Research Paper Medical Science

Investigations Indicating Iron Deficiency Anaemia in Severe Hookworm Infection and Description of Storage, Transport and Functional Compartments for Iron

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ABSTRACT

Objective: Severe anaemia is reported to occur in severe hookworm infection in many studies. But so far detailed study of various investigations which indicate iron deficiency anaemia in patients with severe anaemia due to hookworm infection diagnosed by doing upper gastro intestinal endoscopy was not done. Hence a detailed study of various investigations which indicate iron deficiency anaemia in patients with severe anaemia due to hookworm infection diagnosed by doing upper gastro intestinal endoscopy was done.

Methods: A study of 1259 patients who had undergone upper gastro-intestinal endoscopy for a period of 5 years from May 2009 to April 2014 was carried out. In each of these 1259 patients,the first and second part of duodenum were carefully examined to find out the presence of 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%] peripheral smear examination was also done in addition to haemoglobin estimation . But in one patient with severe anaemia, various investigations which indicate iron deficiency anaemia were also done namely mean corpuscular volume or MCV and mean corpuscular haemoglobin or MCH in addition to haemoglobin estimation and peripheral smear examination. The results were found as given below.

Results:Of these 1259 patients, 14 patients found to have hookworms in duodenum were taken into consideration for our study. Of these14 patients, 9 patients had anaemia and 2 of these 9 patients were found to have severe anaemia [haemoglobin<7g/dl or g%] . The peripheral smear of both the patients showed severe hypochromic anaemia. In one patient with severe anaemia,haemoglobin, mean corpuscular volume or MCV and mean corpuscular haemoglobin or MCH were very low and peripheral smear examination showed microcytic hypochromic anemia which indicate iron deficiency anaemia.

Conclusion: Hence low haemoglobin, mean corpuscular volume[MCV] and mean corpuscular haemoglobin or MCH and microcytic hypochromic anemia in peripheral smear examination indicate iron deficiency anaemia in patients with severe anaemia due to hookworm infection diagnosed by doing upper gastro intestinal endoscopy .

KEYWORDS iron deficiency anaemia, haemoglobin estimation, mean corpuscular volume , mean corpuscular haemoglobin , peripheral smear

Introduction:

Severe anaemia is reported to occur in severe hookworm infection in many studies (1 to 17). But so far detailed study of various investigations which indicate iron deficiency anaemia was not done in patients with severe anaemia due to hookworm infection diagnosed by doing upper gastro intestinal endoscopy. Hence a detailed study of various investigations which indicate iron deficiency anaemia in patients with severe anaemia due to hookworm infection diagnosed by doing upper gastro intestinal was done

Materials and Methods:

This study was conducted in the department of general surgery, Aarupadai Veedu Medical College And Hospital, Puducherry. A study of 1259 patients who had undergone upper gastro-intestinal endoscopy for a period of 5 years from May 2009 to April 2014 was carried out. In each of these 1259 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. Anaemia is defined as haemoglobin < 12g/dl or 12g% in women and haemoglobin < 13g/dl or13g% in men. Severe anaemia is taken as haemoglobin <7g/dl or g% . In patients with severe anaemia[haemoglobin <7g/dl or g%] peripheral smear examination was also done in addition to haemoglobin estimation . But in one patient with severe anaemia ,various investigations which indicate iron deficiency anaemia were also done namely mean corpuscular volume or MCVand mean corpuscular haemoglobin or MCH in addition to haemoglobin estimation and peripheral smear examination. The results were found as given below.

Results:

Of these 1259 patients, 14 patients found to have hookworms in duodenum were taken into consideration for our study. Of these14 patients, 9 patients had anaemia and 2 of these 9 patients were found to have severe anaemia[haemoglobin <7g/dl or g%]. The peripheral smear of both the patients showed severe hypochromic anaemia. But in one patient with severe anaemia, various investigations which indicate iron deficiency anaemia were also done namely mean corpuscular volume or MCV and mean corpuscular haemoglobin or MCH in addition to haemoglobin estimation and peripheral smear examination. The results were found as given below.

Detailed investigations which indicate iron deficiency anemia in the patient with severe anaemia due to hookworm infection.

The various investigations which indicate iron deficiency anaemia were done in the patient namely haemoglobin estimation ,mean corpuscular volume or MCV, mean corpuscular haemoglobin or MCH and peripheral smear examination.

a.Haemoglobin [decreased in iron deficiency anemia]

Anaemia is defined as the reduction in haemoglobin concentrations below the expected values[WHO,1972] . Haemoglobin levels were based on the World Health Organisation standards of 13 g/dl for adult males 12 g/dl for adult women and 11 g/dl for pregnant women and preschool children below which were considered to have iron deficiency anemia(18) .In our patient with severe anaemia due to hookworm infection diagnosed by doing upper gastro intestinal endoscopy haemoglobin is very low3.2g%.

b.Mean red cell volume or MCV[decreased in iron deficiency anemia]
In our patient, mean red cell volume or MCV is very low and is only 50.7femolitres or fl[normal range 82-92 fl] indicating that the RBCs are very small with small volume and are microcytic.

c. Mean corpuscular haemoglobin or MCH[decreased in iron deficiency anemia]
Mean corpuscular haemoglobin or MCH is also very low and is only. 15 picograms or pg [normal range 27-32pg] in our patient indicating that the RBCs are hypochromic and have low amount of haemoglobin.

d .Peripheral smear examination
Our patient had also undergone peripheral smear examination which showed severe microcytic anaemia and severe hypochromic anaemia.

Discussion
Storage, transport and functional compartments for iron

Iron-containing compounds in the body are one of three types: a) storage forms for iron and b) compounds that serve as transport and c) functional compounds that serve in metabolic or enzymatic functions (19).

a) Ferritin is the primary storage compound for the body's iron
b) Iron is distributed within the body via transferrin in the plasma, a transport protein that mediates iron exchange between tissues.
c) Hemoglobin constitutes the major fraction of body iron (functional iron) with a concentration of about 0.5 mg iron/mL blood(19). 65% of iron in the body is bound up in haemoglobin. 30% of iron in the body is stored as ferritin in the spleen,bone marrow and the liver. There are about 2 gm of iron in the adult female, and up to 6 gm iron in the adult male. About 1.5 to 2 gm of this total iron is found in red blood cells as heme in hemoglobin, and 0.5 to 1 gm occur as storage iron, mainly in bone marrow, spleen, and liver, with the remainder in myoglobin and in enzymes that require iron.

There are a number of markers that describe these storage, transport and functional compartments for iron: serum ferritin ,serum iron, total iron binding capacity or transferrin, transferrin saturation, hemoglobin and red blood cell indices (mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH)). (19). These laboratory tests are essential to an accurate diagnosis of iron deficiency and the evaluation of therapy(19).

Investigations which indicate iron deficiency anemia
a.Low haemoglobin
In our patient also with severe hookworm infection haemoglobin is very low 3.2g%. Severe anaemia(haemoglobin <7g/dl or g%) is reported to occur in patients with severe anaemia due to hookworm infection diagnosed by doing endoscopy in many studies (1 to 17).

b.Low mean corpuscular volume (MCV)
There is reduced size of red blood cells, so that the mean corpuscular volume (MCV) is lower[microcytic]. Hence, this is a microcytic anemia.

Other studies have also shown that the mean corpuscular volume (MCV) is lower[microcytic] in patients with severe anaemia due to hookworm infection diagnosed by doing endoscopy(1 to 6).

c. Low mean corpuscular hemoglobin (MCH)
Hookworm infection causes blood loss which results in iron deficiency anemia.
This anemia is characterized by a decreased amount of hemoglobin per RBC, so the mean corpuscular hemoglobin (MCH) is lower[hypochromia].

Studies have also shown that the mean corpuscular hemoglobin (MCH) is lower[hypochromia] in patients with severe anaemia due to hookworm infection diagnosed by doing endoscopy(1, 2).

d. Peripheral smear examination
Our patient had also undergone peripheral smear examination which showed severe microcytic anaemia and severe hypochromic anaemia.

Iron deficiency anemia caused by hookworm infection .
Hookworm infection is the most common cause of iron deficiency in developing nations .A high prevalence of anaemia is often found in developing countries, especially where infections such as malaria or hookworm are common. The end result of decreased dietary iron, decreased iron absorbtion, or blood loss is iron deficiency anemia. Blood loss is almost always the cause of iron deficiency anemia. Hence hookworm infection which causes blood loss results in iron deficiency anemia.

Conclusion:
1. Hemoglobin constitutes the major fraction of body iron (functional iron) . 65% of iron in the body is bound up in haemoglobin. About 1.5 to 2 gm of total iron is found in red blood cells as heme in hemoglobin.

2. Low haemoglobin, low mean corpuscular volume[MCV] , low mean corpuscular haemoglobin or MCH and microcytic hypochromic anemia in peripheral smear examination indicate iron deficiency anaemia in patients with severe anaemia due to hookworm infection diagnosed by doing upper gastro intestinal endoscopy.

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