

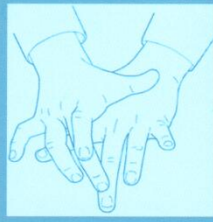
Approach to Chronic Kidney Disease

Prof. Jamal Al Wakeel

Professor of Internal Medicine, Nephrology
Consultant

Nephrology Unit, Department of Medicine

Notes by Ghaida Alsaeed



تأليف

نيكولاس ج. تالي سيمون أوكونر

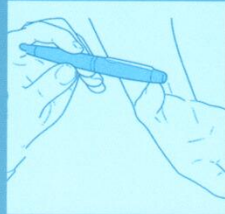


NICHOLAS J TALLEY
SIMON O'CONNOR

كتاب الفحص الإكلينيكي الجيبي

ترجمة

أ.د. جمال بن صالح الوكيل

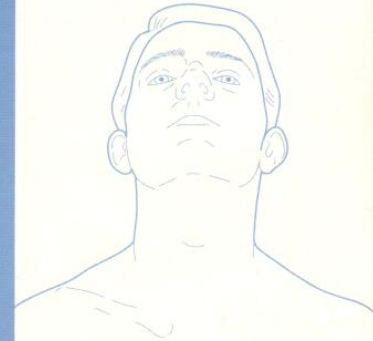


جامعة الملك سعود

النشر العلمي والمطابع

POCKET CLINICAL EXAMINATION

SECOND EDITION



Chronic Kidney Disease

Objective

- Epidemiology of CKD
 - Definition of CKD
 - Classification
 - Symptoms, signs and complications
 - Management of CKD

What is the prevalence of chronic kidney disease?

- a. From 1 % to 3 %
- b. From 10% to 16%
- c. From 5 % to 8%
- d. Age dependent

Ans: D

Prevalence of CKD

- **CKD in aged ≥ 20 yrs is $>10\%$ - 16%**
- **The prevalence of CKD increases with age:**
- **4% at age 29-39 y**
- **47% at age >70 y**
- **The majority of cases are stage 3**
- **mortality in patients with CKD was 56% greater than that in patients without CKD.**
- **The 5-year survival rate for a patient undergoing long-term dialysis in the United States is approximately 35%**
- **Normally by age, each 1 year increase, GFR decrease 1mL.
By age of 80, GFR decrease 40 mL**

Patients in replacement therapy in SA in 2016

Tx. Pts 2017 11,509

Year : 2018 | Volume : 29 | Issue :
4 | Page : 1012-1020

Total HD Pts. 2017 18270

In 2017, Peritoneal Dialysis a total of 1,389 patients

2016 Total No 26225 pt

2017 Total No 31168 pt

mean total cost of dialysis per patient per year was 46,332 USD (173,784 SR)

Total 1,215,056,700 SR *

Kalid Al Saran, Alaa Sabry

*audi J Kidney Dis Transpl 2012;23(1):78-82

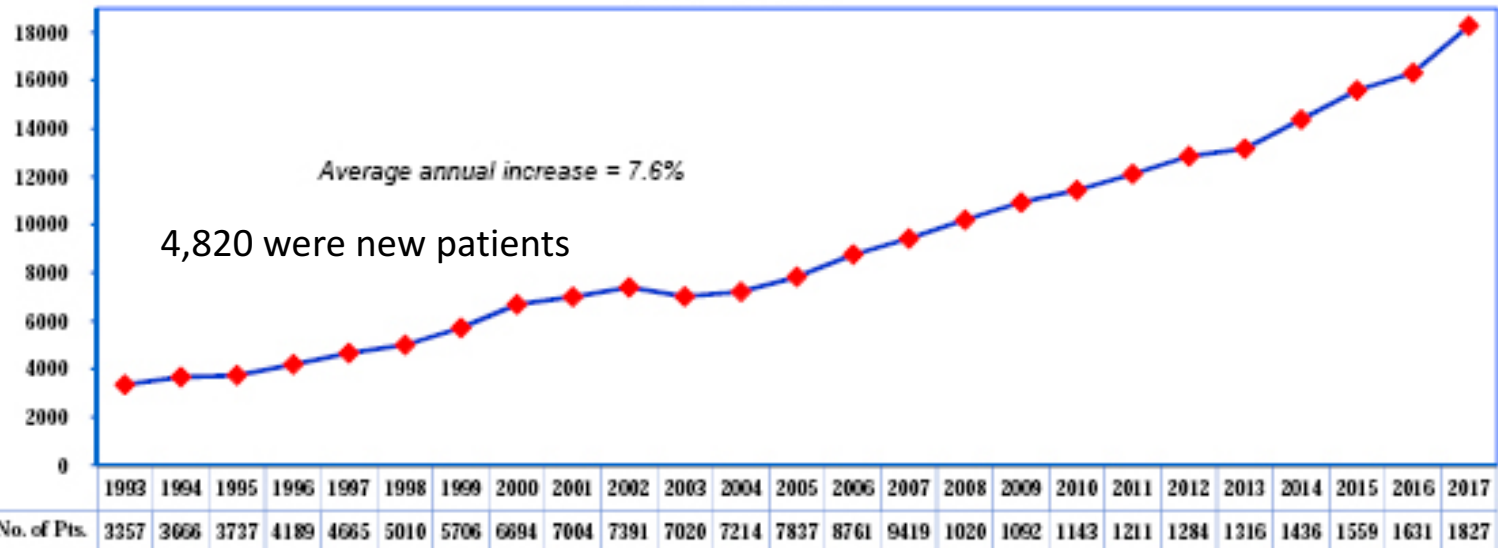
© 2012 Saudi Center for Organ Transplantation

4.7% increase in new hemodialysis patients. in 2016

Costly disease.

Best treatment of CKD is prevention

Dialysis Population - Net Annual Increase 1993 - 2017



- Dialysis in the Kingdom of Saudi Arabia. Saudi J Kidney Dis Transpl [serial online] 2018 [cited 2020 Mar 17];29:1012-20. Available from: <http://www.sjkd.org/text.asp?2018/29/4/1012/239666>

Risk Factors CKD

- 45% of dialysis patients have DM
- 35% of dialysis patients have HTN

Which of following are risk factors for CKD (more than one answer)??

- TB infection
- History of colon cancer
- Smoking
- History of SLE
- Obesity

Risk Factors CKD

Diabetes Mellitus 30%

30% of DM patients reach ESRD

Hypertension 25%

25% of HTN patients reach ESRD

Old age 50%

Low GFR E.g. small kidney

AKI

More susceptible to CKD

Obesity

Compared to HTN and DM they play the same role of leading to stroke, ESRD

Cardiovascular disease

E.g. Congestive heart failure, ischemic heart disease.
Cardiorenal syndrome: meaning cardio leads to renal failure

NSAID

Family History

Familial diseases like polycystic kidney disease, alport syndrome are more susceptible

Smoking

Smokers have HTN and vasoconstriction

Cause of Renal Failure	N	%
Diabetic Nephropathy	6535	40%
Hypertensive Nephropathy	6211	38%
Unknown Etiology	1100	7%
Primary Tubulo Interstitial Disease	491	3%
Obstructive Uropathy	339	2%
Hereditary Renal Disease	279	2%
Congenital Malformation	271	1.6%
Vasculitis	215	1%
Primary Glumerular Disease	128	1%
Pregnancy Related	73	0.4%
Others	673	4%
Total	16,315	100%

Table 4.8. Causes of end-stage renal disease in HD patients 2016

By preventing diabetic and hypertensive nephropathy number of CKD patients decrease by 80%.

chronic Kidney disease can be diagnosed ??

- a. If the patient have ultrasound shows scaring in the kidney
- b. If patient have only proteinuria but normal serum Cr
- c. If the patient have high serum creatinine.
- d. If the patient have proteinuria and hematuria with low eGFR

Answer is discussed in the next slides

Chronic kidney disease is a new term we used to call it chronic renal failure, renal impairment, and impaired renal function.



Kidney International Supplements 2017 7, 1-59DOI: (10.1016/j.kisu.2017.04.001)

Kidney International Supplements 2017 7, 1-59DOI: (10.1016/j.kisu.2017.04.001)

Copyright © 2017 KDIGO [Terms and Conditions](#)



Any single change (either structural or functional) for 3 months or more is a chronic kidney disease

Structural abnormalities

Structural abnormalities detected by imaging

Abnormalities detected by histology
History of kidney transplantation

Structural (kidney shape):

- Ultrasound: scarring
- Biopsy: e.g. glomerulonephritis

Functional abnormalities

Albuminuria

Electrolyte and other abnormalities

Urine sediment abnormalities
tubular disorders

Kidney damage

Functional:

- Proteinuria
- Hematuria
- Electrolyte imbalance
- High serum creatinine
- Acidosis

GFR < 60
ml/min/1.73 m²

for ≥3 months

GFR normal range depends on the age but it range from 110-140

Chronic kidney disease definition: A disease that damage the kidney and decrease the function over 3 months presented by $GFR < 60$

Staging of chronic kidney disease depend on ?

- a. Measurement of serum creatinine
- b. Measurement creatinine clearance
- c. Estimated GFR
- d. Urine albumin creatinine ratio
- e. Causes of chronic kidney disease

Ans: C.

+E? because doctor said each disease has a different outcome for example DM is faster than HTN, so you have to mention the cause with the stage.

- DM takes 5 years to reach ESRD.
- HTN takes 5-10 years to reach ESRD.
- Glomerulonephritis takes 20 years

KDIGO recommendation -classified based on:(CGA)

– Cause

– **Stage of CKD** (GFR category)

Staging depends
on 2 things:

– Albuminuria category

- GFR
- Proteinuria

KDIGO recommendation -classified based on:(CGA)

- Cause
- **Stage of CKD** (GFR category)
- Albuminuria category

CKD Classification

Estimation and Measurement of GFR

Estimate and/or
Measure GFR

Filtration Markers
(Endogenous)

Currently we do this.
It's a calculated equation,
it depends on patient data

Creatinine
Clearance (CrCl)

24 h collection of urine.
Normal range is 110-140

Cystatin C

Polypeptide
chain of 120 amino acids

If high > CKD, If low > normal

Unlike creatinine, higher level of cystatin c polypeptide is **not**
correlated with worse CKD. It's just a marker of CKD.

eGFR equations

eCKD- EPI cr

eCKD-EPI-cyc



National **Kidney** Foundation™

[Chronic Kidney Disease Epidemiology
Collaboration \(CKD-EPI\)](#)

[Modification of Diet in Renal Disease \(MDRD\)
Study equation](#)

Calculators

There are many formulas to
calculate eGFR:

The first 2 formulas are the most
commonly used

CKD-EPI Creatinine Equation

Preferred method

MDRD Study Equation

CKD-EPI Cystatin and Creatinine 2012 Equation

Cockcroft-Gault Formula

Revised Bedside Schwartz Formula

For ages 1 - 17

CKD – EPI Calculation



National Kidney Foundation™

Press Here for Clinical Use and Formula

S_{cr}:

mg/dL

Age:

years

Gender:

Male

Female

Race:

Black

Other

eGFR:

Clear All

mL/min/1.73 m²

Calculators CKD-EPI



National Kidney Foundation™

Press Here for Clinical Use and Formula

S_{Cr}:

100

umol/L

Age:

65

years

Gender:

Male

Female

Race:

Black

Other

eGFR:

68

Clear All

mL/min/1.73 m²



Calculators



About GFR



About CKD

Calculators CKD-EPI



National Kidney Foundation™

Press Here for Clinical Use and Formula

S_{Cr}:

100

umol/L

Age:

65

years

Gender:

Male

Female

Race:

Black

Other

eGFR:

51

Clear All

mL/min/1.73 m²



Calculators



About GFR



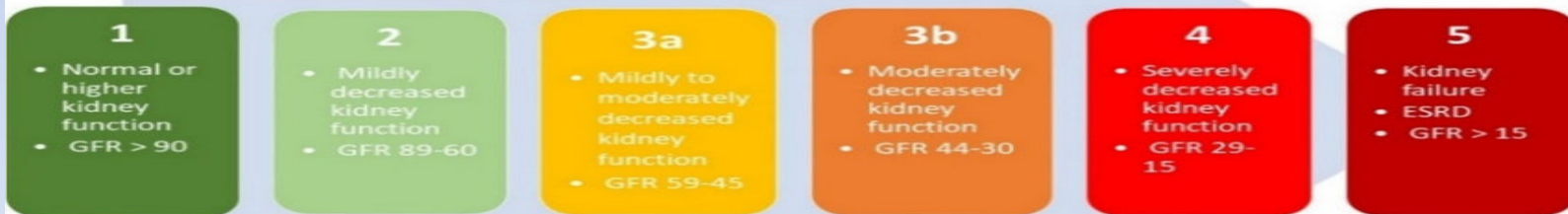
About CKD

Staging

The stages of CKD are classified as follows

- **Stage 1: Kidney damage with normal or increased GFR (>90 mL/min/1.73 m²)** **Normal or high**
High risk patients: they have normal GFR with proteinuria or hematuria or acidosis or hyperkalemia or structural changes (any structural or functional abnormality). When treated early, CKD is prevented.
- **Stage 2: Mild reduction in GFR (60-89 mL/min/1.73 m²)** **Mildly decreased***
Slow progression, correct the risk factors, they will not go to CKD
- **Stage 3a: Moderate reduction in GFR (45-59 mL/min/1.73 m²)** 3a: Slow progression
- **Stage 3b: Moderate reduction in GFR (30-44 mL/min/1.73 m²)** 3b: Rapid deterioration of kidney function
- **Stage 4: Severe reduction in GFR (15-29 mL/min/1.73 m²)** -Symptoms start to appear when GFR < 45 with nephrotic syndrome.
-without nephrotic syndrome symptoms appears when GFR < 30
- **Stage 5: Kidney failure (GFR < 15 mL/min/1.73 m² or dialysis)** when GFR < 30
Stage 5 patient need to start dialysis (due to symptoms of uremia)

Stages of chronic kidney disease



- The majority of cases are stage 3

KDIGO recommendation -classified based on:(CGA)

- Cause
- Stage of CKD (GFR category)
- Albuminuria category

Albuminuria categories as follows:

*note that where albuminuria measurement is not available, urine reagent strip results can be substituted

Differentiate between proteinuria and albuminuria

When patient has 30 albuminuria, his proteinuria would be 50 (albumin + other proteins)

Here we're talking about **albuminuria**

Albuminuria categories in CKD

Category	AER (mg/24 hours)	ACR (mg/mmol)	ACR (mg/g)	TERMS
		approximate	equivalent	
A1	< 30 No proteinuria to mild proteinuria	<3	<30	Normal to mildly increased
A2	30-300 They used to call it micro albuminuria	3-30	30-300	Moderately increased*
A3	>300 Here proteinuria would be 500 because albuminuria is 300	>30	>300	Severely increased**

*Relative to young adult level

** Including nephrotic syndrome (albumin excretion usually > 2200 mg/24 hours [ACR .2220/g; >220 mg/mmol])¹

**Prognosis of CKD by GFR
and albuminuria categories:
KDIGO 2012**

**Persistent albuminuria categories
description and range**

A1	A2	A3
Normal to mildly increased	Moderately increased	Severely increased
<30 mg/g <3 mg/mmol	30–300 mg/g 3–30 mg/mmol	>300 mg/g >30 mg/mmol

The graph shows you the outcome of CKD.

For example when patient is stage 1 (GFR > 90) with A1 (albuminuria < 30) he has a very low risk.

Another example when patient is stage 1 (GFR > 90) with A2 (albuminuria 300) he has increased risk. He will take 12-15 years to develop CKD

GFR categories (mL/min/1.73 m ²) description and range	G1	Normal or high	≥90	Green	Yellow	Orange
	G2	Mildly decreased	60–89	Green	Yellow	Orange
	G3a	Mildly to moderately decreased	45–59	Yellow	Orange	Red
	G3b	Moderately to severely decreased	30–44	Orange	Red	Red
	G4	Severely decreased	15–29	Red	Red	Red
	G5	Kidney failure	<15	Red	Red	Red

Notes: Green indicates low risk (if no other markers of kidney disease, no CKD); yellow indicates moderately increased risk; orange indicates high risk; red indicates very high risk. Reprinted with permission from Macmillan Publishers Ltd: *Kidney Int Suppl.* 2013;3:1–150. Kidney Disease Improving Global Outcomes (KDIGO). 2012 clinical practice guidelines for the evaluation and management of chronic kidney disease. Copyright © 2013.¹⁵

Abbreviation: CKD, chronic kidney disease.

History

You have to take a full hx

- History of major complain
- History of present illness
 - Upper urinary tract
 - Lower urinary tract
 - **History of uremia**
 - Systemic review (arthritis ,ch infection ,hepatitis)

 - History of hypertension(cause, duration, control, medication, complication)
 - Diabetes Mellitus(type, duration, control, medication, complication)

History

- Systemic review
- Past Medical illness+ hospitalization
- Surgical
- Medication
- Family
- Social
- Allergy+ medication side effect

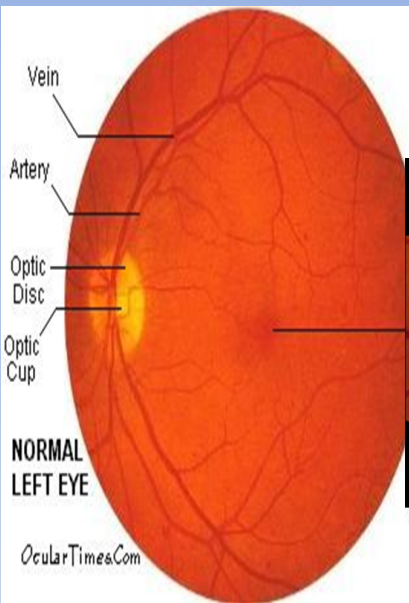
Examination

Full examination is essential because it affects the body from head to toe

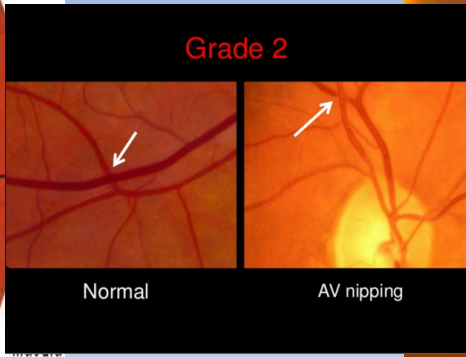
- General look
- Vital sign
- General examination
- Cardiovascular JVP
- Respiratory
- Abdominal
- CNS

Edema always found on the medial malleolus

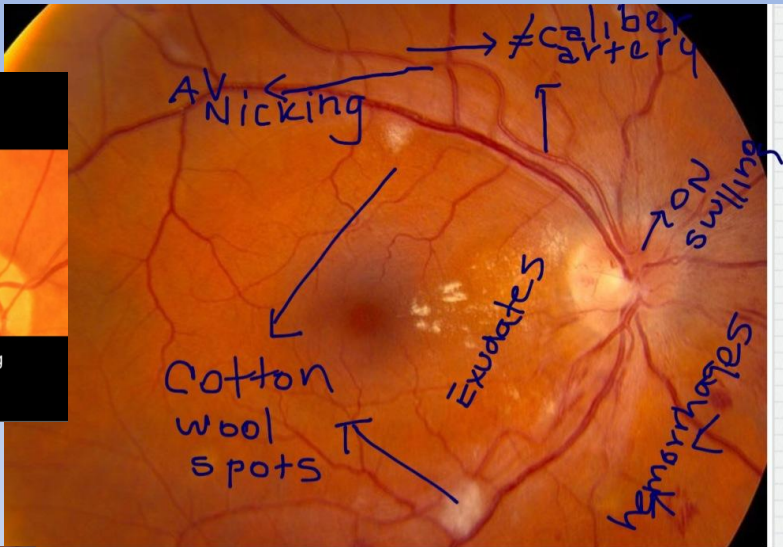




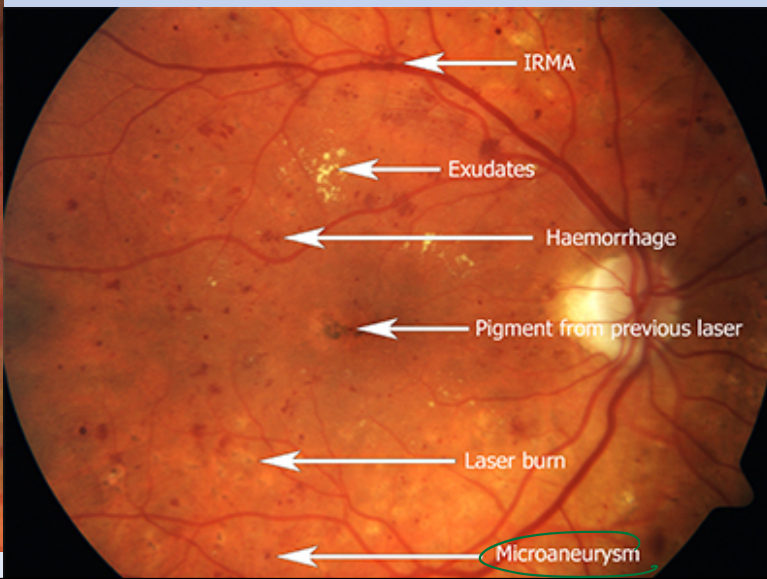
Refer patient to ophthalmologist specially if diabetic



Fundus examination

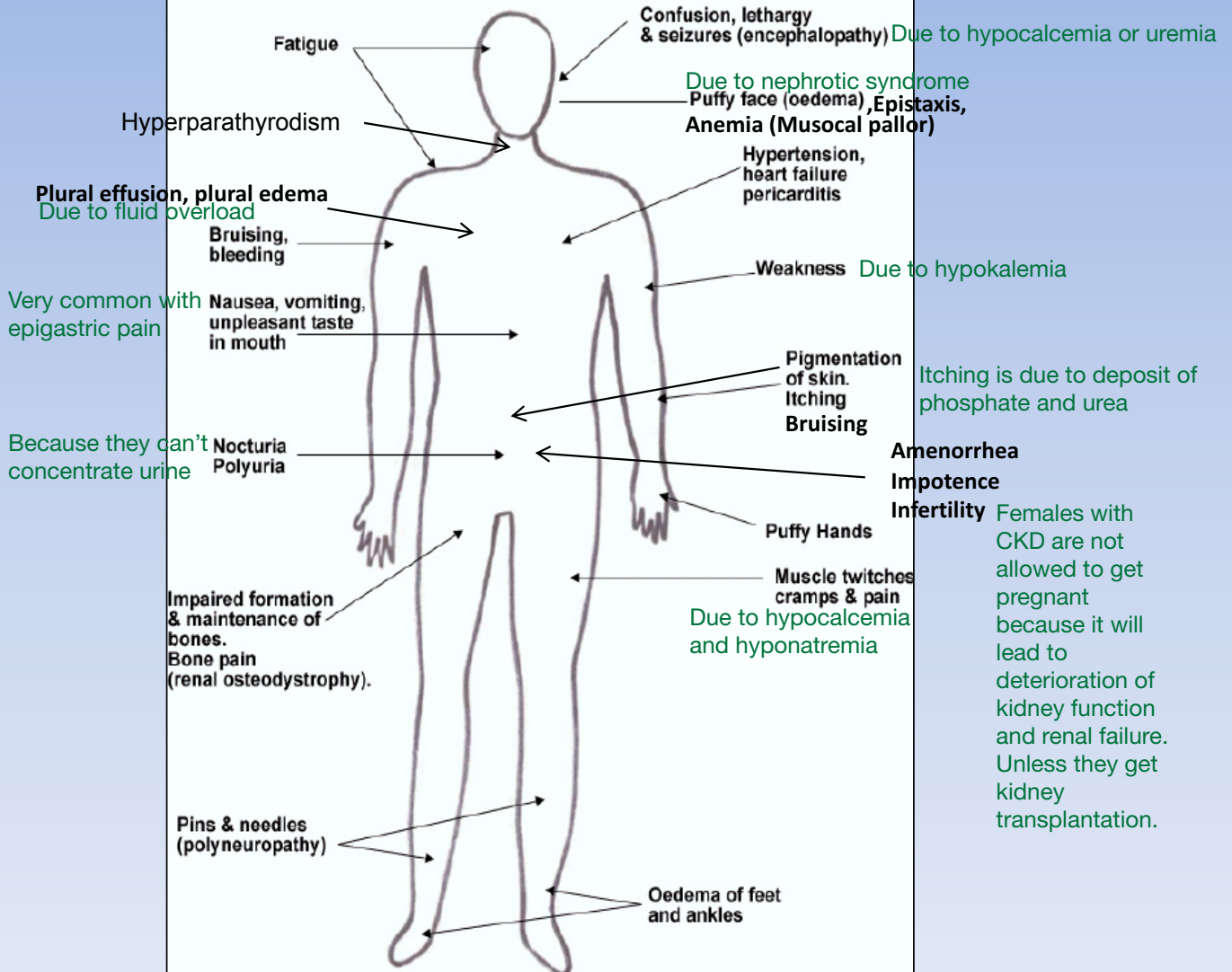


Online Journal of Ophthalmology - www.onjoph.com



Signs and Symptoms

SYMPTOMS & SIGNS OF CHRONIC KIDNEY DISEASE



Which of the following is essential investigation for CKD ?

- Urine electrolyte
- pT, PTT, INR
- Calcitonin & parathyroid hormones
- Kidney Biopsy
- Na,K,Ca, Phosphorus,urea and Cr

Investigations of CKD

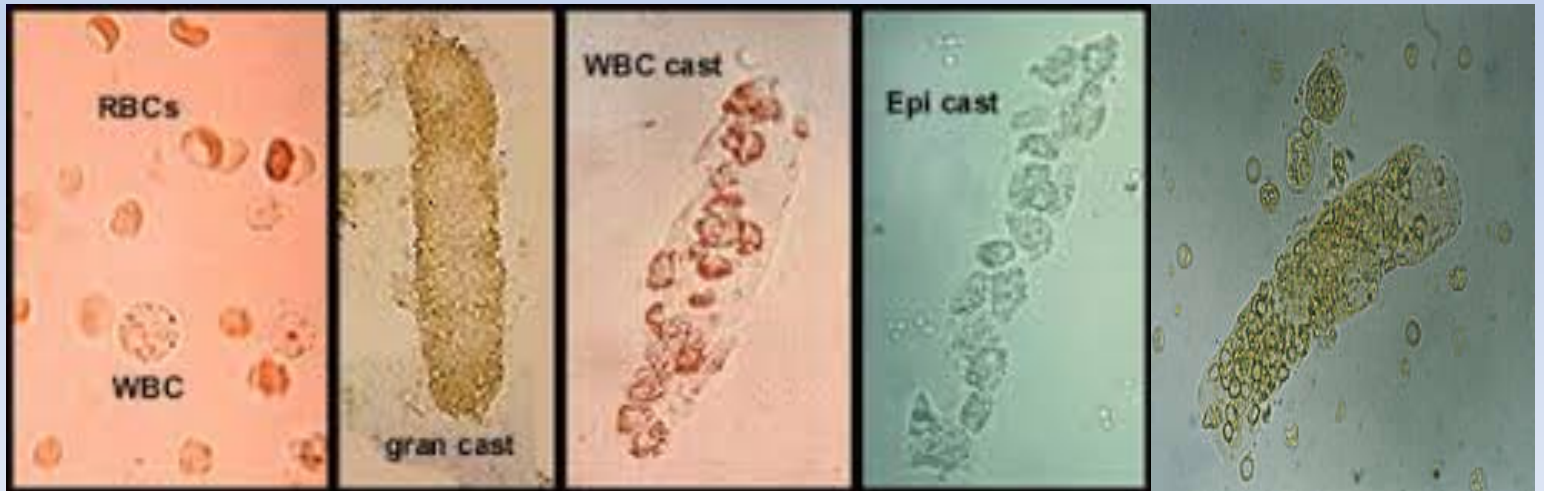
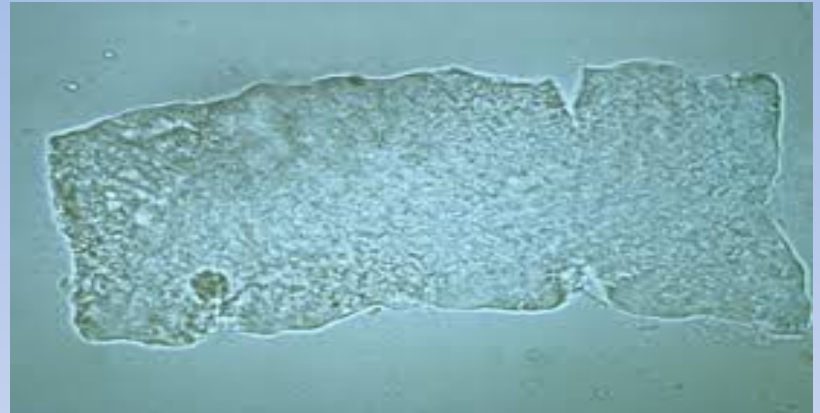
- **Investigations of diagnosis of CKD**
- **Investigations *to diagnose the cause of CKD***
- ***Investigation to diagnosis the complications of CKD***

Investigations of CKD

Basic Laboratory to the diagnosis of CKD can include the following:

- Complete blood count (CBC) To check anemia
- Biochemistries (Na, K, Urea, Cr, HCO_3 , Ca, PO_3 , Uric, Albumin, Alk ph) Serum creatinine is essential to measure GFR, bicarbonate is imp to check acidosis
Hypoalbuminemia > nephrotic syndrome
- Urinalysis Imp because sometimes it's enough to make the diagnosis
- 24 hour urine collection Creatinine clearance and proteinuria To classify the patient to A1, A2, or A3
- Urine albumin:creatinine ratio
- Glucose
- Lipid profile: increased risk of cardiovascular disease

الكاست عبارة عن بروتين



Investigations of CKD

Laboratory studies used in the diagnosis the cause of CKD

HbA1c

ANA To rule out SLE

HBsAg

HCV. Causes silent CKD

C₃, C₄ Some glomerulonephritis patients have low c3, c4

Renal Biopsy

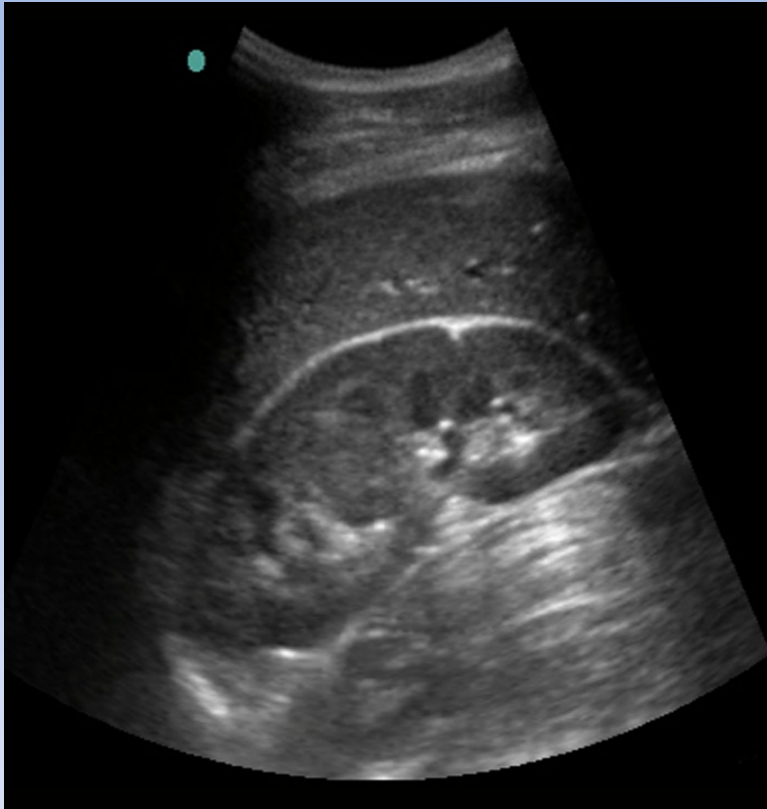
CT, MRI, and Radionuclide Scans

- Renal Ultrasonography : initial imaging
US is essential
- CT, MRI: Intravenous (IV) should be avoided
Because it causes more renal damage
- CT & MRI only in case of obstruction or renal stone
- Radionuclide Scans: assist GFR & obstruction
 Tc^{99m} MAG3 and Tc^{99m} DTPA. Tc^{99m} **DMSA**

Choose the type of radionuclide scan depending on the disease:

- DMSA > kidney scarring
- MAG3 + DTPA > measure renal function, GFR

Investigation



Corticomedullary preserved

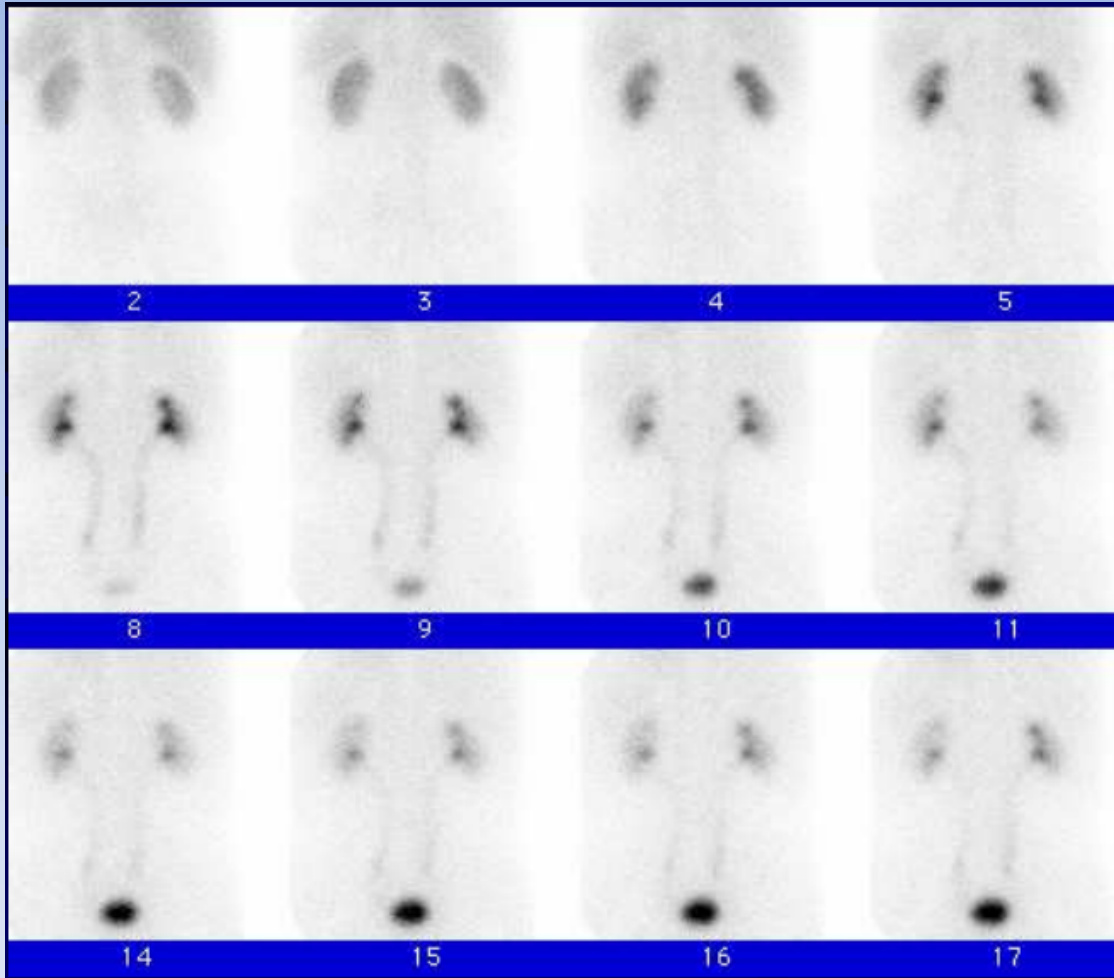
- Normal size kidneys – 12 cm
- Normal Echogenicity



Small w increase
echogenicity
Compared to liver
echogenicity

Shrunken + corticomedullary lost

Nuclear scan safe in kidney disease



Investigation to the diagnosis the complications of CKD

1- CBC: to check anemia

PTH Bone metabolic disease or mineral metabolic disease

VIT D₃ Most renal patients have low vit D because it's lost with the protienuria.
Vit D can reduce blood pressure, improve cardiac disease and other beneficial metabolic effect.

ECH Because many patients have valvular calcification, vessels calcification and HTN which leads to LVH

ECG

Diagnosis of CKD

- Different
 - ✓ Acute Kidney Injury form
 - ✓ CKD

Check patient file if he has any renal abnormalities before 3 months or more.

Differentiating between acute and chronic kidney disease

- 1- **Proper hx:** including family hx (e.g. polycystic kidney disease)
- 2- **PE:** S4 heart sound on auscultation, eyes (hypertensive or diabetic retinopathy), renal bruit > chronic
- 3- **Biochemistry:** hypocalcemia + hyperphosphatemia > chronic
 - CBC:** low hemoglobin > chronic
 - Urinalysis:** RBC cast, WBC cast > Acute, broad widely cast > chronic
- 4- **Ultrasound:** if shrunken kidney > chronic. If enlarged kidney > acute
- 5- Check for any exacerbating factors, correct any **reversible factors** like drugs.

Treatment of chronic kidney disease??

- a. The treatment usually able to cure chronic kidney disease
- b. Its slow progressive of chronic kidney disease
- c. It include treatment of hypertension and reduce proteinuria
- d. Alkalosis should be treated in chronic kidney disease

We're looking for a world without kidney disease in the next 20 year

Diet:

High protein diet is nephrotoxic.
PO3 is used to preserve food but it's toxic for the kidney.
Patients should eat fresh food with low sodium and high potassium to protect the kidney and prolong age

**Prevention
& Slow progress
of CKD**

Glycemic Control

BP control

Proteinuria & RAAS

Give ACE + ARBs to treat proteinuria

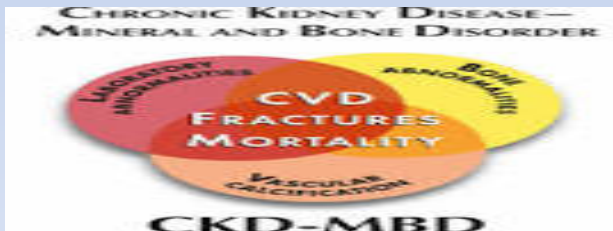
Diet

Protein, PO3 & salt

Correct Acidosis

**Avoid
Nephrotoxic Drug**

Hyperlipidemia



Plus contrast and many herbal medicine

Anyone above 50 y should take statins even if lipid profile is normal

Target Blood Pressure in CKD

≤130/80

Diabetics and Non-diabetics

Diabetics and Non-diabetics		
Albuminuria		Drug of choice
A1 <30 mg/d		CBC, Diuretic, RAAS
A2 >30 mg/d		ARB or ACE-I

If +ve **proteinuria**, you must give **ACE inhibitors + ARBs**

If -ve proteinuria, you can give any hypertensive agent e.g. diuretics, CCB.

Better to use small doses + combination so you get the benefit of each drug with minimal side effects.

No B-blocker

Reduce proteinuria

- Low salt diet *Because salt increases proteinuria*
- Inhibit renin-angiotensin system (RAS) by Angiotensin-Converting-Enzyme Inhibitor (ACE Inhibition) or angiotensin-II-receptor blocker (ARB)

Check serum creatinine and K after 1 week, if not increased continue the medications

Renal Diet

- Low salt diet – 2.4-3 g/day Daily requirement in healthy people is 5-8. Zero salt diet is wrong it might increase the complications
- Low potassium diet For patients on ACEI + ARBs with increased K.
 - (2g-2.5 g), half of normal intake
- Low protein diet - 0.6 to 0.8 g/kg per day Our need is 0.6
- Low phosphorous diet – 800 – 1000 mg/day High phosphorus is dangerous. Found in red meat and canned food.
- Water intake – daily water intake 1.5-2 L Avoid excessive water it can lead to hyponatremia
- Restricted Magnesium

Treatment of Complications

- **Volume overload:** Which leads to pulmonary edema and HTN
 - restrict SALT
 - loop diuretics
- **Metabolic acidosis:**
 - oral alkali supplementation
 - We give Sodium bicarbonate (NaHCO_3).
 - Unlike Sodium chloride, it doesn't increase the pressure.

Anemia in CKD

Anemia is common in patients with $GFR < 45$.

Anemia happens due to:

- Decreased erythropoietin (EPO).
- Hepcidin (inflammatory marker) released by liver, it decreases iron absorption.
- Shortened RBCs life span in CKD from 120 to 35-40

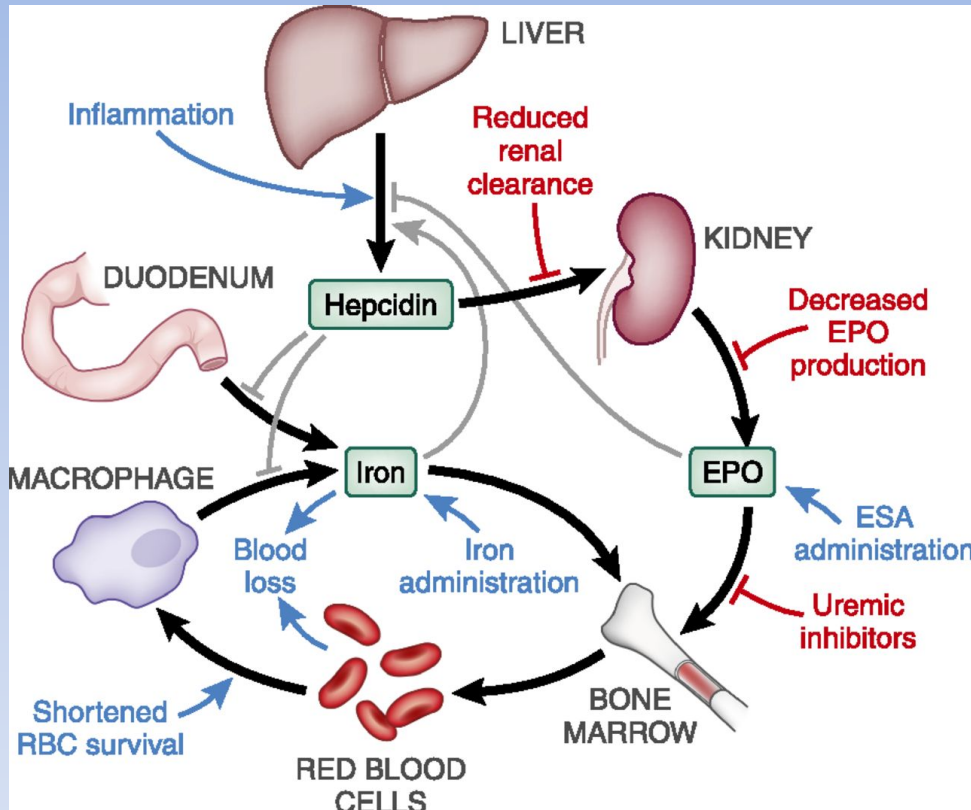
Causes

Decrease EPO

Increase Hepcidin- iron

Bone marrow suppression

Shortened RBC survival



In chronic diseases, high **hepcidin** production inhibits iron release from macrophages and intestinal absorption of iron. This consequently induces an **anemic** condition.

Treatment of anemia

- **Anemia**: *hemoglobin level* ↓ 10 g/dL –
check iron -iron Tablet or IV
erythropoiesis-stimulating agents (ESAs)
 - ✓ epoetin alfa
 - ✓ darbepoetin alfa
 - ✓ Methoxy polyethylene glycol-epoetin beta(Mircera)

Normal ferritin levels range from 100-200. In CKD, we want ferritin levels to reach 300-400. We give iron tablets or IV iron, if not corrected we give ESAs

الESAs مصنع في المعمل، واحد يعطى يوميا، واحد اسبوعيا، واحد شهريا. يعطى حسب هيموقلوبين المريض

It increases the risk of stroke and malignancy, should be avoided in high risk patients

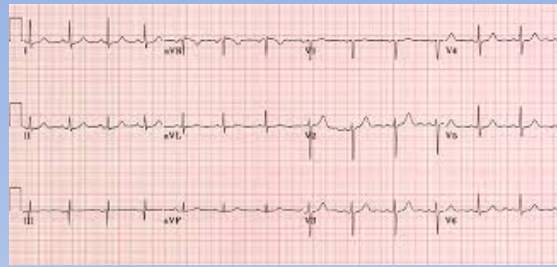
Hyperkalemia

Very important to measure in patients on ACEI + ARBs

- **Cause :**
- Reduce GFR
- ARBs (angiotensin II receptor blockers). ...
- ACE (angiotensin converting enzyme) inhibitors. ...
- Spironolactone
- High K diet مثل التمر، التين، المشمش، المنقا، الموز والطماطم

Asymptomatic & weakness & Arrhythmia

Hyperkalemia is a medical emergency



Peak T wave

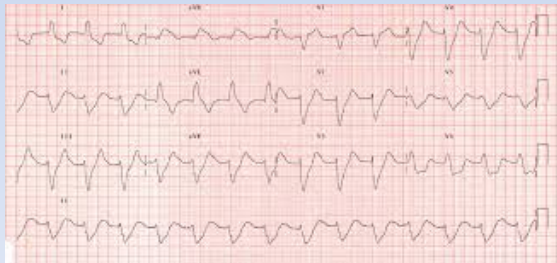
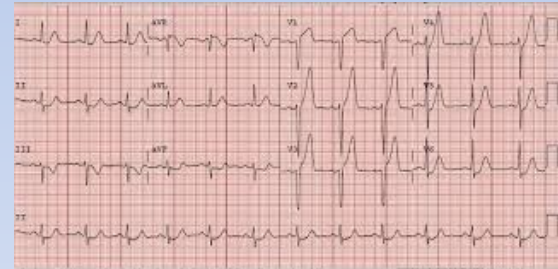
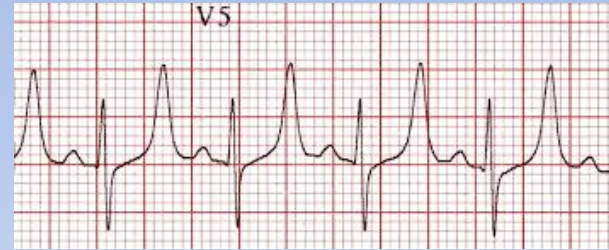
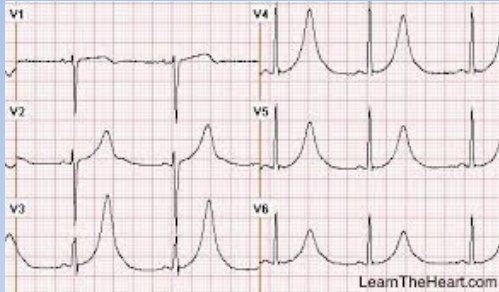


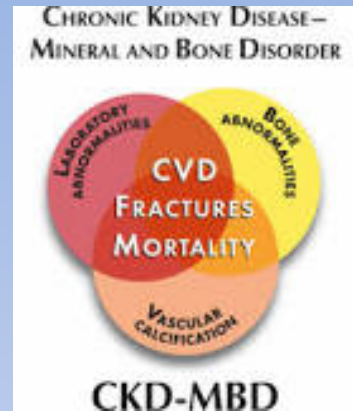
Table 1. Emergency management of acute hyperkalemia

<i>Medication</i>	<i>Response Type</i>	<i>Onset of action</i>	<i>Duration of action</i>	<i>Mechanism of action</i>	<i>Expected decrease in potassium level</i>
Calcium gluconate	rapid	1-2 min	30-60 min	Protect cardiomyocytes	
Glucose + insulin	intermediate	10-20 min	2-6 hours	Shift potassium intracellularly	0.5-1.5 mEq/L (dose dependent)
Beta-agonist	intermediate	3-5 min	1-4 hours	Shift potassium intracellularly	
Sodium bicarbonate	intermediate	30-60 min	2-6 hours	Shift potassium intracellularly	
Exchange resin	delayed	2-6 hours	4-6 hours	Elimination of potassium from the body	
Furosemide	delayed	5-30 min	2-6 hours	Elimination of potassium from the body	
Hemodialysis	delayed	immediate		Elimination of potassium from the body	1mmol/L in the first 60 min and total of 2mmol/L by 180 min

It doesn't manage hyperkalemia, it only protects the heart against hyperkalemia. In ESRD (CKD) those medications don't work. Manage them with dialysis

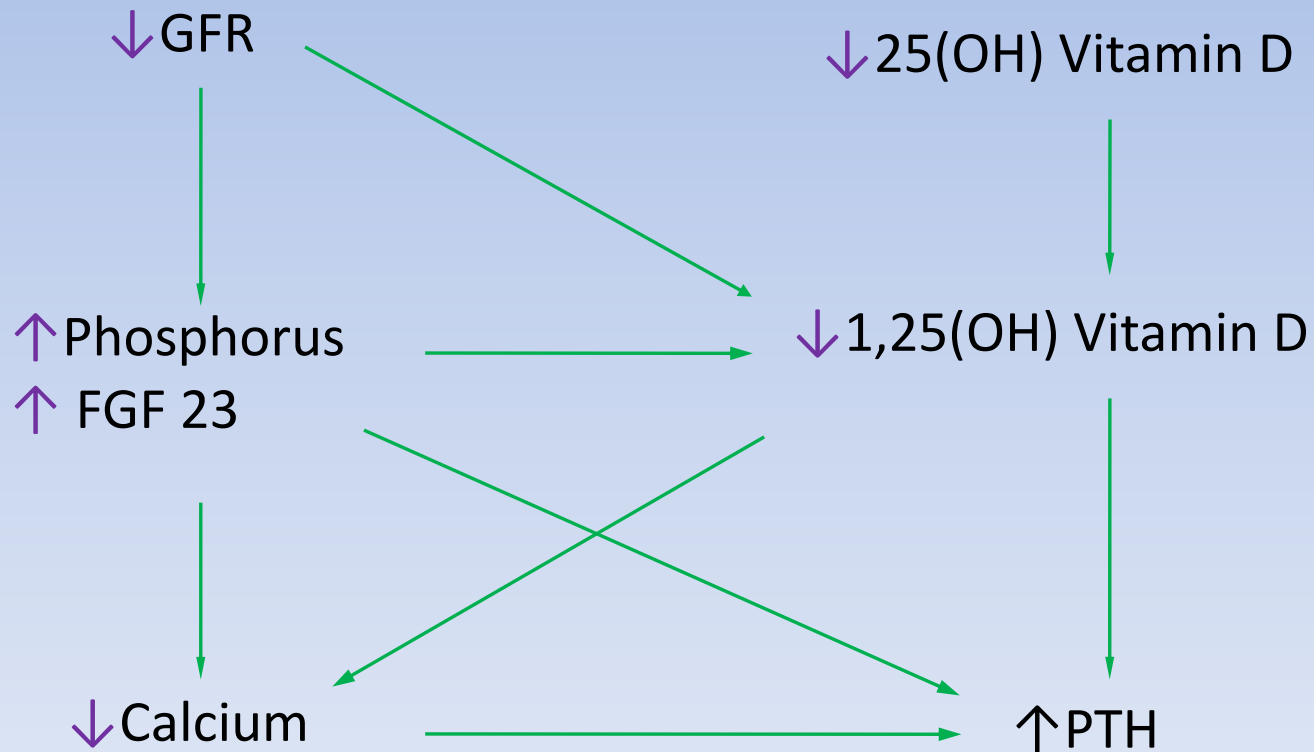
CKD MBD indicate

Mineral & Bone Disorder



- Change in calcium & phosphate & parathyroid hormone, Vit D
Low Ca high phosphate
 - change in the bone metabolize and mineral
 - Indicate change in the extra skeletal calcification and vascular, valvular calcification
- Ca + phosphate normally deposit in bone but in CKD MBD they deposit in other tissues like blood vessels wall (vascular calcification) and valve (valvular calcification).
 - MBD affect 3 things: bone (osteodystrophy), blood vessels (calcification), and minerals imbalance (low ca, high phosphorus, and high parathyroid).

Mineral abnormalities of Chronic Kidney Disease (CKD)



Renal osteodystrophy

- high bone turnover disease related to secondary hyperparathyroidism (referred to as osteitis fibrosa cystica), Makes the bone more prone to fracture with minor trauma.
- low turnover disease (referred to as adynamic bone disease),
Patients with low vitamin D and hyperparathyroid, when given high vit D supplements it will suppress parathyroid and lead to **adynamic bone disease**.
- osteomalacia (low turnover disease accompanied by undermineralized bone tissue)
osteomalacia occurs in children with vitamin D deficiency even without CKD.
- Osteoporosis
- mixed disease where features of both high and low bone turnover disease are present

High bone turnover disease

- osteitis fibrosa cystica),



AP radiograph of the hand in a 66-year-old woman with primary hyperparathyroidism owing to parathyroid adenoma shows subperiosteal bone resorption (arrows) along the radial aspect of 2nd, 3rd, and 4th middle phalanges.



a. extra skeletal calcification and vascular, valvular calcification

CKD-MBD

- **Hyperphosphatemia**

- ✓ dietary phosphate restriction
- ✓ dietary phosphate binders (Ca Carbonate, Ca Acetate, Sovlomie, lanthium)

- **Hypocalcemia**

- ✓ calcium supplements with or without calcitriol

- **Hyperparathyroidism**

- ✓ Calcitriol
- ✓ vitamin D analogs

Treatment of Complications

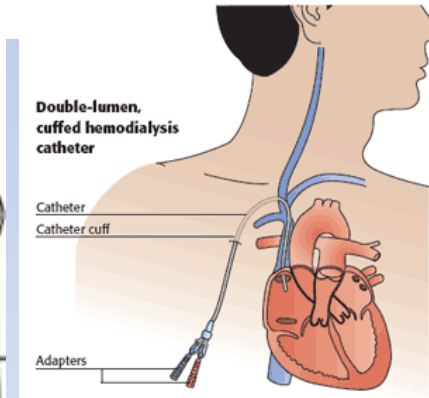
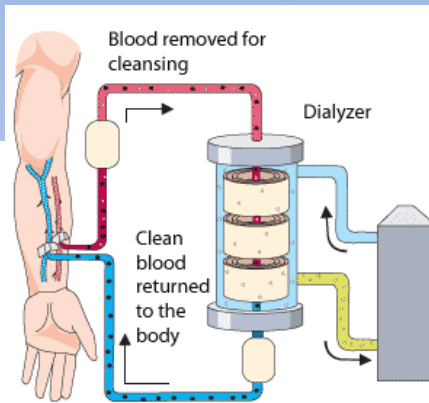
- **Uremic manifestations:**
 - Long-term renal replacement therapy
 - ✓ hemodialysis
 - ✓ peritoneal dialysis
 - ✓ renal transplantation

Renal transplantation is better than hemodialysis

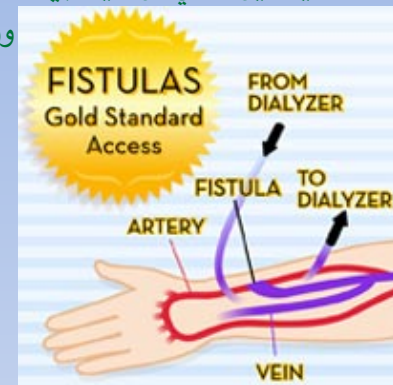
Indications for renal replacement therapy

- Severe metabolic acidosis
- Hyperkalemia *After management failure.*
- Intractable volume overload *After management failure.*
- Pericarditis
- Uremic Symptoms *E.g. Flapping tremors*
 - ✓ Encephalopathy
 - ✓ Failure to thrive and malnutrition
 - ✓ Peripheral neuropathy
 - ✓ Intractable gastrointestinal symptoms
- In asymptomatic patients
 - ✓ GFR of 5-8 mL/min/1.73 m²

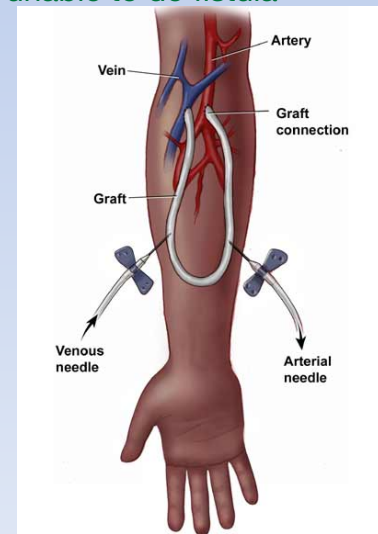
Hemodialysis



الفيسيولوجيا هي توصيلة بين شريان ووريد



This's graft used when unable to do fistula



Hemodialysis Access:

- 1- **Fistula:** Needs to be done 6 months before dialysis
- 2- **Graft:** Needs to be done 2 months before dialysis
- 3- **Catheter:** Use in urgent cases for dialysis to avoid clotting. It's placed in large blood vessels e.g. internal jugular vein, subclavian

Complication of hemodialysis:

- Infection
- Septicemia
- Clotting. need to do another fistula

Complication of peritoneal dialysis:

- Peritonitis
- Hemodialysis is 3 times per week. Peritoneal dialysis is 4 times daily
- البيرتونيال دياسز بيشنتس عندهم حرية الاكل والسفر عكس الهيمودياسز

Renal transplantation:

New kidney is transplanted in the pelvic area.
It has the best outcome.

Complications:

- rejection
- More susceptible for infection

Peritoneal Dialysis

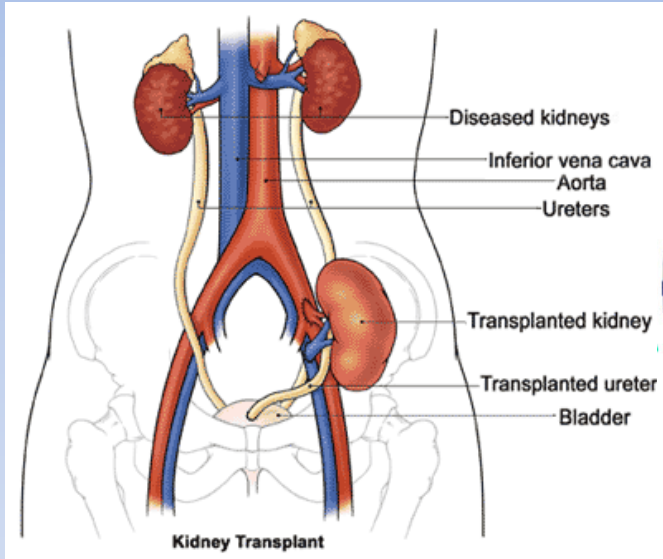


Renal Transplantation

Living related donors (LRD)

Living unrelated donors (LURD)

deceased organ donors



Renal Transplant
Medication

Renal Transplant
Rejection & infection

✓ Better quality of life, less mortality, can be before HD



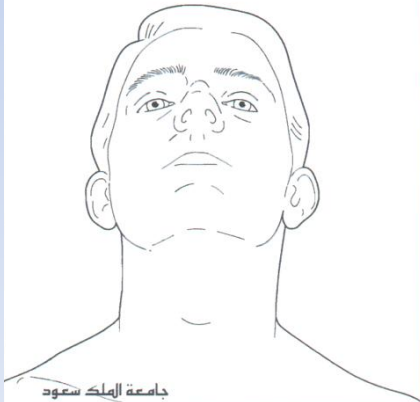
تأليف

نيكولاس ج. تالي سيمون أوكونر

كتاب الفحص الإكلينيكي الجيبي

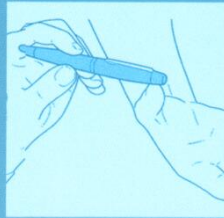
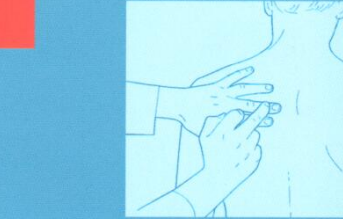
ترجمة

أ.د. جمال بن صالح الوكيل



جامعة الملك سعود

النشر العلمي والمطابع



NICHOLAS J TALLEY
SIMON O'CONNOR

POCKET CLINICAL EXAMINATION

SECOND EDITION

