

Blood

Note : we will talk about some lecture notes (but there are not enough to pass this chapter)

- The percentage of transport the HIV from Jordanian person to another is zero %
 - The blood tests show many communicable diseases , and these tests are mainly used in airport and other travel stations .
 - The HIV test in Jordan costs 15 J.D (not important info)
 - The number of " AIDs infections " until 2005 in Jordan (500 infections) mainly are foreign humans .
 - The number of AIDs infections in Vietnam in until 2005 (200,000 infections) .
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The Blood cells --- 1) RBC 2) Leukocytes (WBC) 3) Platelets

- note : we can easily get the specimen of blood from the body (blood is widespread) but the difficulty in studying this specimen)
- If we get specimen of blood and put it in tube (after a period) → RBCs will precipitate in the bottom of tube (45%) → above the RBCs , WBCs and platelets will precipitate and together make (white coat) 1% → the rest is plasma that forms 55% (yellow in color)
- Most of the blood is plasma , therefore this medium makes the structure of cell (circulated inside) .

Note : the amount of blood in human is (5-5.5 liter) and up to 6 liter in grand people.

- The amount of blood in male is greater than in female because the body mass in male is greater (proportional relationship)
- The plasma elements consists of (thrombocytes – leucocytes – erythrocytes) and other components such as hormones (and we will focus on albumin : that responsible of maintaining of osmotic pressure)
- Remember that the filtration and absorption in the capillary (filtration takes place in the arterial part of the capillary and absorption in the venous part of the capillary) And the control of the (filtration and absorption process) is result of the differences between Hydrostatic pressure and Osmotic pressure .
- The albumin is responsible on the osmotic pressure (Dr. did not the direct function)
- The patients that suffer from (decreasing of albumin level in blood = Hypoalbuminemia) → they will suffer from Edema (the accumulations of fluids in extra cellular spaces)
- The Globulin (The immune system depends on the Globulin group) because there are very important in the clotting case in any part of the body after injures or surgeries .

- we will study several inorganic salts in blood but the most important is Na (it is responsible in hypostatic pressure → because the water will be directed in the same Na direction in the body)

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- the presence of inorganic salts is important (in the hospitals when the Drs give the patients any fluid , it should contain inorganic salts " the osmolarity = 0.9% of inorganic salts in this fluid " → therefore this fluid will be isotonic with plasma .

but if the osmolarity of inorganic salts increases (greater than 0.9% in the fluid) → the fluid will pull the water from the interstitial spaces to the circulatory ((hyper-osmotic fluid)) .

- this hypertonic solutions will be given in the Diarrhea → therefore the fluids in circulations will increase → the filtration from the kidney will increase → the amount of urine will increase (these cases are called osmotic diarrhea)

Note : we should know that any substance is transported from any side of the body to another side , it should pass through the blood circulation (many hormones or proteins in general or any substances that transport from any side of the body to another side play an important role in the blood functions) .

The RBC structure

When we study the RBC , we will see the deeper part in the centre ((AS IF)) the plasma membrane on the upper surface of the cell approaches the plasma membrane on the lower surface , and on the margin they are widespread from each other this provides large surface area relative to the volume therefore increasing the ability of RBC to contain more and more amounts of hemoglobin that is very essential for oxygen transport .

-The distance between the upper membrane and the lower membrane at the central part of the RBC is 0.8 micron But at the peripheral aspect is between 2.6 – 2.8 micron .

- The diameter of RBC is 7.5 micron in general (ranges between 7 to 8 micron) but we should know that the RBC has a flexibility to fit the diameter of capillary (3 micron) when it passes this capillary (means the flexibility of RBC is very important when we talk about the circulation system)

- we should know that the flexibility decreases in old RBCs (old means : from ninetieth day) .

Q : What is the mechanism to get rid of old RBCs ?

the heart pumps 70 cc per pulse (the capacity of left ventricle) and the heart pumps 70 times per minute (in general) → $70 * 70 = 4900$ cc → means : per minute (5 liter)

per hour (300 liter)

per day (7200 liter)

→ means the blood will transport and circulate in all tissues in the body except the tissues that are avascular (epithelium or cartilage) .

Now during the passage of RBCs in the organs such as spleen (here we will find two types of circulation :

1) closed circulation : consists of (artery – capillary – vein) simply the RBC enters from the artery to capillary to the vein then continues the circulation to the liver .

2) opened circulation : the RBCs in the artery transport directly in the stroma of the spleen then they will pass throughout reticular network (inside the spleen) then go to vein then circulation (To the liver)

- But the old RBCs that cannot enter the reticular network (in this area , there are macrophages) , these macrophages get rid of old RBCs and take out hemosiderin (iron-storage complex) to the vein in the spleen or to the bone marrow to reuse to produce new RBCs .

- when the RBCs enter the liver (remember the liver consists of hepatocytes row the capillary then hepatocytes row then capillary and so on .

in the capillary there are kupffer cells (macrophages) and these kupffer cells have processes , these processes help these cells to attach to the endothelial cells (as a result : stabilization the kupffer cells in the capillary) → in this case the kupffer cells will narrow the capillary , when the RBCs enter the capillary , the flexible RBCs can pass , but the inflexible RBCs cannot pass in the capillary) .

Note : any anatomical application said in the lecture about the opened circulation is excluded because we must study histological info not all the medical info in medical world in each subject .

The first organ that the RBCs formed in it (is the spleen) but during the embryonic life the RBCs are formed in the liver (not it continues in the spleen), and in adults they are rarely formed in the liver (they are formed in the Bone marrow that is called in this case red marrow , and when it loses the ability to produce the RBCs , it will be called yellow marrow .

- The yellow marrow is more spread in the body (in the emergency cases the yellow marrow will be changed to red marrow to produce RBCs (means the stem cells of the RBCs are found in the yellow marrow)

- We should know that when taking the specimens of blood (it will be taken from the iliac crest – sternum or other areas (because these areas are rich of red marrow) .

- The areas that produce the RBCs – bone marrow - are fixed (in the adults → therefore the adults do not have anemia , means we do not need more and more RBCs and this reason that the bone marrow in adults is yellow marrow (not active)

-In the adults we will find 4 to 6 million RBCs (in female and male is same) But in the female

maybe we will find the number of RBCs is less than in male because the female loses amounts of blood in menstrual cycle and she needs a period to compensate these amounts .

- The plasma membrane of RBCs contains lipids – proteins (integral and peripheral) and carbohydrates .

- Inside the cytoplasm of these cells there are " enzymes for glucose metabolism " and these enzymes are used in accumulation sugar test (we can determine the amount of RBCs in the last 120 days " in the last cycle of RBCs life " and determine the level of sugars in the blood → therefore we will determine the disorders of diabetes if it is present in the blood .

- If hemoglobin combines with oxygen (Oxy-hemoglobin) and if hemoglobin combines with CO₂ it will form (carbamino-hemoglobin) and the affinity of hemoglobin to CO₂ is more than O₂ , means the percentage of formation (carbamino-hemoglobin) is more when the human inhales the air .

- Carbon monoxide when it combines with hemoglobin , it will form (carbamino-hemoglobin) that is an irreversible compound , means when we give the patients many amounts of Oxygen , we cannot get rid of carbon monoxide (because we cannot reverse the reaction to last state) .

- RBCs (in pre-mature state , when they are released in the capillaries) do not have any organelles (nucleus or other components) , but sometimes have RNA particles in peripheral positions and therefore they give a reticular appearance (and this case is called Reticulocytosis and these cells are called reticulocytes → and the reticulocyte after 4-5 days if we check it , we will find RNA particles in it degenerated (means the RBC complete the maturity in the circulation) .

- If the amount of reticulocytosis is greater than 1% --> indicating increase in peripheral RNA or the bone marrow starts to decrease more amounts of RBCs .

The WBCs (leukocytes)

- According to the types of granules in the cytoplasm , the WBCs are classified into :

1) Granulocytes : possess specific and azurophilic granules (neutrophils – eosinophils and basophils)

2) Agranulocytes : possess azurophilic granules (monocytes and lymphocytes)

- The most spread of WBCs in the blood is neutrophils (60 -70 %) , that indicates when the patient suffers from Leukocytosis (high increasing in the amount of WBCs in the blood) indicates increasing the number of neutrophils .

- The arrangement of WBCs according to their number in the blood

neutrophils is the greatest amount , then the lymphocytes then monocytes , eosinophils then basophils) .

- The neutrophils : their nucleus is multi-lobed (3-5 lobes) , and sometimes we find the x-chromatin suspended in the peripheral lobe (these inactive x-chromatin indicates that cells belong to the female but no presence of x-chromatin not surely mean the cells belong to male , it means the cells maybe belong to male or female) .

the specific and azurophilic granules of neutrophils (specific granules secrete alkaline phosphates , but the azurophilic granules secrete the acid phosphates) .

and the specific and azurophilic (non-specific) granules secrete collagenase , and the azurophilic granules secrete elastase → and these enzymes degenerate the certain fibers inside the ECM around the cells to make the mobility more and more easy .

The three lobes in these cells are not same (multi-lobes but not same) .

- The eosinophils : 2-4% in the body (and they increase in the allergic states , or in children when they eat polluted food)

في حالة الأطعمة الملوثة التي تؤدي إلى إصابة الأمعاء بالدود ويحدث نزيف يظهر في فتحة الشرج ويؤدي ذلك إلى ارتفاع ملحوظ في نسبة هذا النوع من خلايا الدم البيضاء في الدم لكي تهاجم هذا الدود .

they contain specific granules (they appear a lot of changes in color under the EM , light then dark then light area) .

The dark area is called enternum , and the light area surrounded it , called externum – The enternum contains major basic protein (the most important secretory products of eosinophils) , they attack the worms especially in the anus and therefore taking place the bleeding .

- these cells are similar to mast cells : even when they are near the circulation , the secretory products of these cells will affect on the blood vessels (the heparin affects on the blood inside the vessels , and the histamine affects externally)

- The basophils (they are same to the mast cells and same to the eosinophils , same secretory products , same morphological structures , but they are different in the embryonic origins) they secrete eosinophilic and basophilic chemotactic factors , and they are very small amount in the blood (the least amount in comparison with other types of WBCs) .

- Their granules are metachromatic because the presence of GAGs that contains heparin .

Note : when Dr talked about the Lymphocytes , monocytes and the platelets (he mentioned many info related to the immune system "chapter 14 " and we know that this chapter is excluded , because that we will focus in these subjects in the info related to included info " malgaat wallah "

- The lymphocytes (the main cells in the immune system) : spherical nuclei – they are the smallest leukocytes and are abundant , they are subdivided into T-lymphocytes and B-

lymphocytes and natural killer NK cells .

these cells play a main roles in the immune system against invading microorganisms and abnormal cells .

Their diameter 9 to 18 micron , but in general their diameters are similar to RBCs diameter.

The cytoplasm is basophilic and contains a few non-specific granules .

They contain highly condensed chromatin .

-The monocytes : are the cells of MPS in C.T , and they play an important role in the defenses against the foreign microorganisms .

- The diameter is 12-15 micron , and the nucleus is C-shaped (zay habet el fa9olia) , the chromatin is less condensed , and the cytoplasm is basophilic .

-The palates : or thrombocytes : they are non-nucleated particles , 2-4 micron in diameter , they are originated by separation from the ends of cytoplasmic processes extending from giant polyploid bone marrow cells called megakaryocytes .

the main function of palates promotes the blood clotting and help repair tears .

- The platelet is discoid (O-shaped) with a lighter peripheral zone (Hyalomere) and a darker central zone containing granules called (Granulomere) .

- In the ultra-structural study of the palate , we will see the marginal bundle (microtubules and microfilaments) that play an important role in the maintain of the platelets shape .