Lab results in primary health care

Prepared by

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Data station

- Hematology (CBC).
- Liver profile
- Lipid profile
- Hyperuricemia
- FBS/RBS/HbA1c/IGT/IFG
- Thyroid profile
- renal profile ,eGFR and UMA
- Hormonal therapy
- Vit d AND vit B12/hair fall
- Immunology tests/urine /stool analysis

ASK 7

- **Why did you want it?**
- **Who ordered it for you?**
- **Where did you do it?**
- **When did you do it?**
- **What do you know about this test?**
- **Was it first time ?**
- **How did you do it?**

CBC

- 28 years old lady complains of easy fatigability, hair loss and palpitation since 3 month.
- Her CBC showed

RBC 4.28 LOW **MCV 69.9 LOW**

HGB 9.7 LOW **HCT 29.9 LOW**

MCH 22.6 LOW **MCHC 32.2 LOW**

RDW 18.4 HIGH

CASE 1

- What is the most likely Diagnosis?
  a. Iron deficiency anemia
  b. Thalassemia Trait
  c. Both iron deficiency anemia on top of thalassemia trait
  d. Chronic disease anemia

CASE 2

- A 9-years old male
- WBC 4.2 (3.5-10.5)
- **HB 9.0g/dl** (10.3-14.6 g/dl)
- RBC 4.5 x 10^9 (4.0-5.2)
- **Hct 32 %** (32-42)
- **MCV 45fl** (82- 98)
- **MCH 24 pg** (26-34)
- **MCHC 26 g/dl** (31-37)
- RDW 13% (11.5-14.5)
- Plt 360 x10^3 (150-400)

CONT

- Serum iron 160 g/dl (50-120)
- **Serum ferritin 169ng/ml** (7-140)
- **Iron saturation 50%** (0-5)
- Q- **what is the interpretation?**
- **Microcytic hypochromic anaemia with increased iron stores**
- **Diagnosis: Thallassemia**

CONT

	Iron deficiency Anemia	Thalassemia
Hb	Low	Low (100-115)
MCV	< 85: Consider Fe deficiency <75: Fe deficiency	Low (60's)
RBC Count	Low	High
RDW	High	Normal
Ferritin	Low (<30)	

CONT

MCV/RBC

- **If more than 13 likely to be IDA.**
- **If less than 13 likely to be thalassemia trait.**

CONT

	IDA	Anemia of chronic inflammation
Serum ferritin	Decreased	Normal or decreased
Serum iron	Normal or decreased	Normal or decreased
Total iron binding capacity or transferrin	Increased	Normal or decreased
% iron saturation	Decreased (<10%-15%)	Normal or decreased
MCV	Decreased	Normal or decreased
RDW	Increased	Normal
sTfR/log ferritin ratio	>2	<1
Hepcidin (not currently clinically available)	Suppressed	Increased

IDA = iron deficiency anemia; MCV = mean corpuscular volume; RDW = red blood cell distribution width; sTfR = serum-soluble transferrin receptor.

Microcytic hypochromic anemia

- Differential diagnosis:

1. Iron deficiency anemia.
2. Lead poisoning.
3. Thalassemia trait.
4. Sideroplastic anemia.

Iron deficiency anemia

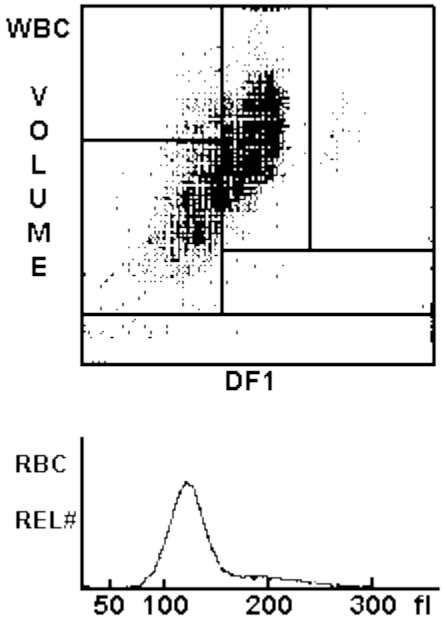
- **Look at ferritin level.**
- **Treatment:**

1. **Ferrous sulfate 200mg bd on empty stomach (2hrs prior and 4 hours after antacid).**
2. **If not tolerated → decrease the dose or give ferrous gluconate.**
3. **Ascorbic acid(vit c) 250-500mg bd with iron.**
4. **Hgb should increase by 2g/100ml over3-4 wks**
5. **Confirm the response 2-4w after starting.**
6. **Continue treatment for 3 months after correction to replenish the iron store.**
7. **Once normal, monitor every 3 months for 1 year then annually.**

CASE 3

- 48 years old Indian patient. Not known to have any previous medical problems. Presented with easy fatigability, weight loss, and numbness in both upper and lower limb.
- His CBC showed:

CONT



WBC	12.1	H			
	%			#	
NE	71.1		H	8.5	H
LY	15.9		L	1.9	
MO	3.3			0.5	
EO	0.5		L	0.1	
BA	8.7		H	1.1	H
RBC	2.69	L			
HGB	10.6	L			
HCT	31.6	L			
MCV	117.6	H			
MCH	39.6	H			
MCHC	33.7				
RDW	14.1				
PLT	578	H			
MPV	7.2	L			

CONT

- What is the most likely diagnosis?
  a. Multiple Myeloma
  b. B12 Deficiency
  c. Folate Deficiency
  d. Acute leukemia

Macrocytic hyperchromic anemia

- **Differential diagnosis:**

1. **Vit B12 deficiency.**
2. **Falate deficiency.**
3. **Alcoholic liver disease.**
4. **Pregnancy.**
5. **Reticulocytosis.**
6. **Myelodysplasia.**
7. **Cytotoxic drugs.**

Vitamin B12 deficiency DDx:

1. **Dietary (vegans).**
2. **Low intrinsic factor (pernicious anemia/gastrectomy).**
3. **Blind loop syndrome.**
4. **Ilial resection.**
5. **Crohn's disease.**
6. **Metformin.**
7. **H.pylori.**
8. **PPI/Ranitidine.**

B12 deficiency

- **Treatment:**

1. **Parenteral B12 (hydroxycobalamin), IM initially 1mg 3X/w for 2 weeks then every 2-3 m.**
2. **If dietary → oral B12 supplement.**
3. **Check response by repeating after 8 weeks.**

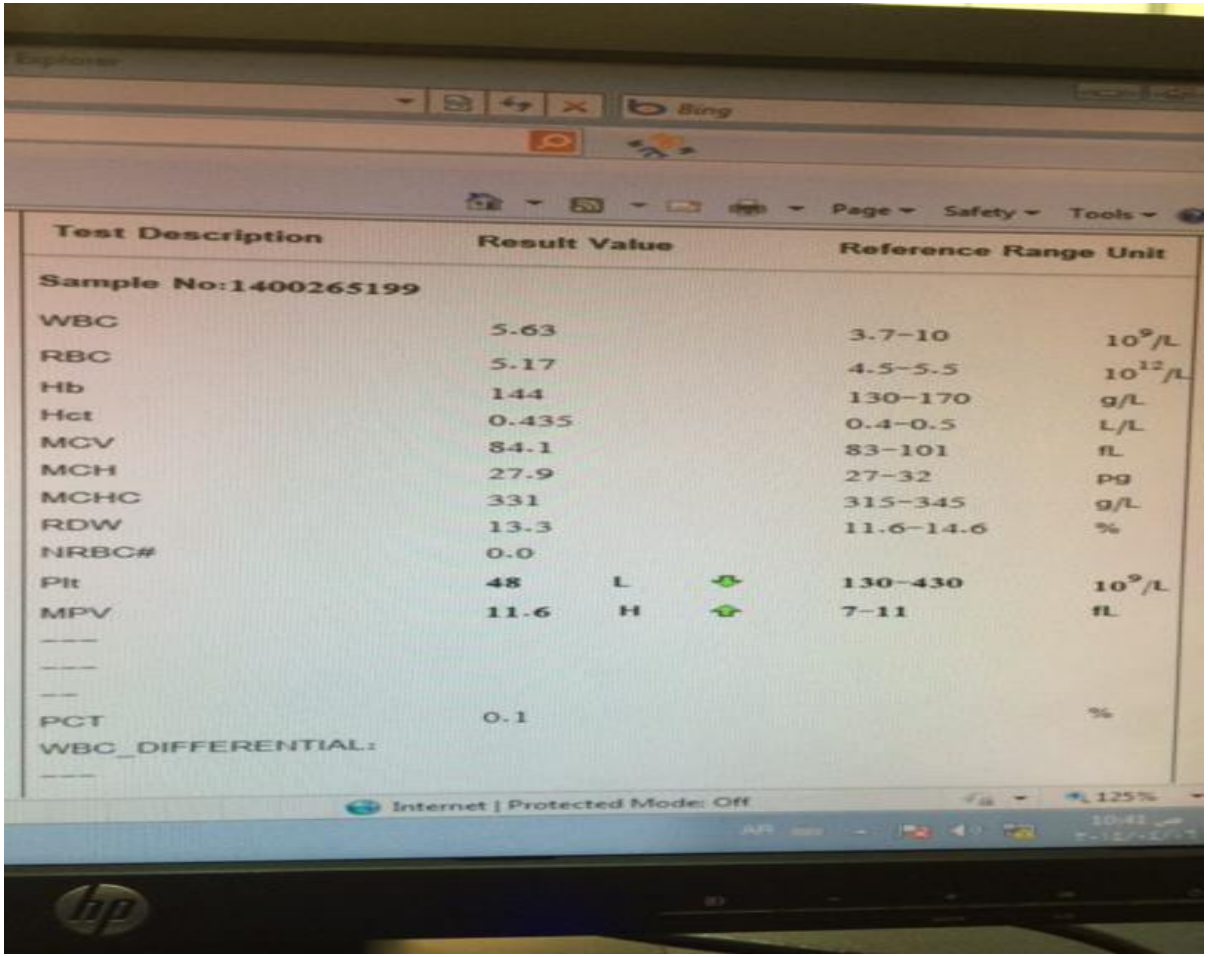
Folate deficiency :

1. **5mg folic acid for 4 months.**
2. **If malabsorption → increase the dose to 15mg.**

CASE 4

- 20 years female complain on heavy periods and easy bruising in the last 1 month. These symptoms proceeded by a viral illness.
- Her CBC showed

CONT



Test Description	Result Value			Reference Range	Unit
Sample No:1400265199					
WBC	5.63			3.7–10	10^9/L
RBC	5.17			4.5–5.5	10^{12}/L
Hb	144			130–170	g/L
Hct	0.435			0.4–0.5	L/L
MCV	84.1			83–101	fL
MCH	27.9			27–32	pg
MCHC	331			315–345	g/L
RDW	13.3			11.6–14.6	%
NRBC#	0.0				
Plt	48	L		130–430	10^9/L
MPV	11.6	H		7–11	fL

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PCT	0.1				%
WBC_DIFFERENTIAL:					

CONT

- What is the most likely diagnosis?
  a. ITP
  b. TTP/HUS
  c. Dilution thrombocytopenia
  d. Inherit ant Thrombocytopenia

Manifestations of thrombocytopenia

- **Petechial hemorrhage.**
- **Easy bruising.**
- **Mucosal bleeding**
- **e.g. _ epistaxis.**
- **_ gum bleeding**

Causes of Thrombocytopenia

- Decreased production
- Congenital disorders
- Radiation or chemotherapy
- Vitamin B12 or folate deficiency
- Drugs
- Systemic lupus erythematosus
- Aplastic anemia
- Acute leukemia
- Lymphomas
- Alcohol abuse
- Viral infections, including HIV
- Splenic sequestration

CASE 5

- 50 years lady found on routine blood test to have a high platelet count. She is a symptomatic and history was not significant.
- What blood test you will initially ask for?
  a. CRP
  b. ESR
  c. Ferritin
  d. Blood film
  e. All of the above

Conditions Associated with Thrombocytosis

- Iron deficiency (overactive reaction)
- Acute blood loss
- Inflammatory disorders (IBD)
- Malignancies
- Splenectomy
- Myeloproliferative disorders
- Essential thrombocythemia
- Polycythemia
- Myelofibrosis

Causes of pancytopenia

- cancers that affect the bone marrow, such as:
  - leukemia
  - multiple myeloma
  - Hodgkin's or non-Hodgkin's lymphoma
  - myelodysplastic syndromes
  - megaloblastic anemia, a condition in which your body produces larger-than-normal, immature red blood cells and you have a low red blood cell count
- aplastic anemia, a condition in which your body stops making enough new blood cells
- paroxysmal nocturnal hemoglobinuria, a rare blood disease that causes red blood cells to be destroyed
- viral infections, such as:
  - Epstein-Barr virus, which causes mononucleosis
  - cytomegalovirus
  - HIV
  - hepatitis
  - malaria
  - sepsis (a blood infection)

CONT

- diseases that damage bone marrow, such as Gaucher disease
- damage from chemotherapy or radiation treatments for cancer
- exposure to chemicals in the environment, such as radiation, arsenic, or benzene
- bone marrow disorders that run in families
- vitamin deficiencies, such as lack of vitamin B-12 or folate
- enlargement of your spleen, known as splenomegaly
- liver disease
- excess alcohol use that damages your liver
- autoimmune diseases, such as systemic lupus erythematosus
- In about half of all cases, doctors can't find a cause for pancytopenia. This is called idiopathic pancytopenia.

CAUSES OF POLYCYTHEMIA

- **Polycythaemia can cause blood clots. These put you at risk of life-threatening problems such as:**
- **pulmonary embolisms – a blockage in the blood vessel that carries blood from the heart to the lungs**
- **deep vein thrombosis (DVT) – a blockage that forms in the blood vessels in your leg before moving elsewhere in your body**

cont

- Polycythaemia also increases your risk of heart attack and stroke. Seek emergency medical help if you think that you or someone you're with is having a heart attack or stroke.

cont

- **Apparent polycythaemia" is where your red cell count is normal, but you have a reduced amount of a fluid called plasma in your blood, making it thicker.**
- **Apparent polycythaemia is often caused by being overweight, smoking, drinking too much alcohol or taking certain medicines – including diuretics (tablets for high blood pressure that make you pee more).**
- **Apparent polycythaemia may improve if the underlying cause is identified and managed. Stopping smoking or reducing your alcohol intake, for example, may help.**

Relative polycythaemia

- **This is similar to apparent polycythaemia. It can happen as a result of dehydration.**

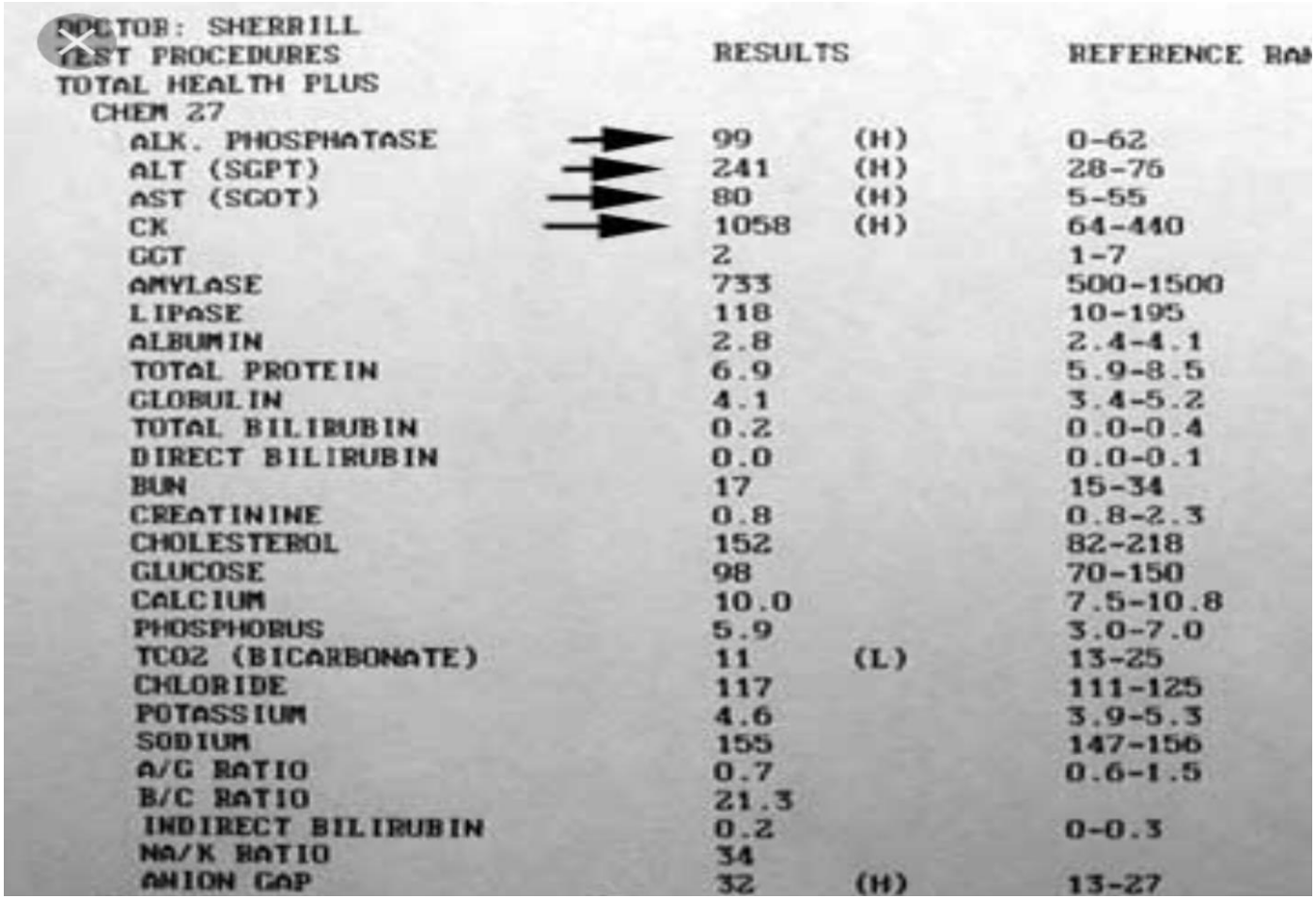
cont

- **Absolute polycythaemia**
- **"Absolute polycythaemia" is where your body produces too many red blood cells. There are 2 main types:**
- **primary polycythaemia – there's a problem in the cells produced by the bone marrow that become red blood cells; the most common type is known as polycythaemia vera (PV)**
- **secondary polycythaemia – too many red blood cells are produced as the result of an underlying condition**

cont

- **Secondary polycythaemia**
- **Secondary polycythaemia is where an underlying condition causes more erythropoietin to be produced. This is a hormone produced by the kidneys that stimulates the bone marrow cells to produce red blood cells.**
- **Health conditions that can cause secondary polycythaemia include:**
- **chronic obstructive pulmonary disease (COPD) and sleep apnoea – these can cause an increase in erythropoietin, due to not enough oxygen reaching the body's tissues**
- **a problem with the kidneys – such as a kidney tumour or narrowing of the arteries supplying blood to the kidneys**

LFT



DOCTOR: SHERRILL
TEST PROCEDURES

	RESULTS		REFERENCE RAN
TOTAL HEALTH PLUS			
CHEM 27			
ALK. PHOSPHATASE	99	(H)	0-62
ALT (SGPT)	241	(H)	28-76
AST (SGOT)	80	(H)	5-55
CK	1058	(H)	64-440
GGT	2		1-7
AMYLASE	733		500-1500
LIPASE	118		10-195
ALBUMIN	2.8		2.4-4.1
TOTAL PROTEIN	6.9		5.9-8.5
GLOBULIN	4.1		3.4-5.2
TOTAL BILIRUBIN	0.2		0.0-0.4
DIRECT BILIRUBIN	0.0		0.0-0.1
BUN	17		15-34
CREATININE	0.8		0.8-2.3
CHOLESTEROL	152		82-218
GLUCOSE	98		70-150
CALCIUM	10.0		7.5-10.8
PHOSPHORUS	5.9		3.0-7.0
TCO2 (BICARBONATE)	11	(L)	13-25
CHLORIDE	117		111-125
POTASSIUM	4.6		3.9-5.3
SODIUM	155		147-156
A/G RATIO	0.7		0.6-1.5
B/C RATIO	21.3		
INDIRECT BILIRUBIN	0.2		0-0.3
NA/K RATIO	34		
ANION GAP	32	(H)	13-27

CONT

- **Abnormal LFT (AST fatty liver,ALT autoimmune/viral,GGT alcohol)**
- **Don’t miss hormonal supplements in adults!!!!**
- **High LFT once → repeat**
- **>/= 3X upper limit of normal:**

Repeat after 1 week

- **< 3X upper limit of normal:**

Repeat after 1 month

CONT

- **If still high LFT results → refer for US and hepatitis screen.**
- **If ALT < 2X ULN(upper limit of normal) + normal US + -ve Hep. Screen → repeat after 3-6 months.**
- **If US shows fatty liver**

a. **Alcohol consumer → stop alcohol then repeat after 3-6 months.**

b. **Non alcohol consumer → treat metabolic syndrome then repeat after 3-6 months.**

ALP

- Elevation of alkaline phosphatase is seen in normal childhood and adolescence, as well as pregnancy.
- Nonspecific and can be seen with liver or bone disorders or can be related to medication .

GGT

- **GGT is a microsomal enzyme that is inducible by alcohol and certain drugs, including warfarin and some anticonvulsants.**

Hepatitis Serology

- Hepatitis A virus (HAV), hepatitis B virus (HBV) and, less often, hepatitis C virus (HCV) are the usual causes of acute viral hepatitis.
- A person with symptoms of acute hepatitis should have the following three hepatitis serologies performed
- **IgM anti-HAV**
- **hepatitis B surface antigen (HBsAg)**
- **anti-HCV (PCR)**
- **Presented in microbiology section**

Hyperurecemia

- Deposition of monosodium urate monohydrate in the synovium.
- Uric acid > 450 Mmol/l.
- Management (RAPRIOP):

R reassurance: resolves within 2 weeks.

A advice: reduce alcohol intake/loose weight if obese/avoid food rich in purines (liver, yeast, kidney, seafood, oily fish e.g. sardines)/Aspirin at low dose increase gout (safe dose 75-150mg).

P prescription:

1. NSAIDs.(It's not an option in uncontrolled hypertensive patients)
2. Intraarticular cortisone injection. .(It's not an option in uncontrolled hypertensive patients)
3. Colchicine (lower onset of action) → SE diarrhea 500Mcg bd max 6mg.(only can be used with uncontrolled hypertensive patients)
4. Oral steroids 15mg od.
5. If no response → allopurinol (zyloric 100mg)or febuxostat(adenouric 80mg od). (start after 2 weeks of settling of symptoms→ increase dose of zyloric till uric acid < 300Mmol

R referral: if hyperurecemia with ureate stone and recurrent UTI → urology.

CONT

investigations:

1. **Uric acid.**
2. **ESR (high).**
3. **WBS (high).**
4. **Microscopy of synovial fluid (needle like crystals).**
5. **X-ray (soft tissue swelling/erosion if severe).**

O observation: after 2 weeks of NSAID to see response.

P prevention: (indication for allopurinol)

1. **Recurrent attacks >/= 1**
2. **Tophi.**
3. **Renal disease.**
4. **Uric acid renal stones.**
5. **Prophylaxis if on cytotoxic or diuretics.**
6. **Radiological findings of chronic disease.**
7. **Urine uric acid > 1100 mg/dl (6.5mmol).**

FBS, RBS, HbA1c, IFG, IGT

- **To diagnose diabetes (TWO READING OR ONE READING WITH SYMPTOMS)**

1. **HbA1c >/= 6.5%**
2. **FBS >/= 7mmol/l**
3. **RBS >/= 11.1 mmol/l**

Prediabetes cut points:

1. **IFG 5.6-6.9 mmol/l**
2. **IGT 7.8-11 mmol/l**
3. **HbA1c 5.7-6.4%**

CONT

- GESTATONAL DM (OGTT)
- **FBS 5.1**
- **AFTER 1 HR 10**
- **AFTER 2HR 8.5**

Prostate specific antigen

- 3 Ng/ml from 50-59y
- 4 Ng/ml from 60-69
- 5 Ng/ml > 70 y

CONT

In older men the prevalence is:

50% at the age of 50 y.

80% at the age of 80 y.

Voiding symptoms/storage symptoms (irritation)/ post micturition.

Complications:

1. **Recurrent UTI.**
2. **Retention of urine.**
3. **Obstructive uropathy.**

Cases of raised PSA:

1. **BPH.**
2. **Prostatitis and UTI (1 m after treatment).**
3. **Ejaculation (48hr).**
4. **Exercise (48hr).**
5. **Urinary retention.**
6. **Instrumentation of the urinary tract.**

CONT

Management:

Watchful waiting

Alpha antagonist (tamsulosin (Omnic 0.4mg)/alfuzosin (xatral 10mg) → decrease symptoms.

SI: retrograde ejaculation, postural hypotension

5 alpha reductase (finasteride/Proscar 5mg) → decrease progression (needs 6 m to show proper effect, decrease PSA by 50%)

Subclinical hypothyroidism

- High TSH & normal T4.
- Presence or absence of mild symptoms of hypothyroidism.
- Risk of progression to overt hypothyroidism is 2-5% per year (higher in men).
- Risk increased by presence of thyroid autoantibodies (thyroid peroxidase AB) thyroglobulin AB used for thyroid cancer follow up
- Treat subclinical hypothyroidism patient if:

1. TSH > 10.
2. Thyroid autoantibodies +ve.
3. Other autoimmune disorders.
4. Previous treatment of Graves's disease.
5. Symptomatic.(wt gain, cold intolerance, bradycardia or constipation)
6. Hypercholesterolemia.

CONT

FT3	FT4	TSH	Comment
↑	↑	↓	1ry Hyperthyroidism
↑	↑	↑	2ry Hyperthyroidism
↓	↓	↑	1ry Hypothyroidism
↓	↓	↓	2ry Hypothyroidism

Renal function test and eGFR

- CR, UREA **(hormonal supplements in adults!!**
-

Table 10. Stages of Chronic Kidney Disease

Stage	Description	GFR (mL/min/1.73 m^2)
1	Kidney damage with normal or ↑ GFR	≥90
2	Kidney damage with mild ↓ GFR	60–89
3	Moderate ↓ GFR	30–59
4	Severe ↓ GFR	15–29
5	Kidney failure	<15 (or dialysis)

Chronic kidney disease is defined as either kidney damage or GFR <60 mL/min/1.73 m^2 for ≥3 months. Kidney damage is defined as pathologic abnormalities or markers of damage, including abnormalities in blood or urine tests or imaging studies.

CONT

- Microalbuminuria (MA) is defined as a persistent elevation of albumin in the urine of

(>20 to <200 microg/min).

- **Other tests section**
- **In diabetic patients treat with ACE INH even if the patient is not hypertensive.**

Autoimmune Diseases

Routine clinical tests:

- **ESR and CRP; ↑ ↑ in inflammation**
- **CBC: anemia and ↓ platelet and ↓ WBCs**
- **routine chemistry panels which may reveal:**
  - **kidney involvement; ↑ ↑ BUN & creatinine**
  - **abnormalities of liver function tests**
  - **↑ muscle enzymes (CPK)**

Lab Diagnosis of RA:

- **Rheumatoid factor:** -ve in 30 % early in illness; can repeat 6 - 12 ms; +ve in numerous other processes (e.g., lupus; scleroderma; SjÖgren's syndrome; neoplastic disease); not an accurate measure of disease progression.
- **Anticyclic citrullinated peptide (Anti-CCP) antibody:** correlate well with disease progression; increases sensitivity when used in combination with RF; more specific than RF.
- **Antinuclear antibody (ANA):** Limited value for screening
- **Complement levels:** Normal or elevated
- **Urinalysis:** hematuria or proteinuria

Lab Diagnosis of SLE:

- Anti-nuclear antibody (ANA)
- Anti-DNA antibody: to determine Abs to the genetic material in the cell
- Anti-Sm antibody: a ribonucleo-protein found in the cell nucleus
- Complement proteins C3 and C4

Vit D def

- Management plan:(vit d 50,000)
- Less than 50 one tab every one week for 8 wks then one tab monthly for 4 mths then repeat test if becomes normal from(75 to 250) preventive dose every 2 mths better to be taken for long life
- Above 50-75 one tab taken monthly for 6 mths then repeat test and if it becomes normal preventive dose better to be taken every 2 mths

Vit B12 def

- Methylcobal injection (b12 injection)better than neurobion because it’s not painful taken E.O.D for 2 wks 6 injection 1gm then tablets taken for 2 to 3 months.
- Stress on diet rich in b12

Roaccutane

- Some tests should be done monthly to follow patient taken roaccutane
- Liver profile , lipid profile(TG),renal profile
- SI: dryness, depression and high lipid and liver profile

Hormonal profile

- (FSH, LH,PROLACTIN AND ESTRAIDOL)
- Should be done 2nd or 3rd day of period look for follicular phase normal FSH higher than LH.
- If LH higher than FSH think in PCO refer for **assessment(Rotterdam Criteria)**
- High FSH and LH with LOW Estraidol in late thirty females think in premature ovarian failure after repeating the test in 4-6 wks

Stool analysis

- Entameba histolytica treated by flagyl 500mg tds for 5 days
- Round worms(Ascaris) treated by mebendazole(vermox) 100mg bd for 3 days
- Not given below 2yrs
- Thread worms(pin worms) caused by enterobius vermicularis treated by single dose of vermox the dose may need to be repeated in 2weeks if infection persists

CONT

- **Consider treating all household contacts as threadworms are highly transmissible.**

Hair fall

- Tests are recommended for hair fall are

Ferritin should be more than 70 normal range from (11-250),CBC, Zinc and TSH.

- Normally 100 hairs fall out per day in females and about 40 in males.