

# Iron metabolism and anemia

DR. Arwa Rawashdeh

# Anemia differential diagnosis

- Iron deficiency anemia
- Red blood cell production
  - Plastic anemia
  - Vitamin B12 and folic acid
  - Chronic inflammation anemia
- Red blood cell destruction
  - extravascular and intravascular hemolysis

## Iron Deficiency anemia (Bleeding)

- GIT Loss in male
- Heavy Menstruation in female
  
- Apo ferritin in the liver and spleen with iron it becomes ferritin . In iron deficiency decrease ferritin level
- Transferrin receptor protein on erythroid precursor and in case of iron deficiency there will be more TRP that break off and detected by TRP test

# Anemia of inflammation (Chronic inflammation)

- Cytokines

Bone Marrow: insensitive to erythropoietin and Suppression

Erythrocyte: Autolysis and Apoptosis

Spleen and liver : Storage of iron into ferritin

.All of these are strategies to prevent bacteria from growth

Lab test : increase ferritin level

decrease transferrin saturation

# Iron deficiency anemia vs chronic deficiency anemia

- Serum total iron binding capacity (TIBC)  
transferrin and Fe+3
- Iron saturation percentage (transferrin saturation)  
Iron/TIBC X100= 33%
- Soluble transferrin receptors (STFR ) concentration

Serum iron

Increase Ferritin IL-6    Decrease EPO IL-6    Hepcidin    Increase FEP

TIBC

% saturation

STFR

Vitamin B12 pernicious anemia

Intrinsic factor from parietal cells in the gut

Co-enzyme in the production of DNA

Co-enzyme of myelin

Folate deficiency

Malnutrition

Alcohol abuse

Anemia required for RBCs DNA

# Hemoglobin structure

4 subunits

Protein (Globin)

Non protein (Heme)

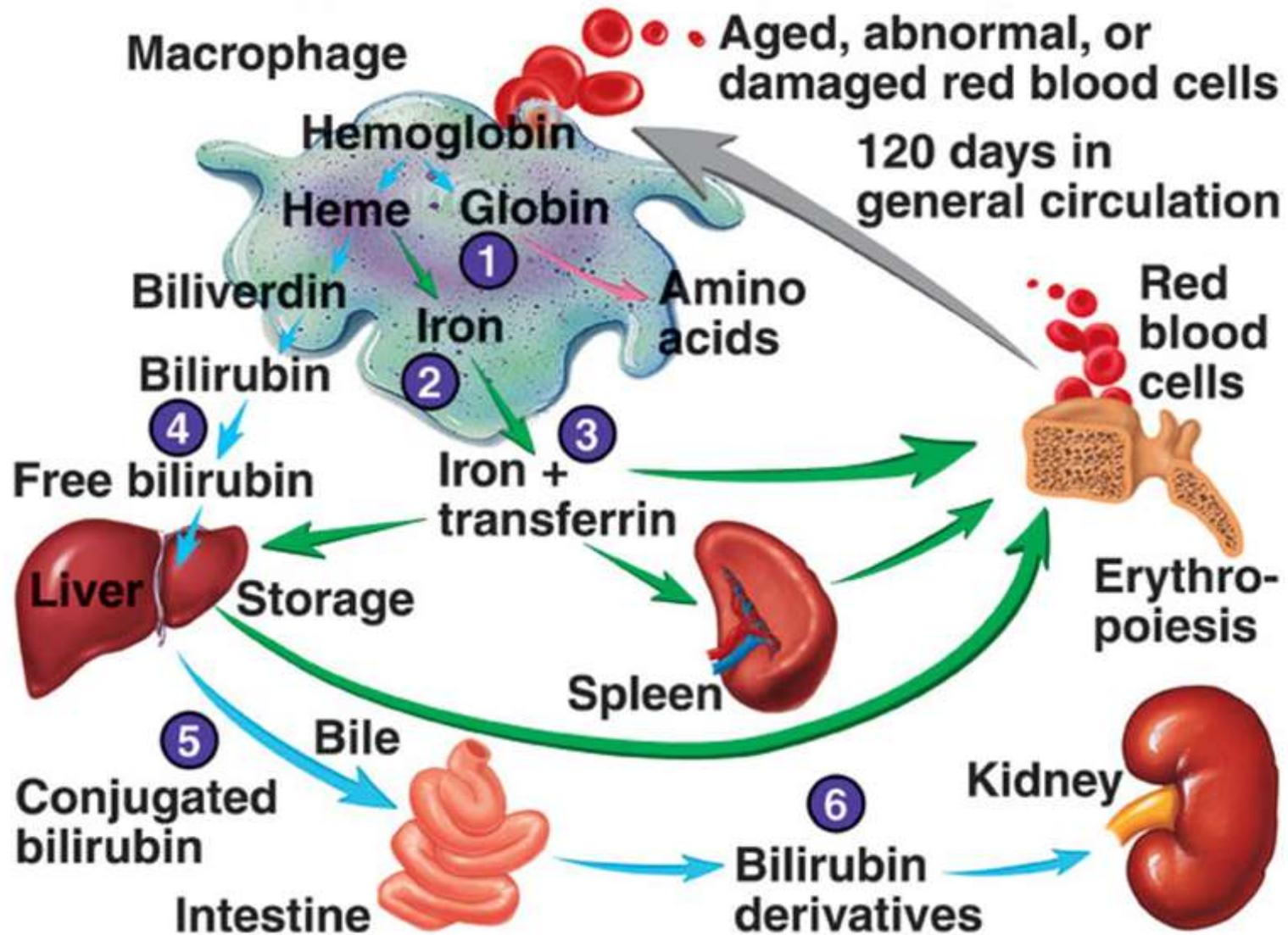
Iron

protoporphyrin

adult HbA 95%

Fetal Hb 1%

HbA2 1.5-3%





## Features of Hemolysis



Extravascular

BOTH

Intravascular

acute

- Reticulocytosis
- Hyperbilirubinemia (indirect)
- ↑ LDH
- ↓ haptoglobin

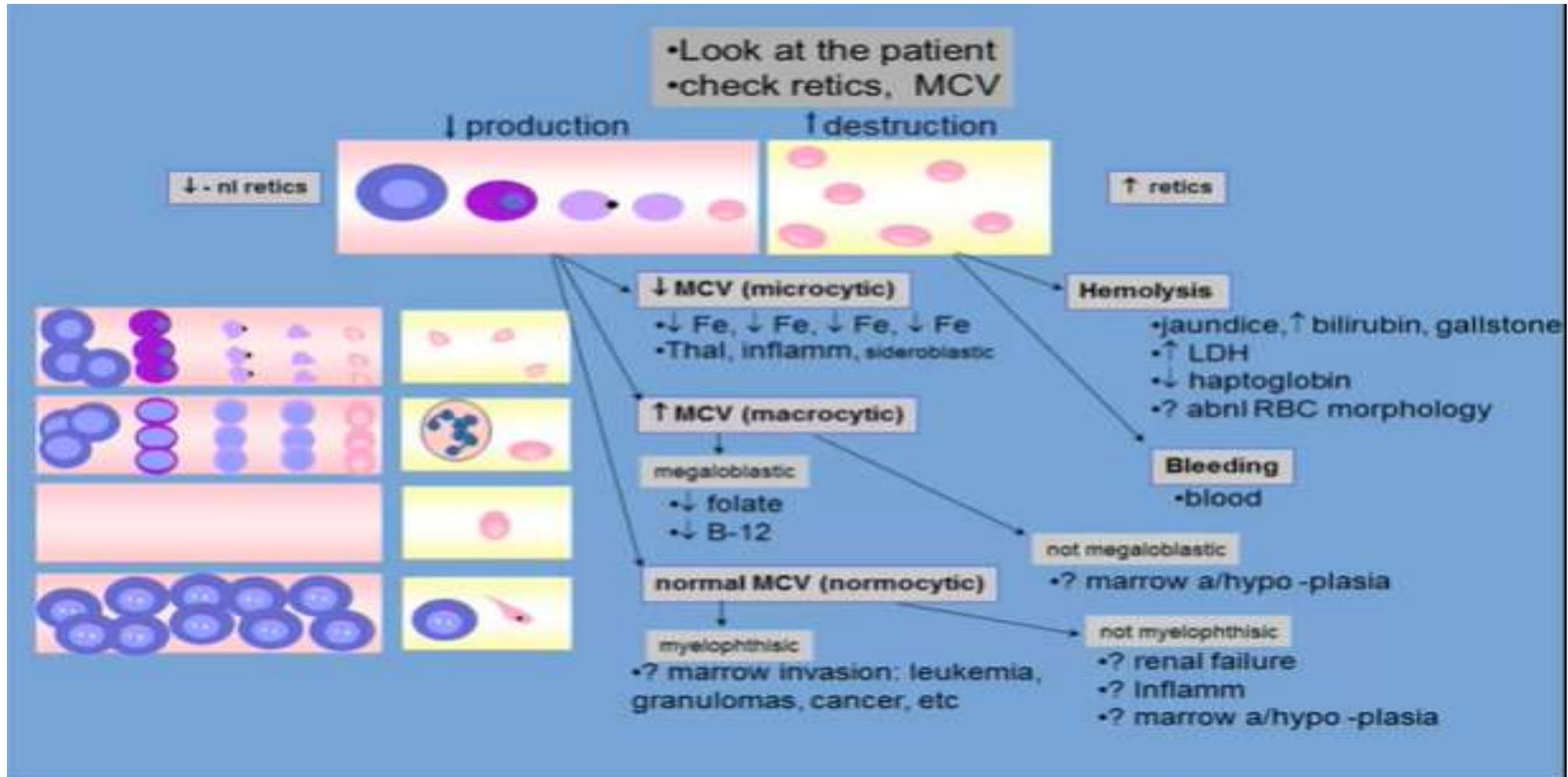
- Free hemoglobin in plasma
- Hemoglobinuria
- Hemosiderinuria

chronic

- BM erythroid hyperplasia
- ↑ folate requirement
- gall stones (bilirubin)

- Fe deficiency

# How to approach Differential diagnosis of anemia



65 yr old woman with fatigue, wt loss, and night sweats.

Test ordered	Result	Units	Ref range
Hemoglobin	6.8L	g/dL	13-18
Hematocrit	22L	%	37-55
Reticulocytes	0.3L	%	0.4-1.5
MCV	93	fL	78-93
Bilirubin, total	1.2	mg/dL	0.2-1.2
Bilirubin, dir.	0.1	mg/dL	0.1-0.3
LDH	230	U/L	100-230
Haptoglobin	200	mg/dL	30-200

5 Year old boy noted by his new pediatrician to be mildly icteric. Mom says: "he's got his father's coloring."

Test ordered	Result	Units	Ref range
Hemoglobin	11.5L	g/dL	13-18
Hematocrit	35L	%	37-55
Reticulocytes	5H	%	0.4-1.5
MCV	89	fL	78-93
Bilirubin, total	1.6H	mg/dL	0.2-1.2
Bilirubin, dir.	0.3	mg/dL	0.1-0.3
LDH	380H	U/L	100-230
Haptoglobin	10L	mg/dL	30-200