

## Data Interpretation

Color Index

IMPORTANT

NOTES

GOLD

EXTRA

### OBJECTIVES – from the guide-

- Interpret CBC findings of anaemia (IDA, Normocytic, Macrocytic and haemolytic) and polycythaemia
- Interpret problems of liver function tests
- Explain different types of thyroid disorders
- Recognize the likely explanations for hypocalcaemia or hypercalcemia.
- Explain different presentation of Hepatitis B markers
- Interpret urine and stool analysis

### DONE BY

Team Leader	Nasser AbuDujain
Members	Mohammad AL Mutlaq, Ghadah Almazrou
Revise	
Sources	F group's Dr's Slides.

# COMPLETE BLOOD COUNT

**Major CBC components:** Hemoglobin, WBCs, Platelets. If all major components are normal, then it is very less likely you miss a serious disease.

## How to Read CBC result?

- ▶ Look to **RBC** and **Hb** together to check if decrease in Hb is matching with decrease in RBC or not.
- ▶ In case of **high RBC** and **Hb** go to **HCT** to check if it exceeds **52** as this reveals **polycythemia**.
- ▶ Look to **WBC** and **Platelet** count for any abnormality
- ▶ Look to **MCV** and **MCH** to see the type of anaemia
- ▶ Look to **RDW** as if high it reflects Heterogeneity in sizes of RBCs and even low serum iron.
- ▶ **Reticulocytosis** reflect **hyperactivity of Bone Marrow** as in haemolytic anaemia and early treatment of IDA.

## Case#1

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	L	4.2	-	5.5 x10.e12/L
HGB .....	87	L	120	-	160 g/L
HCT .....	27.1	L	42	-	52 %
MCV .....	73.6	L	80	-	94 fl
MCH .....	23.6	L	27	-	32 pg
MCHC .....	321		320	-	360 g/L
RDW .....	15.5	H	11.5	-	14.5 %
PLT .....	445	H	140	-	450 x10.e9/L

**Diagnosis:** Hypochromic Microcytic Anaemia (IDA)

(Always check for a cause for IDA and treat the cause and iron deficiency)

On systemic enquiry, she added that she has **menorrhagia** for the last 4 months.

- Mention one investigation of importance to reach the diagnosis.

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

## Case#2

A 68-year-old man presented to PCC with SOB and loss of weight. He looked very pale H/O similar attack 2 years ago and transfusion. No H/O chronic diseases or GIT bleeding. Or diarrhoea. Non smoker

21 May, 2016 00:00 AST - 21 December, 2017							
Lab View	09/11/2017 00:00	08/11/2017 00:00	06/11/2017 00:00	05/11/2017 00:00	02/11/2017 00:00	01/11/2017 00:00	30/10/2017 00:00
<b>General Hematology</b>							
WBC		6.500				6.700 - 7.200 [2]	7.000
RBC		4.2 (L)				2.8 [2]([L])	2.9 (L)
Hgb		88.0 (L)				48.0 [2]([L])	49.0 (L)
Hct		28.2 (L)				16.4 - 16.7 [2]([L])	16.8 (L)
MCV		67.8 (L)				57.7 - 58.4 [2]([L])	57.8 (L)
MCH		21.2 (L)				16.7 - 16.9 [2]([L])	16.8 (L)
MCHC		313.0 (L)				285.0 - 293.0 [2]	290.0 (L)
RDW		29.5 (H)				21.5 - 21.7 [2]([H])	20.8 (H)
Platelet		237.0				336.0 - 383.0 [2]	408.0
<p><b>Ferritin</b> ..... 5.1 <b>ug/L</b> (30 – 400)</p> <p><b>Serum Iron</b> ..... 3.5 <b>umol/L</b> (11 – 31)</p> <p><b>TIBC</b> ..... 96 <b>umol/L</b> (44.8 – 80.6)</p>							
<p><b>Tumor Marker</b></p> <p>CEA ..... 0.864 (Normal)</p> <p><b>Immunology</b></p> <p>ANA ..... Negative *</p> <p>ANA Pattern ..... Not Applicable</p> <p>CRP ..... &lt;5.000</p> <p>Reticulin Ab ..... No Reagent *</p> <p>Gliadin IgA ..... 79.32 *</p> <p>TTG IgA ..... 9.69 *</p> <p>Gliadin IgG ..... 35.26 *</p> <p>TTG IgG ..... 1.24 *</p> <p>Endomysial Ab ..... No Reagent *</p>							

**WHAT IS THE CAUSE OF IDA?**

**Think in Causes: Malignancy like Ca. Colon, Ca Stomach, Malabsorption, PUD, .....**

<20 -ve  
20 -30 weak +ve  
>30 mod to strong +ve

## Case#3

A 17 year old lady presents with dizziness and bouts of fall.

- ▶ WBC ..... 7.4 x10.e9/L 4 -11
- ▶ RBC ..... 3.57 x10.e12/L 4.2 - 5.5
- ▶ HGB ..... 57 g/L 120 -160
- ▶ HCT ..... 20.1 % 37 - 47
- ▶ MCV ..... 56.2 fl 80 - 94
- ▶ MCH ..... 15.9 pg 27 - 32
- ▶ MCHC ..... 282 g/L 320 - 360
- ▶ RDW ..... 25.0 % 11.5 - 14.5
- ▶ PLT ..... 578 x10.e9/L 140 - 450
- ▶ Iron ..... 1.0 umol/L 9 – 30
- ▶ Total Iron-Binding cap ..... 89.6 umol/L 44.8 – 80.6
- ▶ (Always check for a cause for IDA and treat the cause and iron deficiency)
- ▶ Transfused (one pint of blood) and Put on :ferrous sulphate and folic acid

Cont. A 17 year old lady with low Hb, after 6 weeks.

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

### Hb Electrophoresis:

- ▶ 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

## Iron Deficiency Anaemia Biochemistry

TEST	WHAT DOES IT REFLECT	What is Expected?
<b>Iron level</b>	Serum iron	<b>Decreased</b>
<b>Ferritin</b>	Iron stores	<b>Decreased</b>
<b>TIBC</b>	Total Iron Binding Capacity; Iron moves in blood attached to protein called transferrin	<b>Increased</b>
<b>Transferrin Saturation</b>	It is the value of serum iron dividing by TIBC Low Iron / High TIBC = Low	<b>Decreased</b>

### Microcytosis: low MCV

	Serum Iron	Ferritin
▣ IDA	Low	Low
▣ Thalassemia Minor	Normal	Normal

- ▣ RDW: Red Cell Distribution Width:

When increased reflect, heterogeneity in cell size. Also indicating low serum iron level

### Iron Deficiency Anaemia

- ▶ Oral iron therapy, characterized by a modest reticulocytosis beginning in about five to seven days, followed by an increase in haemoglobin at a rate of about 1 gm weekly until the hemoglobin concentration returns to normal.
- ▶ The serum or plasma ferritin concentration is an excellent indicator of iron stores.

### Case#4

A 55 year old man, who is a known case of hypertension on 25 mg hydrochlorothiazide. He is a smoker of 20 -30 cig. per day for >20 years. BP 138/88. He came for routine follow up

◦ WBC.....6.5		4—11 x 10.e9/L
◦ RBC.....7.1	H	4.7—6.1 x 10.e12/L
◦ HB.....197	H	130—180 g/L
◦ HCT.....56.3	H	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

What is the most likely diagnosis?

- 1) 2<sup>nd</sup> Polycythemia based on RBC, HCT and Normal WBC and Platelets.  
(mostly due to smoking)

How are you going to manage this patient?

U/S abdomen to R/O other causes, Advise to stop smoking, Aspirin.

Blood donation e.g. every two weeks till HCT reaches 45

What about management of hypertension?

# 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:

- **Primary Polycythaemia Rubra Vera** (↑ RBC, WBC and Platelets)  
(Increase in RBCs with ↑in WBCs or ↑Platelets or both)
- **Secondary Polycythaemia:**
  - Smoking
  - High altitude
  - Renal Cysts
  - Hypernephroma
  - Hepatoma
  - COPD
  - Cyanotic Cong. H.D
  - Uterine Fibromyoma
  - Adrenal adenoma
  - Phaeochromocytoma

## 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
- Jack 2 Mutation/Jack 2 Interp ..... Positive
- Bone Marrow Examin. Hypercellularity

Polycythaemia vera (Diagnostic criteria)

### Major Criteria:

- ▶ Elevated cell mass
- ▶ Normal arterial oxygen concent. (≥ 92%)
- ▶ Splenomegally

### Minor Criteria:

- ▶ Platelet count > 400.000
- ▶ WBC count >12.000
- ▶ ↑ LAP Score
- ▶ ↑ B12 level

## Case#5

A 58-year-old woman known diabetic, hypertensive and hypothyroid for FU.

Lab View	23/11/2017 00:00	20/11/2017 00:00	09/02/2017 00:00
<b>General Hematology</b>			
WBC	13.700 (H)	10.900	11.300 (H)
RBC	4.4	4.2	4.6
Hgb	114.0 (L)	113.0 (L)	121.0
Hct	36.4 (L)	35.0 (L)	38.5
MCV	83.1	82.8	83.1
MCH	26.0 (L)	26.7 (L)	26.1 (L)
MCHC	313.0 (L)	322.0	315.0 (L)
RDW	17.2 (H)	17.9 (H)	16.8 (H)
Platelet	598.0 (H)	608.0 (H)	462.0 (H)
MPV	7.9	7.7	7.9
Neutro Auto #	9.0 (H)		
Neutro Auto %	66.1		
Lymph Auto #	3.7		
Lymph Auto %	26.8		
Mono Auto #	0.8		
Mono Auto %	6.0		
Eos Auto %	0.6		
Eos Auto #	0.10		
Baso Auto #	0.10		
Baso Auto %	0.50		
NRBC	0.0000		
ESR	65 (H)		40 (H)

## Case#5

A 58-year-old woman known diabetic, hypertensive and hypothyroid for FU.

Lab View	23/11/2017 00:00	20/11/2017 00:00	09/02/2017 00:00
<b>Routine Chemistry</b>			
ALT		22.0	24.0
AST		11 (L)	8 (L)
Albumin		29.08 (L)	32.72 (L)
Alk Phos		133	145
BUN		6.7 * (H)	6.5 * (H)
Creatinine Lvl		64	55
Bili Direct		2.16	2.64
Bili Indirect		10	7
Bili Total		12.53	9.89
CO2		30	25
Calcium		2.34 *	2.33 *
Chloride		101	104
Glucose		7.96 * (H)	9.54 * (H)
Potassium		4.9 *	4.8 *
Sodium		137 *	141 *
Total Protein		66 *	68 *
GGT		68 (H)	73 (H)
Corr Calcium		2.56 * (H)	2.48 *
Phosphorus		1.06 (Z)	1.32 (Z)
Osmolality		289	296 (H)
Iron	5.0 (L)		6.8 (L)
TIBC	68.5		
Ferritin			37.3
Hgb Alc		9.5 (H)	9.7 (H)
Uric Acid		288	
Vitamin B12		293.4	182.2
Vitamin D 25 OH		45.78 * (L)	
<b>Lipids</b>			
Chol		5.27 (H)	5.45 (H)
HDL		1.51	1.30
LDL		2.78	3.00
Trig		2.16 (H)	2.52 (H)
<b>Endocrine</b>			
T4 Free			13.650 *
TSH			7.790 (H) 6.830 (H)
<b>Random Urine Chemistry</b>			
A/C Ratio			7.93
U Creat			10,038.66
U Microalbumin			9
<b>Immunology</b>			
CRP		22.200 *	24.500 *
<b>Molecular Genetics</b>			
JAK 2 Mutation		Negative	
JAK2 Interp		Negative	

## Causes of Thrombocytosis

### Reactive thrombocytosis (more common)

- ▶ Acute bleeding and blood loss
- ▶ Cancer
- ▶ Infections
- ▶ Iron deficiency
- ▶ Removal of spleen
- ▶ Haemolytic anemia
- ▶ Inflammatory disorders, such as rheumatoid arthritis, IBD, ...
- ▶ Surgery or other type of trauma

### Essential thrombocythaemia

- ▶ Myeloproliferative disorder (Molecular genetics; Jack 2 and bone marrow aspiration)

## Case#6

A 25 year old man came for pre-marital checkup . The following CBC is shown below:

WBC .....	6.6		4 - 11	x 10.e 9/ L
RBC .....	<b>5.87</b>		4.7 - 6.1	x 10 .e12/L
HGB .....	<b>121</b>	L	130 - 180	g/L
HCT .....	<b>38.1</b>	L	42 - 52	%
MCV .....	<b>64.0</b>	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.

Low HB (slight), RBCs are high normal and not matching with HB.

The decrease in MCV is more and is disproportionate to the HB level

## Case#6

A 25 year old man came for pre-marital checkup . The following CBC is shown below:

### Haemoglobin Electrophoresis

Hemoglobin A	94.5	(95 -99	%)
Hemoglobin F	0.6	(0 - 2.0	%)
Hemoglobin A2	<b>4.9</b>	H (2.0 -3.5	%)
Hemoglobin S	0.0		
Hemoglobin E	0.0		
Hemoglobin C	0.0		

## Case#7

A 34-year-old man came to check some of results because of being have IBS.

#Test	Result	Unit	Range
<b>EDTA Whole Blood - SAMPLE: 1</b>			
1 WBC	7.70	x10.e9/L	4 - 11
2 RBC	6.83	x10.e12/L	4.7 - 6.1
3 HGB	130.0	g/L	13 - 18.0
4 HCT	43.0	%	42 - 52
5 MCV	63.0	fl	8 - 94
6 MCH	19.8	pg	27 - 34
7 MCHC	314.0	g/L	32 - 36.0
8 RDW	16.2	%	11.0 - 14.0
9 PLT	170	x10.e9/L	14 - 40.0

#Test	Result	Unit	Range
<b>Venous Blood - SAMPLE: 1</b>			
1 Hemoglobin A2	2.0	%	2.0 - 3.0
2 Hemoglobin F	0.0	%	0 - 2.0
3 Hemoglobin A	97.0	%	90 - 99
4 Hemoglobin S	-		-
5 Hemoglobin C	-		-
6 Hemoglobin E	-		-
7 Hemoglobin O	-	%	-

Thalassemia Trait mostly "alpha Thalassemia" as Hb A2 is normal.

## Thalassaemia Minor

- ▶ Microcytosis is much more profound, and the anemia much milder, than that seen in iron deficiency anemia.
- ▶ Patients with 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.

### Thalassaemia Minor

- ▶ MCV usually < 70 fL
- ▶ The decrease in MCV is disproportionate to the HB level.
- ▶ Mentzer Index: MCV / RBC is < 13
- ▶ If RDW is high, Correct Iron level first before proceeding to HB electrophoresis, otherwise giving a false result
- ▶ If HB A2 > 3.5 → B-Thalassaemia Minor
- ▶ If HB A2 is normal → alpha Thalassaemia Minor

## Case#8

A 22 year old man followed for Hypothyroidism. The following CBC is shown below.

# Test	Result	Unit	Range
<b>EDTA Whole Blood - SAMPLE: 1</b>			
1 WBC	11.6	x10.e9/L	4 - 11
2 RBC	2.3	x10.e12/L	4.7 - 6.1
3 HGB	82	g/L	130 - 180
4 HCT	22.1	%	42 - 52
5 MCV	98.1	fl	80 - 94
6 MCH	35.4	pg	27 - 32
7 MCHC	372	g/L	320 - 360
8 RDW	23.6	%	11.5 - 14.5
9 PLT	506	x10.e9/L	140 - 450
Retic Count % 7.78      0.2 - 2.0			

# Test	Result	Unit	Range
<b>Venous Blood - SAMPLE: 1</b>			
1 Hemoglobin A2	2.6	%	2.0 - 3.5
2 Hemoglobin F	26.0	%	0 - 2.0
3 Hemoglobin A	0.0	%	95 - 99
4 Hemoglobin S	71.4		-
5 Hemoglobin C	0.0		-
6 Hemoglobin E	0.0		-
7 Hemoglobin O	0.0	%	-

**SCA and patient is on Hydroxyurea**

## Case#9

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

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

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

What is your diagnosis? **SCA and Beta Thalassaemia Trait**





## Case#11

A 44 year old man, who is a known case of HCV positive.

- WBC.....2.0      L      4—11 x 10.e9/L
- RBC.....2.95      L      4.7—6.1 x 10.e12/L
- HB.....110      L      130—180 g/L
- HCT.....31.9      L      42—52 %
- MCV.....108.1      H      80 - 94 fl
- MCH.....37.3      H      27 - 32 pg
- RDW ..... 19.5      %      11.5 - 14.5
- PLT.....92      L      140 - 450 x 10.e9/L
- HEPATITIS C RNA QUALITATIVE ..... **Positive**
- ▶ HEPATITIS C RNA QUANTITATIVE ..... **389744 IU/ML**

What is your diagnosis?

**Pancytopenia (Bone Marrow Depression) 2<sup>nd</sup> to therapy Like interferon.**

## Case#12

A 70-year-old man, presents with 2 month H/O easy fatigue and tiredness. PMH: unremarkable

The following CBC is shown below:

WBC .....	<b>7.8</b>		4 - 11	x10.e9/L
RBC .....	<b>2.26</b>	L	4.7 - 6.1	x10.e12/L
HGB .....	<b>69</b>	L	130 - 180	g/L
HCT .....	<b>20.2</b>	L	42 - 52	%
MCV .....	<b>89.3</b>		80 - 94	fl
MCH .....	<b>30.6</b>		27 - 32	pg
MCHC .....	<b>343</b>		320 - 360	g/L
RDW .....	<b>15.8</b>	H	11.5 - 14.5	%
PLT .....	<b>179</b>		140 - 450	x10.e9/L

What is your diagnosis?

Normocytic Normochromic Anaemia

D. D. Hypothyroidism, Chronic Diseases, Malignancy

## Normocytic Normochromic Anaemia

Anaemia of chronic diseases characterized by:

Serum Iron	<b>Low</b>
Ferritin	<b>Normal or High</b>
RDW	<b>Normal or High</b>

### Causes:

- ▶ Hypothyroidism
- ▶ Chronic Diseases
- ▶ Malignancy
- ▶ Acute blood loss

## Case#13

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

The following investigations are shown below:

# Test	Result	Unit	Range
<b>EDTA Whole Blood - SAMPLE: 1</b>			
1 WBC	7.0	10.e9/L	4 - 11
2 RBC	3.38	10.e12/L	4.7 - 6.1
3 HGB	101	g/L	130 - 180
4 HCT	30.0	%	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
9 HDW	0	g/L	-
# Test	Result	Unit	Range
<b>Serum - SAMPLE: 1</b>			
1 Ferritin	1583.000	ug/L	30 - 400
2 Vitamin B12	630.600	PM/L	145 - 637
# Test	Result	Unit	Range
<b>Serum - SAMPLE: 1</b>			
1 Iron	9.4	umol/L	11 - 31

Interpret the results.

normocytic normochromic anaemia, due to chronic disease, malignancy, hypothyroidism

cont.

#	Result	Unit	Range
1 Urea	21.0	mmol/L	2.9 - 7.5
2 Serum Creatinine	330	umol/L	62 - 115
3 Sodium	128	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	mmol/L	2.1 - 2.55
12 Inorganic Phosphorus	1.68	mmol/L	0.74 - 1.3
13 Total Bilirubin	58	umol/L	3 - 17
14 Direct Bilirubin	42	umol/L	0 - 5
15 Total Proteins	84	g/L	60 - 80
16 Alkaline Phosphatase	189	U/L	50 - 136
17 Alanine Aminotransferase	72	U/L	20 - 65
18 Aspartate Aminotransferase	62	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	U/L	39 - 308
24 Magnesium	0.8	mmol/L	0.7 - 1.1
25 Amylase	168	U/L	25 - 125
26 Lipase	1414.0	U/L	0 - 200

## Case#14

A 57 year old man presents with 6 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	L	4 - 11	x10.e9/L
RBC	1.90	L	4.7 - 6.1	x10.e12/L
HGB	53	L	130 - 180	g/L
HCT	15	L	42 - 52	%
MCV	118	H	80 - 94	fl
MCH	40	H	27 - 32	pg
MCHC	134	L	320 - 360	g/L
RDW	24.6	H	11.5 - 14.5	%
PLT	39	L	140 - 450	x10.e9/L

Blood film : Hypersegmentation of neutrophils.

What is the most likely diagnosis?

Vitamin B12 Deficiency / Pernicious Anaemia

Vitamin B 12 level 67 PM/L (145 – 637)

How are you going to manage this patient?

Admission for blood transfusion and further assessment like bone marrow Aspiration. The patient in need for B12 injection for life.

## Case#15

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

O/E: plethoric and tip

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
<b>LAP SCORE</b>	<b>237</b>	20 - 80	
<b>Jack 2 .....</b>	<b>Positive</b>		

What is your diagnosis and action taken?

**Polycythaemia Rubra Vera , Referral to Haematology, Bone marrow aspiration**

## Case#16

A 53-year-old man booked for control of high blood pressure. He used to smoke 20 – 40 cig. per day and water pipe.

The following CBC is shown below:

# Test	Result	Unit	Range
<i>EDTA Whole Blood - SAMPLE: 1</i>			
1 WBC	3.9	10.e9/L	4 - 11
2 RBC	7.18	10.e12/L	4.7 - 6.1
3 HGB	224	g/L	130 - 180
4 HCT	66.6	%	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

What is your diagnosis?

**2<sup>nd</sup> Polycythemia**

Think in secondary causes: Smoking, COPD, .....

US abdomen / Advise to stop smoking /Blood donation / Control of BP / Aspirin

## Case#17

A 63 year old woman presents with a 2 months' H/O tiredness and easy bruising. O/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	L	4.7	-	6.1	x10.e12/L
HGB .....	83	L	130	-	180	g/L
HCT .....	30.2	L	42	-	52	%
MCV .....	102	H	80	-	94	fl
MCH .....	36.4	H	27	-	32	pg
PLT .....	52	L	140	-	450	x10.e9/L
<b>Differential</b>						
NEUT .....	8.5%		40	-	75	%
LYMP .....	89%		20	-	45	%
RETIC.....	5.3%		0.2	-	2	%

### 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?

Interpretations:

High WBCs with mainly lymphocytes predominant

Lymphadenopathy and splenomegally

**Diagnosis:** chronic lymphocytic leukaemia

Complications:

Autoimmune Haemolytic Anaemia based on: Low Hb and high reticulocytes

Thrombocytopenia (bone marrow filtration)

Hypogammaglobulinaemia

## Case#18

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 hepatomegally

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

1- What is the most likely diagnosis?

**G6PD deficiency**

2- What additional details in history and further investigations?

- H/O exposure to Fava Beans / Drugs
- Screening test for G6PD, when haemolysis is not present.

## Case#19

A 55-year-old woman; Nurse; known to have HTN, and worried about her CBC results.

Lab View	14/12/2017 00:00	28/02/2017 00:00	02/08/2016 00:00
<b>General Hematology</b>			
WBC	7.000	6.900	6.900
RBC	6.4 (H)	6.0 (H)	6.0 (H)
Hgb	134.0	123.0	123.0
Hct	42.4	40.0	39.9
MCV	66.3 (L)	67.0 (L)	66.7 (L)
MCH	20.9 (L)	20.7 (L)	20.5 (L)
MCHC	315.0 (L)	309.0 (L)	308.0 (L)
RDW	16.4 (H)	15.9 (H)	17.6 (H)
Platelet	322.0	282.0	292.0
MPV	9.0	8.3	8.6
Iron			20.3
TIBC			.
Hgb A1c	5.9		5.7
Uric Acid	261	257	246
Vitamin B12			604.0
Vitamin D 25 OH	99.73 *		127.40 *

## Case#20

A 23-year-old female presents with 3 weeks H/O fever and oral ulcers. She received two courses of antibiotics in private centers.

WBC	2.2	4 - 11	x10.e9/L
RBC	4.7	4.7 - 6.1	x10.e12/L
HGB	93	130 - 180	g/L
HCT	29.8	42 - 52	%
MCV	63.1	80 - 94	fl
MCH	19.7	27 - 32	pg
MCHC	313	320 - 360	g/L
RDW	15.6	11.5 - 14.5	%
PLT	219	140 - 450	x10.e9/L

► Interpret The results.

She has Leucopenia, Hypochromic Microcytic Anaemia (Mostly IDA) and Thalassaemia trait.

► What are the most likely Causes of WBC count?

Viral infection

Connective tissue disease e.g. SLE

## Case#21

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

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

What is your management?

Ferrous fumerate and folic acid to restore Ferritin level \ Vitamin D3

## Case#22

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

## MISCELLANEOUS

### Case#1

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:

Mucous ++

RBCs 30 – 40 /HPF

WBCs 10 – 20 /HPF

C/S: No growth

- Mention two differential diagnosis.
  1. Acute dysentery e.g. Shigella / Amoebic
  2. 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 \ In severe cases, Vancomycin

### Case#2

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+	
▶ HEMOGLOBIN .....	3+	
▶ WHITEBLOODCELLS .....	467	cmm
▶ REDBLOODCELLS .....	968	cmm
▶ CAST .....	NIL	
▶ CRYSTAL .....	NIL	
▶ OTHERS .....	BACTERIA ++	
▶ SPECIFICGRAVITY .....	1.025	

- ▶ What is your diagnosis?  
Lower UTI, Cystitis



### Case#3

A 14 year-old boy presents with one month H/O puffiness of eye lids 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
HEMOGLOBIN	NIL
CULTURE	NO GROWTH

▶ Interpret the results

Proteinuria and mostly Nephrotic syndrome

### Case#4

A 32 year old man who is a known case of IBS for the last 3 years, has 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 and no need for antibiotic

# Liver Function test

## Component of LFT

- Alanine amino transferase (**ALT**)
- Aspartate amino transferase (**AST**)

➔ **Hepatocyte**

- Alkaline phosphatase
- Bilirubin

➔ **Cholestasis**

- G Glutamyl transferase (**GGT**)

➔ **Hepatocyte and Biliary function**

- Prothrombin time
- Serum albumin

➔ **Tests "true" liver function /chronic process**

## Case#1

A 40-year-old man came for routine medical checkup.

The following LFT is shown below:

Total bilirubin .....	10	(3- 17 umol/L)
Total protein .....	73	(60-80 g/L)
Albumin .....	38	(35-50 g/L)
Alkaline phosphatase .....	116	(50-136u/L)
Alanine aminotransferase .....	55	(20-65 u/L)
Aspartate aminotransferase ....	27	(10-31 u/L)
G.G. Transferase .....	198 H	(5-55 u/L)

**Mention two causes for the abnormality?**

- **Drugs like anti-epileptics e.g. Carbamazepine \ Alcohol \ Fatty liver**

## Case#2

A 32-year-old man referred from PHC Center because of Jaundice.

The following LFT is shown below:

Liver function test Profile

Total Bilirubin .....	57 H	3 - 17	mmol/L
Direct Bilirubin .....	6	0 - 5	umol/L
Total Protein .....	78	60 - 80	g/L
Albumin .....	47	30 - 50	g/L
Alkaline phosphatase .....	69	50 - 136	u/L
Alanine Aminotransferase .....	63	20 - 65	u/L
Asparate Aminotransferase .....	31	12 - 37	u/L
Gamma Glutamyl transferase .....	25	15 - 85	u/L

**How are you going to deal with this gentleman?**

- **Request CBC and Reticulocytes to R/O hemolytic anemia**

### Case#3

A 25-year-old man on 4 drug anti-tuberculous treatment. On 2 months follow up visit, he presents with mildly elevated transaminases. Physical examination is unremarkable.

The following LFT is shown below:

Total bilirubin .....	10		(3– 17 umol/L)
Total protein .....	71		(60–80 g/L)
Albumin .....	37		(35–50 g/L)
Alkaline phosphatase .....	126		(50–136u/L)
Alanine aminotransferase .....	99	H	(20–65 u/L)
Aspartate aminotransferase .....	65	H	(10–31 u/L)
G.G. Transferase .....	98	H	(5–55 u/L)

**What is the most likely diagnosis?**

- Drug induced Hepatitis, mostly due to Isoniazid. Continue the medication and follow LFT

### Case#4

A 58-year-old asymptomatic woman presents with elevated liver enzymes on routine screening. Her past medical history is significant for HTN, DM 2 and dyslipidemia. On examination, her BMI is 38 and there is significant acanthosis nigricans on her neck.

The following LFT is shown below:

CBC .....	Normal	U&E .....	Normal
Total bilirubin .....	10		(3– 17 umol/L)
Total protein .....	69		(60–80 g/L)
Albumin .....	38		(35–50 g/L)
Alkaline phosphatase .....	146	H	(50–136u/L)
Alanine aminotransferase .....	112	H	(20–65 u/L)
Aspartate aminotransferase .....	61	H	(10–31 u/L)
G.G. Transferase .....	126	H	(5–55 u/L)
T. chol. ....	6.1	Trig. ..	3.2
		INR .....	1.2 (Normal)

**Mention two investigations of significance?**

- **Viral serology B & C** (Negative) **U/S liver** (increased echogenicity)

**What is the most likely diagnosis?**

**NAFLD** (non-alcoholic fatty liver disease)

### Case#5

A 19-year-old girl presents with new onset fatigue, jaundice and mild pruritus. Her past medical history is significant for acne, which is being treated with minocycline for the past 2 months. There is no history of travel or contact with patients with viral hepatitis. On examination there is mild icterus, no organomegaly

The following LFT is shown below:

Total bilirubin .....	58	H	(3– 17 umol/L)
Indirect bilirubin .....	5		
Albumin .....	38		(35–50 g/L)
Alkaline phosphatase .....	346	H	(50–136u/L)
Alanine aminotransferase .....	116	H	(20–65 u/L)
Aspartate aminotransferase .....	91	H	(10–31 u/L)

**Viral serology for B and C is Negative**

**U/S liver is within normal**

**What is the most likely diagnosis?**

- Drug induced cholestasis- secondary to minocycline.
- Symptoms resolve within 2 weeks of drug discontinuation
- Liver profile normalize within 8 weeks.

## Case#6

A 19-year-old male presents with 3 days H/O abdominal pain, vomiting and yellowish sclera.

Total bilirubin .....	112	(3– 17 umol/L)
Direct bilirubin .....	42	
Total protein .....	71	(60–80 g/L)
Albumin .....	37	(35–50 g/L)
Alkaline phosphatase .....	212	(50–136u/L)
Alanine aminotransferase .....	1092	(20–65 u/L)
Aspartate aminotransferase .....	665	(10–31 u/L)
G.G. Transferase .....	198	(5–55 u/L)

What is the most likely diagnosis?

Hepatitis A virus

What further investigations of choice?

IgM of Hep. A , Hep. B markers / Hepatitis C Ab

## Case#7

A 38-year-old lady presented with 2 weeks H/O yellowish discoloration of sclera together with weakness.

The following LFT is shown below:

Total bilirubin .....	98	H	(3– 17 umol/L)
Indirect bilirubin .....	43		
Albumin .....	36		(35–50 g/L)
Alkaline phosphatase .....	356	H	(50–136u/L)
Alanine aminotransferase .....	316	H	(20–65 u/L)
Aspartate aminotransferase .....	291	H	(10–31 u/L)
G.G. Transferase .....	286	H	(5–55 u/L)
INR .....	normal		

What is the possible DD?

- Viral Hepatitis
- Autoimmune Hepatitis
- Primary biliary cirrhosis
- Alcoholic hepatitis
- Drug induced

What are essential investigations needed to help to reach diagnosis?

- Viral markers (screening) for B, C and A
- Ultrasound liver
- Autoimmune antibodies (ANA, Anti mitoch. Ab and Anti smooth musc. Ab)
- Liver biopsy

## Case#8

A 62-year-old man is a known case of HCV +ve.

The following LFT is shown below:

Total bilirubin .....	6		(3– 17 umol/L)
Indirect bilirubin .....	3		
Albumin .....	23	L	(35–50 g/L)
Alkaline phosphatase .....	180	H	(50–136u/L)
Alanine aminotransferase .....	71	H	(20–65 u/L)
Aspartate aminotransferase .....	77	H	(10–31 u/L)
G.G. Transferase .....	111	H	(5–55 u/L)
INR .....	1.36	H	(0.8 – 1.2)
RBC .....	3.08	L	4.2 – 5.5 x10.e12/L
HGB .....	88.0	L	120 – 160 g/L
HCT .....	26.7	L	42 – 52 %
MCV .....	86.7		80 – 94 fl
MCH .....	28.5		27 – 32 pg

What is your diagnosis?

- Chronic liver disease (CLD), uncompensated, post HC virus.
- Normocytic Normochromic Anemia due to CLD.

# Diabetes Mellitus

## Case#1

A 53-year-old man known case of dyslipidemia.

As a routine investigation:

FPG: 6.2 mmol/L  
5.9 mmol/L

What is your diagnosis? Impaired FPG

OGTT is requested (FPG and 2 hr post 75 gm glucose)

FPG: 6.9 mmol/L  
2 hr: 13.4 mmol/L

What is your diagnosis? Diabetes

## Diagnosis of Diabetes:

- ▶ FPG  $\leq$  5.5 mmol/L = normal
- ▶ FPG  $\geq$  5.6 mmol/L to 6.9 mmol/L = IFG

(If OGTT is requested)

- ▶ 2-h post 75 gm glucose  $<$  7.8 mmol/L = normal GTT
- ▶ 2-h post 75 gm glucose  $\geq$  7.8 mmol/L and  $<$  11.1 mmol/L = impaired GTT
- ▶ 2-h post 75 gm glucose  $\geq$  11.1 mmol/L = DM

# Metabolic Disorders

## Case#1

A 70-year-old blind man known case of hypothyroidism, vitiligo and left ventricle. dysfunction presents with 2m H/O SOB, bouts of dry and irritating cough, loss of appetite, hoarseness of voice and low mood.

**TSH:** 0.288 miu/L .....(0.25 – 5)  
**T4:** 20.5 pmol/L .....(10.3 – 25.8)  
**Ca.** 1.4 mmol/L .....(2.10 – 2.55)  
**Ph.** 1.67 mmol/L .....(0.74 – 1.30)  
**Alb.** 35 gm/L .....(30 – 50 )  
**Alk. Ph.** 86 u/l .....(50 – 136)

### What is your diagnosis?

- Primary hypoparathyroidism

### What is the next investigation of choice?

- **Parathyroid hormone** 0.353 pmol/L .....(1.65 – 6.9)

### What is your management?

- Vitamin D
- **Oral Calcium**

### What other organs or diseases you may screen for?

- **Diabetes** (FPG/A1C)
- **Adrenal gland** (Cortisol level)

## Case#2

A 19-year-old lady presents with 2 months H/O generalized aches and inability to stand from sitting position. She gave H/O passing 1 – 3 motions of bulky stools. She lost 5 Kg.

The following results is shown below:

**Stool analysis:** Fat cells, undigested food particles  
No RBC, No WBC, NO ova and NO cysts

HGB .....	98	L	120 – 160	g/L
Serum Iron .....	7	L	11.0 – 31.0	umol /L
Calcium .....	1.97		2.10 – 2.55	mmol/L
Corrected calcium .....	1.954	L	2.10 – 2.55	mmol/L
Inorganic Phosphorus .....	0.85	L	0.87 – 1.45	mmol/L
Albumin .....	33		35 – 50	g/L
Alkaline phosphatase .....	525	H	60 – 190	u/L

### What is your provisional diagnosis?

- **Malabsorption syndrome / Coeliac disease**

### What further investigations are you going to do?

- **Coeliac antibodies / upper endoscopy for biopsy**

### Case#3

A 14-year-old girl presents with 1-year H/O pain in lower limbs.

O/E: unremarkable

The following results is shown below:

Calcium .....	1.62	L	2.10 - 2.55	mmol/L
Corrected calcium .....	1.6	L	2.10 - 2.55	mmol/L
Inorganic Phosphorus .....	1.13		0.87 - 1.45	mmol/L
Albumin .....	39		35 - 50	g/L
Alkaline phosphatase .....	1191	H	195 - 476	u/L

Vit D ..... 4.0 nmol/L

[ Deficiency <25      Insufficiency 25 - 75  
Suffecient 75 - 250      Toxicity >250 ]

See attached X-Ray

What is your diagnosis and management?



**Radiology report: Widened growth plate with fraying, splaying and cupping of the Metaphysis Involving both distal both Femurs and proximal Tibias and fibulas suggestive of Rickets.**

She was put on Vit. D3 45000 U /week and calcium carbonate 600 mg BID for 2 months.

The results are shown below:

Calcium .....	2.27		2.10 - 2.55	mmol/L
Corrected calcium .....	2.30		2.10 - 2.55	mmol/L
Inorganic Phosphorus .....	2.00	H	0.87 - 1.45	mmol/L
Albumin .....	39		35 - 50	g/L
Alkaline phosphatase .....	687	H	195 - 476	u/L

Vitamin D is measured in two forms of units

1 ng/ml = 2.5 nmol/liter, **Example: 20 ng/mL (50 nmol/liter)**

## Rickets / Osteomalacia

- ❖ Low calcium
- ❖ Low or Normal phosphate
- ❖ High alkaline phosphatase

## Hypoparathyroidism

- ❖ Low calcium
- ❖ High phosphate
- ❖ Normal alkaline phosphatase

### Case#4

A 52- year- old woman presents to your office with 6-month H/O polyuria and lethargy.

O/E: looks dehydrated and has a neck swelling (she has the swelling for years and informed to be a simple goiter)

The following results is shown below:

- Ca:..... 3.4 mmol/L (2.1 – 2.6)
- Ph: ..... 0.62 mmol/L (0.8 – 1.4)
- Urea: ..... 9.2 mmol/L (2.6 – 6.6)
- Chloride:..113 mmol/L (95 – 105)

- **What is your diagnosis?**

Hyperparathyroidism mostly due to parathyroid adenoma

### Case#5

A 48-year-old woman presents with 5 months

H/O difficulty in raising from sitting position.

The following results is shown below:

- |            |             |             |
|------------|-------------|-------------|
| Calcium    | 1.65 mmol/L | (2.1 – 2.6) |
| Phosph.    | 1.52 mmol/L | (0.8 – 1.4) |
| Alk. Phos. | 134 mmol/L  | (43 – 154)  |
| Albumen    | 38 g/L      | (35 – 50)   |

- **What is your diagnosis?**

Hyporparathyroidism.



## Case#6

A 15-year-old girl referred to obesity clinic. BMI 34. The following results is shown below:

Test	Result	Unit	Range
<i>Serum - SAMPLE: 1</i>			
1	Prolactin	165.900	MIU/L 102 - 496
2	Lutenizing Hormone	3.150	IU/L -
3	Follicle Stimulating Horm	1.550	IU/L -
4	Para Thyroid Hormone	<b>9.020</b>	PM/L 1.65 - 6.9
5	FT4	13.040	PM/L 10.3 - 25.8
6	Thyroid Stimulating Hormo	3.860	MIU/L 0.25 - 5
7	VITAMIN D - T	<b>27.870</b>	nmol/L 75 - 250
8	Insulin	<b>103.500</b>	MIU/L 2.6 - 24.9
9	Cortisol	194.000	NM/L 193 - 690
10	Vitamin B12	277.800	PM/L 145 - 637
11	Ferritin	97.350	ug/L 13 - 150
12	Folate	25.670	NML 4.5 - 20.7

#	Test	Result	Unit	Range
<i>Serum - SAMPLE: 1</i>				
1	C-PEPTIDE	<b>3.560</b>	NM/L	0.37 - 1.47
2	Fasting Sugar	4.3	mmol/L	3.3 - 5.5

### Interpret the results:

- Hyperparathyroidism 2<sup>nd</sup> to Vit. D deficiency
- Insulin resistance

# Thyroid Problems

## Case#1

A 50 year- old man presents to your office with 6-month H/O of fatigue and weakness. O/E: no objective positive findings.

- TSH: 12.2 miu/l (0.25—5)
- FT4: 11.6 pmol/l (10.3—25 .8)

### What is your diagnosis?

- a- Primary Hypothyroidism
- b- Subclinical Hyperthyroidism
- c- Subacute Thyroiditis
- d- Subclinical Hypothyroidism**
- e- Secondary Hypothyroidism

## Subclinical Hypothyroidism

Indication of treatment:

- ▶ Clinical symptoms
- ▶ Presence of goiter
- ▶ TSH > 10 miu/l
- ▶ High positive antithyroid antibodies

If TSH < 10 and asymptomatic:

- ▶ Repeat TSH after 6 – 12 months
- ▶ Request thyroid antibodies, if high +ve then treat.

To treat, start with Thyroxin 25 ugm OD

## Case#2

A 19-year-old lady presents with 3 weeks H/O a neck swelling discovered incidentally. The swelling move with deglutition and related to left lobe of thyroid and no

L N swellings. She is euthyroid.

TSH and T4 are within normal.

### What is the most appropriate step in management?

- A- Observation
- B- Referral urgent to endocrine
- C- Thyroglobulin antibodies
- D- Technetium thyroid scan
- E- U/S thyroid**

(Note: U/S to see its type solid or cystic, size, one nodule or more and also to localize the nodule for biopsy)

# Approach to thyroid nodule based of American Thyroid Guidelines 2015

ATA THYROID NODULE/DTC GUIDELINES

13

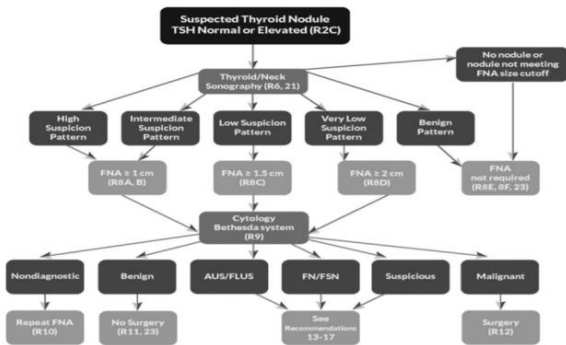


FIG. 1. Algorithm for evaluation and management of patients with thyroid nodules based on US pattern and FNA cytology. R, recommendation in text.

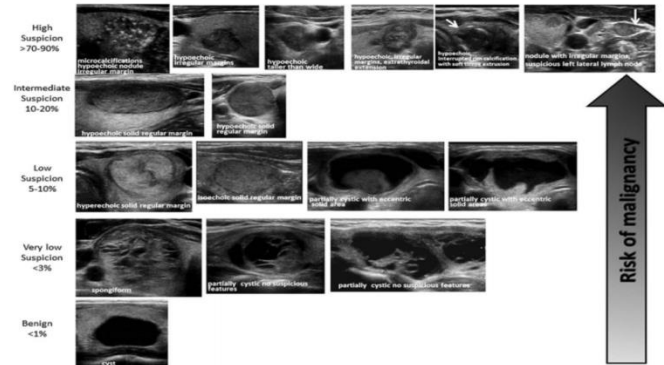


FIG. 2. ATA nodule sonographic patterns and risk of malignancy.

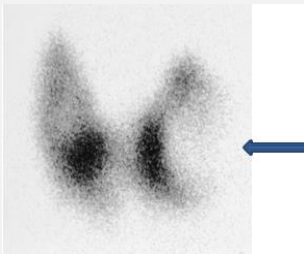
TABLE 6. SONOGRAPHIC PATTERNS, ESTIMATED RISK OF MALIGNANCY, AND FINE-NEEDLE ASPIRATION GUIDANCE FOR THYROID NODULES

Sonographic pattern	US features	Estimated risk of malignancy, %	FNA size cutoff (largest dimension)
High suspicion	Solid hypoechoic nodule or solid hypoechoic component of a partially cystic nodule <b>with</b> one or more of the following features: irregular margins (infiltrative, microlobulated), microcalcifications, taller than wide shape, rim calcifications with small extrusive soft tissue component, evidence of ETE	>70-90 <sup>a</sup>	Recommend FNA at ≥1 cm
Intermediate suspicion	Hypoechoic solid nodule with smooth margins <b>without</b> microcalcifications, ETE, or taller than wide shape	10-20	Recommend FNA at ≥1 cm
Low suspicion	Isoechoic or hyperechoic solid nodule, or partially cystic nodule with eccentric solid areas, <b>without</b> microcalcification, irregular margin or ETE, or taller than wide shape.	5-10	Recommend FNA at ≥1.5 cm
Very low suspicion	Spongiform or partially cystic nodules <b>without</b> any of the sonographic features described in low, intermediate, or high suspicion patterns	<3	Consider FNA at ≥2 cm Observation without FNA is also a reasonable option
Benign	Purely cystic nodules (no solid component)	<1	No biopsy <sup>b</sup>

US-guided FNA is recommended for cervical lymph nodes that are sonographically suspicious for thyroid cancer (see Table 7).  
<sup>a</sup>The estimate is derived from high volume centers, the overall risk of malignancy may be lower given the interobserver variability in sonography.  
<sup>b</sup>Aspiration of the cyst may be considered for symptomatic or cosmetic drainage.  
 ETE, extrathyroidal extension.

## Case#3

A 22-year-old lady presents with 3 weeks H/O a neck swelling. TSH and T4 are normal and US showed solid nodule.



A Technetium-99m pertechnetate thyroid scan is ordered, what is the finding?  
**Cold nodule of left lobe of thyroid.**

## Case#4

A 32-year-old lady, nurse, single presented with one-month H/O palpitation and loss of weight.

O/E: pulse 116 / min      Bp 140 / 70

Apart from fine tremors nothing was significant.

WBC : .....8.4                      ESR : ..... 4  
 TSH:      < 0.01      miu/l                      (0.25—5)  
 FT4:      92.6      pmol/l                      (10.3—25 .8)

**Thyroid scan: Reduced iodine uptake**

◦ **Mention three causes of reduced iodine uptake.**

- 1- Subacute thyroiditis
- 2- Post-partum thyroiditis
- 3- Factitious thyroiditis

## Case#5

A 42-year-old man booked recently in the clinic. Followed in a private psychiatry clinic because of depression mainly insomnia, weakness and fatigue, on 40 mg Paroxetine.

Still not improving, so another antipsychotic drug was added.

The patient has good insight and very cooperative.

**Mention one investigation of importance for this patient.**

TSH :      329.0                      H      mIU/L                      (0.25 - 5)  
 FT4:      2.87                      L      pmol/L                      (10.3 - 25.8)

Cholesterol:      9.86                      mmol/L  
 Trig.: .....      3.12                      mmol/L

## Case#6

A 27-year-old man presents with 3 months H/O weakness and tendency to sleep. The following investigation is shown.

# Test	Result	Unit	Range
<i>Serum - SAMPLE: 1</i>			
1	FT4	0.87	PM/L 10.3 - 25.8
2	Thyroid Stimulating Hormo	1653.00	MIU/L 0.25 - 5
3	FT3	1.69	PM/L 3.96 - 6.8
4	Lutenizing Hormone	2.10	IU/L -
5	Follicle Stimulating Horm	5.81	IU/L -

**2 months later** 0/12/2010

# Test	Result	Unit	Range
<i>Serum - SAMPLE: 1</i>			
1	FT4	14.69	PM/L 10.3 - 25.8
2	Thyroid Stimulating Hormo	1549.00	MIU/L 0.25 - 5
3	FT3	1.75	PM/L 3.96 - 6.8
4	Prolactin	549.20	MIU/L 86 - 324
5	Cortisol	476.40	NM/L 193 - 690
	ACTH	8.63	PM/L

**3 months later**

# Test	Result	Unit	Range
<i>Serum - SAMPLE: 1</i>			
1	FT4	13.63	PM/L 10.3 - 25.8
2	Thyroid Stimulating Hormo	0.59	MIU/L 0.25 - 5
3	Prolactin	334.80	MIU/L 86 - 324

## Case#7

A 30-year-old lady with menstrual irregularities.

- TSH: ..... 44.58 mIU/l (0.25 – 5)
- FT4: ..... 5.58 pmol/l (10.3– 25.8)
- Prolactin .. 1499 mIU/l (102 – 496)

3 months later: (after 100 micgM thyroxin)

- TSH: ..... 7.37 mIU/l (0.25 – 5)
- FT4: ..... 10.68 pmol/l (10.3– 25.8)
- Prolactin .. 1161 mIU/l (102 – 496)

3 months later: (after 125 micgM thyroxin)

- TSH: ..... 2.59 mIU/l (0.25 – 5)
- FT4: ..... 12.58 pmol/l (10.3– 25.8)
- Prolactin .. 1557 mIU/l (102 – 496)

**MRI sella turcica: No significant Macro or Microadenoma.**

**Cabergoline** (dopamine agonist) was started 0.5 mg once weekly.

## Case#8

A 27-year-old woman presents with one-month H/O weight loss, sweating and tremors. She has diffuse neck swelling. Pulse: 124 bpm

CBC: normal ESR: 12 mm/h

- TSH: <0.001 mIU/l (0.25 – 5)
- FT4: 139.2 pmol/l (10.3–25.8)

**What is the differential diagnosis?**

- 1- Graves' disease
- 2- Subacute thyroiditis
- 3- Multinodular toxic goiter
- 4- Toxic nodule /adenoma

**Mention one appropriate investigation to reach the diagnosis.**

1. Thyroid Scan

## **Case#9**

A 28-year-old woman presents to your office with 10 days H/O palpitation, sweating and neck discomfort.

O/E: Wet hands and neck tenderness

pulse: 116/m                      temp. 37.7

CBC: normal                      ESR: 82 mm/h

- TSH: <0.01 mIU/l              (0.25 -5)
- FT4: 89.2 pmol/l              (10.3-25.8)

**What is the most likely diagnosis?**

A- Graves' disease

**B- Subacute thyroiditis**

C- Hashimoto's thyroiditis

D- Multinodular toxic goiter

**Select one investigation to confirm your diagnosis.**

A- Ultrasound neck

B- Thyroid antibodies

C- Free T3 level

**D- Radioactive Iodine thyroid uptake**

E- Fine needle aspiration

**What is the treatment? Choose one or more.**

A- L- Thyroxin

**B- B Blockers**

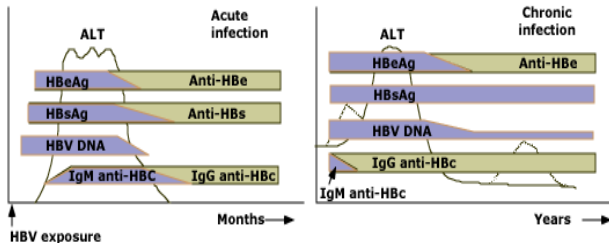
**C- NSAID**

D- Iodine therapy

E- Carbimazole

# Hepatitis B Markers

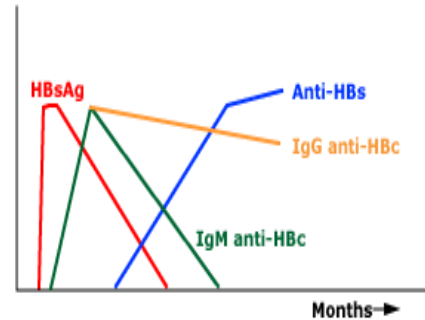
## Serologic responses to HBV infection



Schematic representation of the serologic responses to acute and chronic hepatitis B virus (HBV) infection in relation to the serum alanine aminotransferase (ALT) concentration. Left panel: Acute infection is characterized initially by the presence of HBeAg (hepatitis B e antigen), HBsAg (hepatitis B surface antigen), and HBV DNA beginning in the preclinical phase. IgM anti-HBc (hepatitis B core antigen) appears early in the clinical phase; the combination of this antibody and HBsAg makes the diagnosis of acute infection. Recovery is accompanied by normalization of the serum ALT, the disappearance of HBV DNA, HBeAg to anti-HBe seroconversion, and subsequently HBsAg to anti-HBs seroconversion and switch from IgM to IgG anti-HBc. Thus, previous HBV infection is characterized by anti-HBs and IgG anti-HBc. Right panel: Chronic infection is characterized by persistence of HBeAg (for a variable period), HBsAg, and HBV DNA in the circulation; anti-HBs is not seen (in approximately 20 percent of patients a non-neutralizing form of anti-HBs can be detected). Persistence of HBsAg for more than six months after acute infection is considered indicative of chronic infection.

UpTo

## Window period of acute HBV infection



Schematic representation of the serologic findings during the window period of acute hepatitis B virus infection. The disappearance of HBsAg (hepatitis B surface antigen) is followed by the appearance of anti-HBs. In some patients, however, anti-HBs may not be detectable until after a window period of several weeks to months. At this time, neither HBsAg nor anti-HBs can be detected, the serologic diagnosis may be made by the detection of IgM antibodies against hepatitis B core antigen (IgM anti-HBc).

UpTo

## What do the different hepatitis B serologic markers mean?

- **Hepatitis B surface antigen (HBsAg):** The presence of HBsAg, a protein on the surface of HBV, indicates that the person is infectious.
- **Hepatitis B surface antibody (anti-HBs):** The presence of anti-HBs is generally interpreted as indicating recovery and immunity from HBV infection or been successfully vaccinated against hepatitis B.
- **Total hepatitis B core antibody (anti-HBc):** The presence of anti-HBc indicates previous or ongoing infection with HBV in an undefined time frame.
- **IgM antibody to hepatitis B core antigen (IgM anti-HBc):** Positivity indicates recent infection with HBV ( $\leq 6$  months). Its presence indicates acute infection.
- **Hepatitis B e antigen (HBeAg):** The presence of HBeAg indicates that the virus is replicating and the infected person has high levels of HBV.
- **Hepatitis B e antibody (HBeAb or anti-HBe):** Spontaneous conversion from e antigen to e antibody (a change known as seroconversion) indicates lower levels of HBV.

## Case#1

A 28-year-old man referred from Blood Bank because of being HBsAg positive.

- Hepatitis B S antigen..... **Reactive**
- Anti-Hepa B Core IgG ..... **Reactive**
- Hep-B e Antigen ..... Nonreactive
- Anti- Hepa B e Antigen ..... **Reactive**
- Anti- Hepa B Surface ..... Nonreactive

### ■ What is your next step?

LFT, U/S liver, PCR,

- ▶ HEPATITIS B DNA QUALITATIVE ..... **Positive**
- ▶ HEPATITIS B DNA QUANTITATIVE ..... 889796 IU/ML

### ■ How are you going to deal with any patient in general?

- ▶ Measures for the patient: **Request LFT, U/S liver, PCR**  
**Referral to hepatologist, No blood donation**
- ▶ Measures for Family Contacts: **Screen and Vaccinate the negative ones.**

## Case#2

A 35-year-old man came to the clinic for screening, as one member in his family is HBV positive.

- Hepatitis B S antigen ..... Nonreactive
- Anti-Hepa B Core IgG ..... **Reactive**
- Hep B e Antigen ..... Nonreactive
- Anti- Hepa B e Antigen ... Nonreactive
- Anti- Hepa B Surface ..... **Reactive**

### What is your diagnosis?

**Immune post exposure to HB virus**

### How are you going to deal with patient?

**Reassurance, no further actions could be taken**

## Case#3

A 23-year-medical student came to the clinic for screening.

- Hepatitis B S antigen ..... Nonreactive
- Anti-Hepa B Core IgG ..... Nonreactive
- Hep B e Antigen ..... Nonreactive
- Anti- Hepa B e Antigen ... Nonreactive
- Anti- Hepa B Surface ..... **1000.0 mIU/ml (> 10.0 Positive)**

### ● What is your diagnosis?

**Immune post Vaccination**



## Case#4

A 32-year old man presents to your clinic for routine checkup.

- Hepatitis B S antigen ..... Nonreactive
- Anti-Hepa B Core IgG ..... **Reactive**
- Hep- B e Antigen ..... Nonreactive
- Anti- Hepa B e Antigen ... Nonreactive
- Anti-Hepa B Surface ... Nonreactive

**Interpret the results:** H/O chronic exposure to HB virus

**How:**

- 1- May be recovering from acute HBV infection  
(window period)
- 2- May be distantly immune and test is not sensitive enough to detect very low level of **anti-HBs** in serum.
- 3- May be undetectable level of **HBsAg** present in the serum and the person is actually a carrier.
- 4- May be a false positive anti-HBc.

- HEPATITIS B DNA QUALITATIVE **Positive**
- HEPATITIS B DNA QUANTITATIVE **<20 IU/ML**

**Actions:**

- Measures to Contacts
- No blood donation
- Not candidate for treatment by e.g. Interferon

## Case#5

A 26-year-old female came for premarital checkup.

- Hepatitis B S antigen..... **Reactive**
- Anti-Hepa B Core IgG..... **Reactive**
- Hep- B e Antigen ..... **Reactive**
- Anti- Hepa B e Antigen ... Nonreactive
- Anti-Hepa B Surface..... Nonreactive

- ▶ HEPATITIS B DNA QUALITATIVE **Positive**
- ▶ HEPATITIS B DNA QUANTITATIVE **>110 million IU/ML**

Total bilirubin .....	15	(3- 17 umol/L)
Albumin .....	39	(35-50 g/L)
Alkaline phosphatase .....	225	(50-136u/L)
Alanine aminotransferase .....	960	(20-65 u/L)
Aspartate aminotransferase ....	296	(10-31 u/L)
G.G. Transferase .....	235	(5-55 u/L)

**What is your diagnosis and What actions are you going to do?**

- Chronic viral Hepatitis with active replication and highly infectious  
(e antigen is positive)

**After one and half year of treatment:**

#	Test	Result	Unit	Range
<i>Serum - SAMPLE: 1</i>				
	HEPATITISBDNAQUALITATIVE	Positive	0	-
	HEPATITISBDNAQUANTITATIVE	31	IU/ML	-
#	Test	Result	Unit	Range
<i>Serum - SAMPLE: 1</i>				
1	Urea	4.6	mmol/L	2.5 - 6.4
2	SerumCreatinine	75	umol/L	62 - 115
3	Sodium	138	mmol/L	135 - 145
4	Potassium	4.4	mmol/L	3.5 - 5.1
5	Chloride	102	mmol/L	98 - 107
6	CarbonDioxide	29.2	mmol/L	22 - 32
7	TotalBilirubin	10	umol/L	3 - 17
8	TotalProteins	74	g/L	60 - 80
9	Albumin	42	g/L	30 - 50
10	AlkalinePhosphatase	94	U/L	50 - 136
11	AlanineAminotransferase	52	U/L	20 - 65
12	AspartateAminotransferase	27	U/L	12 - 37
13	Calcium	2.26	mm/L	2.1 - 2.55
14	InorganicPhosphorus	1.15	mmol/L	0.87 - 1.45
15	Albumin	42	g/L	30 - 50
16	AlkalinePhosphatase	94	U/L	50 - 136
17	CorrectedCalcium	2.2	mm/L	2.1 - 2.55