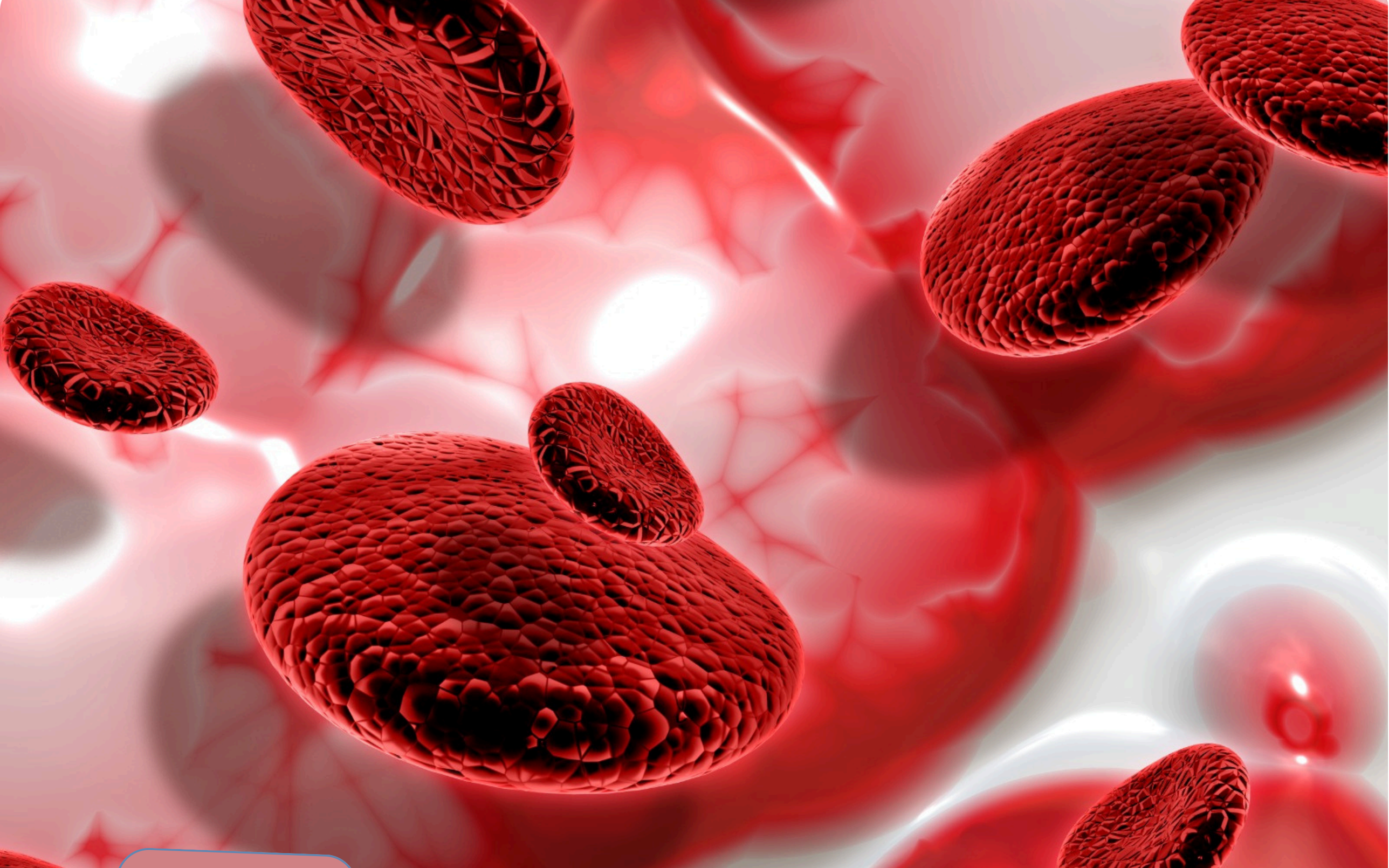

01

CHAPTER

BLOOD "II"

الدم

TOPICS

1. Anemia
2. Blood groups
3. BLOOD TRANSFUSION

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Anemia

Anemia is a decrease in number of RBCs, hemoglobin content or both. Anemia is considered when

RBCs count →
< 4.5 million in males.
< 3.9 million in females.

Hb content →
< 13.5 gm % in males.
< 11.5 gm % in females.

Blood indices

1 Mean corpuscular Hb (MCH) = amount of Hb in single RBC.

$$\frac{\text{Hb content X 10}}{\text{RBC count in million}}$$

- Normally, it is 25-32 picogram.
- Values less than 25 picogram are called hypochromic.

2 Mean corpuscular volume (MCV) = volume of single RBC.

$$\frac{\text{Hematocrit value X 10}}{\text{RBC count in million}}$$

- Normally, it is 80 -95 µ 3
- Values less than 80 are called microcytes and values more than 95 are called macrocytes.

Anemia is classified according to blood indices into

1-Normocytic normochromic anemia → i.e normal blood indices
2-Microcytic hypochromic anemia : → i.e lower blood indices
3-Macrocytic anemia : → i.e. higher blood indices.

1 Normocytic normochromic anemia

Causes :

a- Aplastic anemia: decrease RBC synthesis due to bone marrow inhibition by: antibiotic – malignant tumor – irradiation.
b- Hemolytic anemia: excessive hemolysis of RBC.
c- Acute blood loss: (Acute haemorrhage).

2 Microcytic hypochromic anemia

- Small RBC with low Hb content inside caused by iron deficiency.

Causes of iron deficiency anemia :-

a- Decrease dietary intake: → starvation as in children & pregnancy where there is increase in their needs.
b- Decrease iron absorption as in :
- Gastrectomy where HCl is absent
- Vitamin C deficiency
where they form insoluble salts with iron.
- Small intestine diseases
- increase phosphate & phytate

c- Chronic blood loss: as in piles, peptic ulcer & ankylostoma.

N.B. Tea decrease iron absorption because it contains tannic acid & theophylline

③ Macrocytic anemia

- Due to decrease vit B12 or folic acid → decrease DNA → decrease proliferation of erythroblasts → megalocytes which are macorcytes.

Causes :-

folic acid deficiency :
vit B12 deficiency :
Pernicious anemia :

- It is a familial disease of elderly & more common in women
- It is an autoimmune disease
- There is an immune reaction against gastric parietal cells leading to achlorhydia and absent intrinsic factor.
- There is degeneration of posterior and lateral column of spinal cord leading to neurological manifestations.

Treatment of anemia :-

1- In each type, try to treat the cause:

- In iron deficiency : give ferrous salts by mouth, in severe cases give iron by injection.
- In pernicious anemia: give B12 by injection through the whole life.
- Macrocytic anemia due to folic acid deficiency is treated by folic acid.

2- In severe cases, blood transfusion is needed.

Blood groups

ABO system

- The cell membrane of RBCs contains mucopolysaccharide substances called antigens.
  - Two types of antigens are known: A antigen & B antigen.

- People are classified into 4 groups according to antigen (agglutinogen) on RBC membrane; the plasma contains antibodies (agglutinins) against the absent antigen.

Group	A	B	AB	O
% of people	40	10	5	45
Antigen	A	B	A&B	------
Antibody	Anti-B	Anti-A	-------	Anti-A & Anti-B

- Blood group A : A antigen is present
- Blood group B : B antigen is present
- Blood group AB: A & B antigens are present
- Blood group O : Neither A nor B antigens are present.
- If an antigen is present in RBCs and the plasma contains its corresponding antibodies → agglutination → hemolysis.
- The antigens are called agglutinogen and the antibodies are called agglutinins.

Importance

① Medicolegal importance (Disputed Parenthood):

- Inheritance of blood groups is by 2 antigens from both father & mother The A & B antigens are dominant, while the O one is recessive.
- Blood group is a good negative test in disputed parenthood.

② Blood transfusion:

- In incompatible blood transfusion, the donor RBCs is agglutinated by recipient plasma, as the donor's plasma is diluted by the recipient blood.
- Group O is universal donor, because there is no agglutinogen.
- Group AB is universal recipient, because there is no agglutinin.
- Cross matching test: should be done before blood transfusion in which the recipient plasma is mixed with donor's RBCs, and recipient RBCs is mixed with donor plasma, If no agglutination → transfusion is done.

ImportanRh factor (D factor):

-It is a system composed of C, D, E antigens.
-It is first discovered in blood of Rhesus monkey.
-D is the most antigenic component.
-85 % of people are Rh positive i.e. have D antigen.
-15 % of people are Rh negative i.e. have no D antigen.
-Normally Rh + Ve & Rh – Ve have no anti-D
-Negative Rh persons forms anti D if antigen D is transformed to them.
-Positive Rh never form anti D, whether receives Rh +Ve or Rh -Ve

Importance:

① Erythroblastosis Foetalis

(Rhesus hemolytic disease of the newly born) The disease occurs if:
- An Rh negative female is married from an Rh positive male & she carries an Rh positive fetus.
- At delivery of this first baby (which will be born normal), little fetal blood leaks into maternal circulation.
- Mother will produce anti-D agglutinins (IgG)
- During next pregnancy, maternal agglutinins (IgG) cross the placenta causing fetal hemolysis leading to :

- Anemia of fetus
- Jaundice, increase bile pigments which cross the undeveloped blood brain barrier and deposit in basal ganglia (Kernicterus).
- The first baby is affected in case of maternal sensitization by:
  - Previous Rh + Ve blood transfusion
  - Fetal maternal hemorrhage during pregnancy.
- The disease can be prevented by:
  - Avoiding Rh + Ve blood transfusion to Rh – Ve females.
  - Anti-D antibodies are given to neutralize the Rh +Ve fetal cells and prevent maternal sensitization.

If baby is born alive, he would be treated by exchange transfusion with blood group O Rh negative.

No fetal complication regarding ABO system because ABO antibodies cannot cross the placenta (IgM).

② Repeated blood transfusion:

- If Rh – Ve persons is transfused with Rh +Ve blood, he will produce agglutinins against Rh factor.
- If this person is transfused (later on) with Rh +Ve blood, agglutination occurs.

Blood transfusion

Indications

1) To restore whole blood as in haemorrhage.
2) To restore one element: RBCs, WBCs & platelets.
3) Erythroblastosis foetalis.

Precautions

1) Compatible.
2) free from contamination.
3) High Hb content.
4) Free from disease.
5) Fresh i.e. less than 2 weeks storage.

Complications

1) Mechanical: air or fat embolism
2) Physiological: excess transfusion → overloading →heart failure.
- Pyrogenic reaction → fever.
3) Infective: infective hepatitis, malaria, AIDS.
4) Incompatibility: Transfusion with incompatible blood leads to clumping & hemolysis of given RBCs leading to:

① Blockage of blood capillaries

This occurs by clumping RBCs leading to →backache and joint pain.
Blocking of coronary vessels leads to → angina pain.

② Intravascular hemolysis leads to

1. Shock due to release of histamine and vasodilators-→drop of arterial blood pressure.
2. Liberation of K+ (hyperkalemia)→cardiac arrhythmia.
3. Liberation of Hemoglobin which:

- is broken to bilirubin leading to yellow coloration of skin and mucous membrane (jaundice).
- Leads to blockage of renal tubules as it is filtered by renal glomeruli →leading to renal failure.