

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

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Foundation of Technical Education
Technical college/Kirkuk
Med.Lab.Sciences Dept.

Teaching package
in
HYPOCHROMIC ANEMIAS
(Hematology)

For
Fourth year Students

By

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1/ Over view

1 / A –Target population :-

Fourth year students

Technical college/Kirkuk

Med.Lab.Sciences Dept.

1 / B –Rationale :-

Iron deficiency is the most common cause of anemia in every country of the world. It is the most important cause of a **microcytic hypochromic** anemia in which the red cell indices:

Mean corpuscular volume (MCV) and **mean corpuscular hemoglobin (MCH)** are reduced and the blood film shows small (microcytic) and pale (hypochromic) red cell.

Why?

Because there is defect in hemoglobin synthesis.

HISTORY

A disease believed to be iron deficiency anemia is described in about 1500 B.C. in the Egyptian Ebers papyrus.

It was termed chlorosis or *green sickness* in Medieval Europe , and iron salts were used for treatment in France by the mid-17th century.

Thomas Sydenham recommended iron salts as treatment for chlorosis , but treatment with iron was controversial until the 20th century, when its mechanism of action was more fully elucidated.

NUTRITIONAL ASPECTS OF IRON:

Dietary iron: Iron is present in food as Ferric hydroxides, ferric protein and hem-protein complexes.

Both iron content and the proportion of iron absorbed differ from food to food; in general meat-in particular liver-is a better source than vegetables, eggs or dairy foods.

The proportion of iron absorption can be increased to 20-30% in iron deficiency and pregnancy but even in these situation most dietary iron remains unabsorbed.(see table 3-2) in textbook.

IRON ABSORPTION:

Organic dietary iron is partly absorbed as haem and partly broken down in the gut to **inorganic iron**.

Absorption occurs through **duodenum**. Haem absorbed through a specific receptor, HCP-1 exposed on the apical membrane of the duodenal enterocyte, then digested to release iron.

Inorganic iron absorption is favored by factors such as acid and reducing agents that keep iron in the gut lumen in the **Fe^{2+}** rather than **Fe^{3+}** state.

BODY IRON DISTRIBUTION AND TRANSPORT:

The transport and storage of iron is largely mediated by three proteins: TRANSFERRIN, THE TRANSFERRIN RECEPTOR 1 (TfR1) and FERRITIN.

Transferrin can contain up to two atoms of iron. It delivers iron to tissues that have transferrin receptors, especially erythroblasts in the bone marrow which incorporate the iron into hemoglobin (see Fig.3.2)The Tf is then reutilized.

At the end of their life, red cells are broken down in the macrophages of the reticuloendothelial system (RES) and the iron is released from hemoglobin, enters the plasma and provides most of the iron on Tf.

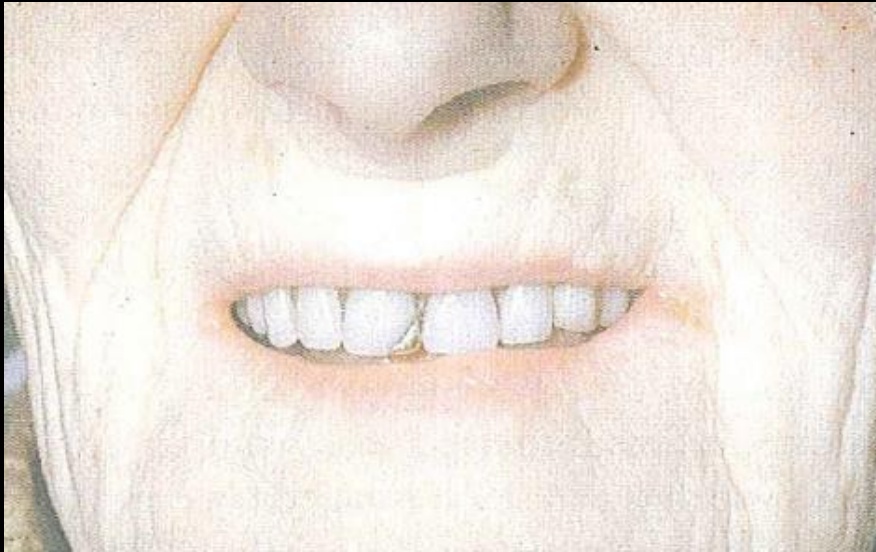
Some iron is stored in the macrophages as ferrettin (water soluble protein-iron complex which contains up to 20% of its weight as iron and not visible by light microscopy) and haemosiderin (an insoluble protein-iron complex of varying composition containing approximately 37% iron by weight, the amount varying widely according to overall body iron status. Iron in ferrettin and hemosdrin is in the ferric form. It is mobilized after reduction to the ferrous form, vitamin C being involved. A copper-containing enzyme, caeruloplasmin, catalyses oxidation of the iron to the ferric form for binding to plasma Tf..

Causes of iron deficiency (Table 3.4).

- Chronic blood loss, especially uterine or from the gastrointestinal tract, is the dominant cause
- Increased demands during infancy, adolescence, pregnancy, lactation and in menstruating women account for the high risk of anaemia in these particular clinical groups.

In pregnancy increased iron is needed for an increased maternal red cell mass of approximately 35%, transfer of 300 mg of iron to the fetus and because of blood loss at delivery.

Clinical features

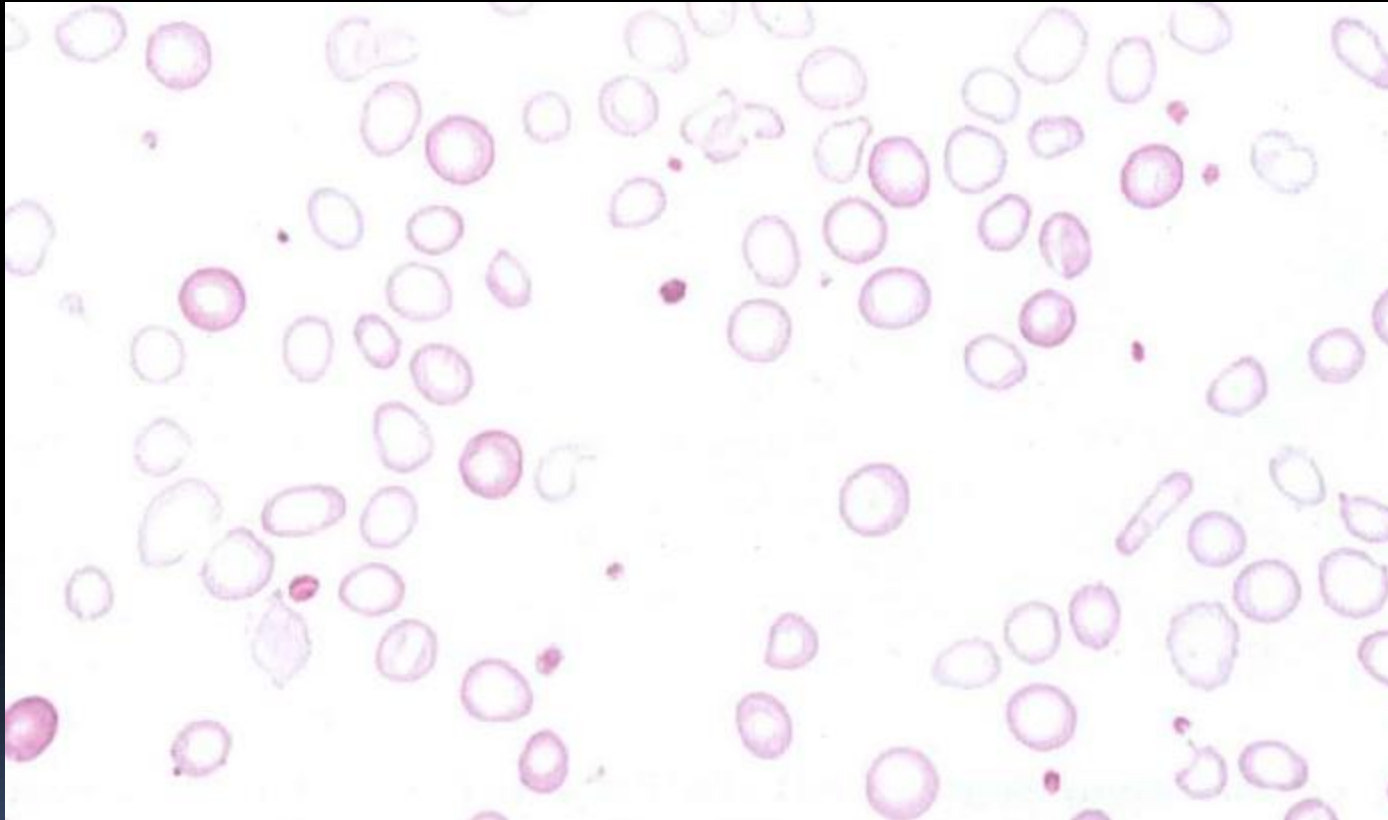


Angular cheilosis: fissuring and ulceration of the corner of the mouth



Koilonychia: typical 'spoon' nails.

Investigation of the cause of iron :d] deficiency



ANEMIA OF CHRONIC DISORDERS:

CAUSES:

Chronic inflammatory diseases:

Infections: e.g pulmonary abscess, tuberculosis, osteomyelitis, pneumonia, bacterial endocarditis:

Non-infectious: Rheumatoid arthritis, systemic Lupus erthematosus, Crohn's disease.

Malignant Disease :

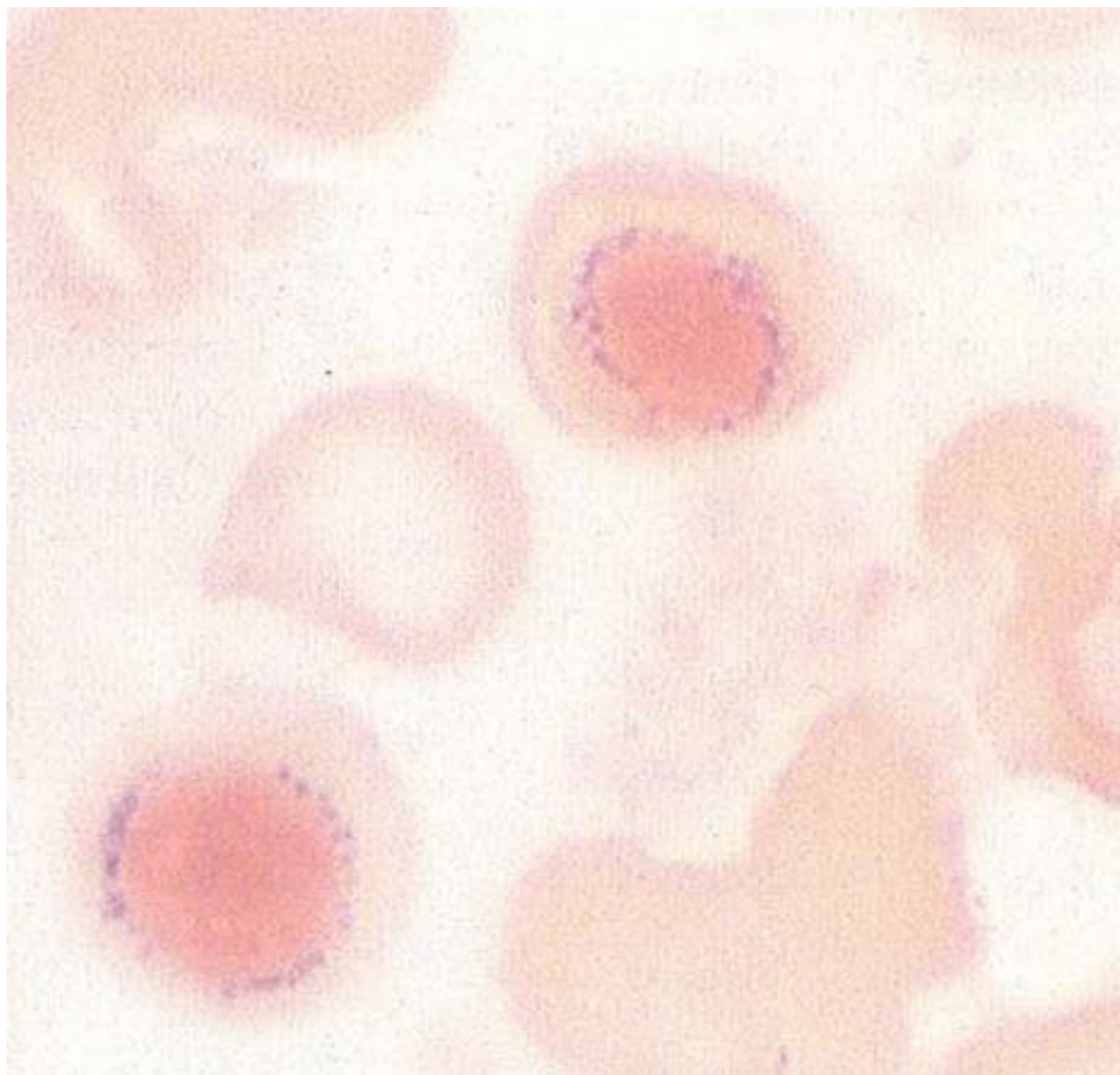
Carcinoma, lynchoma, Sarcoma.

CHARACTERISTIC FEATURES of A.C.D:

- 1-Normochromoc, normocytic or mildly hypochromic (MCV rarely <75 fL)indices and red cell morphology.
- 2-Mild and non-progressive anemia (Hb-rarely <90 g/L).
- 3-Both Serum iron & TIBC are reduced; sTfR levels are normal.
- 4-The sreum ferritin is normal or raised.
- 5-Bone marrow storage (RE) iron is normal but erythroblast iron is reduced.

Sideroblastic anaemia

Sideroblastic anemia is a refractory anaemia with hypochromic cells in the peripheral blood and increased marrow iron; it is defined by the presence of many pathological ring sideroblasts in the bone marrow . These are abnormal erythroblasts containing numerous iron granules arranged in a ring or collar around the nucleus instead of the few randomly distributed iron granules seen when normal erythroblasts are stained for iron.



Classification of sideroblastic anaemia.

Hereditary

Usually occurs in males, transmitted by females; also occurs rarely in females.

Acquired

Primary

Myelodysplasia (refractory anaemia with ring (Sideroblasts)

Secondary:

Ring sideroblast formation may also occur in the bone marrow in:

Other malignant diseases of the marrow (e.g. other types of myelodysplasia, myelofibrosis, myeloid leukaemia, myeloma).

Drugs, e.g. antituberculous (isoniazid, cycloserine), alcohol, lead.

Other benign conditions (e.g. haemolytic anaemia, megaloblastic anaemia, malabsorption, rheumatoid arthritis)

Lead poisoning

Lead inhibits both haem and globin synthesis at a number of points. In addition it interferes with the breakdown of RNA by inhibiting the enzyme pyrimidine 5' nucleotidase, causing accumulation of denatured RNA in red cells, the RNA giving an appearance called basophilic stippling on the ordinary (Romanowsky) stain. The anaemia may be hypochromic or predominantly haemolytic, and the bone marrow may show ring sideroblasts.

Iron overload

can occur in disorders associated with excessive absorption or chronic blood transfusion.

Excessive iron deposition in tissues can cause serious damage to organs, particularly the heart, liver and endocrine organs.

Causes of iron overload

Increased iron absorption:

Hereditary (primary) haemochromatosis

Ineffective erythropoiesis, e.g. thalassaemia
intermedia, sideroblastic anaemia

Chronic liver disease

Increased iron intake:

African siderosis (dietary and genetic)

Repeated red cell transfusions:

Transfusion siderosis

LABORATORY DIAGNOSIS OF A HYPOCHROMIC ANEMIA

PARAMETERS	Iron Def.	An.Chronic D.	Thalassemia	Sideroblastic
MCV	Reduced *	N or Mild	Reduced **	usually low #
MCH	Reduced	Reduced	Reduced	Reduced
Serum iron:	Reduced	Reduced	Normal	Raised
TIBC	Raised	Reduced	Normal	Normal
Serum fTR	Raised	Normal/Low	Variable	Normal
Serum ferritin	Reduced	Normal or raised	Normal	Raised
Bone M. iron stores	Absent	Present	Present	Present
Erythroblast Iron	Absent	Absent	Present	Ring forms
Hb-Electrophoresis	Normal	Normal	Hb A2 Raised+	Normal

REFERENCES



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Quiz 07.11.2018



1-The processes that regulate haemopoiesis and the early stages of formation of granulocytes and monocytes is called)

2- The Embden–Meyerhof pathway generates two high-energy phosphate bonds and ..., which is needed by the enzyme methaemoglobin reductase.

3- All blood cells come from pluripotent hematopoietic stem cells known as

QUIZ

THANK YOU

