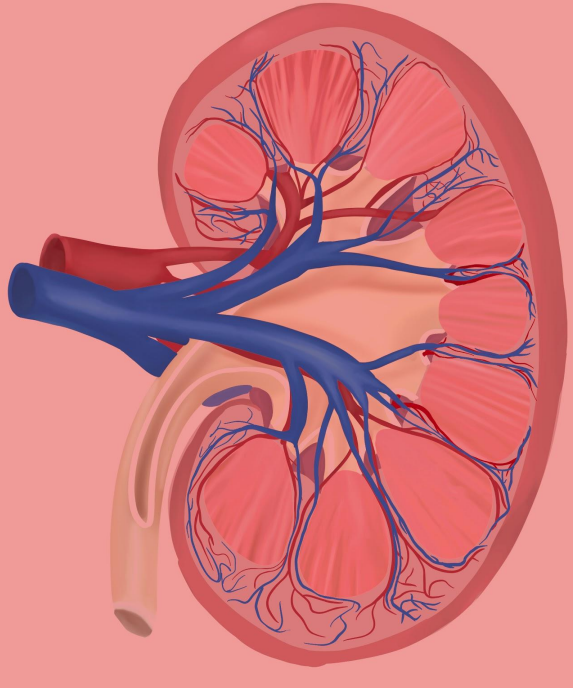
Editing File

SAQs Revision



- This file for **revision** and some possible SAQs.
- Beware the this file **only for revision** , you should study all the lectures.
- The doctor has learned that they will focus on one lecture for SAQ.

Renal function tests

1- What are the functions of the kidneys ?

1. Regulation of :
   - Water and electrolyte balance.
   - Acid base balance.
   - Arterial blood pressure.
2. Excretion of :
   - Metabolic waste products.
   - Foreign chemicals.
3. Hormonal function :
   - Secretion of erythropoietin.
   - Activation of vitamin D .
   - Activation of angiotensinogen by renin.
4. Metabolic function :
   - Site of gluconeogenesis.

2- Give examples of renal diseases :

1. Renal obstructions .
2. Renal calculi.
3. Tubular diseases : proximal or distal tubular renal acidosis (TRA) .
4. Renal hypertension.
5. Renal failure "acute and chronic".
6. Glomerular disease : Acute glomerulonephritis , Chronic glomerulonephritis and Nephrotic syndrome.

3- Why both sCr and CrCl are used as kidney function tests ?

- Confirm the diagnosis of renal disease.
- Follow up the treatment.
- Give an idea about the severity of the disease.

4- Why is sCr a better KFT(kidney function test) than CrCl ?

- Serum creatinine is more accurate.
- Serum creatinine level is constant throughout adult life.

5- What is the normal value for serum creatinine levels ?

- 55 – 120 µmol/L .

6- What is the limitation for creatinine clearance formula ?

- Urine volume

7- What are the limitations for cockroff-gault formula ?

1. Serum creatinine is changing rapidly .
2. Low muscle mass e.g : muscle wasting.
3. The diet is unusual e.g: strict vegetarian.
4. Obesity.

8- What are the conditions where creatinine clearance is only recommended ?

1. Patients with early (minor) renal disease .
2. Assessment of possible kidney donors.
3. Detection of renal toxicity of some nephrotoxic drugs.

9- Why is serum urea inferior to serum creatinine ?

1. Any condition of increased proteins catabolism (Cushing syndrome, diabetes mellitus, starvation, thyrotoxicosis) increases urea formation.
2. High protein diet increases urea formation.
3. 50 % or more of urea filtered at the glomerulus is passively reabsorbed by the renal tubules.
4. Dehydration can increase urea .

10- What is the normal value for creatinine clearance ?

- Average : 110 ml/min :
  - males : 90 - 140 ml/min.
  - Females : 80 - 125 ml/min.

11- What is the normal value for serum urea ?

- 2.5 - 6.6 mmol/L

Renal function tests , Contd..

★12- What are the criteria for a substance used for GFR measurement ?

1. Freely filtered at glomeruli.
2. Neither reabsorbed nor secreted by tubules.
3. Better if the substance is present endogenously.
4. Its concentration in plasma needs to remains constant throughout the period of urine collection.
5. Easily measured.

13 - What are the uses of GFR measurement ?

- Useful index of the number of functioning glomeruli .
- Helps in estimation of the degree of renal impairment by disease.

14- Write the equation for Creatinine clearance .

$$\textbf{Clearance}\ (\text{ml/min}) = \frac{U \times V}{P}$$

15- A 45-year-old woman with type 2 diabetes. She was asked to collect her urine for 24 hrs. She collected 4000 ml of urine, her serum creatinine was 7 mg/dl, and her urine creatinine was 35 mg/dl. What is the GFR?

- 4000/24*60 = 2.78 ml/min " urine volume".
- 7 mg/dl X 88.4 µmol/L = 618.8 µmol/L.
- 35 mg/dl x 88.4 µmol/L = 3094 µmol/L

$$\textbf{Clearance}\ (\text{ml/min}) = \frac{U \times V}{P} \qquad \textbf{13.9}\ (\text{ml/min}) = \frac{35 \times 2.78}{7}$$

بدون الـ conversion factor

$$\textbf{13.9}\ (\text{ml/min}) = \frac{3094 \times 2.78}{618.8}$$

مع الـ conversion factor

16- Write the equation for Cockroft-gault formula .

$$\textbf{GFR} = \frac{\textbf{K} \times (140-\textbf{age}) \times \textbf{Body weight}}{\textbf{Serum creatinine}}$$

17- A 30-year-old man with type type 2 diabetes was presented to the hospital compiling of pain in the lower abdomen. His serum creatinine was 5 mg/dl, and his body weight 75 Kg , What's the GFR? (K for male : 1.23).

- 5 mg/dl x 88.4 µmol/L = 442 µmol/L . *هنا لازم نحوّل مو اختياري

$$\textbf{GFR} = \frac{\textbf{K} \times (140-\textbf{age}) \times \textbf{Body weight}}{\textbf{Serum creatinine}} \qquad \textbf{23}\ (\text{ml/min}) = \frac{\textbf{1.23} \times (140-\textbf{30}) \times \textbf{75 Kg}}{\textbf{442}}$$

18- Mention two methods to determine the GFR ?

1. Cockroff-gault formula.
2. Creatinine clearance formula.

18- According to the previous question which method is better and why ?

- Creatinine clearance formula calculate creatinine clearance using parameters such as serum creatinine level, sex, age, and weight of the subject and makes the GRR more accurate than creatinine clearance because measurement of creatinine clearance requires 24 hours urine collection and this does introduce the potential for errors in terms of completion of the collection.

Chemical examination of urine

1- Enumerate the major organic constituents of urine.

1. Non-protein nitrogen (NPN) compounds.
2. Organic acids.
3. Sugars.
4. Traces of proteins , vitamins , hormones , pigments.

2- Enumerate the major inorganic constituents of urine.

- Sodium , potassium, Chloride , Small amount of Ca , Mg , Sulfur and phosphates and traces of Fe , Cu , Zn , I_2.

3- Give an example of pre-renal proteinuria .

- Multiple myeloma.

4- What's the difference between glomerular and tubular proteinuria ?

- In glomerular proteinuria there is high glomerular permeability and it causes filtration of high molecular weight proteins e.g. Glomerulonephritis.
- In Tubular proteinuria there is low tubular reabsorption with normal glomerular permeability and it causes excretion of low molecular weight proteins e.g. Chronic nephritis.

5- What are the causes of glucosuria ?

1. Diabetes mellitus :
    - Plasma glucose level exceeds the renal threshold.
2. Renal disease (renal glycosuria) :
    - Normal plasma glucose level with proximal tubular malfunction.
    - Decreased renal threshold as observed in :
        a. Gestational diabetes.
        b. Fanconi's syndrome.

6- What are the causes of ketonuria " conditions lead to ketonuria" ?

1. Diabetic ketoacidosis.
2. Starvation.
3. Unbalanced diet : high fat & low CHO diet.
4. Phenylketonuria : inborn error of metabolism.
5. Prolonged vomiting.

7- What are the ketones that could present on the urine ?

- Acetone, Acetoacetic acid and β-hydroxybutyric acid.

8- What are the causes of the presence of bilirubin / bile salts in the urine ?

1. Hepatocellular damage.
2. Obstruction of bile duct due to :
    - Stones (extrahepatic).
    - Hepatic tumors (intrahepatic).

9- What are the conditions that can lead to the presence of urobilinogen in the urine ?

1. Hepatocellular damage.
2. Hemolytic anemia.

10- What are the causes of hematuria ?

1. Acute / Chronic glomerulonephritis.
2. Local disorders of kidney and genitourinary tract :
    - Trauma , Cystitis , renal calculi and tumors.
3. Bleeding disorders : Hemophilia.

11- What are the causes of hemoglobinuria ?

1. Malaria.
2. Hemoglobinopathies : Sickle cell anemia and Thalassemia.
3. Transfusion reaction : blood group incompatibility.

12- What is the cause of orthostatic (postural) proteinuria ?

- Increased pressure on the renal vein in the vertical position.

13- What are the causes of post-renal proteinuria ?

- Lower urinary tract infection , trauma , tumors and stones.

Kidney stones

1- Enumerate conditions causing kidney stone formation.

1. High conc. of metabolic products in glomerular filtrate.
2. Changes in urine pH.
3. Urinary stagnation.
4. Deficiency of stone-forming inhibitors.

2- Enumerate the stone forming inhibitors.

- Citrate , Pyrophosphate and glycoproteins.

3- What are the causes of calcium salt stones ?

1. Hypercalciuria.
2. Hypercalcemia.
3. Hyperoxaluria.
4. Primary hyperoxaluria.

4- Give any FOUR lines of treatment for calcium salt stones.

1. Treatment of primary causes such as infection , hypercalcemia and hyperoxaluria.
2. Oxalate-restricted diet.
3. Increased fluid intake (if there's no glomerular failure).
4. Acidification of urine (by dietary changes).

5- What is the cause of uric acid stones ?

- Associated with hyperuricemia (with or without gout).

6- Give any FOUR lines of treatment for uric acid stones .

1. Treatment of cause of hyperuricemia.
2. Purine restricted diet.
3. Alkalinization of urine (by dietary changes).
4. Increased fluid intake.

7- What is the cause of Mg ammonium PO_4 stones ?

- Associated with chronic urinary tract infection : " microorganisms (such as from proteus genus) "

8- Give any FOUR lines of treatment for Mg ammonium PO_4 .

1. Treatment of infection.
2. Urine acidification.
3. Increased fluid intake.
4. In some cases , it may require complete stone removal (percutaneous nephrolithotomy).

9- What is the cause of cystine stones ?

- Due to homozygous cystinuria and it forms in acidic urine.

10- Give any THREE lines of treatment for cystine stones .

1. Increased fluid intake
2. Alkalinization of urine (by dietary changes).
3. Penicillamine (binds to cystein to form compound more soluble than cystine).

11- What are the lab investigation that are required for a patient that has a risk of stone formation ?

1. Identify causes that may contribute to stone formation :
   - Serum calcium, uric acid and PTH analysis.
   - Urinalysis: volume, calcium, oxalates and cystine levels.
   - Urine pH more than 8 suggests urinary tract infection which can lead to (Mg ammonium PO_4 stones).
2. Urinary tract imaging:
   - CT scan, Ultrasound and I.v. pyelogram.

12- What is the lab investigation that is required for a patient that experienced a stone being formed and removed ?

- Chemical analysis of stone which helps to:
  a. Identify the cause.
  b. Advise patient on prevention and future recurrence.

Inborn errors of amino acids metabolism

1- What is the cause of phenylketonuria ?

- Deficiency of phenylalanine hydroxylase enzyme (PAH).

2- What is the complications of phenylketonuria ?

- Hyperphenylalaninemia and tyrosine deficiency.

3- What are the types of phenylketonuria ?

1. Typical phenylketonuria caused by deficiency of the enzyme phenylalanine hydroxylase (PAH).
2. Atypical phenylketonuria caused by deficiency of the cofactor Tetrahydrobiopterin (BH_4).

4- What are the enzymes responsible for the deficiency of the cofactor BH_4?

1. Dihydrobiopterin synthetase.
2. Dihydropteridine reductase.
3. Carbinolamine dehydratase.

5- What is the cause of albinism ?

- Deficiency of the enzyme Tyrosinase.

6- What is the cause of alkaptonuria ?

- Deficiency of the enzyme homogentisic acid oxidase.

7- What are the characteristics of alkaptonuria ?

1. Early arthritis, Black pigmentation of cartilage and tissue .
2. Dark pigmented urine over time, due to oxidation of homogentisic acid.

8- What are the amino acids that involved in maple syrup urine disease ?

- leucine, isoleucine and valine.

9- What is the cause of maple syrup urine disease ?

- Deficiency in α-ketoacid dehydrogenase enzyme.

10- What are the types of maple syrup urine disease ?

1. Classic : most common " little or no activity of the enzyme".
2. Intermediate / intermittent : some enzyme activity "symptoms are there but milder"
3. Thiamine Responsive : high doses of thiamine increases enzyme activity.

11- What is the cause of homocystinuria ?

- Deficiency of cystathionine β-synthase enzyme.

12- What are the conditions that associated with homocystinuria ?

1. Vascular disease (atherosclerosis) and heart disease.
2. Skeletal abnormalities and osteoporosis.
3. Mental retardation.
4. Neural tube defect (spina bifida).
5. Displacement of eye lens.

13- What is the treatment for homocystinuria ?

- Methionine-restricted diet and Oral administration of vitamins B6, B12 and folate.

14- What is the treatment for maple syrup urine disease ?

- limited intake of leucine, isoleucine, and valine.

15- What is the treatment for alkaptonuria ?

- Restricted intake of tyrosine and phenylalanine will reduce homogentisic acid levels and reduce the dark pigmentation.

16- What is the treatment for phenylketonuria ?

- A lifelong Phenylalanine Restricted diet.

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