

CHAPTER 3

HOOKWORM ANAEMIA

A variety of intestinal parasites infest man, and hookworm is one which is characteristically associated with hypochromic microcytic anaemia. Hookworm infestation gives rise to an iron deficiency anaemia. It is, therefore, necessary to give a special consideration to this topic which is of great importance in the tropics.

The parasite was first discovered in 1838 by an Italian physician Angelo Dubini, whereas its pathogenesis and mode of entrance of the larvae into man was worked out by Looss in 1898.³⁵ It is widely distributed in all tropical and sub-tropical countries occurring in places where

humidity and temperature are favourable for the development of larvae in the soil. Thus, it is found in Europe, Central Africa, Egypt, India, Ceylon, China, Japan, Italy, Pacific Islands and South America.³⁵

Hookworm disease or ankylostomiasis is a clinical syndrome caused by infection with *Ankylostoma duodenale* or *Necator americanus*. Hookworm infection implies the harbouring of hookworms in the intestine, with or without symptoms.³³

The clinical state and the blood picture are similar to that observed in iron deficiency anaemia in the absence of hookworm, a noteworthy difference being, however, that no predilection for the female sex has been described. The anaemia possesses all the characteristic of iron deficiency and can be relieved by the administration of iron, whether the worms are removed or not.

AETIOLOGY AND PATHOGENESIS

It appears that multiple factors are responsible for hookworm anaemia. In the first place, there is chronic blood loss due to the infesting parasite. The blood loss results from the withdrawal of blood by the parasites for their food and also from the chronic haemorrhages from the punctured sites. It is known that each worm is capable of drawing about 0.67 ml. of ~~blood~~ blood, and in heavy

infestation, Such daily withdrawal of blood by a large number of parasites over a prolonged period would be sufficient to cause anaemia. Darling estimated that the loss of haemoglobin is 1 per cent for each 12 worms.³⁵ The actual amounts of blood loss and iron loss as determined by different investigators are as follows :-

1. Average Blood Loss:³⁵

- (a) *A. duodenale* : 0.20 ml./worm/day
- (b) *N. americanus* : 0.03 ml./worm/day

Thus, *Ankylostoma* consumes more blood than *Necator*.

2. Intestinal Blood Loss and Calculated Iron Loss :¹¹³

- (a) Blood loss in stool : 2.0 to 251.5 ml./day

There was a rough correlation between the severity of infestation and the amount of blood lost.

- (b) Blood loss in Stool : 0.82 to 7.14 ml./1000 ova/
gm. of stool/day

There was a rough correlation between the number of ova in the stool and amount of blood lost.

- (c) Average blood Loss : 0.2 ml/hookworm/day

OR

: 2.74 ml./1000 ova/gm.of
stool/day.

- (d) Calculated iron loss: 1.2 to 29.1 mg./day.

3. Intestinal Iron Loss and Reabsorption :¹¹²

- (a) Intestinal iron loss : 2.74 to 21.434 mg./day
- (b) Faecal iron loss : 1.80 to 16.24 mg./day
- (c) Amount reabsorbed from the intestinal iron loss:

Range : 13.1 to 76.4 per cent

Mean : 44.1 per cent

Thus, a wide range of iron was reabsorbed but the net loss was substantial nevertheless.

It has been further observed that the plasma forms the main source of nourishment for these parasites and the red blood cells pass out from the worm practically unchanged into the lumen of host's intestine. The development of hookworm anaemia is also related to a certain extent on the amount of reabsorption of iron from the blood lost in the intestinal tract.³⁵

The amount of iron loss, of course, diminishes as the patient becomes more anaemic and there is a tendency to ~~be~~ stabilization when the iron absorption from the food equals the iron loss in faeces due to bleeding. It is, however, quite certain that the severity of the anaemia is not necessarily a function of the so-called "intestinal load"; very severe anaemia may be met with when the number of worms is small.

Rhodes et al.⁴⁰ have emphasised the role of dietary deficiencies as contributing factor. The diet of infested subjects is usually poor in iron and protein, the substances essential for haemoglobin regeneration. If there is achlorhydria, these deficiencies are still more exaggerated. Steward has shown that heavy nematode infections lessen the amount of protein digestion.

The two factors of chronic blood loss and deficiency of blood-building materials eventually induce a hypoplasia or even aplasia of the marrow and when this is well established mere removal of the worms does not cure the anaemia.

At one time the view was widely held that the hookworm anaemia is due to the elaboration of a toxin. No such mysterious concept is necessary.¹³⁶ There is no evidence that the parasite produces a haemolysin or that intravascular haemolysis ~~is~~ plays any part in the production of the anaemia.

Thus, it is clear from the foregoing considerations that though multiple factors are concerned in the pathogenesis of hookworm anaemia, **chronic** blood loss is of prime importance. Nevertheless, it is also true that all the infested persons do not necessarily develop anaemia and that the anaemia, when it develops, is not related to the ~~kw~~ load of parasites.⁴⁰

CLINICAL MANIFESTATIONS

The most common manifestation of the disease is a chronic anaemia giving rise to the usual symptoms, of weakness, easy fatigability, dyspnea and palpitation. Dermatitis is usual, due to the penetration of the parasite through the skin. Children are often physically and mentally backward, puberty may be delayed, and a "pot-belly" is usual. Ashford et al. made a detailed study of acute ankylostomiasis, in which form the disease is characterised by acute dermatitis, fever, sore throat, cough and dysphagia due to the larvae, epigastric pain, vomiting, diarrhea, gross intestinal haemorrhage and rapidly developing asthenia. In the acute disease the anaemia is sometimes produced so rapidly, and so profound, that transfusion may be necessary. Sometimes Ankylostome worms may be present without producing symptoms.

In severe cases the skin becomes yellow and dry, & the mucous membranes pale, pulsating cervical veins, hemic murmurs, retinal haemorrhages, edema of the feet and serous effusion may be found. Epigastric tenderness, enlarged liver dyspepsia, mental and physical lethargy are characteristic.

DIAGNOSIS

A microcytic hypochromic anaemia, especially associated with eosinophilia, should arouse suspicion particularly

in a tropical patient. The diagnosis, in all cases, is clinched by finding the characteristic ova in the faeces. Melaena is common, but when it is not obvious, the faeces almost always contain occult blood.

Eosinophilia is usual, and may reach a high level. An eosinophilia of 90 per cent has been observed in acute cases, the phenomenon taking three to four months to develop from the time of original infestation. The gastric secretion is variable. Rhoads and Caste state that achlorhydria is common, whilst Biggam and Ghalioungui have rarely found any deficiency of the free hydrochloric acid.¹³³

Intradermal test as a method of diagnosis for ankylostomiasis was first mentioned by Coventry (1928). Since then not much work was done on this test till the recent years, when workers like Noda (1953), Sawada et.al.(1954), Verdardini et. al. (1955) and Ping-Hsing and Nien-Kung(1958) have used it and declared it to be highly specific.¹⁰¹

PROGNOSIS

The mortality rate is low, even in natives, the chief danger being anaemia, which predisposes to inter-current disease unless specific treatment is instituted. Hookworm infection is especially serious in children owing to its effect on their physical as well as mental development.¹⁰²

PREVENTION

The following measures may be adopted :

1. Attack on Adult Parasite :

Treatment of carriers and diseased persons simultaneously with wholesale treatment of a community (treatment en masse).

2. Attack on Larvae :

Substitution of latrines for promiscuous defaecation. Prevention of soil pollution by sanitary disposal of human excreta. Disinfection of faeces or soil.

3. Personal Protection :

Wearing good shoes and gloves. But local customs and cost often preclude their use.

TREATMENT

Besides general measures, the essential treatment includes the dietetic treatment, anthelmintic treatment, and the anti-anaemic treatment.

1. General Measures :

This includes rest, treatment of intercurrent

infection such as Malaria, and the anti-septic dressings for secondary coccal infection. The ground-itch may be treated with Ung. Zinc oxide and Ung. Acid Salicylate.

2. Dietetic Treatment :

A well-balanced diet containing proteins, vitamins, and vegetables should be given.

3. Anthelmintic Treatment :

Preparation for anthelmintic treatment is important, but it should not be overdone. The patient is given a liquid evening meal without fats. If the patient is constipated, a thorough cleansing enema is indicated. Anti-hookworm drug should be given early in the morning and breakfast should be omitted. Food should be omitted for 4 to 5 hours.³³

Tetrachlorethylene is the drug of choice for the treatment of hookworm as it is safe, effective and cheap.³³ The adult dose of tetrachlorethylene is 3 to 5 ml. in gelatin capsules. The drug is followed by an after-purgation, the object of which is to get rid of both, the drug as well as the parasites. After the saline purgation, the stools should be examined and the number of worms recorded if time permits. In 7 to 10 days time, the stools are re-examined,¹⁰² and if ova are still present, another course of medication may be considered advisable. The effectiveness of treatment

is determined by the disappearance of symptoms as well as the ova from the faeces, as revealed by the later microscopic examination.

4. Anti-anaemic Treatment :

Iron in large doses will cure the anaemia, even though the worms are still present (Foy and Kondi, 1960), and the diet defective. However, a haemoglobin figure not maintained at a normal level is indicative of continued infestation (Lane, 1937). When prolonged treatment with iron fails to raise the haemoglobin to the full normal level, it may be inferred that the individual is still infested even though stool examinations are negative.¹³³