Functional morphology of the kidneys

The kidneys are an important excretory, **excretory organ** . They are located **retroperitoneally** in the area Th 12 –L 2 . They participate in maintaining homeostasis and maintain a **balance** between income and expenditure. The balance can be positive when income is greater than expenditure or negative balance when expenditure is greater than income.

They provide:

- **isovolemia** - constant volume,
- **isoosmosis** - osmotic pressure,
- **isohydria** - **ABR**,
- **isolation** ,
- **excretion of metabolites ,**

  urea - a product of AMK metabolism,
  uric acid - a product of NK metabolism,
  creatinine - a product of creatine catabolism,
  others - **Hb**, hormones,

- **hormone secretion ,**

  renin - a hormone of the juxtaglomerular apparatus. It cleaves angiotensinogen and angiotensin I , which is converted to angiotensin II by ACE (*angiotensin converting enzyme).* It has vasoconstrictive effect.

  erythropoetin- stimulates the production of erythrocytes,
  prostaglandins and kinins - affect the vascular smooth muscle,
  1,25-dihydroxyvitamin D 3 - increases plasma Ca 2+ levels .

Bark

- formed by cortical glomeruli, a number of proximal and distal tubules,
- variously arranged bloodstreams,
- the osmotic pressure of the cortex has the same value as blood plasma.

Marrow

- longitudinally arranged formations, straight parts of proximal and distal tubules,
- both straps of the Henle loop,
- collecting ducts,
- the osmolarity rises from the bark-marrow interface towards the papilla.

Histology

The parenchyma is made up of a functional system of three basic components that must be in harmony.

1. interstitium
2. blood circulation
3. set of nephronsDiagram of the Malpigi body on the left and histological picture on the right.

It consists of a Bowman's case and a glomerulus. Its main task is the ultrafiltration of blood plasma. A high filtration pressure must be ensured.

Glomerular filtration - the movement of water and low molecular weight substances from the plasma into the Bowman's capsule and into the initial part of the proximal tubule.

Mesangium - formed by mesangial cells and matter. They provide support for glomerular capillaries. They affect the filtration area by **reducing** - due to angiotensin II, relaxation - due to prostaglandins.

Extraglomerular mesangial cells with *macula densa* - epithelial cells of the final part of the coarse segment of the ascending part of the Henle loop, which check the composition of the filtrate and give information as to whether they filter little or much. So-called tubuloglomerular feedback. With granular cells, which are modified *vas afferens* and *vas efferens cells* produce **renin** .

Nephron monitors its own level of GF receptors in the macula densa (they detect tubular fluid flow and Na *+* , chemical signals of the *macula densa* affect the contraction or relaxation of smooth muscle of afferent and efferent capillaries and thus affect the GF. tubular fluid. Filtration barrier Chemical signals are sent out and vasodilation of your afferens occurs. The hydrostatic pressure in the glomerular capillaries increases and GF is restored. As the

filtration rises, the opposite occurs. Glomerular flow is strictly regulated and maintained, but only in the range of arterial pressures in the range of **80-180 mmHg** . When falling below 80 mmHg, these local regulatory mechanisms fail.

Filtration barrier

Composed of **fenestrated blood capillary epithelium** that is permeable to water, small solutes, ions, glucose, AMK, urea, albumin. The second component of the barrier is the **basement membrane** , formed by collagen fibers. It has a negative charge, which means that it repels particles charged negatively - anions. The third component is **podocytes** . They form the main barrier for erythrocytes. The fourth component is **nephrine** . It is a protein produced by the podocytes that is stored between them and surrounds them. It also has a **negative charge** and thus repels negatively charged molecules.

Tubular system

The glomerular filtrate passes from the initial part of the **proximal tubule** into the **Henle loop** → it enters the renal medulla and connects to the **coarse segment** → which flows smoothly into the **distal tubule** → it into the **collecting duct** , which passes through the cortex and medulla → and finally urine into the **renal calyx** .

- **cortical nephron :**

  superficial,
  the most common type,
  they are located in the outer layer of the bark,
  only the top of Henle's short loop goes to the marrow.

- **juxtamedular nephron :**

  less numerous,
  are located in the inner layer of the cortex together with the proximal, distal tubule and Henle loop,
  Henle's loop is long and extends into the marrow,
  Vasa recta accompanies Henle's loop,
  ability to form highly concentated or maximally diluted urine.

Links

Related Articles

- Kidneys
- Examination of urinary sediments
- Tubular processes
- Osmolarity

Source

- Notes from lectures by prof. MUDr. Otomar Kittnar, CSc., MBA from the Institute of Physiology 1 LF

References

- KITTNAR, Otomar, et al. *Medical physiology.* 1st edition. Prague: Grada, 2011. 790 pp. ISBN 978-80-247-3068-4 .

Kategorie:Fyziologie Kategorie:Nefrologie