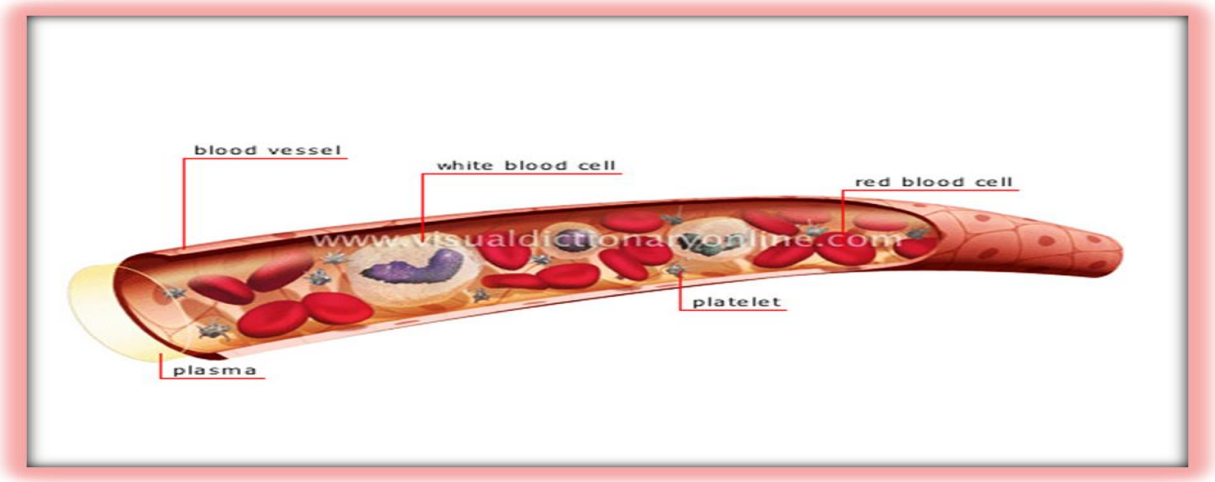
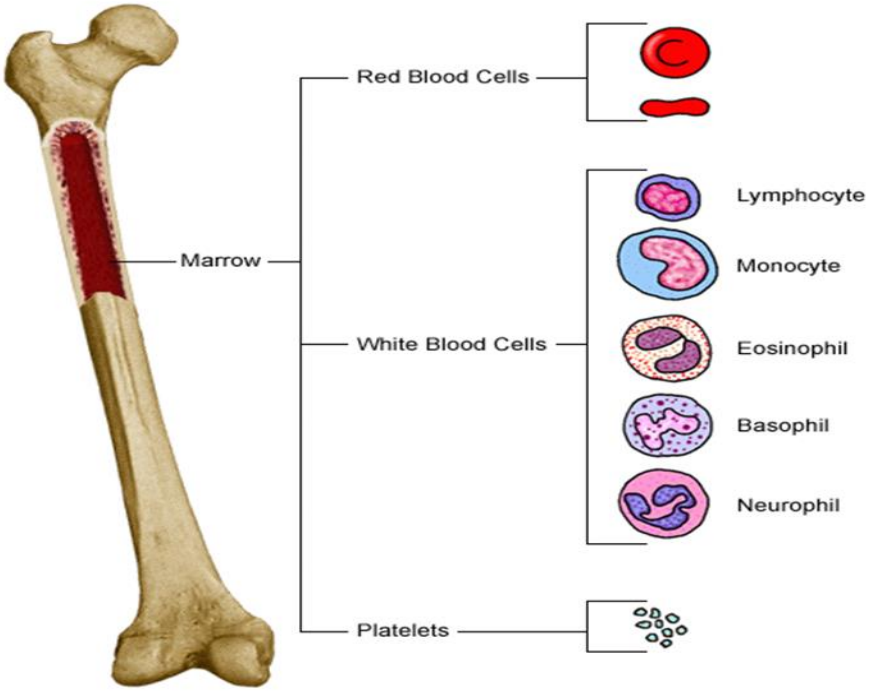


Blood: is specific connective tissue, there are general functions of blood are transportation(Materials transported by the blood include nutrients, waste products, gases, and hormones is provided by red blood cells), regulation(The blood helps regulate acid–base balance and the body temperature is provided by platelets) and protection (Protection against pathogens is provided by white blood cells).

BLOOD CELLS

There are three kinds of blood cells: red blood cells, white blood cells, and platelets. Blood cells are produced from stem cells in bone marrow.



Packed Cell Volume(PCV) or Hematocrit (HCT) Value

P.C.V. :- Is the volume of red blood cells in whole blood , or determination of the ratio of the red cell column length in blood.

A hematocrit test is part of a complete blood count (CBC) or complete blood picture(CBP) . Hematocrit is defined as the volume occupied by erythrocytes in a given volume of blood or is the volume percentage (%) of red blood cells in blood.

The hematocrit may also be referred to as Packed Cell Volume (PCV) The P.C.V. Is also used in conjugation with the Hb concentration to calculate the mean corpuscular Hb concentration when a tube of blood is centrifuged, the erythrocytes pack into the bottom part of the tube with the plasma on top. The white cells and platelets are found in a thin area, (the Buffy layer), above the column of red cells.

Factors that effect on P.C.V

P.C.V. increased either because pathological or physiological factors

pathological factor

1-polycythemia

2-dehydration

3-Acute burns

4-Heart diseases

5-Lung diseases

physiological factors

with persons that live in high regions

P.C.V. decreased either because pathological or physiological factors

pathological factors

1-acute anemia

2-some liver and spleen diseases

3-kidney diseases

4-Leukemia

5-hemorrhage

physiological factors

pregnancy

Normal value

Newborn / 55-65%

Infant/child / 30-40%

In adult men / 45-55%

In adult women / 40- 50%

Methods

1-Microhaematocrit. It requires less blood and also less time to determine a haematocrit

2-Electronic Cell Counting by CBC system

Microhaematocrit Method

Material and Instruments

1-Microhaematocrit tube 75 mm in length and 1mm in diameter which contain heparin and show a red ring at the end of the tube

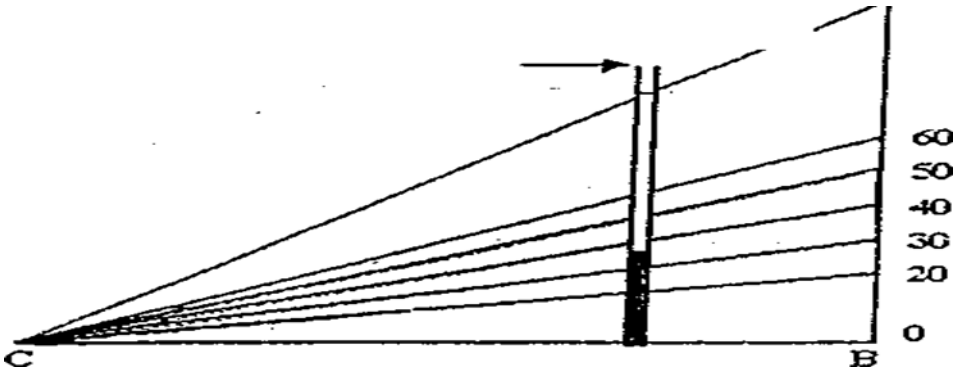
2-Microhaematocrit centrifuge capable of producing a relative centrifugal .force of 10000 to I5000g

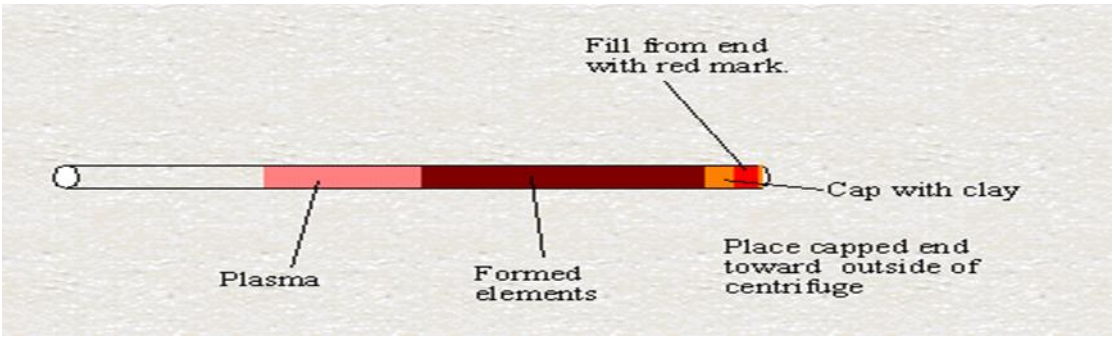
3-Plastic seal or Bunsen burner flame to seal one end of microhaematocrit tube

4-(microhaematocritrit reader (Fig.)

5-Lancet

6-Cotton





Procedure

1-Fill two capillary tubes approximately three quarters full with blood anti-coagulated with EDTA or heparin. Alternatively, blood for heparinized capillary tubes may be collected by capillary puncture. Wipe any excess blood from the outside of the tube.

2-Seal the end of the tube with the colored ring with nonabsorbent clay.

3-Balance the tubes in the centrifuge with the clay ends facing the outside away from the center, touching the rubber gasket.

4-Tighten the head cover on the centrifuge and close the top. Activate the centrifuge for 5 minutes between 10,000 and 15,000 rpm . Do not use the brake to stop the centrifuge.

5-After that a centrifuge hematocrit tube you can see three distinct layers , a top layer of clear slightly milky plasma , a thin Buffy coat layer consisting of WBC and platelets and a dark packed of RBC layer.

6-Determine the HCT by using a microhematocrit reading device Read the level of RBC packing; do not include the buffy coat (leukocytes and platelets when reading).

Red blood cells count (RBCs count)

This test is one of medical tests that help in identification many of diseases

Erythrocytosis: is increased in red cell count over normal range, this case occur either to pathological causes or physiological causes, pathological causes are increase in erythropoietin protein and Polycythemia, while physiological causes are age, sex,Nutrition and high regions.

Erythropenia: is decreased in red cell count below normal range, this case occur to pathological causes are decrease in erythropoietin protein, anemia, Hemorrhage, Leukemia, Cardiac failure and Dehydration, while physiological causes are pregnancy.

Sites production of red blood cells

1-yolk sac: during third week of pregnancy

2-liver: during fourth week of pregnancy

3-placenta: during fifth and sixth week of pregnancy

4-bone marrow: during last three weeks of pregnancy until adult

5-kidney: during failure in bone marrow function, kidney produce erythropoietin protein responsible for production of new red blood cells

Structure of red blood cells

1-membrane

A-50% protein

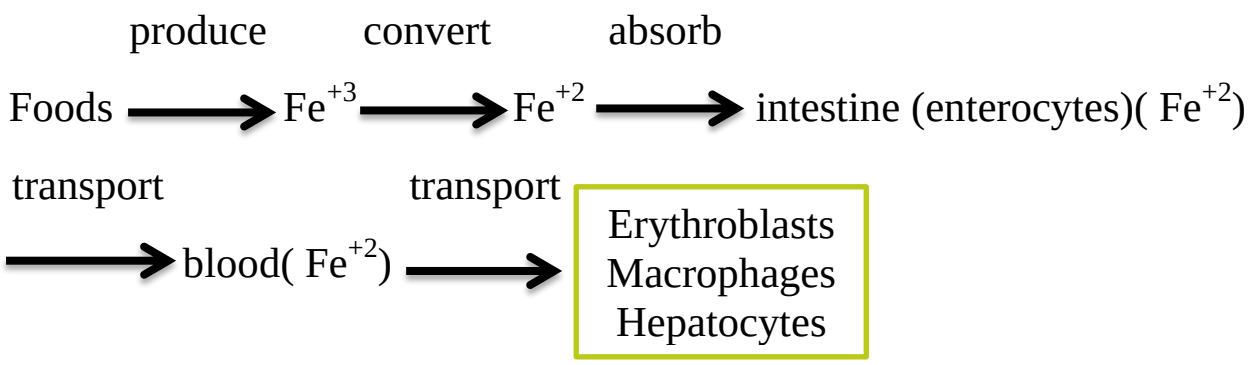
B-40% lipids

C-10% carbohydrates

D-bilayer of phospholipids

2-cytoplasm

Contain on hemoglobin consist of two parts are globin protein and heam (iron Fe^{+2})



Stages of red blood cells maturation

1-pronornoblast

2-basophilicnormoblast

3-polychromatophilicnormoblast

4-orthochromicnormoblast

5-reticulocytes

6-mature red blood cells

Changes in red blood cells during maturation

1-reduces size of cell

2-reduces ratio of nucleus: cytoplasm

3-nuclear chromatin becomes more condensed

4-cytoplasm color is altered and becomes more prominent

Materials & Apparatus

1- Haemocytometer: include

A- Red blood cells pipette is tube graduated (0.5, 1, 101)

B- Neubauer's chamber consist of five large squares located in center of chamber inside each large square present 16 small square

2- Isotonic diluting solution called Hayem's solution consist of

1- Mercuric chloride (0.5 gm)

2-Sodium chloride (1 gm)

3-Sodium Sulphate(5 gm)

4-Distilled water (200ml)

3-Microscope and lancet

Method

1-clean of chamber slide

2-puncture of finger by lancet and aspiration of blood by Red blood cells pipette until 0.5

3-clean of pipette tip from outside and put in isotonic diluting solution and fill until 101 and them close pipette by fold of rubber part of pipette and put in horizontal shape and mixture of blood with isotonic diluting solution for 3 minute

4-put of Cover Slide on chamber

5-leave of first drops of solution and put of pipette tip in angle 45^{o} at cover tip to allow drop to down under cover

6-examined of slide under low lens then high lens and calculated of red cells in five squares and selection of square four in angles and one square in medium

Other procedure

Take of 10 microliter of blood and add it to 2 ml of Hayem's solution in

Plastic tube and leave 5 minute then by blue capillary tube transport of sample from plastic tube into slide chamber and make same of former steps

R.B.C count =NX 10000

N=numbers of R.B.C. in five squares

Normal value

Female: 4-5 million/mm3 of blood

Male: 5-6 million/mm3 of blood

Calculations

No. of small squares= 16*5= 80

Depth of each small square= 0.1

Area of each small square= 0.0025

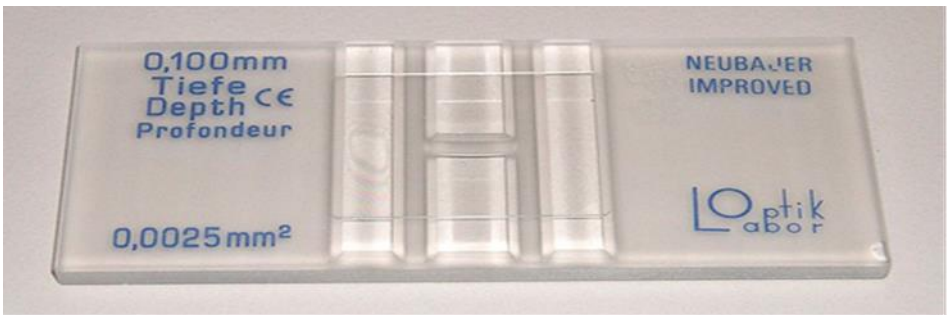
$$\text{Total number of RBCs} = \text{No. of cells in 5 square} * \frac{\text{Dilution factor}}{\text{Volume factor}}$$

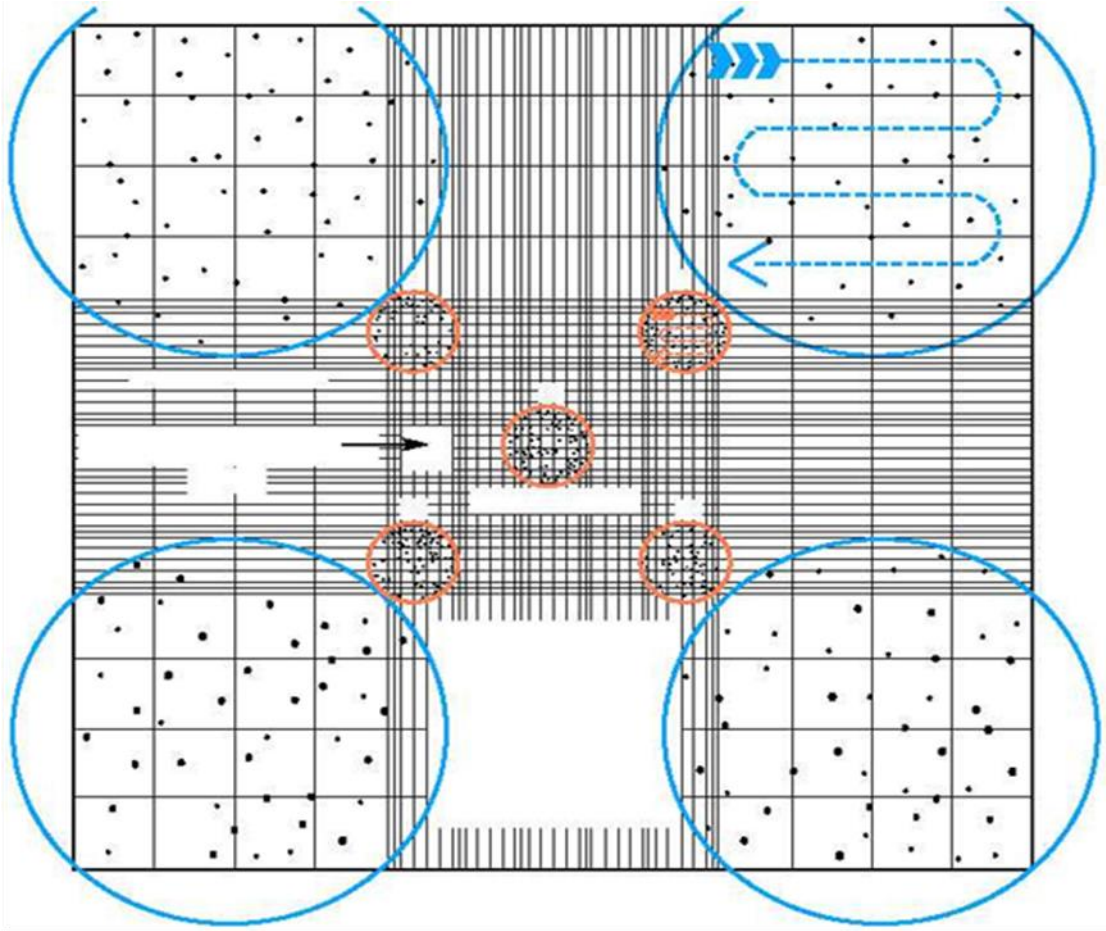
$$\text{Dilution factor} = \frac{\text{Solution volume}}{\text{Blood volume}} = \frac{2\text{ml}(2000\mu\text{L})}{10\ \mu\text{L}} = 200$$

Volume factor=area of each small square*depth of each small square*No. of each small square

= 0.0025*0.1*80= 0.02

$$\text{Total number of RBCs} = N * \frac{200}{0.02} = N*10000$$





Erythrocytes Sedimentation Rate (ESR)

ESR is distance in which red blood cells fall after a specific time period (1hour) away about plasma under effect of gravity, ESR is depend on concentration of proteins present in plasma such as fibrinogen, albumin and globulin and considered of ESR important in identification of some pathological cases such as anemia, rheumatism and inflammations in human body and there are five signs of inflammation are high temperature, redness, tumor, pain and loss of function to inflammatory organ.

Principle of ESR

At occur inflammation in the body occur increased in proteins secreted from liver in the blood, surface red blood cells carry negative charge therefore red blood cells are disharmony among them, but at secretion of proteins in blood that carry positive charge occur equivalent in charge between red blood cells and proteins therefore red blood cells gather together and occur sedimentation of red blood cells.

E.S.R. Increased in:

1-Chronic conditions such as Rheumatoid Arthritis and Tuberculosis

2-Acute and chronic infections

3-Malignant diseases such as Myeloma

4- normal conditions like pregnancy and elderly people

E.S.R .decreased in:

1-Polycythemia

2- heart failure

(**Westergren Method**)

Material and Instruments

1-Westergren pipette is a straight glass 30 cm in length and 2.55 mm diameter. It is graduated and open at both ends. The graduation is from zero to 150 mm

2-Westergren pipette rack. All racks should be equipped with level screws and a spirt level

3-EDTA tube contain anticoagulant

4-Whole blood, 3 mL

Procedure

1-Put blood sampe in EDTA tube contain anticoagulant and Mix the tube for 2 minutes.

2-Fill the Westergren pipette to exactly the 0 mark, making certain that there are no air bubbles in the blood by enter of Westergren glass in EDTA tube

3-Place the tube exactly vertical and leave undisturbed for 1 hour.

4-At the end of 1 hour, read the number of millimeters the RBC's have fallen (i.e. the height of the clear plasma above the upper limit of the column of the sediment cells)

5-The result is the ESR in mm / 1 hour

Normal value

In adult men 0-10 mm / 1 hour

In adult women 0-15 mm / 1 hour

C- reactive protein (CPR)

C- reactive protein (CRP) is protein present in patients serum that infects by pneumonia, this examination use to measure amount of protein called c-reactive protein, this protein secreted by liver cells in acute infection only.

properties of CRP

1- is abnormal protein present in patients serum that infects by acute cases to different diseases and don't present in healthy person serum

2-protein is thermolabile

3-protein don't pass during placenta

4-protein is increase after infection and it reach high level after 14-16 hour from occur disease and hidden after recovery from disease

C- reactive protein is increased in the following cases:

1- Bacterial infection

2-Acute Rheumatoid fever

3- Rheumatoid Arthritis

4-Acute myocardial infarction

5- cancer diseases

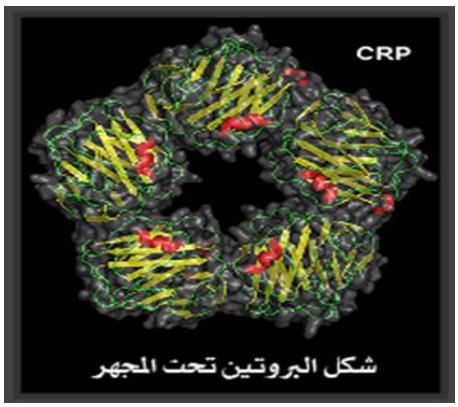
6- lung diseases

7- Tuberculosis disease

Principle of test:

C- reactive protein is antigen present in serum of patient and add antibodies to serum (anti-CRP)

anti-CRP (Ab) +CRP (Ag) in the serum of patients



Procedure

1-take 1 ml fresh blood or red capillary tube

2-centerfuge of blood

3-put drop of serum on slide and put 2 drop from the kit of CRP on serum, mixture of serum with kit by stick if appear agglutination is positive and if don’t appear agglutination is negative

Hemoglobin Concentration Analysis

Hemoglobin:-Is the most important pigment present in the blood and imparting red color to it, each red blood cell contains approximately 300million hemoglobin molecules, each of which can bond to four oxygen molecules, the main function of Hb is oxygen carrying from lungs to the body tissues and the Co_2 transport from body tissue to the lungs.

Types of normal hemoglobin in the blood:

1-Hemoglobin A: forms 96-98% of hemoglobin

2-Hemoglobin A2:forms 1,5-2% of hemoglobin

3- Hemoglobin F: forms high percent in fetal hemoglobin and called fetal hemoglobin

Types of abnormal hemoglobin in the blood

There are Types of abnormal hemoglobin in the blood are hemoglobin(C , J , E, HbS , H , D) which produced by genetic disease

Methods calculate of hemoglobin concentration

1-Electronic cell count: by CBC system and called complete blood count (CBC).

2-HB concentration can be determine by P.C.V value as the following:

HB=P.C.V-3/3 or HB=P.C.V/3-1

Normal Values

Adult male 14 – 16 gm

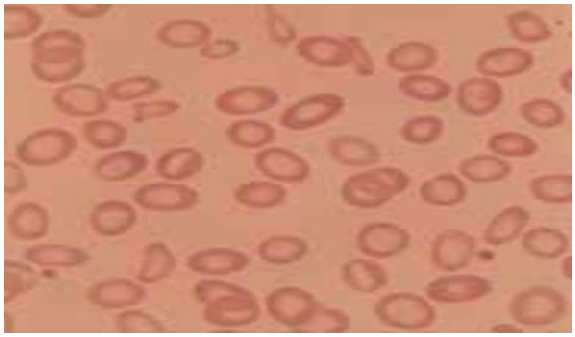
Adult female 12 – 14 gm

New born 18 – 20gm

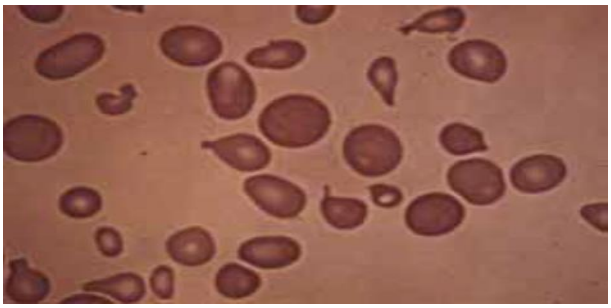
This test detects the anemia disease which have symptoms as dizziness , headache , hypotension and hair falling. This disease followed by nutrition instructions.

There are many different types of anemia

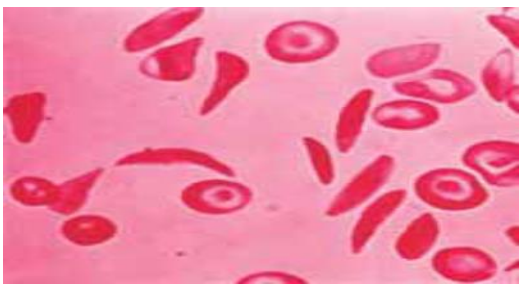
1-Iron deficiency anemia: is caused by a lack of dietary iron . A person with this type of anemia may have a normal RBC count and a normal hematocrit, but the hemoglobin level will be below normal.



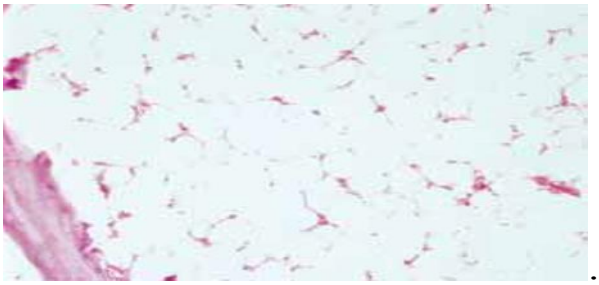
2-Pernicious anemia: is caused by deficiency of vitamin B12, in which the RBCs are large and fragile.



3-Sickle anemia: It is a genetic disorder of hemoglobin, which causes conversion of RBCs from circle shape to sickle shape , clog capillaries, and rupture



4-Aplastic anemia: disorder that may be caused by exposure to radiation, - certain chemicals such as benzene, plastic anemia is causes inhibition of the red bone marrow function, with decreased production of RBCs, WBCs, and platelets.



5-Hemolytic anemia is any disorder that causes rupture of RBCs before the - end of their normal life span.

Blood Group and Rhesus Factors

Blood Group

Red blood cells membranes in human contain different types of antigens while plasma contain on antibodies

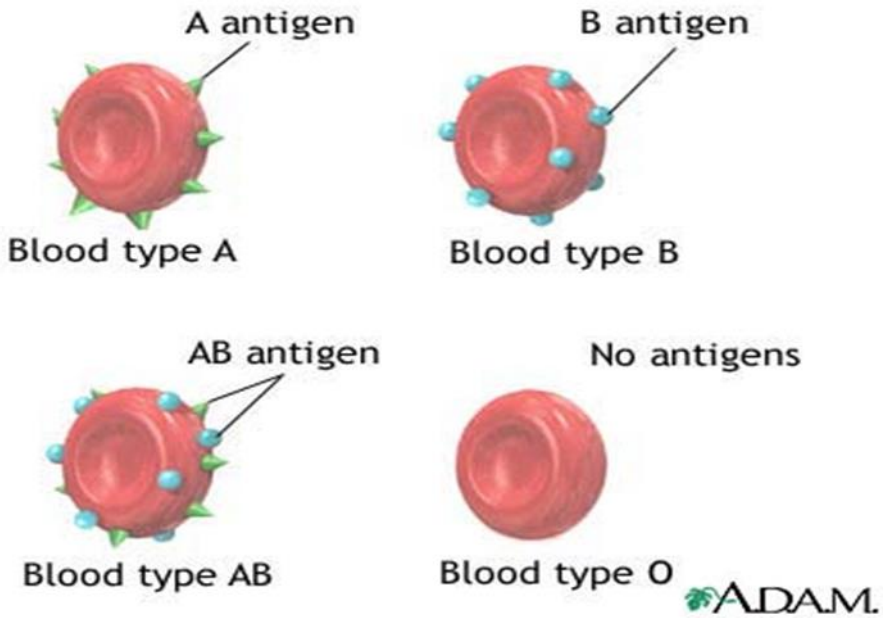
There are four of blood groups are (A, B, O, AB), as the following:

1-A blood group: in which the persons that have A antigen in red blood cell membranes and they have b antibody in plasma and forms about 42%.

2-B blood group: in which the persons that have B antigen in red blood cell membranes and they have a antibody in plasma and forms about 9%.

3- AB blood group: the persons that have A, B antigen in red blood cell membranes and they don't have antibody in plasma and forms about 3%.

4-O blood group: the persons that don't have A, B antigen in red blood cell membranes and they have a,b antibody in plasma and forms about 46%.



Blood group	Antigens in red blood cell	Antibodies in plasma
A	A	b
B	B	a
AB	AB	————
O	————	a , b

Notes:

1-A^+ blood group donates both A^+ , AB^+ blood groups and recipient blood from A^+, A^-, O^+, O^- blood groups

2-A^- blood group donates both A^+, A^- blood groups and AB^+, AB^- blood groups and recipient blood from, A^-, O^- blood groups

3-B^+ blood group donates both B^+ , AB^+ blood groups and recipient blood from B^+, B^-, O^+, O^- blood groups

4- B^- blood group donates both B^+, B^- blood groups and AB^+, AB^- blood groups and recipient blood from B^-, O^- blood groups

5- AB^+ blood group donates AB^+ blood group only and recipient blood from A^+, A^-, B^+, B^-, AB^+, AB^-, O^+, O^- blood groups

6- AB^- blood group donates both AB^+, AB^- blood groups and recipient blood from A^-, B^-, AB^-, O^- blood groups

7- O^+ blood group donates A^+ , B^+ , AB^+ , O^+ blood groups and recipient blood from O^+, O^- blood groups

8- O^- blood group donates both A^+ , B^+ , AB^+ , O^+ blood groups and A^- , B^-, AB^-, O^- blood groups and recipient blood from O^- blood group only

Blood group	Donate blood to	Recipient blood from
A^+	A^+ , AB^+	A^+, A^-, O^+, O^-
A^-	A^+, A^-, AB^+, AB^-	A^-, O^-
B^+	B^+ , AB^+	B^+, B^-, O^+, O^-
B^-	B^+, B^- , AB^+, AB^-	B^-, O^-
AB^+	AB^+	A^+, A^-, B^+, B^-, AB^+, AB^- , O^+, O^-
AB^-	AB^+, AB^-	A^-, B^-, AB^-, O^-
O^+	A^+ , B^+ , AB^+ , O^+	O^+, O^-
O^-	A^+, A^-, B^+, B^-, AB^+, AB^- , O^+, O^-	O^-

RH(father)	RH(mother)	RH(fetus)	New born condition
RH^+	RH^+	RH^+	normal
RH^-	RH^-	RH^-	normal
RH^-	RH^+	RH^- or RH^+	Normal
RH^+	RH^-	RH^+ →	Abnormal Anti-RH (Gamma Globulin)
		or RH^- →	normal

Gamma globulin : is muscular injection that give after first delivery directly and that stop production of antibodies in mother blood

Effect of RH different between fetus and mother on second fetus

The first fetus is normal at first delivery passes blood from fetus to mother at cut of umbilical cord the blood mother sensitive for antigens in blood fetus because of different of RH and blood mother lead to production large amounts of antibodies against antigens for fetus and therefore antibodies in blood mother become sensitive to any antigens enter into blood mother in future therefore at onset second pregnancy antibodies in blood mother attack antigens in blood fetus and lead to hemolysis of red blood cells for fetus and causes congenital disorders and finally death of fetus therefor must be inject anti-RH(Gamma globulin) into mother after first delivery directly that lead to stop production of antibodies in mother blood

Blood agglutination:

Is adhered of red blood cells together when mixed non compatibility blood together, blood agglutination is considered danger phenomena in blood transfusion among persons and blood agglutination can be divided into two major types :

1- **Isoagglutination**: is agglutination that occur between two individual blood belong to same type such as (human blood with other human blood).

2- **Hetero agglutination**: is agglutination that occur between two individual blood belong to two different types such as (human blood with animal blood).

Rh factor:

Is antigen present on red blood cell surfaces and it differ about blood group antigens, about 85% of individuals contain their red blood cells on this antigen therefore called Rh^+ and about 15% of individuals don't contain their red blood cells on this antigen therefore called Rh^-, in the case of blood transfusion among persons must be detect both of blood group and RH factor to donor and recipient person, RH factor detect by D antigen as the following:

If occur agglutination in D antigen called Rh+ and don't occur agglutination in D antigen called Rh-

Material and Instruments

1-Anti-A

1-Anti-B

3-Anti-D

4-Slide

5-Microscope

6-sticks for mixing

7-Lancet

Method

1-the finger is sterile and it puncture by lancet, then take three drops of blood and put on slide.

2-put drop of A antigen on first blood drop and drop of B antigen on second blood drop and drop of D antigen on third blood drop.

3-mixture both two drops together by sticks and leave it for period of time.

4-Read the result as following:

1-if occur agglutination on first blood drop and A antigen is A blood group.

2- if occur agglutination on second blood drop and B antigen is B blood group.

3- if occur agglutination on both first and second blood drop and both A and B antigen is AB blood group.

4- if don't occur agglutination on both first and second blood drop and both .A and B antigen is O blood group

5- if occur agglutination on third blood drop and D antigen is Rh+ and if don't occur agglutination on third blood drop and D antigen is Rh-

White blood cell count

Total Leukocytes Counting

There are two major types of White blood cells are granular cells include neutrophil, basophil and eosinophil and non-granular cells include lymphocyte and monocyte. Special staining for microscopic examination gives each kind of WBC a distinctive appearance. Numbers of WBC is smaller compared to a normal RBC count. Many of our WBCs are not circulating within blood vessels but are carrying out their functions in tissue fluid or in lymphatic tissue.

Leukocytosis: are increase in white blood cells that caused by either pathological or physiological factors, pathological factors include inflammations such as appendicitis, allergy and asthma diseases, Leukemia, parasitical and bacterial infections while physiological factors include pregnancy, stresses and pain

Leukopenia: are decrease in white blood cells that caused by either pathological or physiological factors, pathological factors include pneumonia, typhoid fever, aids disease and viral infections, while physiological factors include ingestion some of medical drugs

The White blood cell count denotes the number of WBC in 1 liter of whole blood

METHODS

1-Manual method

2-Electronic Cell Counting (CBC system)

Material and Instruments

1- WBC pipette is tube graduated (0.5, 1, 101)

2- Thoam,s Solution

Laical acetic acid 1.5 ml (to hemolysis RBC cell)

Violet gensain pigment 1ml (to color the nuclei of WBC)

Distilled water 100 ml

3-Haemocytometer(Neubauer,s counting chamber) with cover glass

5-Microscope

6-Lancet

Method

1-Obtain a drop of blood draw blood up to the mark 0.5 using WBC pipette

2-Aspirate diluting fluid up to mark 101.

3-Remove blood from the outside of the pipette with a clean gauze

4-Gently rotate the pipette horizontally with your hand to ensure a proper amount of mixing for 3 minutes

5-After mixing ,discard the first four drops of the mixture

6-Fill the counting chamber with diluted blood by holding the pipette at 45◦ with the slide and allow the mixture to seep under the cover slid .The filled chamber should be allowed to stand for about 1 minute prior to counting

7-Count the WBC using low power 10 x then 40x objective.

8-Count all WBC in four large corner squares and add the results together to obtain the total number of cells counted . each large corner square contain 16 small square.

Not: count of cells that touch edges of square from upper and left side and don't count of cells that touch edges of square from lower and right side

Other procedure

Take of 20 microliter of blood and add it to 380 microliter or 400 microliter of thoams solution

Plastic tube and leave 5 minute then by blue capillary tube transport of sample from plastic tube into slide chamber and make same of former steps

Normal value:

New born (18000-25000) cell/mm^3

Children (4.500-13.500) cell/mm3

Adults (4000-11000) cell/mm^3

Calculations

The volume of one corner square=1/10 mm3

dilution=1/20

$$\text{total number of WBCs} = \text{number of WBCs in four square} \times \frac{\text{dilution factor}}{\text{volume factor}}$$

$$\text{dilution factor} = \frac{\text{Solution volume}}{\text{Blood volume}}$$

$$= \frac{400 \text{ micron}}{20 \text{ micron}}$$

$$= 20$$

Volume factor = length x width x high x number of squares

$$= 1x1x0.1\ x4 = 0.4$$

$$\text{total number of WBCs} = \text{number of WBCs in four square} \times \frac{\text{dilution}}{\text{volume factor}}$$

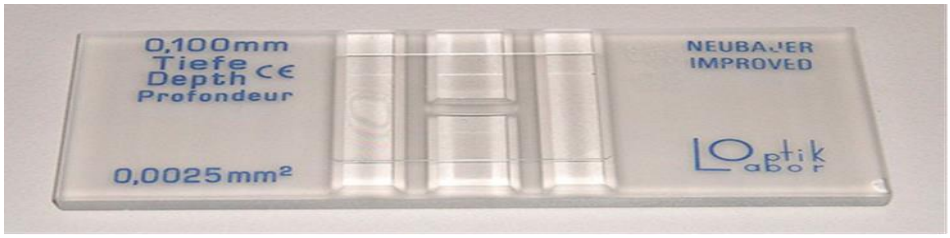
$$= N \times \frac{20}{0.4}$$

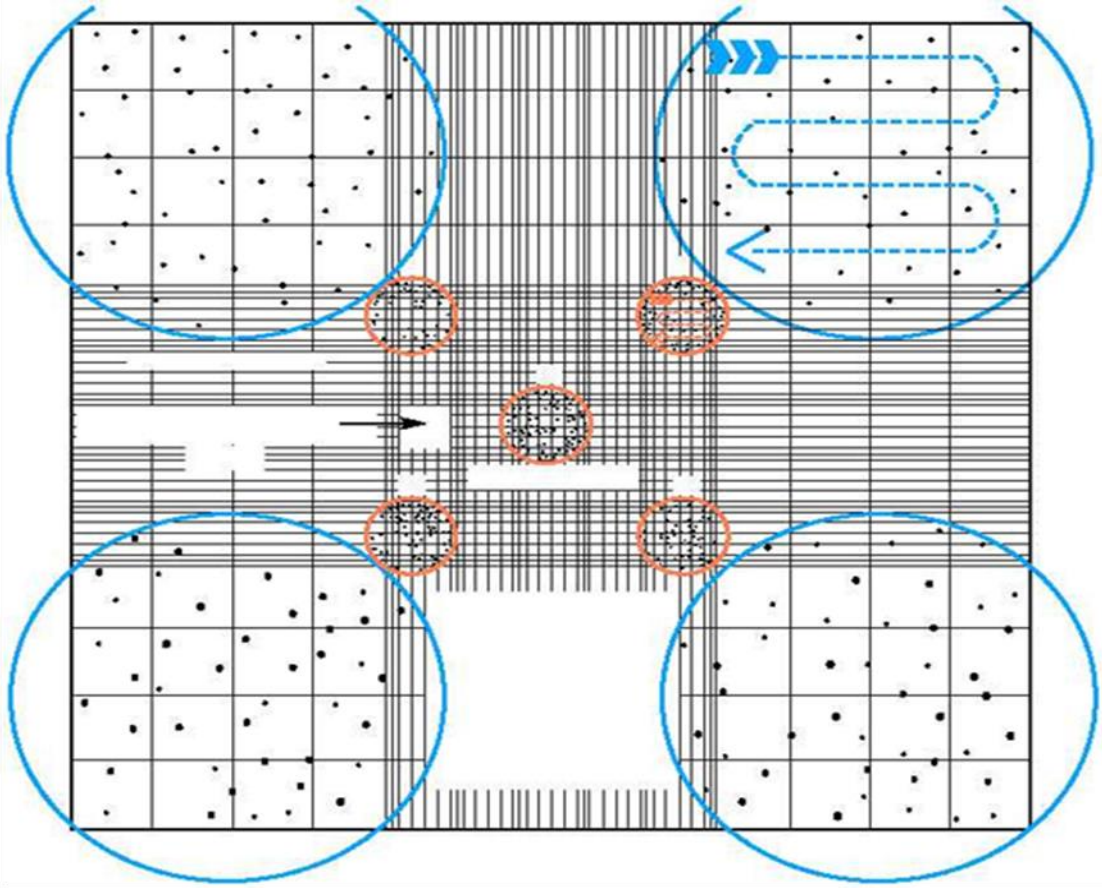
$$= N \times 50$$

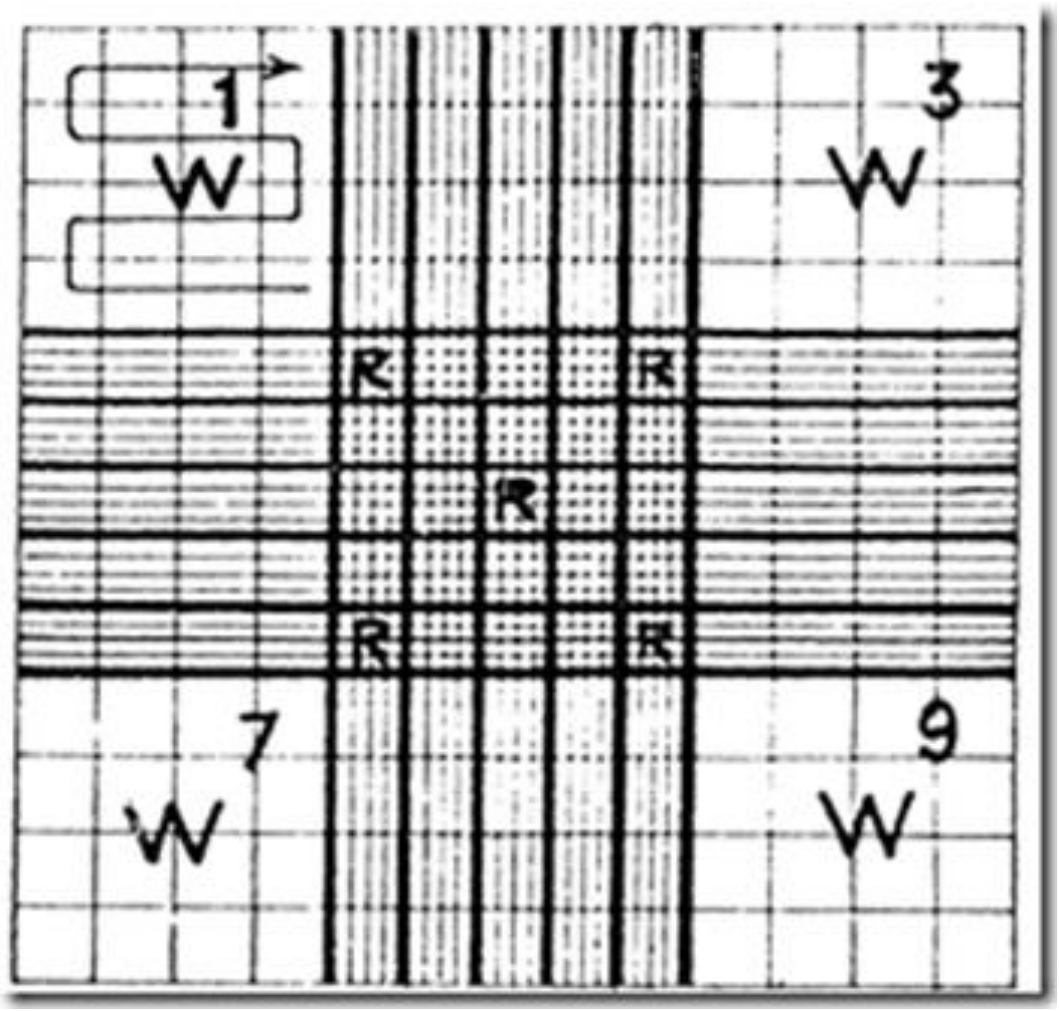
N=number of WBC in four corner squares

Total number of WBC in one square =N×200

Total number of WBC in all squares =N×50






1
W
3
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Blood sugar

Blood sugar concentration, or glucose level, refers to the amount of glucose present in a mammal's blood .Glucose comes from carbohydrate foods. It is the main source of energy used by the body. Normally, your blood glucose levels increase slightly after you eat, This increase causes your pancreas to release insulin so that your blood glucose levels do not get too high

Insulin: is a hormone produced by the pancreas and released into the blood when the amount of glucose in the blood is increased.

Blood glucose levels that remain high for long period can damage your eyes, kidneys, nerves and blood vessels

The Units:

The unit used for blood sugar measurement is mg/dL (milligrams per deciliter)

Normal value of blood sugar are 80-120 mg/dL

Merhods

1-Simple sugar system

2-Spectrophotometer system

Materials

1-sugar system

2-strips of sugar

3-Lancet

Procedure:

1-put strip in sugar system

2-puncture of finger by lancet and near of strip from drop of blood

3-After about 5 second appear the result in system

Diagnosis of sugar

1-Randum Blood Sugar(R.B.S)

The purpose of test is knew of blood sugar level for patients and health persons and perform this test in any time of day and don't required the fasting.

Normal value 80-120 mg/dL

2-Fasting Blood Sugar(F.B.S)

The purpose of test is knew of blood sugar level for patients only and required the fasting from 6-8hours before perform of test.

Normal value 70-110 mg/dL

3-Glucose Tolerance Test(G.T.T)

The purpose of test is diagnosis of diabetes mellitus and required the fasting from 6-8hours before perform of test and in this test patient take glucose dose about 1gm/km of body weight and take blood sample each 30 minute for 3 hours.

Normal value 100-126 mg/dL

4-Glycosylated Hemoglobin Test or Cumulative Sugar Test (HbA1C)

The purpose of test is control on blood sugar on long level (from 2 month into 3 month) according to life rate of RBCs(3 months) and in this test increase of blood sugar due to increase attachment glucose in globin part of hemoglobin and test perform each 3 months if sugar blood normal and test perform each 6 months if sugar blood is abnormal

Normal value

4-5% : non infection

6% : exposure to infection in future

7% : infection with control on infection

More than 7% : infection with non-control on infection

Types of sugar diseases

1-Type 1 diabetes

Is autoimmune disease in which immune system attack pancreas and rupture of beta cells that lead to production of few amounts of insulin

2-Type 2 diabetes

Is common disease and this type associated with aging, obesity, genetic factors and family history in this type of diabetes pancreas produces sufficient amount of insulin but the body don't use of insulin and this case called insulin resistance that lead to accumulate of glucose in blood and body in this cast body can't use glucose as source of energy

3-Gestational diabetes

Is disease infect female during pregnancy period only especially in 6 month of pregnancy

Bleeding time

Bleeding :means loss of blood from damaged or injured Small blood vessels.

Hemostasis: the process of prevention of blood loss through the injured vessel.

The Bleeding time: the time taken from the onset of wound until bleeding cease(Hemostasis)

Factors effected on Bleeding time

1-In platelets functional disorders, the Bleeding Time is Prolonged

2-In thrombocytopenia states ,the B.T is Prolonged

3-Vitamin K deficiency, the B.T is Prolonged

4-in hemophilia the B.T is Prolonged

5-Patients on long-term oral anticoagulant therapy B.T is prolonged

6-Aspirin prolonged the B.T.

method

Duke Test

Material and Instruments

1-Sterile disposable lancet

2-Stopwatch

3-Circular filter paper

4-Alcohol prep pads

Procedure

1-The ear lobe or thumb is cleansed with an alcohol sponge and allowed to dry

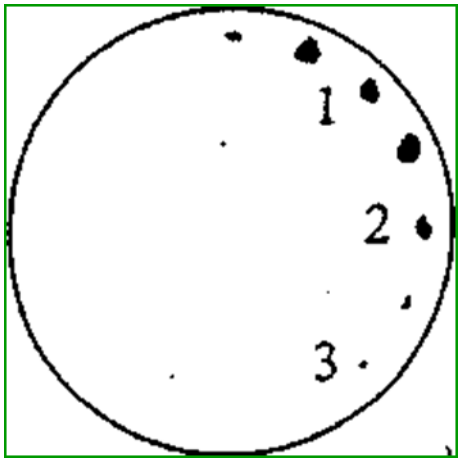
2- puncture of the ear lobe or thumb, using a sterile blood lancet

3-The stop watch is started at the moment of the puncture

4- blotted of circular filter paper in blood every 30 seconds without allowing the filter paper to touch the wound

5-When bleeding stopping, the stop watch is stopped and the bleeding time recorded

Normal range 1-5 minute



Normal spots on filter paper

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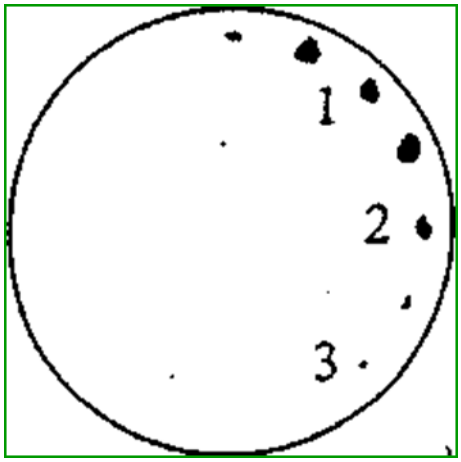


Normal spots on filter paper

Clotting time

Clotting time: is the time required for a measured amount of blood that clot under certain specialized conditions. The process is dependent on the blood clotting factors and on the amount of fibrinogen.

Clotting time include two main steps are:

First step: include conversion of prothrombin to thrombin in presence of thromboplastin (protein secretes by platelets as a result adhered of platelets in injury region) also this step need to Ca^{+}

Thromboplastin

Step 1: Prothrombin----------Thrombin

Ca^{+}

Second step: include conversion of fibrinogen to fibrin in presence

Of thrombin and Ca^{+}

Thrombin

Step 2: Fibrinogen ----------Fibrin

Ca+

Factors effected on Clotting time

1- Clotting time is prolonged in hemophilia

2-Clotting time is prolonged in liver diseases

3-Clotting time is prolonged in hypo fibrinogen

Normal range

5-15 minutes

Method

Capillary tube method

Materials

1-stop watch

2-Lancet

3-blue capillary tube

Procedure

1-sterlization of finger by alcohol

2-puncture of finger by lancet

3-Fill of capillary tube by blood

4-stop watch is started at at the moment of the puncture

4- each 30 second move of blue capillary tube and after stop of blood about motility inside capillary tube break of part of capillary tube each 30 second and continue to break until formation fibrin during the break

5-Read the time when notice of fibrin

Blood pressure

is the pressure that exerted by blood on the walls of blood vessels(arteries, veins and capillaries) during flow of blood within blood cycle

Systolic pressure:- is high pressure in the arteries, which occurs near the beginning of the cardiac cycle when the ventricles are contracting.

Diastolic pressure:- is low pressure in the arteries, which occurs near the end of the cardiac cycle when the ventricles are diastolic.

Normal range of blood pressure

An example of normal measured values for a resting, healthy adult human is 120 mmHg systolic and 80 mmHg diastolic (written as 120/80 mmHg).

If systolic pressure is 140/90 or more of that mean hypertension or high in blood pressure, while if diastolic pressure is 100/60 or lower of that mean hypotension or low in blood pressure

Pulse pressure:- is the difference between systolic and diastolic pressures.

The Units

The unit used for blood pressure measurement is mmHg (millimeter of mercury).

Factors effected on blood pressure

1-Range of heart beats.

2-Range of venous blood flow

3- Systole and diastole of blood vessels effected by hormones such as Aldosterone

4-blood viscosity

5-Gentic factor

6-Diatery system

Aldosterone: is hormone produce by adrenal gland cortex this hormone causes

1-reabsorbtion of sodium

2-excretion of potassium

3-aids in water retention

4-deduces urine volume

5-help to restore normal fluid volume

6-increase in blood pressure

Renin-Angiotensin system

First step:

Kidney —(Produce)→ pro renin(inactive form) —(kallikrein)→ renin —(causes)→ control on blood volume and blood pressure

Second step:

Renin (enzyme) —(enter)→ blood —(release)→ Angiotensin-1 (enzyme) (Ang-1) —(transport)→ Heart —(transport)→ Lung (Angiotensin converting enzyme-1)(ACE-1)

Third step:

Ang-I(Lung) —((ACE-1)stimulate)→ Ang-II(Lung) —(transport)→ Heart —(transport)→ blood —(causes)→ vasoconstriction → **decrease in diameter arteriole**

→ increase in blood volume → increase in blood pressure

transport release

→ Kidney(adrenal cortex**)** → aldosterone

Fourth step:

(ACE-2)stimulate transport

Ang-II(kidney) ⟶ Ang-III(kidney) → blood causes

→ vasodilation → increase in diameter arteriole

decrease in blood volume → decrease in blood pressure

note: Ang-III is act against effects of Ang-II

Measure of blood pressure

1- Blood pressure measured by use system called Sphygmomanometer this system is consist of belt presence inside it sac filled in air by hand air pump and attached with sac, and uses of earphone to hearing sound of blood flow during measured.

2-system take two read are:

1-the upper read: represent of systolic pressure, normal range of systolic pressure is 110-130

2-the lower read: represent of diastolic pressure, normal range of diastolic pressure is 70-90

Method measure of blood pressure

1-Sedwen on back support seat and put of upper tips on same level of heart

2-tying of belt on hand (over elbow)

3-put of phone under belt and fixed it

4-closed of air valve

5-Blow of belt that attached with Sphygmomanometer and continue to blow until stop of blood flow(until graduated 160 mmHg)

6-open of air valve so as to empty of belt from air, at start of blood flow can hearing of sound and determine of point that hearing the sound called Systolic pressure

7-when hiding of sound determine the point in which the sound is hide and called Diastolic pressure

Differential white blood cell count

Immune system

Is complex network of organs, cells and proteins and perform the following functions

1-protect the body from pathogens such as viruses, bacteria, parasities and fungi

2-remove of tumor cells, aging cells and dead cells

Types of immunity

1-Innate immunity

Is nonspecific immunity kill different types of pathogens this immunity include:

1-mechenical barriers such as skin and mucus membranes

2-chemical barriers such as HCL, lysozyme and lactic acid

3-biological barriers such as normal flora

4-immune cells include:

A-Granular cells

1- Neutrophils: present in high percent in blood about 55-65% and have multi lobes nucleus about 3-5 lobes

Functions of neutrophil

1-sneak: migration of neutrophil present in blood during of blood vessels walls into tissues

2-amebic motion: at inflammations neutrophil migration by amebic motion into inflamed region to eat of foreign bodies such as bacteria and secreted of hemolytic enzymes that lead to die of bacteria

2-Eosinophil: forms of percent about 6% and have two lobes nucleus

Function of eosinophil is absorption of histamine that produced from sensitivity cases

3-Basophil: forms of percent about 1% and have S-shape nucleus

Function of Basophil is production of heparin enzyme that prevent coagulant of blood inside of blood vessels

B-Non granular cells

1- **Lymphocyte**: forms of percent about 25-35% and have large nucleus fill of cell volume

Function of lymphocyte is regulation of immune system in the body

Lymphocytes divided into two types

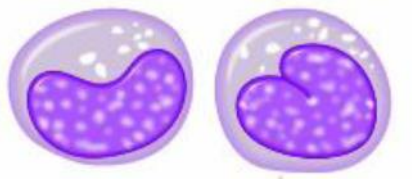
1-B lymphocytes: is cells produce from bone marrow and function of cells is production of antibodies

2-T lymphocytes: is cells produce from thymus and function of cells is production of lymphokines

2-**Monocyte**: forms of percent about 2-10% and have kidney shape nucleus

Function of monocyte is kill of microbes

At infections monocytes migrate from blood into infection tissue or organ and convert into macrophages for kill of foreign bodies by process called phagocytosis and macrophage named according to organ in which present such as in macrophages in brain called microglia, macrophages in lung called alveolar cells and macrophages in liver called kupffer cells



2-Adaptive immunity

Is specific immunity kill one type of pathogens and this type of immunity include:

1-antibodies

2-immune cells include B cells, plasma cells and memory cells

At primary infection with pathogens (antigens) such as viruses like mumps, measles and smallpox this pathogens (Ags) bind with antibodies(Abs) present on B cells which divided into plasma cells and memory cells during primary infection B cells produce specific new antibodies stored in memory cells

At secondary infection in same of pathogens, memory cells introduce on this antigens and release of stored antibodies that specific in this pathogens and attack this antigens and their kill by formation immune response

Differential white blood cell count

The aim of this attempt to determine each type of white blood cells in peripheral blood cells, percent of this cells is differ in blood and increased of certain types and decreased of other types in certain diseases

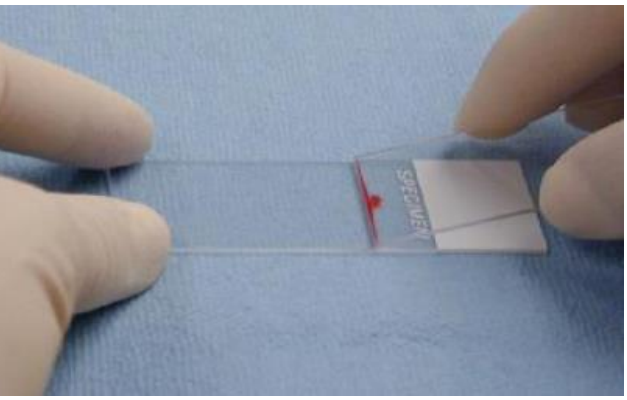
Method

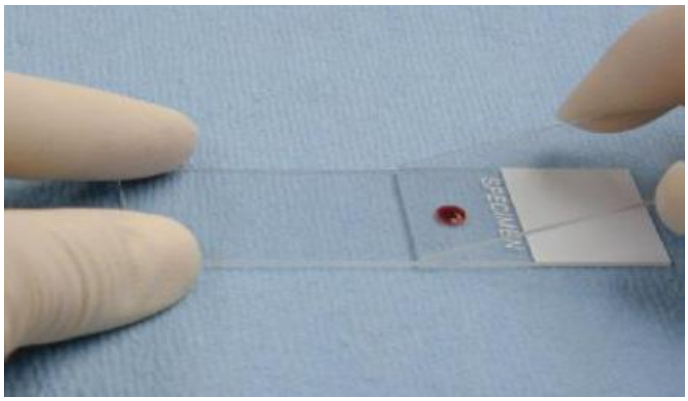
1-Preparation of slide

1-the slide that used must be clean

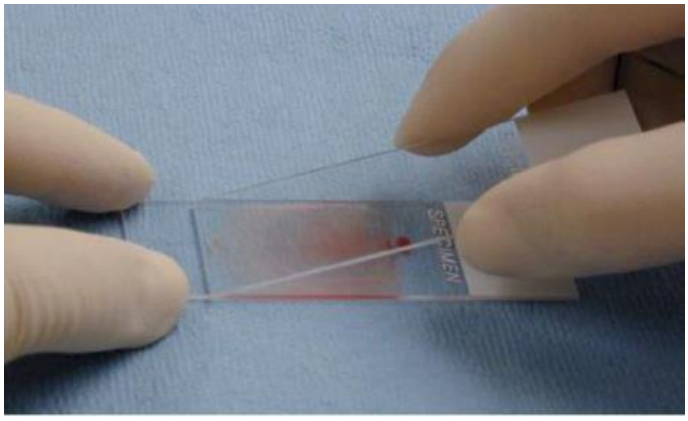
2-put drop of blood on distance 1-2cm from one of slide tips

3-published drop of blood by use other slide, put this slide over first slide in angle of 45^{o} and move slide to back until fill drop of blood seek line between the two slide





4-published drop of blood quickly to forward



5-leave the slide in room temperature to dry in air and then stained by lieshman stain

2-Stain of slide

1-put of slide on stand over basin

2-put the stain on slide and leave for 10 minute

3-Add of distil water about double of stain amount and leave for 7-10 minute so as to stain slide

4-wash of slide by water and leave to dry in air

3-Examination of slide

1-examined of mid region of slide by use of oil lens after put drop of oil on slide

2-calculated 100 cell of white blood cells (neutrophil, basophil, eosinophil, lymphocyte and monocyte) and calculate percent for each type by following equation:

Percent of neutrophil =number of neutrophil/total number of WBCs X 100

Percent of basophil =number of basophil/total number of WBCs X 100

Percent of eosinophil =number of eosinophil/total number of WBCs X 100

Percent of lymphocyte=number of lymphocyte/total number of WBCs X 100

Percent of monocyte =number of monocyte/total number of WBCs X 100

For example

Percent of neutrophil =number of neutrophil/total number of WBCs X 100

Percent of neutrophil =60/100 X 100= 60%