PHC

432 Team

11 DATA INTERPRETATION (I)

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COLOR GUID: Doctor's Notes Team Notes slides Not important Important **431 team work**

Objectives

- Not Given

Mind Map

Anemia

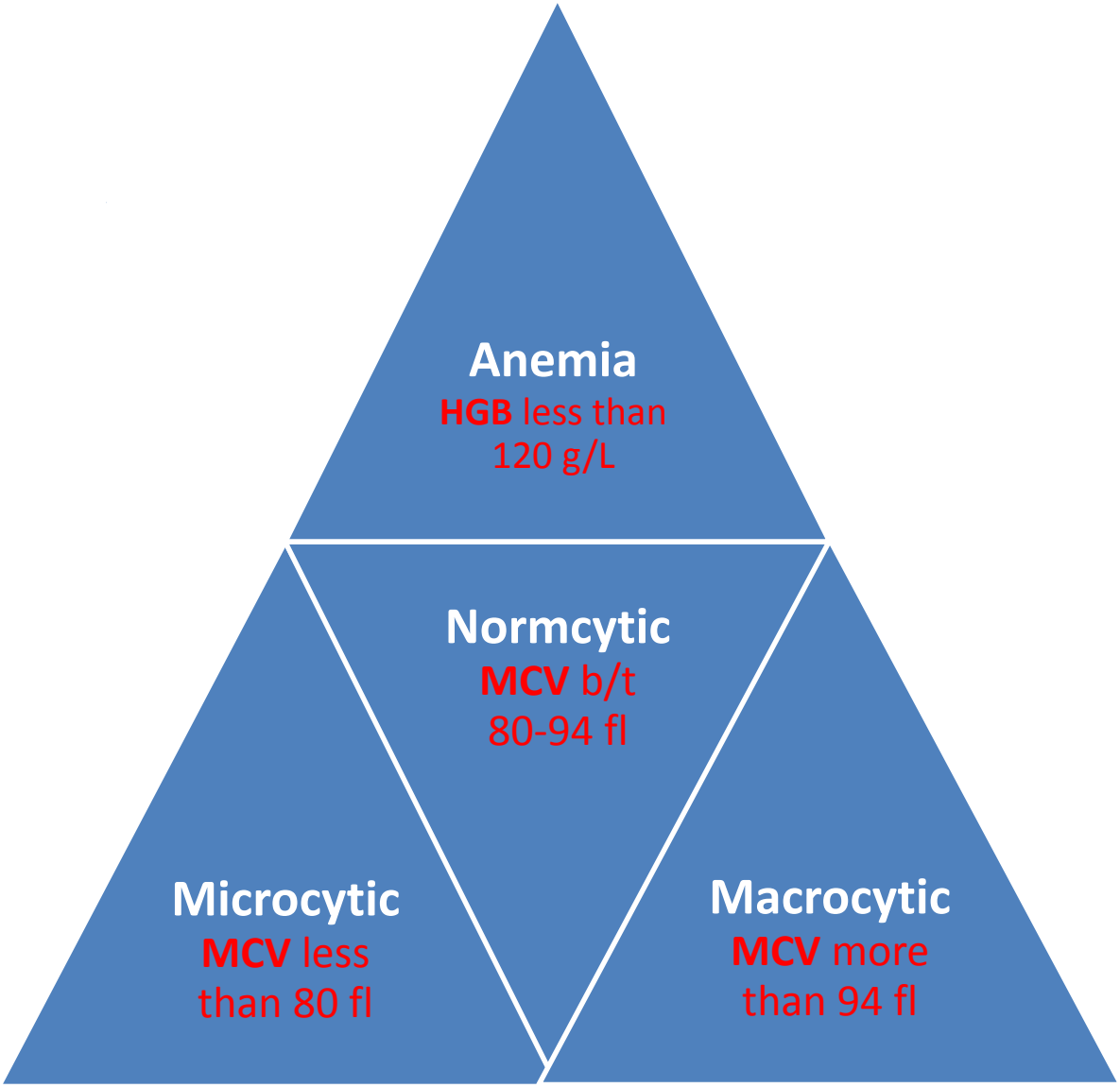
- Cases

Polycythemia and CLL

- Cases

Other

- Cases



To know type of anemia look to MCV:

- Low MCV: Microcytic e.g. Iron Deficiency Anemia (IDA) and Thalassemia.
- Normal MCV: Normocytic e.g. Anemia of Chronic Diseases and Aplastic Anemia (pancytopenia).
- High MCV Macrocytic e.g.Vit B12 Deficiency.

Other type of Anemia:

- Hemolytic Anemia e.g. Sickle Cell Anemia SCA and Glucose -6-phosphate Dehydrogenase Deficiency (G6PD deficiency).

Microcytosis:

Low MCV

	Serum Iron	Ferritin
IDA "Iron Deficiency Anemia"	**Low**	**Low**
Thalassemia Minor	**Normal**	**Normal**
Sideroblastic Anemia	**High**	**High**

- ✓ Sideroplastic Anemia is Uncommon, defect in heme synthesis and ringed sideroplasts in bone marrow. Very rare disease. May not see one in your life!

◘ RDW: Red Cell Distribution Width, when increased reflects heterogeneity in cell size or indicating low serum iron level.

Iron Deficiency Anemia

- ✓ Oral iron therapy, characterized by a modest reticulocytosis beginning in about five to seven days, followed by an increase in hemoglobin at a rate of about 2 to 4 g/dL every three weeks until the hemoglobin concentration returns to normal.
- ○ The serum or plasma ferritin concentration is an excellent indicator of iron stores.

  Patient with Iron deficiency anemia not response to treatment means:
  - Non-compliance to medication
  - Malabsorption (give I.V.)

Cases

First case:

A 37- year- old lady, presents with 3 months H/O dizziness and easy fatigue. The following CBC is shown below:

WBC	7. 0	4 – 11	x10.e9/L		
RBC	3. 68	4.2 – 5.5	x10.e12/L	low	
HGB	87	120 – 160	g/L	low	
HCT	27.1	42 – 52	%		
MCV	73.6	80 – 94	fl	low	
MCH	23.6	27 – 32	pg	low	
MCHC	321	320 – 360	g/L		
RDW	15.5	11.5 – 14.5	%	high	
PLT	445	140 – 450	x10.e9/L		

- **Interpretation the CBC :**
  - ✓ RBC Low
  - ✓ HGB Low
  - ✓ HCT Low
  - ✓ MCV Low
  - ✓ MCH Low
  - ✓ RDW High

- RBC, HGB and HCT are low **Anemia**.
- MCV is low **Microcytic**.
- MCH is low **Hypochromic**.
- RDW is high **Serum Iron is low**

- The **Diagnosis** through the CBC is Hypochromic Microcytic Anemia
  The most common case is **iron deficiency anemia (IDA).**
  - ✓ On systemic enquiry (y3ni through systemic review Hx), she added that she has **menorrhagia** for the last 4 months.
  - ✓ **DDX:** Diet, GI bleeding, medication e.g. aspirin, and malabsorption.
- **Mention one investigation of importance to reach the diagnosis:**
  The Most Common cause of Menorrhagia is **Hypothyroidism**

TSH :	89	mIU/L	(0.25 – 5)
FT4:	8.6	pmol/l	(10.3—25 .8)

- Primary Hypothyroidism

- **Treatment**: thyroxine, iron supplement (ferrous sulfate or ferrous fumarat) and folic acid. We treat usually at least 4 to 6 months.
  Stop the treatment when the Ferritin become in normal range.
- **Second case:**

A 16-year-old girl presents with 2 m H/O dizziness, palpitation and recurrent faints.The following CBC is shown below:

WBC	**8.1**		4 –11	x10.e9/L
RBC	**1.42**	L	4.2–5.5	x10.e12/L
HGB	**24**	L	120–160	g/L
HCT	**8.0**	L	37–47	%
MCV	**56**	L	80–94	fl
MCH	**16.6**	L	27–32	pg
MCHC	**295**	L	320–360	g/L
RDW	**22.9**	H	11.5 –14.5	%
PLT	**181**		140 –450	x10.e9/L
Retic. Count	**3.5**	H	0.2 - 2.0	%

- **Interpretation the CBC:**
  - ✓ RBC Low
  - ✓ HGB Low
  - ✓ HCT Low
  - ✓ MCV Low
  - ✓ MCH Low
  - ✓ RDW High
  - ✓ Retic.count High Because of bone marrow hyperactivity

- RBC, HGB and HCT are low Anemia.
- MCV is low Microcytic.
- MCH is low Hypochromic.
- RDW is high Serum Iron is low
- **Retic.count is Immature RBC**

- **Diagnosis**: Microcytic Hypochromic Anemia,severe Iron deficiency anemia.

- **Most common cause is** Menstrual Cycle Disturbances (Very common in this age).

- **HOW ARE YOU GOING TO MANAGE THIS PATIENT?**
  - ✓ Admission, Blood Transfusion, Two large bore IV line, Fluid and cross matching.
  - ✓ Treat the cause beside Iron and Folic A.

- **Third case: (1)**

A 17-year-old lady presents with dizziness and bouts of fall.
The following CBC is showing below:

WBC: 7.4	4 -11	x10.e9/L
RBC: 3.57	4.2 - 5.5	x10.e12/L
HGB: 57	120 -160	g/L
HCT: 20.1	37 - 47	%
MCV: 56.2	80 - 94	fl
MCH: 15.9	27 - 32	pg
MCHC: 282	320 - 360	g/L
RDW: 25.0	11.5 - 14.5	%
PLT: 578	140 - 450	x10.e9/L
Iron: 1.0	9 - 30	umol/L
Total Iron-Binding cap: 89.6	44.8 - 80.6	umol/L

- RBC, HGB and HCT are low Anemia.
- MCV is low Microcytic.
- MCH is low Hypochromic.
- RDW is high Serum Iron is low

- **Interpretation of the CBC:**
  - ✓ RBC Low
  - ✓ HGB Low
  - ✓ HCT Low
  - ✓ MCV Low
  - ✓ MCH Low
  - ✓ MCHC Low
  - ✓ RDW High
  - ✓ PLT High
  - ✓ IRON Low
  - ✓ TIBC High

Commonly, the platelet count (PLT) is slightly above the high limit of normal in IDA (mild thrombocytosis). This effect was classically postulated to be due to high erythropoietin levels in the body because of anemia, cross-reacting to activate thrombopoietin receptors in the precursor cells that make platelets

- **Diagnosis :**
  Microcytic Hypochromic Anemia Iron Deficiency Anemia

- **Treatment :** Transfused (one pint of blood) and Put on :ferrous sulphate and folic acid

- **Third case: (2 Cont.)**

A 17-year-old lady with low Hb, **after 6 weeks.** "after treatment"

WBC: 8.4	4 -11	x10.e9/L
RBC: 4.71	4.2 - 5.5	x10.e12/L
HGB: 105	120 -160	g/L
HCT: 32.5	37 –47	%
MCV: 68.9	80 –94	fl
MCH: 22.3	27 –32	pg
MCHC: 324	320 - 360	g/L
RDW: 35.7	11.5 -14.5	%
PLT: 296	140 - 450	x10.e9/L
Ferritin: 6.77	13 -150	ug/L
G6PD: NORMAL	100 - 200	IU/10^9

- After 6 month of treatment, the parameters are increase except the Ferritin still low, so we must continue on the treatment until the parameters (particularly ferritin) become in normal values.

- We ordered **hemoglobin electrophoresis** because we have high normal RBCs (4.7) in comparison to low HGB(105)

Hemoglobin A2 : 2.3	2.0 - 3.5	%
Hemoglobin F : 0.0	0 - 2.0	%
Hemoglobin A : 97.7	95 - 99	%
Hemoglobin S : 0.0	NORMAL	

✓ All normal.

REMEMBER:

- in G6PD deficiency, we see the deficient in G6PD enzyme in old RBCs not the young ones.
- We shouldn't request G6PD for a patient in attack of anemia because the bone marrow produces a lot of young RBCs which do not have deficiency in G6PD enzyme even if this patient has G6PD deficiency) So, we will have false negative normal G6PD.

- **Thalassemia Minor:**

Microcytosis is much more profound, and the anemia much milder, than that seen

in iron deficiency anemia.

Patients with beta thalassemia minor/trait also tend to have **total red blood cell counts higher than normal**, often into the "polycythaemic" range.

The **RDW** in patients with thalassemia trait tends to be normal, since virtually all cells are hypochromic and microcytic**.**

- ✓ **When increased reflect heterogeneity in cell size or indicating low serum iron level.**

MCV usually< 70 fL

- The decrease in MCV is disproportionate to the HB level.
  - ✓ y3ni MCV is very low and HB is mild low.
- **Mentzer Index: MCV / RBC is < 13**
- If RDW is high, Correct Iron level first before proceeding to HB electrophoresis, otherwise giving a false negative result.
- Hemoglobin electrophoresis:
  - ✓ If HB A2> 3.5 → B-thalassemia Minor.
  - ✓ If HB A2 < 1.5 → alpha thalassemia Minor.

- **Fifth case:**
  A 25-year-old man came for pre-marital checkup(means healthy) The

following CBC is shown below:

WBC	6.6		4 – 11 x 10.e 9/ L
RBC	5.87		4.7 – 6.1 x 10 .e12/L
HGB	121	L	130 – 180 g/L
HCT	38.1	L	42 – 52 %
MCV	64.0	L	80 – 94 fl
MCH	20.6	L	27 – 32 pg
MCHC	318	L	320 – 360 g/L
RDW	14.3		11.5 – 14.5 %
PLT	271		140 – 450 x 10.e9/L

- **Interpret this data:**
  - ✓ RBC High normal
  - ✓ HGB Low
  - ✓ HCT Low
  - ✓ MCV Low
  - ✓ MCH Low
  - ✓ MCHC Low
  - ✓ The decrease in MCV is more and is disproportionate to the HB level

When RBC not matching with HGB (RBC is high and HGB is low , vice versa) we order the Haemoglobin Electrophoresis.

- **Haemoglobin Electrophoresis:**
  - ✓ Hemoglobin A 94.5 95 -99 %
  - ✓ Hemoglobin F 0.6 0 – 2.0 %
  - ✓ **HemoglobinA2 4.9 H 2.0 – 3.5 %**
  - ✓ Hemoglobin S 0.0
  - ✓ Hemoglobin E 0.0
  - ✓ Hemoglobin C 0.0

- **DDX :**
  - ✓ Beta-thalassemia minor " trait"

To diagnose thalassemia:
Mentzer Index: MCV/RBC= less than 13
* Used only in thalassemia without iron deficiency anemia

- **Treatment:**
  - ✓ Patient with Beta-thalassemia minor don't need to treatment.

Extra from 431

Genotype	HbA%	HbA2%	HbF (%)
Normal (β/β)	97	2.5 –3.5	<1.5
Thalassaemia major	0	High >3.5	High
Thalassaemia intermedia	present	High >3.5	High
Thalassaemia minor	>90	High 3.5 –10.0	1-2 "sometimes higher"
Thalassaemia minima	97	<3.2	<1

* in β -Thalassaemia, HB A_2 is high >3.5

While in α- Thalassaemia HB A_2 is <1.5

Patients with beta-thalassemia minor don't need treatment (thalassemia therapy only for βeta-thalassemia major, sometimes for intermedia, and HbH disease "in alfa- thalassemia")

- ## Sixth case:

  A 34-year-old man came to check some of results because of being have IBS. The following CBC is shown below:

#	Test		Result	Unit	Range
EDTA Whole Blood *- SAMPLE: 1*					
1	WBC		7.75	x10.e9/L	4 - 11
2	RBC	H	6.83	x10.e12/L	4.7 - 6.1
3	HGB		135.0	g/L	130 - 180
4	HCT		43.0	%	42 - 52
5	MCV	L	63.0	fl	80 - 94
6	MCH	L	19.8	pg	27 - 32
7	MCHC	L	314.0	g/L	320 - 360
8	RDW	H	16.20	%	11.5 - 14.5
9	PLT		175	x10.e9/L	140 - 450

  - ✓ RBC High, HBG normal , MCV & MCH are very low, RDW is High.
  - ✓ Not matching with HGB so, we order Hemoglobin Electrophoresis.

#	Test	Result	Unit	Range
Venous Blood *- SAMPLE: 1*				
1	Hemoglobin A2	2.5	%	2.0 - 3.5
2	Hemoglobin F	0.50	%	0 - 2.0
3	Hemoglobin A	97.0	%	95 - 99
4	Hemoglobin S	0		-
5	Hemoglobin C	0		-
6	Hemoglobin E	0		-
7	Hemoglobin O	0	%	-

  - ✓ HB A2 normal !

- **DDX:**
  Thalassemia Trait mostly “alpha Thalassemia”

- ## Seventh Case:

A 31-year-old man presents with heart burn and known to have IBS.The following CBC is shown below:

#	Test	Result		Unit	Range
EDTA Whole Blood - SAMPLE: 1					
1	WBC	13.6	H	x10.e9/L	4 - 11
2	RBC	4.94		x10.e12/L	4.7 - 6.1
3	HGB	106	L	g/L	130 - 180
4	HCT	33.1	L	%	42 - 52
5	MCV	67.1	L	fl	80 - 94
6	MCH	21.4	L	pg	27 - 32
7	MCHC	319	L	g/L	320 - 360
8	RDW	19.7	H	%	11.5 - 14.5
9	HDW	0.0		g/L	0 - 0
10	PLT	375		x10.e9/L	140 - 450

✓ RBC not matching with HGB so, we order Hemoglobin Electrophoresis:

#	Test	Result		Unit	Range
Venous Blood - SAMPLE: 1					
1	Hemoglobin A2	7.3	H	%	2.0 - 3.5
2	Hemoglobin F	5.2	H	%	0 - 2.0
3	Hemoglobin A	0.0	L	%	95 - 99
4	Hemoglobin S	87.5	H		-
5	Hemoglobin C	0.0			-
6	Hemoglobin E	0.0			-
7	Hemoglobin O	0.0		%	-

- **What is your diagnosis?**
  - ✓ Sickle cell anemia SCA and Beta Thalassemia Trait

- **Treatment:**
  - ✓ Patient with SCA treat by hydroxyurea, which is increase HBF.

HBF is very high affinity for oxygen, that way patient live with less symptoms!

Coexistent of beta-thalassemia with SCA, made it less severe. However, if he had a pure SCA, HBA2 will be less than 7.

- **To differentiate Beta-thalassemia from S-beta thalassemia, we focus on HbA2:**
  - ✓ **If its percentage >3.7% it is S-Beta thalassemia.**
  - ✓ **If its percentage >3.5% and <3.7% it is sickle cell anemia.**
  - ✓ **If its percentage < 3.5% or < 1.5% it is S-alfa thalassemia**

If Hb S =< 45% sickle cell trait (AS)
If Hb S > 45% sickle cell anemia/disease (SS)

Eighth Case:

A 49-year-old woman presents with weakness and easy tiredness.
The following investigations are shown:

WBC: 7.8		4 - 11	x10.e9/L
RBC: 4.16		4.2 – 5.5	x10.e12/L
HGB: 76	L	120 – 160	g/L
HCT: 25.2	L	37 – 47	%
MCV: 60.6	L	80 – 94	fl
MCH: 18.3	L	27 – 32	pg
MCHC: 303	L	320– 360	g/L
RDW: 19.2	H	11.5 – 14.5	%
PLT: 383		140 – 450	x10.e9/L

Iron: 2.0		9 – 30	umol/L
Ferritin: 4.57		13 - 150	ug/L
Total Iron-Binding cap: 89.3		44.8 - 80.6	umol/L

- **Interpret this data:**
  - ✓ **RBC** Normal
  - ✓ **HGB** Low
  - ✓ **HCT** Low
  - ✓ **MCV** Low
  - ✓ **MCH** Low
  - ✓ **MCHC** Low
  - ✓ **RDW** High
  - ✓ **Iron** Low
  - ✓ **Ferritin** Low
  - ✓ **TIBC** High

- RBC low normal,
- HB very low = no matching = thalassemia trait.
- Very low serum iron, low ferritin, high TIBC = typical picture of iron deficiency anemia.
- In case of pure IDA: RBC must be very low.

- **What is your diagnosis?**
  - ✓ Iron deficiency anemia and thalassemia trait

- **Three cases!**

	41yo SF pre-op screening	45 yo Indian male pre-employment	52 yo Filipino male HTN	Normal
Anemia	Microcytic	Microcytic	Microcytic	
RBC	3. 40 L	5.87 High normal	4.98	4.7 -6.1x 10.e 12/L
Hb	89 L	126 L	119 L	130 - 180 g/L
MCV	70.9 L	63.3 L	70.8 L	80-94 fl
S. Iron	2.6	13	34 H	9-30µmol/L
Ferritin	3.39 ↓	266.7	691 ↑	30-400µg/L
Hemogl.A2	2.1	5.4 "because high"	2.2 "because normal"	2.0-3.5
Hemogl F	0	<0.5	0	0-2.0
Hemogl A	97.9	>94	97.8	95-99
Hemogl S	0	0	0	-
Hemogl C	0	0	0	-
	IDA	Beta-Th. Trait	Alfa-Th. Trait	

The Filipino guy took a lot of iron supplements → secondary hemosedrosis. Stop and educate and the levels will go back to normal. (no serious risk)

Normocytic Normochromic Anemia:

- **Anemia of chronic diseases characterized by:**
    - Serum Iron Low
    - Ferritin Normal or High
    - RDW Normal or High

- **Causes:**
    - Acute blood loss
    - Hypothyroidism (most common)
    - Chronic Diseases (Rheumatoid Arthritis، Renal failure)
    - Malignancy

Ninth Case:

A 70-year-old man, presents with 2-month H/0 easy fatigue and tiredness.
PMH (Past Medical History): unremarkable,
The following CBC is shown below:

WBC:	7.8		4	– 11	x10.e9/L
RBC:	2.26	L	4.2	– 5.5	x10.e12/L
HGB:	69	L	120	– 160	g/L
HCT:	20.2	L	37	– 47	%
MCV:	89.3		80	– 94	fl
MCH:	30.6		27	– 32	pg
MCHC:	343		320	– 360	g/L
RDW:	15.8	H	11.5	– 14.5	%
PLT :	179		140 – 450		x10.e9/L

- **Interpret this data:**
  - ✓ **RBC** Low
  - ✓ **HGB** Low
  - ✓ **HCT** Low
  - ✓ **RDW** High

- RBC, HGB and HCT are low Anemia.
- MCV is normal Normocytic.
- MCH is low Normochromic.
- RDW is high
  Serum Iron is low

- **Diagnosis:**
  - ✓ Normocytic Normochromic Anemia

- **Possible causes:**
  - ✓ Hypothyroidism, Chronic Diseases (rheumatoid arthritis , renal failure) , Malignancy

- **Tenth Case**: (1)

A 70-year-old man, known diabetic, admitted because of abdominal pain. The

# Test	Result		Unit	Range
EDTA Whole Blood - SAMPLE: 1				
1 WBC	7.0		10.e9/L	4 - 11
2 RBC	3.38	L	10.e12/L	4.7 - 6.1
3 HGB	101	L	g/L	130 - 180
4 HCT	30.0	L	%	42 - 52
5 MCV	88.8		fl	80 - 94
6 MCH	29.9		pg	27 - 32
7 MCHC	336		g/L	320 - 360
8 RDW	17.8		%	11.5 - 14.5

# Test	Result		Unit	Range
Serum - SAMPLE: 1				
1 Ferritin	1583.000	H	ug/L	30 - 400
2 Vitamin B12	630.600		PM/L	145 - 637

# Test	Result		Unit	Range
Serum - SAMPLE: 1				
1 Iron	9.4	L	umol/L	11 - 31

following investigations are shown below:

- **What is your diagnosis?**
  - ✓ Normocytic normochromic anemia, due to chronic disease, malignancy or hypothyroidism.

Why the ferritin is very high in this patient?
Because the ferritin is actant for the inflammation–means once we have inflammation (acute or chronic), the ferritin level will increase "this will give you also impression about ferritin stores".

- **Tenth Case (Cont. 2):**

Test	Result	Unit		Range	
1	Urea	21.0	H	mmol/L	2.9 - 7.5
2	Serum Creatinine	330	H	umol/L	62 - 115
3	Sodium	128	L	mmol/L	135 - 145
4	Potassium	4.2		mmol/L	3.5 - 5.1
7	Random Blood Sugar	8.6		mmol/L	3.9 - 9
10	Albumin	37		g/L	30 - 50
11	Corrected Calcium	2.4		mml/L	2.1 - 2.55
12	Inorganic Phosphorus	1.68	H	mmol/L	0.74 - 1.3
13	Total Bilirubin	58	H	umol/L	3 - 17
14	Direct Bilirubin	42	H	umol/L	0 - 5
15	Total Proteins	84	H	g/L	60 - 80
16	Alkaline Phosphatase	189	H	U/L	50 - 136
17	Alanine Aminotransferase	72	H	U/L	20 - 65
18	Aspartate Aminotransfer.	62	H	U/L	12 - 37
19	Gamma G T	142		U/L	15 - 85
21	Globulins	47.0		g/L	20 - 40
23	Creatine Kinase	6	L	U/L	39 - 308
24	Magnesium	0.8		mmol/L	0.7 - 1.1
25	Amylase	168	H	U/L	25 - 125
26	Lipase	1414.0	H	U/L	0 - 200

This pt. also has pancreatitis

A 70-year-old man, known diabetic, admitted because of abdominal pain.

- Lipase most significant to diagnose acute pancreatitis

- **What is the kind of chronic disease cause Normocytic Normochromic Anemia in this patient?**
  - ✓ Chronic Renal Failure. Because urea and creatinine high

Macrocytic Hyperchromic:

MCV > 94 fl

❖ Causes:

- ✓ **Megaloblastic :** B12 deficiency/ Folate deficiency
  (**MCV** mostly > 120 fl)

- ✓ **Non Megaloblastic:**
  Myelodysplastic Syndrome
  Liver Disease
  Alcohol
  Hypothyroidism

- ✓ **Cytotoxic Drug**

- ## Eleventh Case:

A 57-year-old man presents with 5 weeks H/O numbness and weakness of the lower limbs. He was looked pale with signs of peripheral neuropathy.
The following CBC is shown below:

WBC:	3.20	4 –	11	x10.e9/L
RBC:	1.90	4.2 –	5.5	x10.e12/L
HGB:	53	120 –	160	g/L
HCT:	15	37 –	47	%
MCV:	118	80 –	94	fl
MCH:	40	27 –	32	pg
MCHC:	134	320–	360	g/L
RDW:	24.6	11.5 –	14.5	%
PLT	:39	140 –	450	x10.e9/L

Blood film: Hypersegmentation of neutrophils.

- **Interpret this data:**
  - ✓ **WBC Low**
  - ✓ **RBC Low**
  - ✓ **HGB Low**
  - ✓ **HCT Low**
  - ✓ **MCV High**
  - ✓ **MCH High**
  - ✓ **RDW High**
  - ✓ **PLT Low**

- RBC, HGB and HCT are low
  Anemia.
- MCV is High
  Macrocytic.
- MCH is low
  Hyperchromic.
- RDW is high
  Serum Iron is low

- **What is the most likely Diagnosis?**
  - ✓ Vitamin B12 Deficiency / Pernicious Anemia.

- **Mention three investigation necessary for this patient:**
  - ✓ Vitamin B12 level
  - ✓ Bone Marrow Aspiration
  - ✓ Gastroscopy " never do it when the HB less than 10 g "
- **How manage this patient?**
  - ✓ Admission
  - ✓ Give B12 Injection
  - ✓ May give Folate " but never give Folic acid before vit.B12 because might worsen the symptoms "

- **If Vit.B12 deficiency untreated what will happen?**
  - ✓ Will develop Sub acute combined degeneration.

- Once we see MCV above 110, we usually suspect the patient might have megaloblastic anemia (due to vitamin B12or folate deficiency) until proven otherwise.
- Hypersegmentation of neutrophils confirms megaloblastic anemia. so, now we say the patient has vit.B12 deficiency not folate deficiency), because he has peripheral neuropathy.
- VitaminB12 deficiency causes bone marrow depression "pancytopenia" because vit.B12 is imp. In production of RBC,WBC & PLT.

EXTRA

- Causes: (almost all cases are due to impaired absorption) Of vitamin B12

Low dietary intake	Abnormal utilization
Vegans = vegetarian	Congenital transcobalamin II deficiency
Impaired absorption	
Stomach (from a lecture: lack of gastric acidity) Pernicious anaemia Gastrectomy Congenital deficiency of intrinsic factor *Small bowel* Ileal disease or resection Bacterial overgrowth chron's disease Fish tapeworm (*Diphyllobothrium latum*)	(from a lecture: metformin)

Pernicious anemia: is an autoimmune disorder in which there is atrophic gastritis with loss of parietal cells in the gastric mucosa with consequent failure of intrinsic factor production and vitamin B12 malabsorptio → Causing vitamin B12 deficiency. It is the most common cause in the Western hemisphere. There is an association with other autoimmune diseases: thyroid disease (commonest), Addison's disease and vitiligo. Also there is a higher incidence of gastric carcinoma.

- **Twelfth case:**

  A 12-year-old boy presented with two days H/O of lethargy. His mother has noted him to be jaundiced. He was usually well. His PMH is unremarkable.
  O/E, he was pale and obviously jaundiced, no hepatomegaly.
  The following investigations are shown below:

HB	76	130 – 180	g/L
WBC	6.90	4 – 11	x10.e9/L
PLT	413	140 – 450	xl0 .e9/L
Retic.	5.4	0.2 - 2.0	
Total bilirubin:	94	3- 17	umol/L
Direct bilirubin:	5		
Urine urobilinogen:	+ve		
Alanine amino transferase (ALT):	35	20-65	u/L

- **What is most likely diagnosis?**
  - ✓ G6PD deficiency / Hemolytic anaemia.
- **What additional details in history and further investigations *?***
  - ✓ H/O exposure to Fava Beans / Drugs
  - ✓ Screening test for G6PD, when haemolysis is not present.
- **Management:**
  - ✓ Iron and folic acid supplement
  - ✓ Referral to Hematologist and nutritionist
  - ✓ Wait to 6 weeks or to 2 months then check the G6PD, if the patient had the disease will be <u>low</u>. To confirm the diagnosis.

- Total bilirubin high, direct is normal so indirect is high (you have to specify whether direct or indirect– because in case of hemolysis, we have high indirect not direct).
- Low HB "means anemia", High reticulocytes "indicates hemolytic anemia".
- So, what is the most common cause of hemolytic anemia "especially in child"? G6PD. Don't screen G6PD when acute. It'll give a false negative because all RBCs present are new. Give iron, folic acid & list of food that should be avoided in patients with G6PD. Then, once he improve & his HB backs to normal, we check the level of G6PD later on, then, we decide for final management. The previous treatment was based on theory, now we confirm it".

Polycythaemia:

- **Absolute** Polycythaemia: (Red Cell mass ↑)
- **Relative** Polycythaemia: (GaisBock's):
  - Normal Red Cell Mass
  - Decrease in plasma volume
  - Obese, middle aged men with
  - Anxiety and hypertension.

- **Absolute: very imp**

◘ Primary Polycythaemia Rubra Vera (↑ RBC، WBC and Platelets) OR (Increase in RBCs with ↑in WBCs, ↑Platelets or both).

◘ Secondary Polycythaemia Causes :

- Smoking
- COPD
- High altitude
- Cyanotic Cong. H.D
- Renal Cysts
- Uterine Fibromyoma
- Hypernephroma
- Adrenal adenoma
- Hepatoma
- Phaeochromocytoma

✓ One investigation to role most causes of 2nd polycythemia is abdominal US in male patient and abdominal and pelvic US in female patient. Very imp.

- **What is the role of erythropoietin?**
  - If the erythropoietin level is **high**: secondary polycythaemia.
  - If the erythropoietin level is **low**: polycythaemia rubra vera
- **Lap. Features of Polycythaemia Rubra Vera:**
  - Increased in HB
  - Increased in WBC (>12.000)
  - Increased platelets (> 400.000) could be within normal level
  - Increased uric acid
  - Increased LAP (Leukocyte Alkaline Phosphatase) Score
  - Increased serum Vit B12
  - Bone Marrow Examin: Hypercelularity

Polycythaemia vera (Diagnostic criteria)

- **Major Criteria:**
  - ✓ Elevated cell mass
  - ✓ Normal arterial oxygen concent. (≥ 92%)
  - ✓ Splenomegaly

- **Minor Criteria:**
  - ✓ Platelet count > 400.000
  - ✓ WBC count >12.000
  - ✓ ↑ LAP Score
  - ✓ ↑ B12 level

• Thirteenth Case:

A 55-year-old man, who is a known case of hypertension controlled on 25 mg hydrochlorothiazide. He is a smoker of 20 cig. per day for >20 years.
He came for routine follow up:

WBC:	6.5	4—11	x 10.e9/L
RBC:	7.1	4.7—6.1	x 10.e12/L
HB:	197	130—180	g/L
HCT:	56.3	42—52	%
MCV:	88	80 - 94	fl
MCH:	30.3	27 - 32	pg
PLT:	305	140 - 450	x 10.e9/L
ESR:	4	0 – 10	mm/hr

- **Interpret this data:**
  - ✓ **RBC** High
  - ✓ **HB** High
  - ✓ **HCT** High

- **What is the differential diagnosis?**
  - 2nd Polycythemia (mostly 2nd Polycythaemia due to smoking)
  - Polythycaemia rubra vera (primary)

- **The diagnosis is**
  Secondary polycythemia (WBC and PLT are normal!)

- **How are you going to manage this patient?**
  - Blood Donation.
  - Stop smoking.
  - Aspirin.
  - Shift to another anti-HTN (calcium channel blocker), (because hydrochlorothiazide is diuretic, which cause decrease in plasma volume in consequence the polycythemia will increase).

- ## Fourteenth Case:

A 44-year-old man, who is a known case of HCV positive.
The following investigations are shown below:

WBC: 2.0	4—11	x 10.e9/L
RBC: 2.95	4.7—6.1	x 10.e12/L
HB: 110	130—180	g/L
HCT: 31.9	42—52	%
MCV: 108.1	80 - 94	fl
MCH: 37.3	27 - 32	pg
RDW: 19.5	11.5 – 14.5	
PLT: 92	140 - 450	x 10.e9/L

HEPATITIS C RNA QUALITATIVE (detect the RNA or DNA): Positive
HEPATITIS C RNA QUANTITATIVE (unit of virus in ML): 389744 IU/ML H

- **Interpret this data:**
  - ✓ WBC, RBC, HB, HCT and PLT are Low
  - ✓ RDW, MCV and MCH are High

- **Diagnosis:**
  - Pancytopenia 2nd to therapy like interferon. (drug-induce bone marrow depression).

- **Management:**
  - Only Stop the treatment and follow up.

WBC, RBC, platelet count are all low, it's pancytopenia (bone morrow depression).
Then we ordered PCR to know whether the virus is there or not (RNA or DNA and present or not qualitative and quantitative "viral load") in this case 389744 is high.
He was on interferon (to treat HCV) One of its side effects is bone morrow depression.
Stop medication and give a chance for the bone morrow to recover. It will take approximately 2 weeks but the hepatologist should consider other medications to treat the patient.

- ## Fifteenth Case:

A 64-year-old man presents with 3 month H/ODizziness and headache. His PMH: unremarkable O/E: plethoric and tip of the spleen is palpable.
The following CBC is shown below.

WBC:	21.8	4 – 11	x10.e9/L
RBC:	8.59	4.7 – 6.1	x10.e12/L
HGB:	213	130 – 180	g/L
HCT:	66.6	42 – 52	%
MCV:	81	80 – 94	fl
MCH:	28.3	27 – 32	pg
MCHC:	324	320 – 360	g/L
RDW:	14.3	11.5 – 14.5	%
PLT:	350	140 – 450	x10.e9/L
LAP SCORE:	237	20 – 80	

*Leukocyte Alkaline Phosphate support the DX

- **Interpret this data:**
  - ✓ WBC, RBC, HB and HCT are high

- **What is your diagnosis and action taken?**
  - ✓ Polycythaemia Rubra Vera
  - ✓ Admission Referral to Haematology and Bone marrow aspiration.

Patient has high RBC (means polycythemia) , WBC or PLT High or both– here we have WBC (means rubra vera)
Based on the symptoms palpable spleen "diagnostic" , headache & dizziness " due to high viscosity of blood , leading to slow and increase of pressure in circulation"

- ## Sixteenth Case:

A 53-year-old man booked for control of high blood pressure. He used to smoke 20–40 cig. per day and cheesha.
The following CBC is shown below:

#	Test	Result	Unit	Range
EDTA Whole Blood - SAMPLE: 1				
1	WBC	3.9 L	10.e9/L	4 - 11
2	RBC	7.18 H	10.e12/L	4.7 - 6.1
3	HGB	224 H	g/L	130 - 180
4	HCT	66.6 H	%	42 - 52
5	MCV	92.7	fl	80 - 94
6	MCH	31.3	pg	27 - 32
7	MCHC	337	g/L	320 - 360
8	RDW	13.7	%	11.5 - 14.5
9	HDW	0	g/L	-
10	PLT	163.0	10.e9/L	140 - 450

- **Interpret this data:**
  - ✓ RBC, HB and HCT are high

- **What is your diagnosis?**
  - ✓ 2nd Polycythemia

- **Think in caused by**
  - ✓ Smoking
  - ✓ COPD

Management:

- Blood Donation every week
- Stop smoking.
- Aspirin.

- **We have to do ultrasound "to rule out other causes of 2nd polycythemia, even if you are 100% sure that is caused by smoking".**
- **Treat by antihypertensive"e.g. CCBs or ACEIs, but never used thiazide", aspirin & frequent blood donation.**

- ## Seventeenth Case:

A 63-year-old woman presents with a 2 months' H/0 tiredness and easy bruising. 0/E cervical lymph nodes are felt and her spleen is palpable 4 cm below the costal margin.

The following investigations are shown below:

WBC	42.7	4 – 11	x10.e9/L
RBC	2. 6	4.7 – 6.1	x10.e12/L
HGB	83	130 – 180	g/L
HCT	30.2	42 – 52	%
MCV	102	80 – 94	fl
MCH	36.4	27 – 32	pg
PLT	52	140 – 450	x10.e9/L
Differential			
NEUT	8.5	40 – 75	%
LYMP	89	20 – 45	% (most WBC are lymphocyte)
RETIC	5.3	0.2 - 2	% (RETIC High = Hemolytic anaemia)
Immunoglobulins			
IGG:	3.5	8 - 18	g/L
IGM:	0.1	0.6- 2.5	g/L
IGA:	0.1	0.9- 4.5	g/L

- **Interpret the results and what complications are seen?**
  - ✓ High WBCs with mainly lymphocytes predominant
  - ✓ Lymphadenopathy and splenomegaly
- **What is your diagnosis?**
  - ✓ Chronic Lymphocytic Leukaemia.
- **Complication:**
  - ✓ Autoimmune Haemolytic Anaemia Low Hb and high reticulocytes.
  - ✓ Thrombocytopenia (bone marrow filtration)
  - ✓ Hypogammaglobulinaemia (Low Immunoglobulins, because they are synthesized by the lymphocytes that are damaged and not functioning)
- **Management:**

  Admit patient and refer to hematologist

• Eighteenth Case:

A 15-year-old girl presents with 6 months H/O hair fall.
The following investigations are shown:

Hb:	111	(120 – 160)	g/L
Ferritin:	4.7	(13 – 150)	ng/ml
Vit D:	11.2	(75 – 250)	nmol/L
TSH:	3.2	(0.25 – 5)	mIU/L
Zinc:	10.2	(7.65 – 22.95)	umol/L

- **What is your management?**
  - ✓ Ferrous fumarate and folic acid to restore Ferritin level
  - ✓ Vitamin D3

- **What are the investigation will order for patient with hair fall?**
  - ✓ CBC
  - ✓ Ferritin
  - ✓ Vit D
  - ✓ TSH to exclude Hypothyroidism
  - ✓ Zinc

Doctor Skip this case!

- ## Nineteenth Case:

A 62-year-old lady, known case of IHD presents with one week H/O black stools which is documented to be melena on PR. She was pale and abdomen is soft.
Investigations revealed:

HGB	96	120 – 160 g/L
PLT	260	140 – 450 x10.e9/L

- **What is the most common cause could be responsible for this condition?**
  - ✓ Aspirin
- **The most appropriate next step to do is:**
  - ✓ A- Start her on ferrous sulphate
  - ✓ B- Start her on H2 blocker
  - ✓ C- Start her on proton pump inhibitor
  - ✓ D- Refer her for gastroscopy

○ **Answer: D**

- ## Twentieth Case:

A 24-year-old man presents with 2 days H/O loose motions, 3 – 5 times per day with blood and mucous. He gave H/O URTI and a course of antibiotic. Stool analysis is shown:

Mucous ++
RBCs 30 – 40 /HPF
WBCs 10 – 20 /HPF
C/S: No growth

- RBCs and WBCs in stool analysis mean Infection.
- Culture and sensitivity not growth means not bacterial infection.

- **Mention two differential diagnosis**.
  - ✓ Acute dysentery e.g. Shigella / Amoebic
  - ✓ Pseudo Membranous Colitis

- **What is the most appropriate diagnosis based on the scenario?**
  - ✓ Pseudo Membranous Colitis

- **Mention three drugs responsible for that picture:**
  - ✓ 1. Clindamycin 2. Ciprofloxacin 3. Amoxicillin

- **What is the causative agent?**
  - ✓ Clostridium Difficile

- **Management:**
  - ✓ Discontinue Antibiotic
  - ✓ Oral fluids
  - ✓ Metronidazole " Vancomycin in severe or resistant cases "

Twenty First Case:

A 42-year-old lady presented with 2 days H/O lower abdominal pain and vomiting. Result Unit Range URINE - SAMPLE: 1

NITRITE: POSITIVE
PH: 8.5
PROTEIN 1+
GLUCOSE NIL
KETONE TRACE
BLOOD 3+
HG 3+
WBCs 467 cmm
RBCs 968 cmm
CAST NIL
CRYSTAL NIL
OTHERS BACTERIA ++
SPECIFIC GRAVITY: 1.025

- ✓ When nitrite is positive = **infection**
- ✓ High WBC = infection
- ✓ **So, it is clear case of infection** upper or lower? Pyelonephritis or Cystitis?
- ✓ If **pyelonephritis** vomiting, fever etc.
- ✓ She needs admission.
- ✓ Choice of antibiotic? **Ciprofloxacin** and follow.

- **What is your diagnosis?**
  - ✓ UTI – Caused by most likely, E.coli.

Twenty Second case:

A 14-year-old boy presents with one-month H/O puffiness of eyelids mainly by morning. The following urine analysis is shown below.

NITRITE negative
PH 5.8
PROTEIN 4+
WBC 10 / CMM
RBC 10 / CMM
CASTS NIL
ANTIBACTERIAL ACTIVITY: NIL
HG: NIL
CULTURE : NO GROWTH

- All normal except the protein.

- **INTERPRET THE RESULTS:**
  - ✓ Proteinuria and mostly Nephrotic syndrome.

- ## Twenty Third Case:

A 32-year-old man who is a known case of IBS for the last 3 years.
The stool analysis shown below.

OCCULT BLOOD:	NEGATIVE
OVA, CYST & PARASITE:	NO OVA CYST or PARASITE SEEN
CULTURE:	SALMONELLA SEROGROUP C1

- **How are you going to manage this patient?**
  - ✓ Self-limiting, no need for antibiotic and follow up.

This patient was exposed **to food poisoning**
Salmonella causes food poisoning.

Should we give antibiotic?
No, if non-typhi don't give, it's self-limiting.
Repeat culture after one month and it will be negative.

Summary

- **Anaemia has different types:**
    - Microcytic Hypochromic (MCV < 80 fl) e.g.
        - ✓ IDA "serum iron and ferritin are low ".
        - ✓ Thalassemia "serum iron and ferritin are normal".

RDW: Red Cell Distribution Width, when increased reflect heterogeneity in cell size or indicating low serum iron level.

- Normocytic Normochromic (MCV = 80-94 fl)(serum iron low , ferritin normal or high and RDW normal or high) e.g.
    - ✓ Chronic disease e.g. RA and RF
    - ✓ Acute blood loss
    - ✓ Malignancies
    - ✓ Hypothyroidism

- Macrocytic Hyperchromic (MCV > 94 fl)e.g.
    - ✓ Megaloblastic; Vit B12 deficiency.

- **Primary Polycythemia** Rubra vera criteria are
    - RBC, WBC and Platelets are High
    - RBC WBC are High
    - RBC and Platelets are High

- **Secondary Polycythemia** caused by either natural or artificial increases in the production of erythropoietin, hence an increased production of erythrocytes. E.g.
    - ✓ High altitude, Smoking, COPD, Adrenal Adenoma Phaeochromocytoma, etc.

    - **Abdominal US used to exclude the most of caused secondary Polycythemia.**

Questions

1) A 33- year old women present with 3 months history of dizziness, her CBC show low RBC, HB, HCT, MCV, MCH and high RDW.
What is your diagnosis?

a. Normocytic Normochromic Anaemia
b. Microcytic Hypochromic Anaemia
c. Macrocytic Hyperchromic Anaemia
d. Pernicious Anaemia

2) A 31-year old man present heartburn and known to have IBS, his CBC show Normal RBC and Low HB, MCT, MCV, MCH. Hemoglobin Electrophoresis show HbA2 = 7.3 (normal 2.0–3.5) and present of HBS (normal null).
What is you diagnosis?

a. Beta Thalassemia Trait
b. SCA with Beta Thalassemia Trait
c. Alpha Thalassemia trait
d. Alpha Thalassemia major

3) 57-year-old man known case of HTN uncontrolled, he is smoker of 20 cigarette per day for > 25 year, came for routine checkup. His CBC show: normal except RBC, HB and HCT are high.
What is your diagnosis?

a. Macrocytic Hyperchromic Anaemia
b. Primary Polycythemia
c. Secondary Polycythemia
d. Relative Polycythemia

4) What is the most important investigation to rollout the most causes of secondary polycythemia?

a. CBC
b. US
c. Urine analysis
d. X-ray

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Answers:

1st Questions: B

2nd Questions:B

3rd Questions: C

4th Questions: B