Lec11&12

جامعة الفرات الاوسط التقنية /المعهد التقني سماوة

قسم تقنيات صحة مجتمع

المحاضرة11 و12

اسم المادة / وظائف اعضاء 1.

المرحلة الدراسية / الاولى

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استاذ المادة. م .م شيماء جبار حسين

Lec11&12

Renal system

1-12 structure of renal system

The renal system consists of all the organs involved in the formation and release of urine. It includes the kidneys, ureters, bladder and urethra.

1- The kidneys

are bean-shaped organs which help the body produce urine to get rid of unwanted waste substances. When urine is formed, tubes called ureters transport it to the urinary bladder, where it is stored and excreted via the urethra.

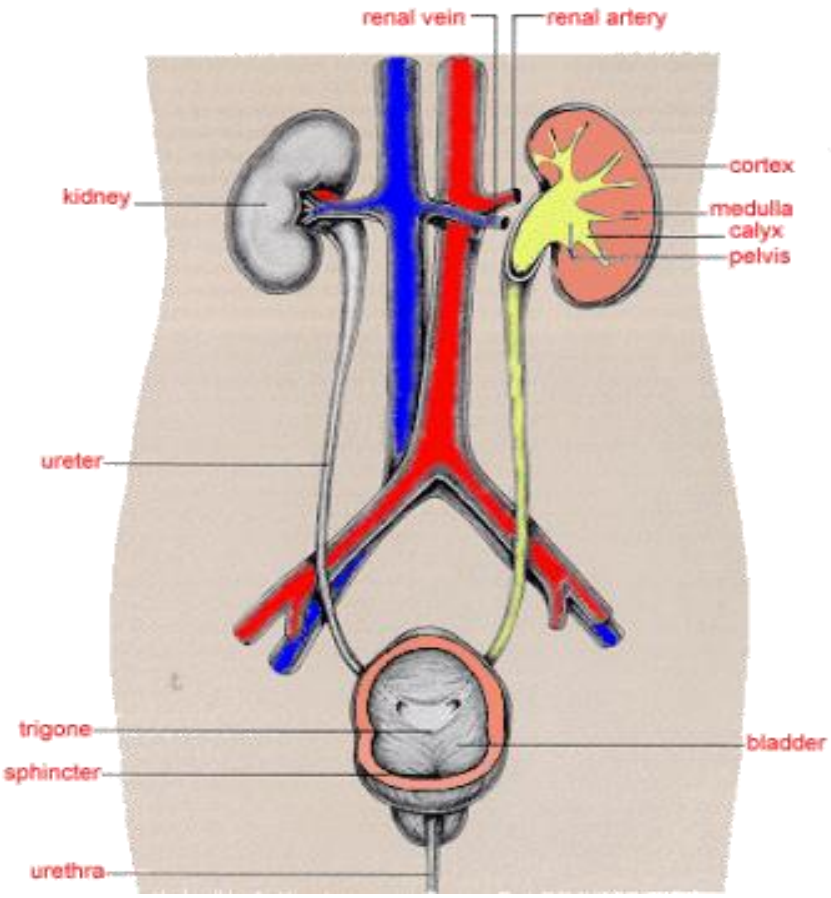
2- Bladder

The bladder is a pyramid-shaped organ which sits in the pelvis (the bony structure which helps form the hips). The main function of the bladder is to store urine and, under the appropriate signals, release it into a tube which carries the urine out of the body. Normally, the bladder can hold up to 500 mL of urine. The bladder has three openings: two for the ureters and one for the urethra (tube carrying urine out of the body). The bladder consists of smooth muscles. The main muscle of the bladder is called the detrusor muscle. Muscle fibres around the opening of the urethra forms a ring-like muscle that controls the passage of urine. When we want to urinate, stretch receptors in the bladder are activated, which send signals to our brain and tell us that the bladder is full. The ring-like muscle relaxes and the detrusor muscle contracts, allowing urine to flow. The blood supply of the bladder is from many blood vessels. Some of these blood vessels are named: the vesical arteries, the obturator, uterine, gluteal and vaginal arteries. In females, a venous network drains blood from the bladder arteries into the internal iliac vein. Nervous control of the bladder involves centres located in the brain and spinal cord

3- Urethra

The male urethra is 18–20 cm long, running from the bladder to the tip of the penis. The male urethra is supplied by the inferior vesical and middle rectal arteries. The veins follow these blood vessels. The nerve supply is via the pudendal nerve.

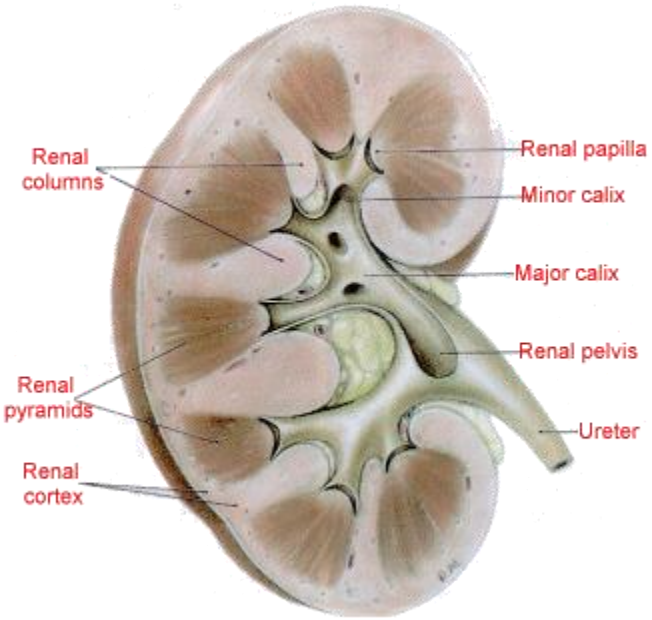
The female urethra is 4–6 cm long and 6 mm wide. It is a tube running from the bladder neck and opening into an external hole located at the top of the vaginal opening. As the female urethra is shorter than the male urethra, it is more likely to get infections from bacteria in the vagina. The female urethra is supplied by the internal pudendal and vaginal arteries.



2-12 structure of kidney

On sectioning, the kidney has a pale outer region- the cortex- and a darker inner region- the medulla.The medulla is divided into 8-18 conical regions, called the renal pyramids; the base of each pyramid starts at the corticomedullary border, and the apex ends in the renal papilla which merges to form the renal pelvis and then on to form the ureter. In humans, the renal pelvis is divided into two or three spaces -the major calyces- which in turn divide into further minor calyces. The walls of the calyces, pelvis and ureters are lined with smooth muscle that can contract to force urine towards the bladder by peristalisis.

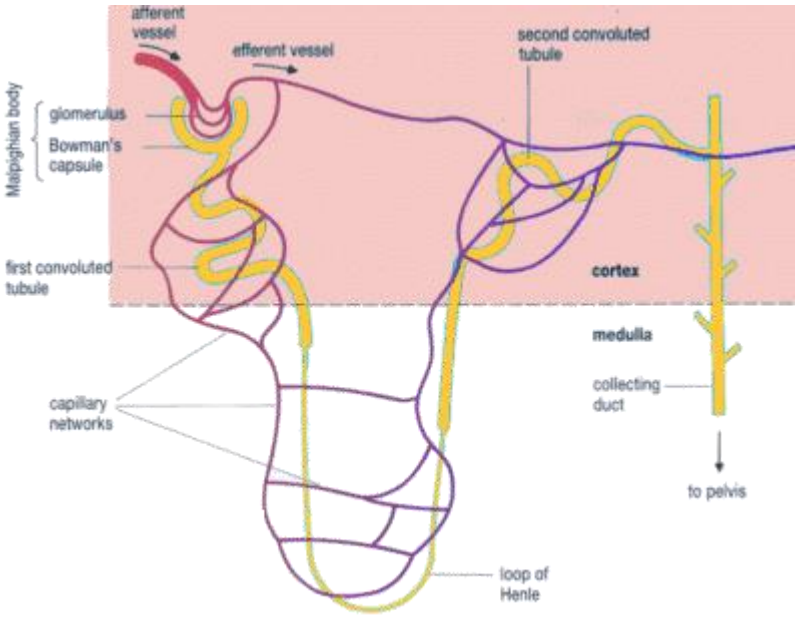
The cortex and the medulla are made up of nephrons; these are the functional units of the kidney, and each kidney contains about 1.3 million of them.



3-12 structure of nephron

The nephron is the unit of the kidney responsible for ultrafiltration of the blood and reabsorption or excretion of products in the subsequent filtrate. Each nephron is made up of:

- **A filtering unit- the glomerulus. 125ml/min of filtrate is formed by the kidneys as blood is filtered through this sieve-like structure. This filtration is uncontrolled.**
- **The proximal convoluted tubule. Controlled absorption of glucose, sodium, and other solutes goes on in this region.**
- **The loop of Henle. This region is responsible for concentration and dilution of urine by utilising a *counter-current multiplying* mechanism- basically, it is water-impermeable but can pump sodium out, which in turn affects the osmolarity of the surrounding tissues and will affect the subsequent movement of water in or out of the water-permeable collecting duct.**
- **The distal convoluted tubule. This region is responsible, along with the collecting duct that it joins, for absorbing water back into the body- simple maths will tell you that the kidney doesn't produce 125ml of urine every minute. 99% of the water is normally reabsorbed, leaving highly concentrated urine to flow into the collecting duct and then into the renal pelvis.**



Test No.1

Describe the structure of nepheron

Test no.2

Enumerate the functions of kidney (this test for unit 13)

Unit thirteen

1-13 functions of the kidney

1. Control of the body's water balance. The amount of water in the body must be balanced against the amount of water which we drink and the amount we lose in urine and sweat etc.

2. Regulation of blood pressure via the renin-angiotensin-aldosterone system

3. Regulation of blood electrolyte balance - Na+, Ca2+, K+ etc.

4. Excretion of metabolic wastes such as urea, creatinine and foreign substances such as drugs and the chemicals we ingest with our food

5. Help in the regulation of the body's acid base balance

6. Regulation of red blood cell production via the hormone erythropoietin

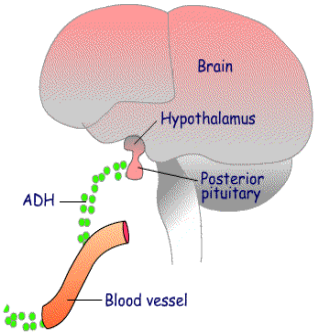
7. Help in the production of vitamin D

As this list indicates, the renal system is very important to the normal functioning of the body.

2-13 water regulations by the kidneys

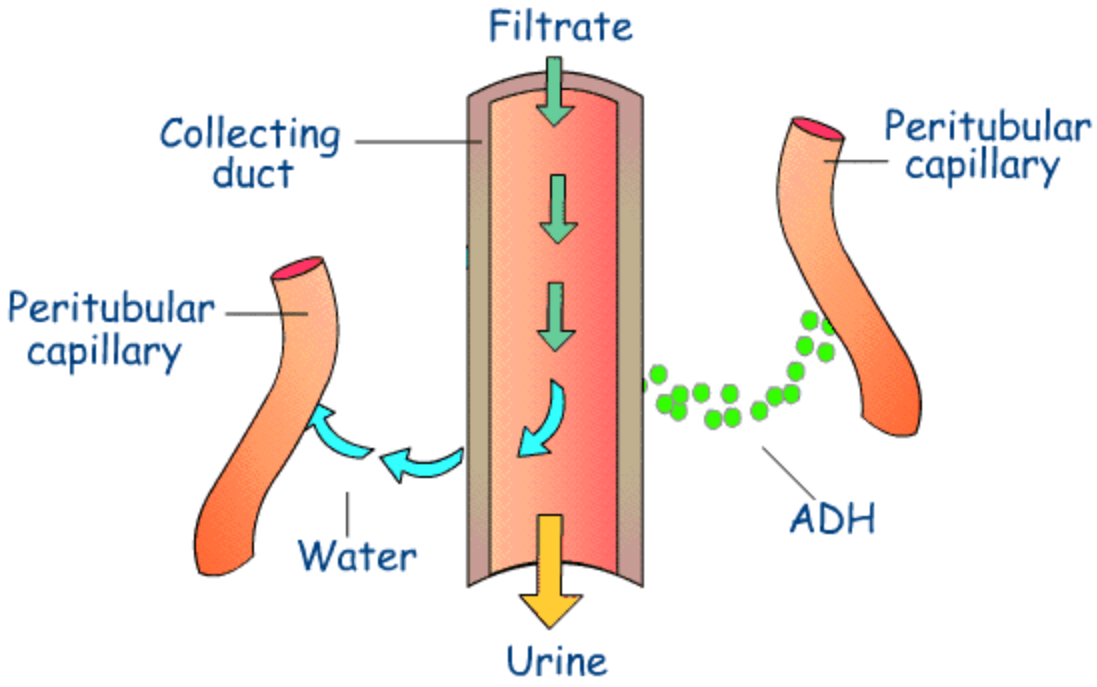
The water content of the body can vary depending on various factors. Hot weather and physical activity such as exercise make us sweat and so lose body fluids. Drinking tends to be at irregular intervals when socially convenient. This means that sometimes the body has too little water and needs to conserve it and sometimes too much water and needs to get rid of it. Most of the control of water conservation takes place in the distal and collecting tubules of the nephrons under control of anti-diuretic hormone, (ADH), sometimes called vasopressin. This hormone is released by the posterior pituitary under control of the hypothalamus in the mid-brain area. The hypothalamus monitors the water content of the blood.

If the blood contains too little water (indicating dehydration) then more ADH is released. If the blood contains too much water (indicating over-hydration) then less ADH is released into the blood stream



Release of ADH from the posterior pituitary into the bloodstream

ADH released from the pituitary travels in the blood stream to the peritubular capillaries of the nephron. ADH binds to receptors on the distal and collecting tubules of the nephrons which causes water channels to open in the tubule walls. This allows water to diffuse through the tubule walls into the interstitial fluid where it is collected by the peritubular capillaries. The more ADH present, the more water channels are open and the more water is reabsorbed - Figure



Reabsorption of water from the filtrate under the influence of ADH

Over 99% of the filtrate produced each day can be reabsorbed. The amount of water reabsorbed from the filtrate back into the blood depends on the water situation in the body. When the body is dehydrated, most of the filtrate is reabsorbed but note that even in cases of extreme of water shortage, the kidneys will continue to produce around 500 ml of urine each day in order to perform their excretory function.