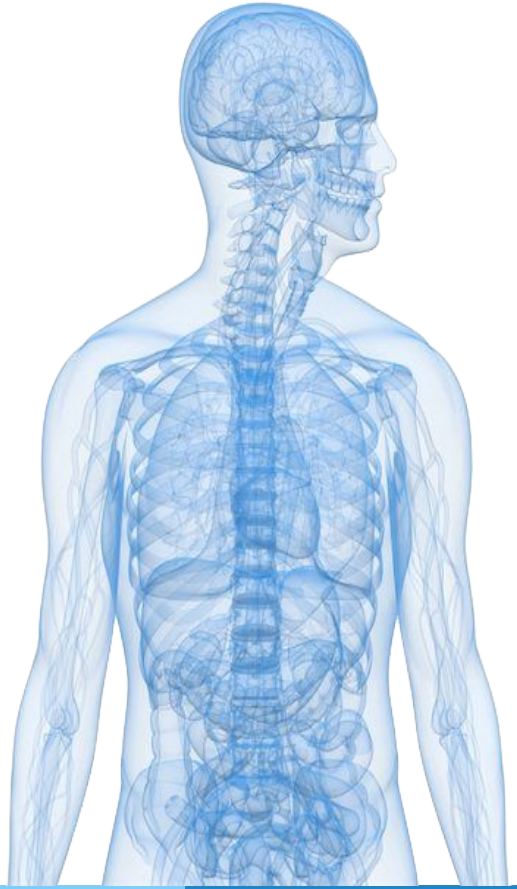

Practical

CBC & ESR

Red: Important
Black: In Male & Female slides
Blue: In male slides
Pink: In female slides
Green: Notes & extra information

Team Leaders:
Haya Alenazi
Abdulrahman Alswat

Objectives

- Recognize. the method used to measure the different hematological values, and compare it with the normal values.
- Do the calculation of indices, their normal values and their importance in diagnosis of different types of anemia.

Aim of the practical

- Counting Red blood cells.
- Counting White blood cells.
- Determination of hemoglobin concentration.
- Determination of packed cell volume (PCV)
- hematocrit.
- Calculation of red blood cell indices. Determination of ESR

COMPLETE BLOOD TEST (CBC)

It is a test panel requested by a doctor or other medical professional that gives information about the cells in a patient's blood.

The machine that does the counting is called COULTER COUNTER

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age 1 of 1 — C:4.10 D:2.0[2222] — P. O. Box 169015
ABADMIN — (800) 526-6932 — Miami, FL 33116-9015

	Cass / Pos	Sample ID	Date	Time	Run Status	Instrument	Operator
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WBC	8.1	10^3/µL	RBC	4.91	10^6/µL	RET %		
			HGB	13.6	L g/dL	RET #		
NE %	51.4	%	HCT	40.2	%	MRV		
LY %	39.0	%	MCV	81.9	fL	IRF		
MO %	7.8	%	MCH	27.6	pg			
EO %	1.2	%	MCHC	33.7	g/dL			
BA %	0.6	%	RDW	13.0	%			
			RDW-SD	38.1	fL			
NE #	4.2	10^3/µL						
LY #	3.2	10^3/µL						
MO #	0.6	10^3/µL	PLT	279	10^3/µL			
EO #	0.1	10^3/µL	MPV	9.2	fL			
BA #	0.0	10^3/µL						

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age 1 of 1
ABADMIN

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BA #	0.0		10^3/µL				

Male slides

Coulter counter Principle:

It count and measure the size of the cells by: detecting and measuring electrical resistance when a liquid pass through aperture.

While passing the aperture, the cells impedes the current and causes a measurable pulse.

Number of pulses --> number of particles.
Height of pulses --> volume of particles.

Materials & Methods

1. Coulter analyzer
2. Diluent reagents
3. Lytic reagent
4. Calibrator kit
5. EDTA anticoagulant blood

NORMAL VALUES

RBC , WBC cell count & HB:

5 ml of venous blood will be drawn in EDTA anticoagulant tube.
- Diluted by the reagent I and used to count RBC.
- Lysing RBC using reagent II and used for counting WBC and Hb.

	Male	Female	Average
RBC	4.5-6.5 $x10^6/\mu l$	3.8-5.8 $x10^6/\mu l$	4.7–6.5 $x10^6/\mu l$
WBC	4 – 11 $x10^3$ $/\mu l$	4 – 11 $x10^3$ $/\mu l$	4 – 11 $x10^3$ $/\mu l$
HB	13-18 g/dl	11.5-16.5 g/dl	13 –18 g/dl
Platelet	150-400$x10^3$ $/\mu l$	150-400$x10^3$ $/\mu l$	150-400$x10^3$ $/\mu l$

1. **Mean Cell Volume:**
This is the volume of an average RBC measured in cubic microns.

$$\text{MCV} = \frac{\text{Packed Cell Volume} \times 10}{\text{RBC count}} \qquad (78\text{-}98\ \mu m^3)$$

↓ MCV : microcytes

↑ MCV : macrocytes

2. **Mean Cell Hemoglobin:**
This is the weight of hemoglobin in an average RBC measured in pico-grams (pg) = micro-microgram (μμg).

$$\text{MCH} = \frac{\text{Hemoglobin Concentration} \times 10}{\text{RBC count}} \qquad (27\text{-}32\ \mu\mu g)$$

↓ MCH : hyporchromic

↑ MCH : hyperchromic

3. **Mean Cell Hemoglobin Concentration:**
This is the concentration of hemoglobin per 100 mls of RBCs measured in g/dl.

$$\text{MCHC} = \frac{\text{Hemoglobin Concentration} \times 100}{\text{Packed Cell volume}} \qquad (30\text{-}35\ g/dl)$$

Helpful video

Clinical terms

1. ↓ RBC = aneamia
2. ↑RBC= polycythemia
3. ↓WBC= leucopenia
4. ↑WBC= leucocytosis
5. ↓Platelets= thrombocytopenia
6. ↑Platelets= thrombocytosis

Clinical applications

Low numbers of RBCs	High numbers of RBCs	High numbers of WBCs (Leukocytosis)	Low numbers of WBCs (leukopenia)	platelet count
-Blood loss: – Anemia (various types). – Hemorrhage. -Bone marrow failure (for example, from radiation, toxin, fibrosis, tumor). -Erythropoietin deficiency (secondary to renal disease). -Hemolysis (RBC destruction). causes hemolytic anemia	-Low oxygen tension in the blood – Congenital heart disease – Cor pulmonale – Pulmonary fibrosis -Polycythemia vera. -Dehydration (such as from severe diarrhea).loss of plasma so the count of rbc is more -Renal (kidney) disease with high erythropoietin production.	-Infectious diseases. -Inflammatory disease (such as rheumatoid arthritis or allergy). -Leukemia. -Severe emotional or physical stress. -Tissue damage (burns).	-Bone marrow failure (for example, due to infection, tumor or fibrosis).aplastic anemia -Presence of cytotoxic substance. -Autoimmune/collagen -vascular diseases (such as lupus erythematosus). -Disease of the liver or spleen. -Radiation exposure.	**Thrombocytosis :** - Chronic myeloid leukaemia. **Thrombocytopenia:** - A plastic anemia. - Chemotherapy.

Team 437

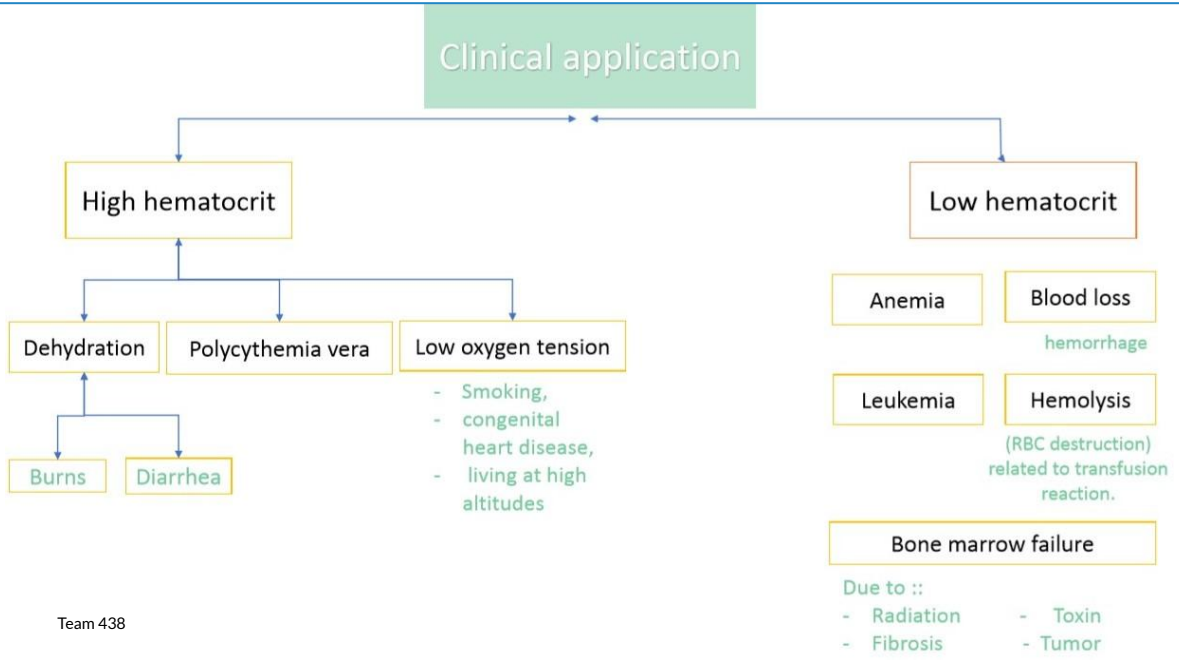
*The whole slide is from girls

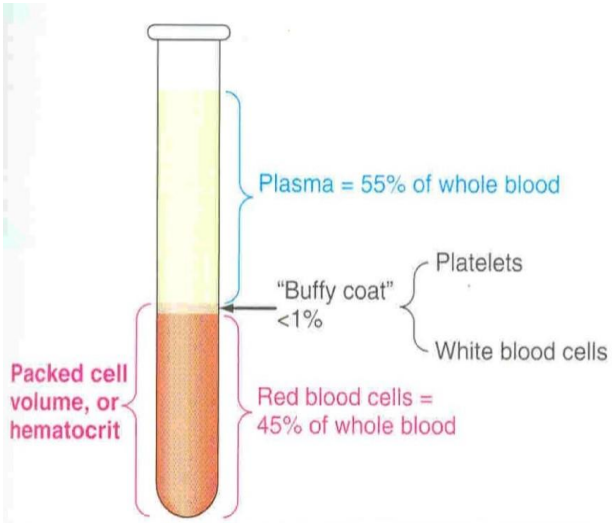
Types of anemia

	Case A	Case B
RBC	Low	Low
HB	Low	Low
PVC	Low	Low
MCV	Low	High
MCH	Low	N / high
MCHC	Low	N / low
Type of anemia	Microcytic hypochromic	Macrocytic megaloblastic
Cause	Iron deficiency	Vit B12 or folic deficiency

Hematocrit: Packed Cell Volume(PCV)

The ratio of packed cells volume (RBCs together) to plasma.

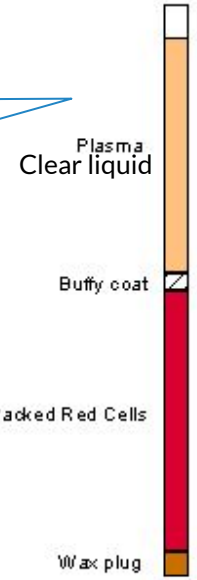




Procedure

1. Capillary blood obtained from pricking finger tip after cleaning it with alcohol.
2. Fill a heparinised capillary tube, then seal one end by plasticine.
3. Centrifuge for 5 minutes to packed the cells at one end of the tube leaving a clear plasma on top.
4. Use the hematocrit reader to find the packed cell volume.

Hematocrit tube



Hematocrit reader.

	male	female	Average
PCV%	40-54	35-47	35-54

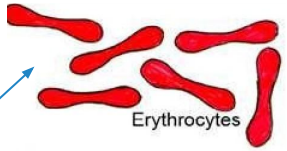
https://www.youtube.com/watch?v=sGaoC0I-IVk

Erythrocyte Sedimentation Rate (ESR)

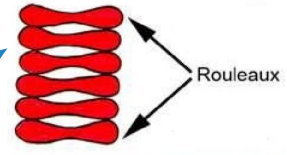
* Is the rate at which red blood cells sediment in a period of 1 hour.

* ESR is a non-specific measure of inflammation

Fibrinogen(+) = erythrocytes(-)



Fibrinogen(+) > erythrocytes(-)



RBCs sedimentation

* controlled by the balance between **fibrinogen** (+ve charged plasma protein) and **erythrocytes**(-ve charge separate RBCs) .

* In inflammatory, fibrinogen will increase and cause RBCs to stick together to form "**rouleaux**".

يزيد fibrinogen في حالات الالتهاب, زيادته تؤدي إلى تراص RBCs ويتحول اسمها من erythrocytes إلى rouleaux .

When red blood cells are stacked together in long columns or chains because of their biconcave disc like surfaces sticking to each other, it is called Rouleaux formation.

Material & Methods

- Westergren's sedimentation apparatus.

Procedure :
Using a sterile syringe draw 1.6ml of blood from a suitable vein. Transfer it to a test tube containing EDTA and then draw up blood into a Westergren tube exactly to the zero mark.
Place the tube upright in the stand and leave undisturbed. The height of the column of clear plasma at the top of the tube is noted at the end of an hour and again at the end of 2nd hours.

- Anticoagulant (EDTA).
- Disposable sterile syringes and needles.

Test tube containing:
- blood
- EDTA (anticoagulant)

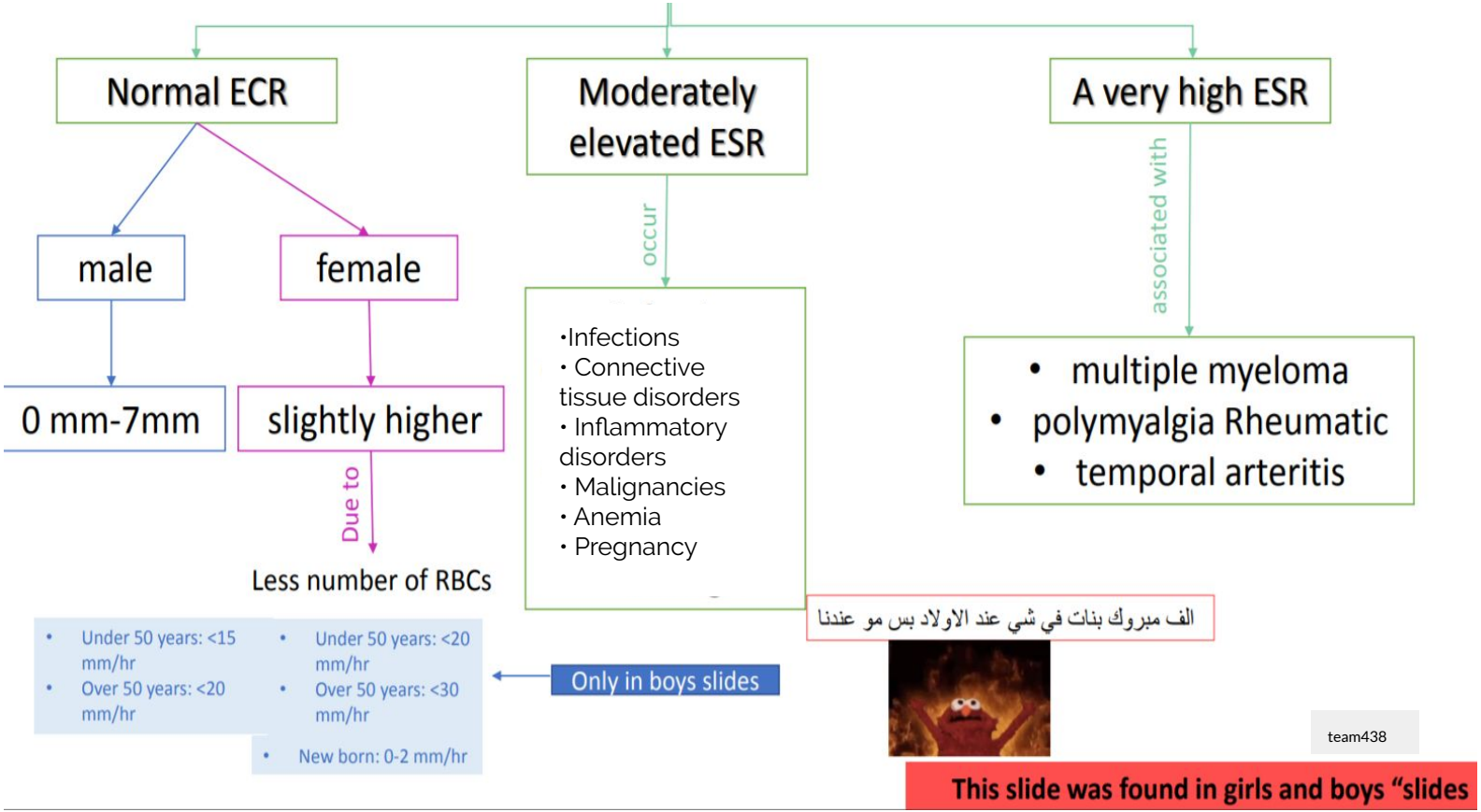
Westergren apparatus

Clinical application of ESR

- Nonspecific test.
- Prognostic not diagnostic
- Monitor disease activity and response to therapy
- ESR is a nonspecific marker of inflammation
- is affected by other factors

ESR results must be used along with other clinical findings

ESR Results


Normal ECR
Moderately elevated ESR
A very high ESR
male
female
occur
associated with
0 mm-7mm
slightly higher
•Infections
• Connective tissue disorders
• Inflammatory disorders
• Malignancies
• Anemia
• Pregnancy
• multiple myeloma
• polymyalgia Rheumatic
• temporal arteritis
Due to
Less number of RBCs
• Under 50 years: <15 mm/hr
• Over 50 years: <20 mm/hr
• Under 50 years: <20 mm/hr
• Over 50 years: <30 mm/hr
• New born: 0-2 mm/hr
Only in boys slides
الف مبروك بنات في شي عند الاولاد بس مو عندنا
team438
This slide was found in girls and boys "slides

C-reactive protein & ESR

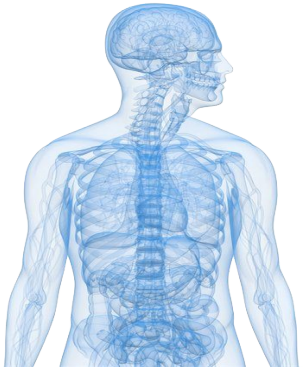
C-reactive protein is an acute phase protein produced by the liver during an inflammatory reaction.

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

باختصار اختبار C-Reactive protein في الدم يعطينا تصور هل فيه inflammatory reaction
لأن وقت ال inflammation يفرز بروتين الـ C-Reactive من الكبد

More about the topic

- Lab photos team 438 girls click.
- Laboratory file click.
- Summary file click.
- Helpful video start .



Thank You

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- محمد السلمان
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- مرشد الحربي
- منيب الخطيب
- نايف الشهري
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- عبد العزيز الغليقة
- عبد العزيز السحيم
- حصة العليان
- شذى الظهير
- سمو الزير
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- سارة القحطاني
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Physiology 439

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