

## Stool examination for hookworm ova in severe hookworm infection diagnosed by doing endoscopy in our study compared with other studies

Govindarajalu Ganesan

Associate professor, Dept. of General surgery, Indira Gandhi Medical College and Research Institute, Puducherry, Tamil Nadu, India

### Abstract

**Objective:** Stool examination for hookworm ova in patients with severe hookworm infection diagnosed by doing endoscopy in our study was compared with other studies.

**Methods:** A study of 1100 patients who had undergone upper gastro-intestinal endoscopy for a period of four and half years from May 2009 to October 2013 was carried out. In all the patients found to have hookworms in duodenum, investigations were done to know about the presence of anaemia. In patients with severe anaemia [haemoglobin <7g/dl or g%] due to severe hookworm infection, stool examination was done to look for the presence or absence of hookworm ova. The results were found as given below.

**Results:** Out of these 1100 patients, 14 patients found to have hookworms in duodenum were taken into consideration for our study. Out of these 14 patients, 2 patients were found to have severe anaemia [haemoglobin <7g/dl or g%] due to severe hookworm infection. But in both these patients, stool examination was negative for hookworm ova despite a heavy burden of hookworm infection with severe anaemia.

**Conclusion:** Thus even a heavy burden of hookworm infection with severe anaemia can present with negative stool examination for hookworm ova. Hence upper gastro intestinal endoscopy should be done to confirm the presence of hookworms in all patients with severe anaemia even when stool examination is negative for hookworm ova.

**Keywords:** severe anaemia, severe hookworm infection, stool examination for hookworm ova, upper gastro intestinal endoscopy

### Introduction

Severe anaemia is reported to occur in severe hookworm infection in many studies [1 to 17]. Stool examination for hookworm ova in patients with severe anaemia due to severe hookworm infection diagnosed by doing endoscopy in our study was compared with other studies.

### Materials and Methods

This study was conducted in the department of general surgery, Aarupadai Veedu Medical College and Hospital, Puducherry. A study of 1100 patients who had undergone upper gastro-intestinal endoscopy for a period of four and half years from May 2009 to October 2013 was carried out. In each of these 1100 patients, the first and second part of duodenum were carefully examined to find out the presence of single or multiple hookworms. In all the patients found to have hookworms in duodenum, investigations were done to know about the presence of anaemia. In patients with severe anaemia [haemoglobin <7g/dl or g%] stool examination was done to look for the presence or absence of hookworm ova. Anaemia is defined as haemoglobin <12g/dl or 12g% in women and haemoglobin or <13g/dl or 13g% in men. Mild anaemia is taken as haemoglobin 10to12g/dl or g%, moderate anaemia is taken as haemoglobin 7to10g/dl or g% and severe anaemia is taken as haemoglobin <7g/dl or g%. The results were found as given below.

### Results

Out of these 1100 patients, 14 patients found to have hookworms in duodenum while doing upper gastro intestinal

endoscopy were taken into consideration for our study. Out of these 14 patients, 9 patients had anaemia and 2 of these 9 patients were found to have severe anaemia [haemoglobin <7g/dl or g%]. Severe anaemia indicates significant loss of blood which will occur only due to heavy burden of hookworms in severe hookworm infection.

### Severe anaemia with negative stool examination for hookworm ova in patients with severe hookworm infection diagnosed by doing endoscopy in our study.

In both the patients with severe anaemia due to severe hookworm infection diagnosed by doing endoscopy in our study [haemoglobin 2.1 g%, 3.2g%], stool examination was negative for hookworm ova.

1. Multiple hookworms in duodenum in a patient with severe anaemia [haemoglobin 2.1 g %] due to severe hookworm infection diagnosed by doing endoscopy but with negative stool examination for hookworm ova is shown in fig 1, 2.
2. Multiple hookworms in duodenum in the patient with severe anaemia [haemoglobin 3.2 g %] due to severe hookworm infection diagnosed by doing endoscopy but with negative stool examination for hookworm ova is shown in fig 3.

### Discussion

There are two human- specific hookworms, namely *Ancylostoma duodenale* and *Necator americanus* [2]. The most common laboratory finding in hookworm infection is iron deficiency anemia [14]. The degree of anemia depends on hookworm burden and the species, because *Ancylostoma*

duodenale causes more blood loss than *Necator americanus* [14].

Each worm sucks between 0.1 and 0.4 mL of blood/day [17]. It can be responsible for a blood loss of up to 250 mL/day in heavy infection [17]. The severity of blood loss in hookworm disease depends on the acuteness and magnitude of infestation [17].

Hookworm is one of the most common parasites in the world, but can be missed on stool examination (12). It is important to check carefully in the duodenum at routine upper gastrointestinal endoscopy whenever parasitic disease is suspected but is hard to diagnose because of a limited number of eggs in feces (12).

Hookworm is one of the most common parasites around the world, especially in warm and moist places (13). Hookworms are estimated to infect more than 740 million people around the world. The prevalence of infection is as high as 80% in tropical areas within developing countries, and only 20% in drier climates (13). Hookworm usually lives in the upper part of small bowel (13). Iron deficiency anemia secondary to loss of iron into the gut is the most significant risk of hookworm infection. Although hookworm infection is rarely fatal, severe complications could happen due to iron deficiency anemia (13). Definite diagnosis is made by seeing hookworm eggs during stool examination, however sometimes its diagnosis can be missed. Hookworm infestation sometimes is not easy to be detected in stools (13).

#### **Stool examination for hookworm ova in severe hookworm infection in our study compared with other studies**

a. In both our patients in our study, stool examination was negative for hookworm ova despite a very heavy burden of hookworm infection with severe anaemia.

b. In many other studies also, stool examination was negative for hookworm ova despite a very heavy burden of hookworm infection with severe anaemia [2, 3, 9, 17].

1. In the study conducted by Wu KL *et al.* (2) in Taiwan, a 78-year-old man complained of intermittent black color stool passage for 4 months. Laboratory data showed iron-deficiency anemia (hemoglobin of 3.7 g/dL). Stool routine examination was negative for hookworm ova. Upper gastro intestinal endoscopy showed live worms measuring 4-6 mm in length were found in the second portion of the duodenum. They were removed by using the biopsy forceps and these worms were identified as adult hookworms of *Necator americanus* species.
2. In the study conducted by Kuo YC *et al.* (3) in Taiwan, a 61-year-old male farmer complained of general malaise and melena for 6 months. Laboratory data showed iron-deficiency anemia (hemoglobin of 6.5 g/dL). Stool examination was negative for hookworm ova. Upper gastro intestinal endoscopy showed several squirming red worms in the duodenal bulb. Hookworm (*Ancylostoma duodenale*) infection was diagnosed histologically from a specimen obtained endoscopically.
3. In the study conducted by Li ZS *et al.* (9) in Shanghai, China, a 38-year-old Chinese woman complained of 3-month history of black stool passage and dizziness. Laboratory test results included hemoglobin, 40 g/L (normal: 120 - 160 g/L). Stool examination was negative for hookworm ova. A capsule endoscopy performed to

evaluate the patient further for occult gastrointestinal tract bleeding showed multiple hookworms.

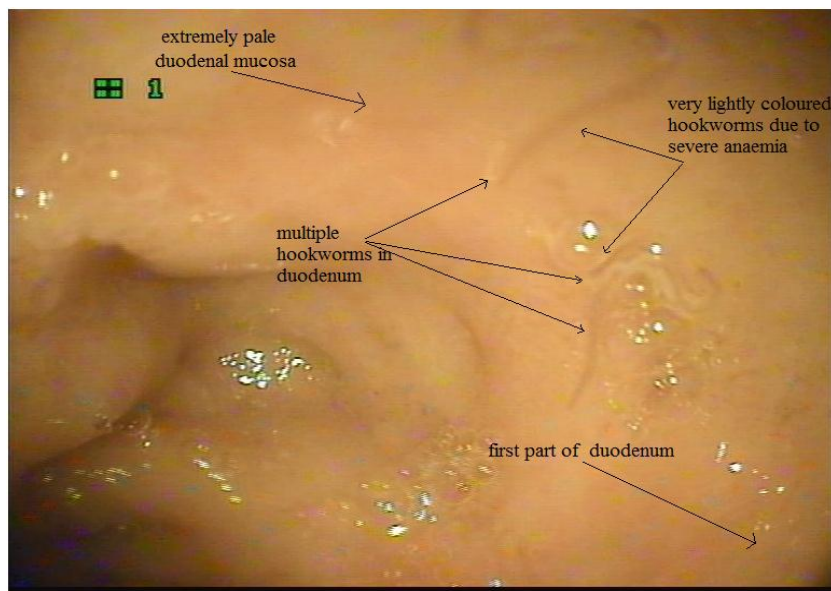
4. In the study conducted by Kalli T *et al.* (10) in Athens, Greece, a 22-year-old man of Pakistani origin, European resident for 1 year, was admitted because of severe iron deficiency anemia. Hematology testing showed findings of severe iron deficiency anemia: hemoglobin, 6.3 g/dL. Stool examination was negative for hookworm ova or larvae in multiple stool samples. The patient underwent video capsule endoscopy examination that identified multiple hookworms in the proximal small bowel. Stool samples sent after capsule endoscopy were also negative for hookworm eggs or larvae, indicating that stool examination might not be as sensitive as thought.
5. In the study conducted by Chen JM *et al.* (11) in China, a 53-year-old male patient complained of intermittent tarry stool with fatigue and shortness of breath for 1 week. Laboratory data revealed hemoglobin of 66 g/L (normal: 120 - 160 g/L). Stool examination was negative for hookworm ova. A capsule endoscopy performed to evaluate the patient showed multiple hookworms.
6. In the study conducted by Kato T *et al.* (12) in Kurashiki, Japan, a 31-year-old man complaining of epigastric discomfort, had laboratory findings of iron-deficiency anemia. Stool examination was negative for hookworm ova. He was found to be infected with hookworm (*Ancylostoma duodenale*), which was directly detected and retrieved from the duodenum with biopsy forceps during upper gastrointestinal endoscopy. This report indicates that it is important to check carefully in the duodenum at routine upper gastrointestinal endoscopy whenever parasitic disease is suspected but is hard to diagnose because of a limited number of eggs in feces.
7. In the study conducted by Cedron-Cheng H *et al.* (13) in Lima, Perú, a 31-year-old man complaining of weakness and intermittent hematochezia had laboratory findings of iron-deficiency anemia (hemoglobin of 6.8 g/dL). Stool examination was negative for hookworm ova. A capsule endoscopy performed to evaluate the patient showed numerous white translucent rounded helminthic parasites attached to the mucosa of small bowel. Based on the S-shaped appearance the likely diagnosis was hookworm infestation.
8. In the study conducted by Yan SL *et al.* (14) in China, a 60-year-old male farmer presented with intermittent melena and anemia for 1 month. Laboratory data revealed a hematocrit of 24.2% (normal: 42± 52%). Stool examination was negative for ova or parasites. The patient underwent push enteroscopy, demonstrating several reddish worms grazing in the duodenum. Three worms were removed with biopsy forceps and were identified on microscopic examination as hookworm, *Necator americanus*.
9. In the study conducted by Chao CC *et al.* (15) in Taiwan, a 67-year-old farmer was investigated because of iron-deficiency anemia (hemoglobin 64 g/L). Fecal microscopy was negative. At capsule endoscopy, small worms were identified in the small bowel that had the appearance of hookworms. An atypical feature in this case was the apparent absence of eggs in feces as heavy infections are normally associated with higher fecal egg counts.

10. In the study conducted by Christodoulou, D. K *et al.* (16) in Greece, a 24-year old Pakistani man who immigrated to Greece one year ago complaining for worsening fatigue had laboratory findings of severe anemia with a hematocrit of 15.6% (normal 41%-53%) and hemoglobin: 2.3 mmol/L (normal 8.4-10.9 mmol/L). Stool test showed no ova or parasites. The capsule endoscopy performed revealed a large number of hookworms infesting the patient's small bowel. The diagnosis of hookworm infestation is normally based on the microscopical examination of feces to detect hookworm eggs. However in this case, stool microscopy failed to identify any eggs.
11. In the study conducted by Bamanikar S *et al.* (17) in Pune, Maharashtra, India, a 35-year-old male presented with iron-deficiency anemia (hemoglobin: 4.6 g/dl). Stool routine examination was negative for hookworm ova. Upper gastro intestinal endoscopy showed live worms. They were removed by using the biopsy forceps and these

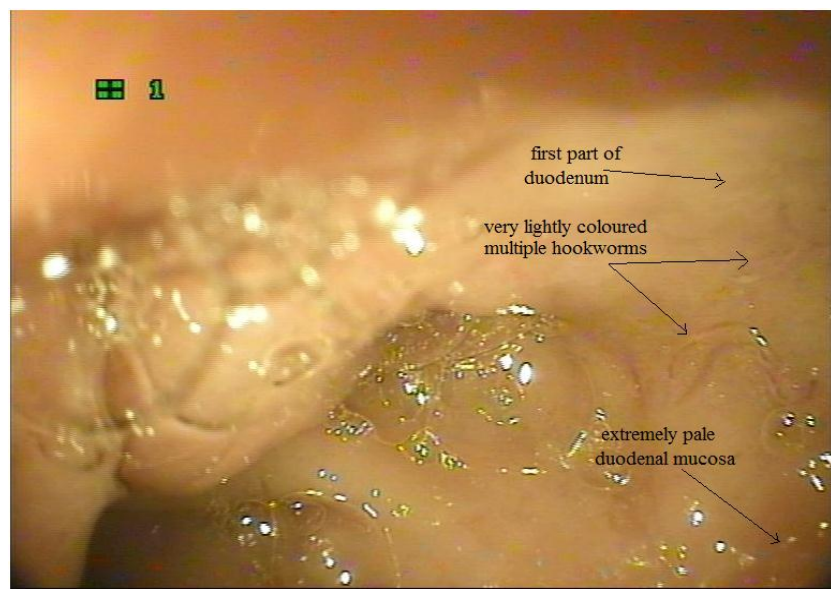
worms were identified as adult hookworms of *Ancylostoma duodenale* species histologically.

### Conclusion

1. In many studies, stool examination was negative for hookworm ova in patients with severe anaemia due to severe hookworm infection.
2. Stool examination was also negative for hookworm ova in both our patients with severe anaemia due to severe hookworm infection.
3. Thus even a very heavy burden of hookworm infection with severe anaemia with multiple hookworms in duodenum seen during endoscopy can present with negative stool examination for hookworm ova.
4. Hence upper gastro intestinal endoscopy should be done to confirm the presence of hookworms in all patients with severe anaemia in tropical countries even when stool examination is negative for hookworm ova.

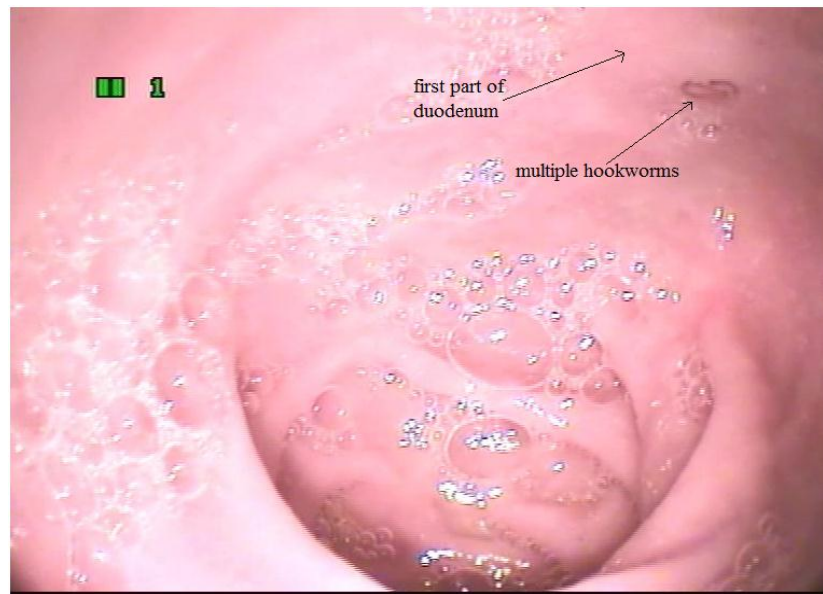


**Fig 1:** multiple hookworms in duodenum with severe anaemia [haemoglobin 2.1 g %] showing extremely pale duodenal mucosa and very lightly coloured hookworms but with negative stool examination for hookworm ova.



**Fig 2:** multiple hookworms in duodenum with severe anaemia [haemoglobin 2.1 g %] showing extremely pale duodenal mucosa and very lightly coloured hookworms but with negative stool examination for hookworm ova [different view].





**Fig 3:** multiple hookworms in duodenum with severe anaemia [haemoglobin 3.2 g%] due to severe hookworm infection but with negative stool examination for hookworm ova

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