PHYSIOLOGY PRACTICAL REVISION

OSPE Exam instructions

- The exam is more likely to be short answers questions, no experiments will be performed.
- Don't forget your calculators, you're going to need them for simple calculations of red blood indices(MCV,MCH,MCHC), which are important to know different types of anemia. Remember their units.
- Understanding blood groups is very important.
- Remember the normal values and the related clinical conditions.
- Identify WBCs under the microscope, identify their function.
- **This revision is not sufficiently enough, you have to read the teamwork's lectures or the handouts.**

Physiology practical team

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WE WISH YOU THE BEST OF LUCK

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Normal Values + clinical conditions

	Average Normal Value	↑ Levels indicate	↓ Levels indicate
RBC	4.7–6.5 x10^6/µl	1. Low oxygen tension in the blood 2. Polycythemia vera. 3. Dehydration due to Burns or Diarrhea 4. Renal disease with high erythropoietin production.	1. Blood loss, due to either Anemia or Hemorrhage. 2. Bone marrow failure. 3. Hemolysis (RBC destruction). 4. Renal disease with Erythropoietin deficiency
PCV: Packed Cell Volume (hematocrit)	35-54%	• Same as RBC in conditions 1,2&3	• Same as RBC in conditions 1,2&3 • Leukemia.
WBC	4 – 11 x10^3 /µl	Leukocytosis, due to: • Infectious diseases. • Inflammatory disease • Leukemia. • Severe emotional or physical stress. • Tissue damage (burns).	Leukopenia, due to: • Bone marrow failure. • Presence of cytotoxic substance. • Autoimmune/collagen-vascular diseases. • Disease of the liver or spleen.
Platelets	150-400x10^3 /µl	Thrombocytosis, due to: • Chronic myeloid leukemia	Thrombocytopenia, due to: • Aplastic anemia. • Chemotherapy.
Hemoglobin (Hb)	13 –18 g/dl	_____	_____

Normal Values + clinical conditions

	Normal Value	Abnormal Levels	
ESR	Males: (3-5 mm/ 1st hour) (7-15mm/ 2nd hour) Females: slightly higher due to less RBC	Moderately High: • Infections. • Inflammation • anemia • Malignancies • pregnancy • old age	Very High: • Multiple myeloma • Polymyalgia Rheumatic • Temporal arteritis
Clotting time *** a rough measure of all intrinsic clotting factors.**	Almost 3-10 min.	**Clotting time is Prolonged in deficiencies in the intrinsic coagulation pathway.** • Deficiency of factor 8 leads to Hemophilia **A**. • Deficiency of factor 9 or **Christmas** factor leads to Hemophilia **B**.	
Bleeding time *** a test of platelet function**	2 – 5 minutes	**Bleeding time is prolonged in the following conditions:** • Platelet dysfunction. • Blood vessel wall disorders. • Haemophilia. • Thrombocytopenia. • Vitamin K deficiency. • Medications: Aspirin.	

Anticoagulants

- **EDTA** used in CBC & ESR tests
- **Heparin** used in Hematocrit (heparinized tubes)

Stains

- used in preparation of peripheral blood film
  * **Wright's stain** * **Leishman's stain**

Normal Values + clinical conditions

Red Blood Indices	Calculation	Average Normal Value	↑ Levels	↓ Levels
Mean Cell Volume (MCV)	$MCV = \frac{PCV \times 10}{RBC\ count}$	77-98 µm3 (fl)	RBC are large in size and they are called macrocytes.	RBC are small in size and they are called microcytes
Mean Cell Hemoglobin (MCH)	$MCH = \frac{Hb \times 10}{RBC\ count}$	27-32 pg	hyperchromic	Hypochromic
Mean Cell Hb Concentration (MCHC)	$MCHC = \frac{Hb \times 100}{PCV}$	30-36 g/dl	**Concentration normal or lower than normal:** Macrocytic normochromic anemia (Megaloblastic anemia or Pernicious anemia)	**Concentration lower than normal:** Microcytic Hypochromic anemia (Iron deficiency or thalassemia)

Erythrocyte Sedimentation Rate (ESR)	C-reactive protein
• ESR is the rate at which RBCs sediment in a period of 1 hour. • Prognostic (Monitor disease activity and response to therapy) not diagnostic, because it is a nonspecific marker of inflammation and is affected by other factors , therefore, ESR results must be used along with other clinical findings.	• C-reactive protein is an acute phase protein produced by the liver during an inflammatory reaction. • Since C-reactive protein levels in the blood rise more quickly after the inflammatory or infective process begins, ESR is often replaced with C-reactive protein measurement.

Types of anemia

Anemia: Reduced ability of blood to carry Oxygen due to either decreased red blood cell count and/or hemoglobin concentration.

TYPES OF ANEMIA		CAUSE
Hemorrhagic Anemia		Loss of blood
Aplastic Anemia		Bone marrow suppression by drugs or radiations etc.
Hemolytic Anemia		Increased destruction of RBCs such as sickle cell disease
Nutritional Anemia	Macrocytic normochromic anemia	**Megaloblastic anemia** : Deficiency of folic acid, Vitamin B12
		Pernicious anemia : Malabsorption of Vit 12 due to lacking of intrinsic factor in the stomach
	Microcytic Hypochromic anemia	Deficiency of Iron
Microcytic Hypochromic non-nutritional anemia		Thalassemia

Rh incompatibility

Clinical condition:

Rh- mother carrying Rh+ fetus, her immune system makes antibodies that destroy the baby's circulating RBCs. When RBCs are broken down, they make bilirubin. This causes an infant to become jaundiced. Because it takes time for the mother to develop antibodies, firstborn infants are often not affected.

Prevention:

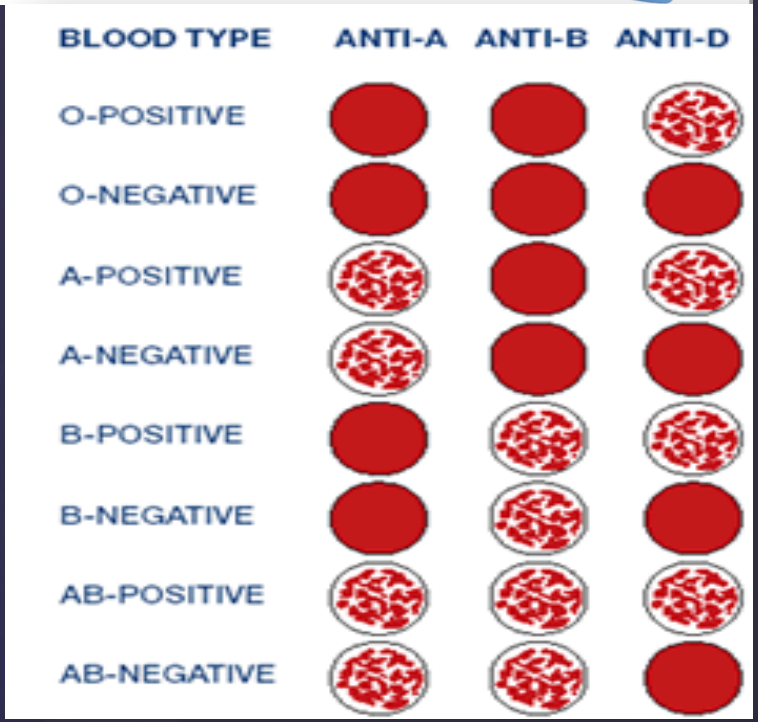
Anti-D antibodies (RhoGAM) injections are used to prevent Rh incompatibility. These injections prevent the development of antibodies against Rh-positive blood.

Treatment:

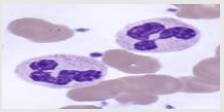
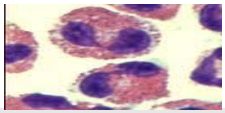
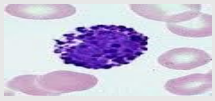
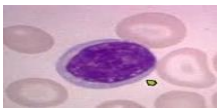
- Mild Rh incompatibility: drugs, fluids, and light therapy.
- Severe Rh incompatibility: blood transfusion.

Blood groups

- O- universal donor
- AB+ universal recipient
- O+ most common in Saudi Arabia
- AB- least common in Saudi Arabia



Blood type	Antigens on blood cells	Anibodies made by the immune system	Can donate blood to	Can receive blood from
O-	None	Anti-A, Anti-B, Anti-Rh	All blood types	O- only
O+	Rh	Anti-A, Anti-B	Any Rh+ blood types	O- or O+
A-	A	Anti-B, Anti-Rh	Any A or AB	O or A-
A+	A, Rh	Anti-B	A+ or AB+	Any O or A
B-	B	Anti-A, Anti-Rh	Any B or AB	B- or O-
B+	B, Rh	Anti-A	B+ or AB	Any O or B
AB-	A, B	Anti-Rh	Any AB	Any Rh-
AB+	A, B, Rh	None	AB+	All blood types

WBCs		Percentage of leukocytes	Increased percentage indicates	Cytoplasm morphology	Nucleus morphology	Microscopic picture
Granular	Neutrophil	The most common type: 50-70%	acute bacterial or fungal infections	Small purple/pink stained granules (neutrophilic)	Segmented, 2-5 lobed	
	Eosinophil	Less common: 1-3%	parasitic infections and allergies	Bright red granules (eosinophilic)	Bi-lobed purplish	
	Basophil	The rarest of WBCs: 0.4-1%	allergies and malignancies.	Large, blue granules (basophilic)	Bi-lobed, hidden behind the large granules	
Agranular	Lymphocyte * The smallest leukocyte.	Second common cell: 25-35%	acute viral infections (infectious mononucleosis) and malignancies.	Light blue, no granules. The nucleus occupies most of the volume of the cell, leaving only a thin rim of the cytoplasm around it.	Single large Oval purple	
	Monocyte * The largest of all blood cells.	Third common cell: 4-6%	chronic infections	Basophilic, no granules	Large, horseshoe-shaped (kidney-like)