

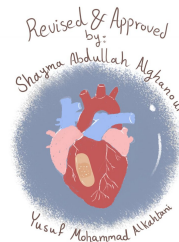
# Anemia and Polycythemia



Team Leaders:

Haya Alenazi

Abdulrahman Alswat



**Red: Important**

**Black: In Male & Female slides**

**Blue: In male slides**

**Pink: In female slides**

**Green: Notes & extra information**

# Objectives

- Define and classify anemia and explain its assessment
- Describe the physiological consequences and clinical picture of anemia
- Recognize the different types and causes and **symptoms** of anemia
- Know how to differentiate between the different types and causes of anemia
- Know the blood indices, their normal values and how to calculate them
- Define and classify polycythemia
- Describe the physiological consequences of polycythemia
- Recognize causes of polycythemia.**

# Anemia

## Definition:

↓  
Decrease the number of RBC  
Decrease HB  
↓  
Oxygen supply to tissues

*Below the normal  
level of the same  
age & Gender*

## Major causes of anemia:

- 1- Decrease RBC production
- 2- Increase RBC destruction
- 3- RBC loss without RBC destruction

## Symptoms - depending on the severity - :

- Pale skin (pallor)
- Fatigue + Weakness + Tiring easily
- Breathlessness (tachypnea)+ Racing heart or palpitations (tachycardia)
- Cold intolerance
- Reduce in oxygen carrying capacity → lack of O<sub>2</sub> for ATP and heat production
- Postural (orthostatic) hypotension: Drop in blood pressure when standing from a sitting or lying position – this may happen after acute blood loss, like a heavy period

## Signs:

**Koilonychia:** is when the nail curves upwards (becomes spoon-shaped)

**Angular stomatitis:** deep cracks and splits form at the corners of the mouth

**Tachycardia and tachypnea:** due to compensatory sympathetic stimulation.

# Causes of anemia

RBC loss without RBC destruction  
(Hemorrhage)

## Causes:

- Trauma

- Disorders: e.g.  
Cancer, ulcer

## Types:

### Acute:

RBCs return to normal 3-6 W  
normocytic normochromic

### Chronic:

Iron deficiency anemia  
- Menstruation  
- Gynecological disorders  
- GIT bleeding (peptic ulcer-  
Bilharziasis-piles-hookworms).  
Microcytic hypochromic

Decreased RBCs production

Nutritional deficiency

Iron deficiency  
Microcytic hypochromic

Vit. B12 & folic acid deficiency  
**Pernicious anemia:**  
is a special type of megaloblastic anemia due to intrinsic factor deficiency causing vit B12 deficiency.

Increased demands

(childhood & pregnancy)

Renal disease

lack of erythropoietin production

Bone marrow failure  
Aplastic anemia

- irradiation or excessive X-ray usage.  
- invasion of bone marrow by (secondary cancer cells or fibrosis).  
- drugs e.g. chloramphenicol

Destruction of RBCs  
Haemolytic anemia

Intrinsic Abnormalities

Hereditary

Thalassemia

Spherocytosis  
Abnormal Cells (membrane defect)

(Hb-S) = Sickle cell anaemia  
Abnormal Hb

Erythroblastosis fetalis

-Enzymatic defect (G6PD deficiency)

Extrinsic Abnormalities







Infections

Malaria

Mycoplasma

Incompatible blood transfusion

# Types of anemia

Microcytic hypochromic	Normocytic normochromic	Megaloblastic or macrocytic
		
		
<p>Decrease in Hb content, RBCs count, PCV(HCT value)</p>		
<p>Causes: Iron deficiency</p>	<p>Causes: Acute blood loss</p>	<p>Causes: Folic acid (folate) or vit B12 deficiency</p>
<ul style="list-style-type: none"> <li>- microcytic = smaller size</li> <li>- hypochromic = less hemoglobin</li> <li>- increased zone of central pallor</li> <li>- <b>decrease in MCV and MCH</b></li> <li>- anisocytosis = variation in size</li> <li>- poikilocytosis = variation in shape</li> </ul>	<ul style="list-style-type: none"> <li>- Normal HB (in each RBC)</li> <li>- normal RBCs' size.</li> <li>- <b>normal MCV and MCH</b></li> </ul> <p>The decrease in the RBCs count will lead to decrease the total number of Hb in the blood</p>	<ul style="list-style-type: none"> <li>- The hypersegmented neutrophil and also that the RBC are almost as large as the lymphocyte.</li> <li>- There are fewer RBCs.</li> <li>- <b>increase in MCV and MCH</b></li> </ul>

# Haematological indices

Indices	Male	Females
Hematocrit (Hct) (%)	47	42
Red blood cells (RBC) ( $10^6/L$ )	5.6	4.8
Hemoglobin (Hb) (g/dL)	16	14
Mean corpuscular volume (MCV) (fL)	90-95	
Mean corpuscular hemoglobin (MCH) (pg)	29	
Mean corpuscular hemoglobin concentration (MCHC) (g/dL of cells)	34	

# Haematological indices

MCV is the most accurate method of measuring red blood cells and most useful in classification of anemia

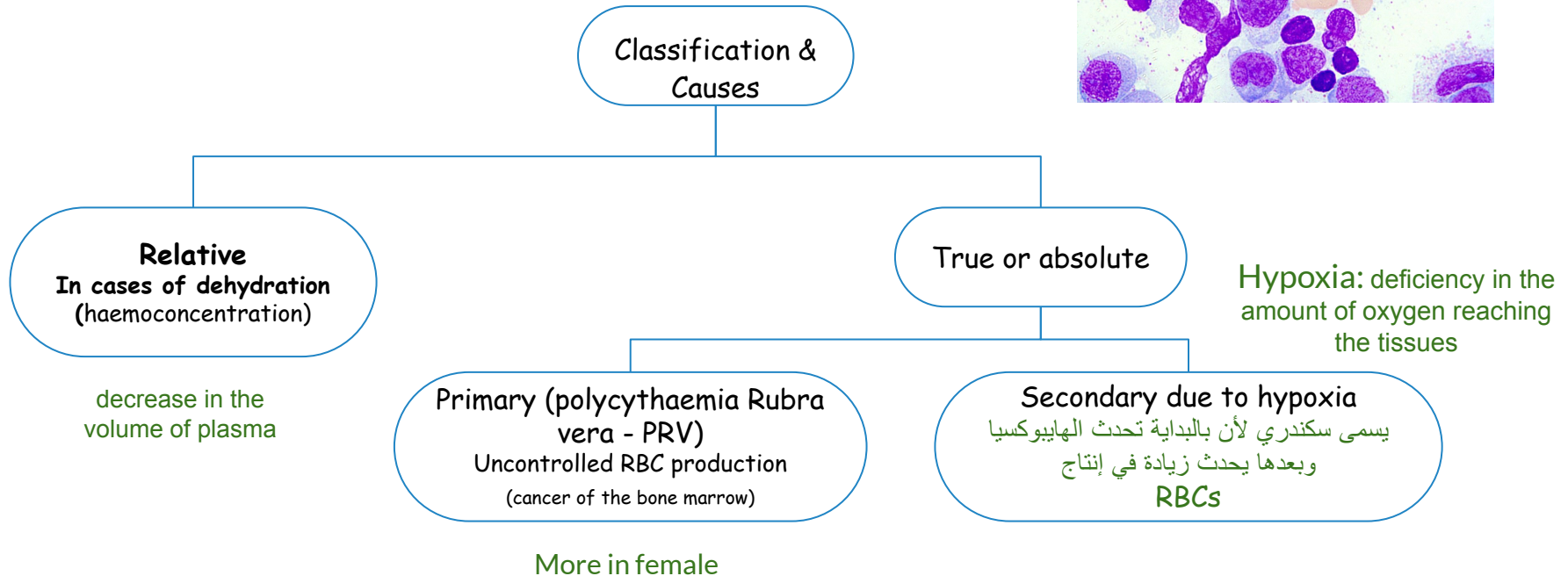
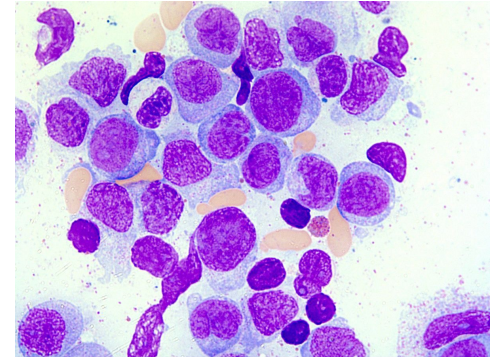
<b>(MCV)</b> Mean corpuscular volume	The average volume of the RBCs	Expressed in femtoliters (fL) or cubic micrometers.	$= \frac{Hct * 10}{RBC \left(\frac{10^6}{\mu L}\right)}$	<p>↑ 95 fl : Macrocytic anemia</p> <p>Normal value ( <b>90-95 fl</b> ): normocytic anemia</p> <p>↓ 90 fl : Microcytic anemia</p>
<b>(MCH)</b> Mean corpuscular Hb	The average amount of hemoglobin inside a RBC	Expressed in picograms (pg)	$= \frac{Hb * 10}{RBC \left(\frac{10^6}{\mu L}\right)}$	<p>↑ 33 pg: Hyperchromic</p> <p>Normal value ( <b>27-33 pg</b> ): normochromic</p> <p>↓ 27 pg: Hypochromic</p>
<b>(MCHC)</b> Mean corpuscular concentration	The average concentration of hemoglobin in the RBCs	expressed as (gm/dl)	$= \frac{Hb * 10}{Hct}$	Normal value ( <b>32-36 g/dl</b> ) of RBCs
<b>Reticulocyte index</b>	<b>Reticulocytes</b> are immature red blood cells (RBCs)		$\frac{Hematocrit}{NormalHematocrit}$	<p>↑ 2% excessive RBC destruction or loss (Hemolytic anemia)</p> <p>↓ 2% decreased production (Aplastic anemia)</p>

Indices	Hematocrit (Hct)	RBC	Hb	MCV	MCH	MCHC
Male	47%	5.6x10 <sup>6</sup> /L	16 g/dL	90-95 fl	29 pg	34 g/dL of cells
Females	42%	4.8x10 <sup>6</sup> /L	14 g/dL			

# Polycythaemia

## Definition:

Increase in the number of RBCs per unit volume of blood





# QUIZ!

## MCQs

Q1: which type of Anemia has RBC's are **smaller** than normal?

A) Aplastic anemia

B) Microcytic hypochromic anemia

C) Megaloblastic Anemia

D) Hemolytic anemia

Q2: Which of the following is correct about **normocytic normochromic** anemia :

A) decrease in MCV and MCH

B) increase in MCV and MCH

C) normal MCV and MCH

D) normal RBCs count

Q3: **Increased demands** of RBCs - like during childhood & pregnancy - will lead to :

A) Increased RBCs production

B) Destruction of RBCs

C) Blood loss

D) Decreased RBCs production

Q4 : **iron deficiency** is the major cause of :

A) Microcytic hypochromic anemia

B) Normocytic normochromic anemia

C) Macrocytic anemia

D) Sickle cell anemia

## SAQ

Q1: what are the **symptoms** of Anemia? - Only 2 -

Q2: What Are the Classification of **Polycythaemia**?

MCQs key answer :  
1) B  
2) C  
3) A  
4) A

SAQ answer key :  
1) Pale skin  
- Fatigue + Weakness + Tiring easily  
- Breathlessness + Racing heart or palpitations  
2) 1- Relative. 2- True.

# Thank You

## Team members:

- ▶ أحمد الخياط
- ▶ ماجد العسكر
- ▶ مشعل الثنيان
- ▶ عبدالعزيز الربيعة
- ▶ باسل فقيها
- ▶ محمد بيارى
- ▶ محمد السلطان
- ▶ عبدالرحمن الدويش
- ▶ مرشد الحربي
- ▶ منيب الخطيب
- ▶ نايف الشهري
- ▶ فيصل العمري
- ▶ عبدالعزيز الغليقة
- ▶ عبدالعزيز السحيم

- ▶ حصة العليان
- ▶ شذى الظهير
- ▶ سمو الزير
- ▶ نورة الشثري
- ▶ سارة القحطاني
- ▶ **يناد الحميدي**
- ▶ ياسمين القرني
- ▶ يارا الزهراني
- ▶ لمى الأحمدى
- ▶ آلاء السلمي
- ▶ سارة العيدروس
- ▶ بدور المبارك
- ▶ فرح البكر
- ▶ سارة العبيد



• Made by



Contact info: physiology439@gmail.com



Editing file



Physiology 439 file