



PHYSIOLOGY Team 433

Physiology Revision For (OSPE)

Color Index

Blue = Main Topic

Violet = sup topic

Red = important

Orange = Explanation

White & Black = Addition

Contact us: PHT433@gmail.com

Important Instructions:

- Do not forget to write units at the end of the written value
- Do not forget to bring your calculator.
- **You have to know all normal values of Blood components, types and measurement :**

	Normal value
RBCs	Male: $5.2 * 10^6 \text{ mm}^3$ Female : $4.7 * 10^6 \text{ mm}^3$
WBCs	4000 – 11000 mm^3
Neutrophils	50 – 70 % of WBC
Eosinophils	1 – 3 % of WBC
Basophils	0.4 – 1 % of WBC
Monocyte	4 – 6 % of WBC
Lymphocyte	25 – 35 % of WBC
Packed Cell Volume (PCV)	45% of Blood
Plasma	55% of Blood
Hemoglobin	14-16 g/dl in the blood

	Normal Value
MCV	78 – 98 FL
MCH	27 – 32 PG
MCHC	32 – 36 g/dl
ESR	0 – 7 mm/per hour
Clotting time	3 – 10 Min
Bleeding time	2 – 5 Min

COMPLETE BLOOD COUNT

Calculation of red blood cell:

1. MEAN CELL VOLUME (MCV)

This is the volume of an average red blood cell measured in **femtoliters (fl)**

$$MCV = Packed Cell Volume \times \frac{10}{RBC Count}$$

MCV of a normal person ranges from **78 – 98 fl**.

If MCV is **low**, it means that red blood cells are small in size and they are called **microcytes**.

But if MCV is **high**, it means that red blood cells are large in size and they are called **macrocytes**.

2. MEAN CELL HEMOGLOBIN (MCH)

This is the weight of hemoglobin in an average red blood cell measured in **picograms (pg)**.

$$MCH = Hemoglobin concentration \times \frac{10}{RBC Count}$$

MCH of a normal person ranges from **27 – 32 pg**.

High value of MCH tell us that red blood cells are **hyperchromic**

Low value of MCH will be seen if red blood cells are **hypochromic**.

3. MEAN CELL HEMOGLOBIN CONCENTRATION (MCHC)

This is the concentration of hemoglobin per 100 ml of red blood cell measured in **grams/deciliters (g/dl)**.

$$MCHC = Hemoglobin Concentration \times \frac{100}{Packed Cell Volume}$$

MCHC of a normal person ranges from **32 – 36 g/dl**.

Value of MCHC below normal suggests Iron **deficiency Anemia**.

The formulas for MCV, MCH and MCHC are important.

Important Terminology:

Polycythemia	Increased red blood cell count above normal.
Anemia	Reduced ability of blood to carry Oxygen due to either decreased red blood cell count and/or hemoglobin concentration.
Leucocytosis	Increased white blood cell count above normal.
Leucopenia	Decreased white blood cell count below normal.
Thrombocytosis	Increased platelets count above normal.
Thrombocytopenia	Decreased platelets count below normal.

Questions and Problems

1. Discuss briefly the etiological classification of Anemia?

TYPE OF ANEMIA	CAUSE
Hemorrhagic Anemia	loss of blood
Aplastic Anemia	Bone marrow suppression by drugs or radiations etc.
Nutritional Anemia	Deficiency of Iron, folic acid, Vitamin B12
Hemolytic Anemia	Increased destruction of RBCs such as sickle cell disease

2. An examination of the blood of 2 adult males (A and B) provided the following data:

	A	B
Rbc count	$3.6 \times 10^6 / \text{mm}^3$	$2.5 \times 10^6 / \text{mm}^3$
HB concentration	7.2 g/dl	8 g/dl
Packed cell volum(PCV)	25%	25%

HB = Hemoglobin

(a) Calculate MCV, MCH and MCHC for each of these subjects.

SUBJECT "A"	SUBJECT "B"
MCV = $25 \times 10 / 3.6 = 69.4 \text{ fl}$	MCV = $25 \times 10 / 2.5 = 100 \text{ fl}$
MCH = $7.2 \times 10 / 3.6 = 20 \text{ pg}$	MCH = $8 \times 10 / 2.5 = 32 \text{ pg}$
MCHC = $7.2 \times 100 / 25 = 28.8 \text{ g/dl}$	MCHC = $8 \times 100 / 25 = 32 \text{ g/dl}$

(b) What are the abnormalities encountered in these men. What are the possible causes of these abnormalities?

Subject "A" → Microcytic hypochromic anemia (Iron deficiency anemia)

Subject "B" → Macrocytic normochromic anemia (Megaloblastic anemia or Pernicious anemia)

The difference between Megaloblastic anemia and Pernicious anemia is that:

Megaloblastic anemia is due to deficiency of Vit12 or folic acid or both.

Pernicious anemia is caused by malabsorption of Vit 12 due to lacking of intrinsic factor in the stomach

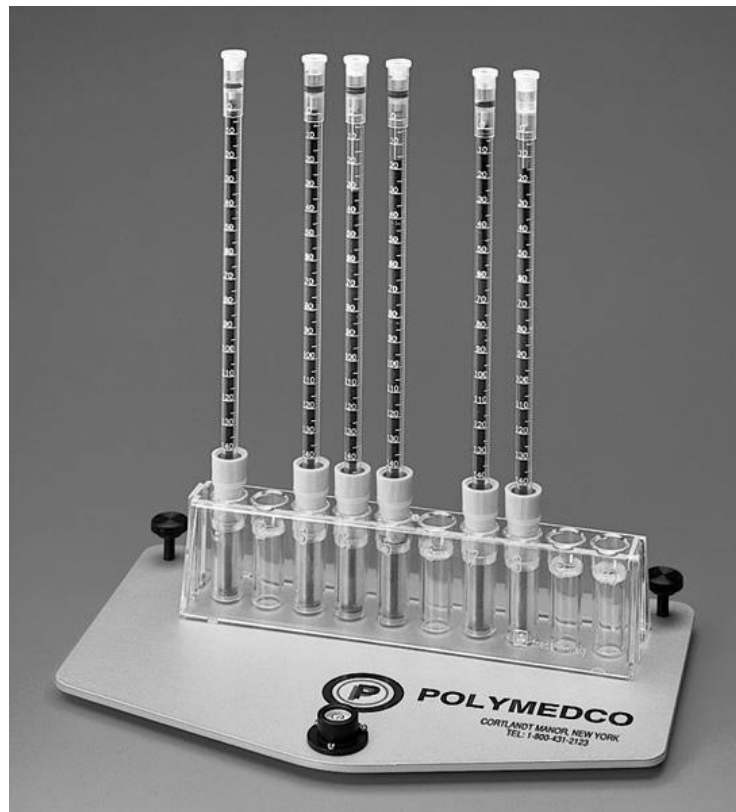
ERYTHROCYTE SEDIMENTATION RATE (E.S.R.)

1. What is the clinical significance of E.S.R.?

- This is a non-specific indicator of presence of a disease.
- This is a useful prognostic tool.

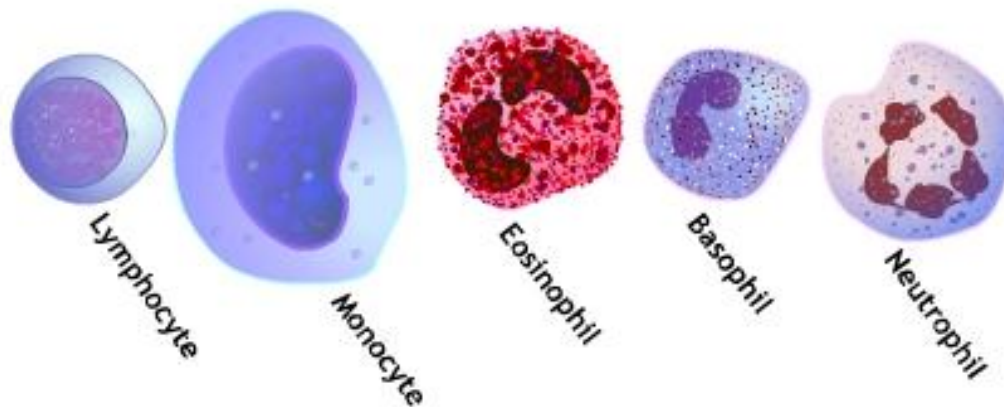
2. What conditions are associated with an increased E.S.R.?

- Infections
 - Connective tissue disorders
 - Inflammatory disorders
 - Malignancies
 - Anemia
 - Pregnancy
- E.S.R has to be read after **1 hour** to measure RBC volume or plasma
 - E.S.R in females is higher than males because they have less RBCs count
 - **More RBCs = Less E.S.R.**



WESTERGREN'S TUBES

DIFFERENTIAL LEUCOCYTE COUNT



Agranular leukocyte:

Lymphocyte: large nucleus compared with cytoplasm

Monocyte: kidney-shape nucleus

Granular leukocyte:

Eosinophil: 2-3 lobes – **reddish color**

Basophil: 2 lobes – **Bluish color**

Neutrophil: 2-5 lobes – **purple color**

Questions and Problems

Under what conditions are the percentages of the various types of white blood cells increased?

- | | | |
|-------------|---|---|
| NEUTROPHILS | → | will increase in acute bacterial or fungal infections. |
| EOSINOPHILS | → | will increase in parasitic infections and allergies. |
| BASOPHILS | → | will increase in allergies and malignancies. |
| MONOCYTES | → | will increase in chronic infections. |
| LYMPHOCYTE | → | will increase in acute viral infections and malignancies. |

BLOOD GROUPS, BLEEDING & CLOTTING

Questions and Problems

- 1] What are the agglutinogens and agglutinins found in people with different blood groups in ABO system?

BLOOD GROUP	AGGLUTINOGENS	AGGLUTININS
A	A	Anti – B antibodies
B	B	Anti – A antibodies
AB	A, B	No antibodies
O	No Antigens	Both Anti-A and Anti-B antibodies

- 2] How the different blood groups can donate or receive blood among them during blood transfusion?

Blood Group	Can give blood to	Can receive blood from
AB ⁺	AB ⁺	All blood groups
AB ⁻	AB ⁻ , AB ⁺	AB ⁻ , A ⁻ , B ⁻ , O ⁻
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 ⁻
O ⁺	O ⁺ , A ⁺ , B ⁺ , AB ⁺	O ⁺ , O ⁻
O ⁻	All blood groups	O ⁻

3] What is the distribution of the ABO and Rh blood groups in Saudi Arabia?

O+	48%
AB-	0.23%

4] Under what circumstances can Rh incompatibility develop and how?

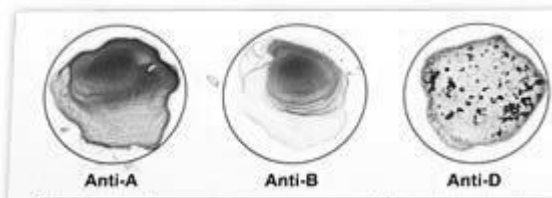
Rh incompatibility is a condition that develops when a pregnant woman has Rh-negative blood and the baby in her womb has Rh-positive blood inherited from the Rh-positive father.

I. How it is treated?

Infants with severe Rh incompatibility may be treated with exchange transfusion after birth or intrauterine transfusion before birth.

II. How it is prevented?

(anti-D antibodies) injections prevent the development of antibodies against Rh-positive blood.



O+



A+

O- Blood group → universal donor

AB+ Blood group → universal recipient



Determination Of Clotting Time:

1] What is the normal range of clotting time?

3 – 10 minutes

2] What are the clinical conditions in which the clotting time is greater than normal?

Hemophilia A: deficiency of factor 8

Hemophilia B: deficiency of factor 9

Determination Of The Bleeding Time:

1] What is the normal range of bleeding time?

2 – 5 minutes

2] Which blood cells deficiency may prolong the bleeding time?

Platelets

3] Name one condition in which bleeding time is prolonged (increased)?

Thrombocytopenia

Good Luck