evidence of hookworms in the duodenum and colon

## DISCUSSION

Iron deficiency anemia, the world's most common nutritional disorder, is a global public health problem. It affects more than 2 billion people with approximate prevalences of 40% in preschool children, 30% in women of childbearing age and up to 38% in pregnant women. (7) It is responsible for almost half of all cases of anemia in low and middle income countries. (8) In developing countries it usually results from poor nutrition or gastrointestinal blood loss due to intestinal parasites. (7)

The symptoms of anemia vary greatly and are nonspecific. Classic symptoms include fatigue, dyspnea related to exercise, itching, headache and impaired concentration (which can manifest as the result of iron deficiency without associated anemia). Some obvious signs are cutaneous and mucosa paleness, tachycardia and orthostatic hypotension. Other less frequent, and perhaps more subtle, symptoms include glossitis, angular stomatitis and koilonychia. (9)

There is a broad spectrum of possible causes of iron deficiency anemia (Table 2), not least of which is gastrointestinal bleeding (manifest or occult). (10) Parasitosis should be considered in the initial diagnosis of patients with iron deficiency anemia due to digestive losses. Late diagnosis can generate use of unnecessary diagnostic aids and expose patients to risks of possible complications such as neurodevelopmental delay, heart failure, miscarriages, and morbidity in pregnant women. (2, 7)

The most serious cases of anemia produced by parasites are observed in hookworm infections, malaria, trichuriasis and diphyllobothriasis. Parasitosis can cause anemia secondary to chronic malnutrition through various pathophysiological mechanisms. These include malabsorption and anorexia

resulting from inadequate diet; hemolytic anemia, as in cases of malaria and babesiosis; and gastrointestinal bleeding due to lesions in the gastrointestinal mucosa such as those that occur in infections by protozoans such as *Entamoeba histolytica*, *Balantidium coli* or infections by helminths such as *Ancylostoma duodenale*, *Necator americanus*, *Strongyloides stercoralis* and *Trichuris trichiura*. (10)

The etiology of anemia in this case was initially attributed to more than one factor since the initial diagnosis was *P. falciparum* malaria. However, hemolysis markers were not documented nor did the patient's hemoglobin levels improve noticeably successful completion of treatment with artemether/lumefantrine (Coartem®). In addition, eosinophilia is rare in cases of malaria.

Hookworm infection is a parasitic disease caused by *Necator americanus* or *Ancylostoma duodenale*, two species of blood-borne nematodes of the Ancylostomatidae family. These infections cause digestive disorders and hypochromic microcytic anemia which is more intense in massive infections. Infection in humans is caused by penetration of the skin by filariform larvae which are found in contaminated soils. In early stages of maturation, they are called rhabditiform larvae. In the migration phase, the larvae reach the lungs and penetrate the alveolar sacs. The intestinal phase begins with swallowing which results in erosions or ulceration of the gastrointestinal mucosa. The correlation between clinical severity and the intensity of parasitism varies according to nutritional status and any preexisting anemia in these patients. (2)

Clinically, hookworm infections are considered to be mild when the fecal egg count is below 2,000 eggs per gram. Moderate infections have 2,000 to 4000 eggs per gram, and severe infections have counts greater than 4,000 eggs per

**Table 2.** Causes of iron deficiency anemia

Cause	Condition	Mechanism
Increased requirements	Children and adolescents Pregnancy	Rapid growth Increase red cell mass
Inadequate diet	Poor nutrition, vegetarians	Dietary iron deficiency
Diminished absorption	Gastrectomy, duodenal bypass, bariatric surgery, celiac disease, inflammatory bowel disease, atrophic gastritis, <i>Helicobacter pylori</i> infection, proton pump inhibitor, Chronic renal insufficiency	Decreased absorption surface and/or increased gastric pH and/or hepcidin
Chronic bleeding	Gastrointestinal lesions, steroids, NSAIDs, uterine bleeding, intravascular hemolysis, coagulation defects	Increased blood loss due to conditions that perpetuate bleeding
Mechanisms associated with inflammation	Chronic renal insufficiency inflammatory bowel disease, obesity and heart failure	Increased hepcidin
Acute blood losses	Major surgery	Postoperative anemia

Adapted from C. Camaschella Blood. 2017; 31 (4): 225-33.

gram. (2) For *Necator americanus*, the approximate number of adult worms is obtained by dividing the number of eggs per gram of fecal matter by 80. Cases of severe infestation are estimated to have 50 adult parasites in the intestine. It has been shown that *Necator americanus* generates a daily blood loss of at least 0.04 mL per parasite while for *Ancylostoma duodenale* daily blood loss is estimated to be 0.20 mL per parasite. Transient bleeding results when a worm detaches itself from the mucosa to move to another site. After a few months of infection, the result is microcytic and hypochromic iron deficiency anemia. (2) Other manifestations include pruritic dermatitis and nonspecific neurological and pulmonary symptoms such as pulsatile headache and drowsiness. In cases of early childhood infections, retardation of growth and neurodevelopment may occur. (2)

A diagnosis is confirmed when worm eggs are found in feces or when adult parasites are seen. Useful methods include direct examination, the Willis-Faust concentration method, and the quantitative techniques of Stoll and Kato-Katz which indicate the number of eggs per gram of feces. (10) Fecal culture by the Harada-Mori method allows differentiation between *Ancylostoma duodenale* and *Necator americanus* species according to the morphologies of their filariform larvae. (10)

In the case presented, the diagnosis was made from the sum of clinical, laboratory and endoscopic data. Although the endoscopic studies in this case played an important role in the diagnosis, we believe that expensive and invasive examinations can be avoided with a more rational approach.

Treatment consists of administration of anthelmintics, especially benzimidazole and pyrantel pamoate, plus treatment of anemia. In Colombia, the most commonly recommended and most frequently used anthelmintics are mebendazole, albendazole and pyrantel pamoate. Their cure rates vary (Table 3). (1, 2) The authors' preference is pyrantel pamoate because it inhibits the cholinesterase enzyme and causes depolarization of the muscle plaque. This causes spastic paralysis of the nematodes which has a beneficial effect on massive parasitosis by minimizing the risk of larval migrations. (2). These schemes are inexpensive and have few adverse effects, so they can be administered whenever there is suspicion of a hookworm infection even in patients without a confirmed diagnosis who live in areas of high prevalence.

### Conflicts of Interest

None.

### Funding Source

This study did not receive any funding from any entity.

**Table 3.** Medications used to treat hookworm infections in Colombia

Medication	Dose	Cure rate
Mebendazole	100 mg 2 times a day for 3 days. 500 mg single dose	Healing rate: 22% Reduction of eggs: 82% (in control campaigns)
Albendazole	400 mg/day for 3 days. 500 mg single dose in control campaigns	56% cure rate and 98% egg reduction rate (in control campaigns)
Pyrantel Pamoate	10 mg/kg/day for 3 days	80% cure rate 95% egg reduction rate

Adapted from D. Botero et al. Parasitosis humanas. Corporación para Investigaciones Biológicas. 2012. p. 145-60

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