



H PATHOLOGY S



W r i t e r : Huda Baidoun



C o r r e c t o r : Lana Khabbas



D o c t o r : Tareq Adiely

ANEMIA

Anemia: is defined as reduction in the oxygen carrying capacity in the blood secondary to decreased RBCs mass .

Mass not volume or number. **Mass is measured by** hemoglobin concentration and hematocrit .

** Anemia leads to hypoxia .

** Erythropoietin is a hormone produced by kidneys ,sometimes from liver, it activates bone marrow to synthesize more red cells.In the case of anemia,it triggers the production of erythropoietin causing compensatory erythroid hyperplasia in bone marrow which will mature to RBCs and go to the bloodstream.

In acute (sudden) anemia erythropoietin can increase by five times or more in healthy people. If erythropoietin production persists for a long time , there will be strong activation of hematopoiesis out of bone marrow (Extramedullary hematopoiesis) in spleen and liver and sometimes lymph nodes (reticuloendothelial system).

** Exceptions: Anemia of renal failure and anemia of chronic inflammation(erythropoietin will be low)

NOW

Classification of Anemia according to cause:

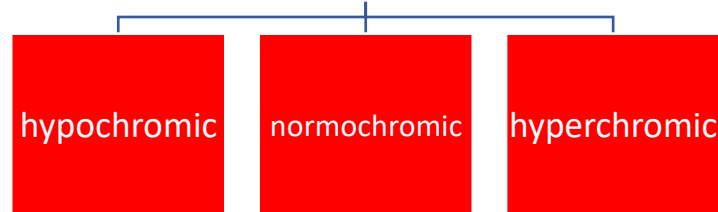
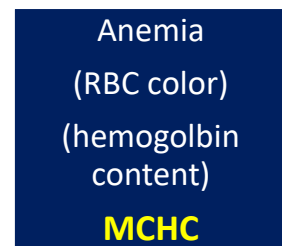
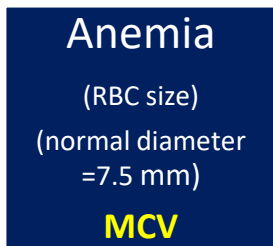
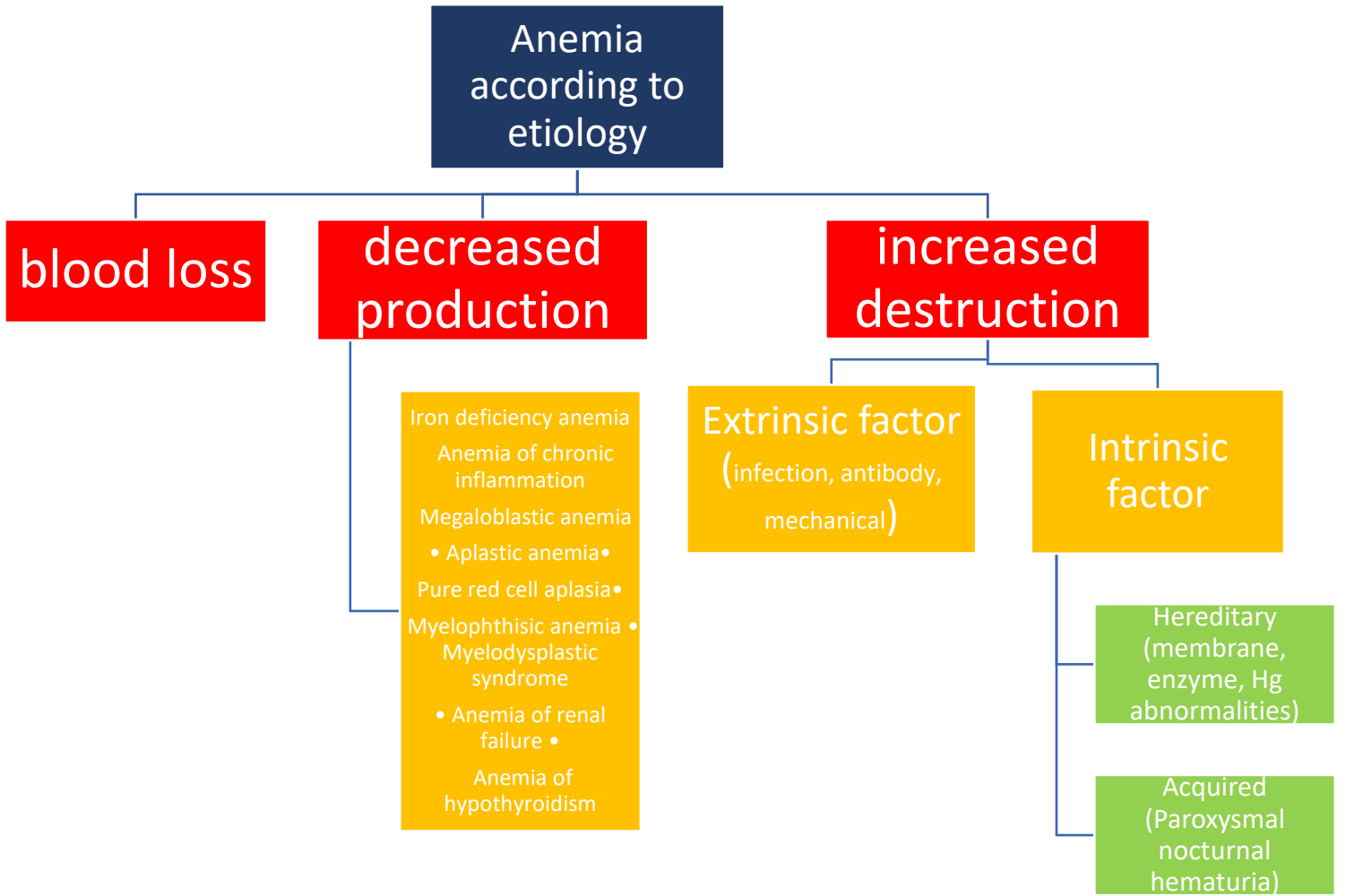
1. Anemia of blood loss
2. Anemia of diminished RBC production (most common)
 - Iron deficiency anemia • Anemia of chronic inflammation • Megaloblastic anemia • Aplastic anemia • Pure red cell aplasia • Myelophthisic anemia • Myelodysplastic syndrome • Anemia of renal failure • Anemia of hypothyroidism
3. Anemia of increased destruction (hemolytic anemia)

Normal production from bone marrow but the RBCs die early

- Extrinsic factors (infection, antibody, mechanical)
- Intrinsic RBC abnormalities:

1)Hereditary (membrane, enzyme, Hg abnormalities)

2)Acquired (Paroxysmal nocturnal hematuria)



Measurements in yellow

- We put drop of blood fix it and stain it to see it under microscope.((Blood smear or blood film examination
-))

- Size: normocytic , microcytic ,macrocytic (MCV)
- Color: normochromic , hypochromic (MCHC)
- Shape: anisopoikilocytosis (spherocytes (ball) , sickle, schistocytes) (RBC distribution width) (RDW)
- Automated lab test gives us mean cell volume which indicates anemia by size , normal mcv = (80-100 fl).
- Hypochromic microcytic anemia usually reflects impaired Hg synthesis (iron deficiency , thalassemia)
- Macrocytic anemia reflects stem cell disease and maturation(large RBCs but are less in number)

RBC INDICES :

(what effects RBC count)

** Slight variation is present between labs, geographic areas (high altitude , higher Hb conc.)

** **Sex** (males higher Hb conc. bec of androgens than females who have menstruation), **age** (neonates more Hb) , **race** (African less Hb than others) , **mobility status** (less movement less Hb conc.)

** Reticulocytes are immature anucleated RBC which will mature to RBC, it's bigger than RBC and has streaks of RNA. Naturally 1-2% within total RBCs -maximum 2.5%.

** Reticulocyte count helps differentiate type of anemia.

hemolytic anemia (high) from aregenerative anemia (low).

Clinical symptoms of Anemia:

- General symptoms because of hypoxia:Dizziness, Fatigue , Pallor, Headache
- Adaptive changes: Tachycardia(increased heart rate) , Tachypnea (increased respiratory rate)

- On cell level (adaptive) : Increased red cell 2,3-diphosphoglycerate (this molecule replaces oxygen on haemoglobin, facilitating its delivery to tissues)

If the patient has heart or lung diseases, symptoms will be worse

Special Clinical symptoms of Hemolytic anemia :

When RBC are destructed hemoglobin get out and get metabolized to bilirubin (insoluble)) so we will affect the skin and sclera so we will have jaundice , pigmented gallbladder stones , red urine(toxic haemoglobin excreted).



Special clinical symptoms of Extramedullary hematopoiesis:

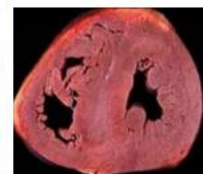
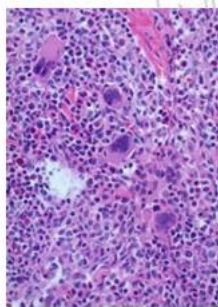
Splenomegaly , Hepatomegaly

Special clinical symptoms of thalassemia major and sickle cell anemia : (they have also Extra Medullary Hematopoiesis)

**hepatomegaly and spleomegaly—distended abdomen

growth retardation, bone deformity (prominent cheeks and jaw) ,

biopsy of spleen or liver will give same look of bone marrow (megakaryocytes , myeloid cells ...) and deposition of iron which is hard to be got rid of , so it deposits in tissues and this is called secondary hemochromatosis . (damage to heart, endocrine glands).



Anemia of blood loss: (Acute and chronic)

Acute :sudden loss of blood

Symptoms are not obvious, rather related to decreased intravascular volume (hypovolemia and hypotension)

If loss is > 20% of blood volume, patient might have hypovolemic shock and death bec of ischemia in kidney and brain

- 1- If a patient survived blood loss , Body responds by shifting fluid from interstitial to intravascular space (to correct for decreased BP), causing dilutional anemia and worse hypoxia (stays 2-3days) which worsen anemia , as we dilute the blood that already lost big amount of hemoglobin.
- 2- Erythropoietin secretion is stimulated, activating BM erythropoiesis (needs 5-7days)
- 3- In internal hemorrhage, iron is restored from extravasated RBCs and used again in erythropoiesis BUT In external and GIT hemorrhage, iron is lost, which complicates anemia

Acute blood loss anemia is normochromic normocytic with reticulocytosis

Anemia of chronic blood loss

RBC destruction more than production,continuous loss over long period of time.

**Mostly occurs in gastrointestinal diseases (peptic ulcer ,celiac, colitis , hemorrhoids)

Also in excessive menstruation (Gynecologic)

This leads to iron deficiency anemia so it appears hypochromic and microcytic, low reticulocyte.