

# Caught on Capsule: Iron-deficiency Anemia Due to Hookworm Infection



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## PRESENTATION

A tiny ingestible camera identified an otherwise elusive source of anemia in a 63-year-old man. The patient presented to an outside hospital with a 2-week history of generalized weakness, malaise, nausea, and loss of appetite. He denied rectal bleeding. His past medical history was significant for a Billroth II gastric bypass and prior gastric angioectasias. Initial laboratory studies showed that his hemoglobin level, at 7.3 g/dL, was lower than it had been 1 week earlier, when it was 9.9 g/dL, and that, in turn, was reduced from a baseline measurement of 13-15 g/dL, which had been obtained several months prior. Results were also remarkable for leukocytosis at  $21.4 \times 10^3$  cells/mm<sup>3</sup>.

A rectal examination revealed brown stool that proved positive for blood with a Hemoccult test. Push enteroscopy, with intubation of afferent and efferent limbs of the patient's Billroth reconstruction, showed mild erythema in the gastric remnant but no angioectasias, ulcers, or evidence of bleeding. Colonoscopy subsequently disclosed internal grade I hemorrhoids and melena throughout the colon and distal small bowel. No source of bleeding was evident. Five units of packed red blood cells did not produce an appreciable increase in his hemoglobin. He was then transferred to our hospital for further workup for a presumed source of bleeding in the small bowel.

Upon the patient's presentation, his wife reported that he had been having dark-colored stools for the past 3-4 years. He had undergone upper endoscopy 1 year earlier and been diagnosed with an angioectasia. This was treated with argon plasma coagulation.

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## ASSESSMENT

On physical examination, the patient's vital signs were stable with a blood pressure of 125/83 mmHg and a pulse of 81 beats/minute. His conjunctivas were pale, and his abdomen was soft, obese, nondistended, and nontender to palpation. Bowel sounds were normoactive. Several external hemorrhoids were evident, and the vault was without stool. Pertinent laboratory results were as follows: hemoglobin, 6.8 g/dL; white blood cell count,  $9.6 \times 10^3$  cells/mm<sup>3</sup>; platelets, 268,000 cells/mm<sup>3</sup>; international normalized ratio, 1.26; partial thromboplastin time, 29.4 seconds; ferritin, 12.3 ng/mL; and iron saturation, 6.5%. Other results, including an eosinophil count, were unremarkable.

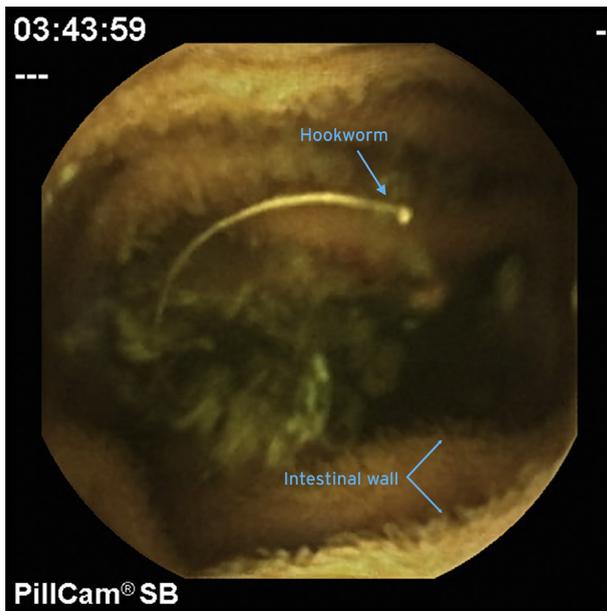
## DIAGNOSIS

The patient underwent a computed tomography angiogram of the abdomen, which showed no definite evidence of a gastrointestinal bleed or retroperitoneal hematoma. Repeat upper endoscopy revealed mild nonerosive gastritis that was not thought to be the source of bleeding. A capsule endoscopy demonstrated multiple worm-like objects in the mid-jejunum, all with a similar curvature and large "heads" (Figures 1 and 2). The images were concerning for a hookworm infection. Upon further questioning, the patient reported that he frequently walked outside on his farm without shoes.

## MANAGEMENT

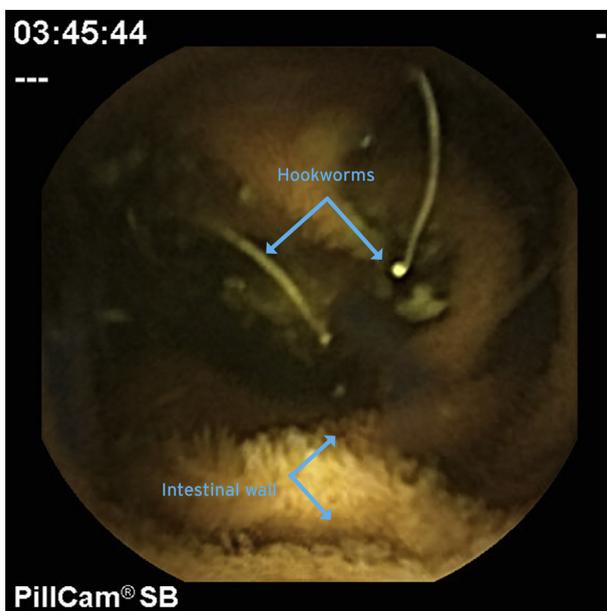
The patient was given a single dose of albendazole and was discharged home the following day. His hemoglobin at discharge was 9.2 g/dL. Three months later, he was admitted with pneumonia. His hemoglobin level was 14.3 g/dL on admission, and it dropped to 12.1 g/dL during his hospital stay. He was no longer having the previously reported dark-colored stools.

While hookworm infections are not among the common causes of upper gastrointestinal bleeding, they can induce blood loss during attachment to the intestinal mucosa by



**Figure 1** Capsule endoscopy identified hookworms in the patient's midjejunum.

tearing into mucosal capillaries and ingesting the blood. This process is facilitated by the production of anticoagulant peptides that inhibit activated factor X, factor VIIA, and platelet activation.<sup>1,2</sup> Each worm consumes between 0.3 and 0.5 mL of blood each day, which can lead to anemia and contribute to impaired nutrition, especially in patients with heavy infection.<sup>3,4</sup> Other gastrointestinal symptoms due to hookworm infection tend to be nonspecific and may be



**Figure 2** Another image obtained with capsule endoscopy demonstrated the presence of hookworms.

difficult to differentiate from other sources of abdominal pain and flatulence.

Hookworm infection, caused by parasites belonging to the species *Necator americanus* and *Ancylostoma duodenale*, is most commonly transmitted through contact with contaminated soil, although oral ingestion of larvae is also possible. It occurs predominantly in impoverished areas and was believed to be a factor in delayed economic development in the southern United States.<sup>3</sup> Diagnosis is traditionally established by stool examination, though this method is insensitive, and serial examinations may be needed to make the diagnosis.<sup>5</sup>

In addition to evidence from a stool examination, unexplained eosinophilia may be a major clue to the presence of a parasitic infection. Usually, eosinophilia occurring with hookworm is mild and varies over the course of the disease. In 1 study, infected volunteers had blood eosinophilia that increased after 2-3 weeks and peaked at 5-9 weeks.<sup>6</sup>

Several case reports detail diagnosis of intestinal hookworm infection by capsule endoscopy.<sup>7-11</sup> In one of these, the patient's stool was positive for eggs. Three of the cases did not mention stool testing at all. However, in 1 case where endoscopy demonstrated the presence of hookworms, the patient's stool samples were negative for eggs and larvae. This supports the opinion that examination of the stool is insensitive. As such, capsule endoscopy may offer a better means of diagnosis for intestinal hookworm infections. We would suggest that hookworm infection be actively considered in the differential diagnosis of a patient with obscure gastrointestinal bleeding who is undergoing capsule endoscopy.

## ACKNOWLEDGMENTS

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### SUPPLEMENTARY DATA

Supplementary video accompanying this article can be found in the online version at <http://dx.doi.org/10.1016/j.amjmed.2015.08.004>.