Physiology of Excretion, Diseases & Disorders of Excretory system- A Review article

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Abstract: The excretory system is one of the major functional units of the human body, responsible for the elimination of solid and liquid wastes from the body. Dysfunctions of the excretory system may lead to the retention of the toxic wastes that may give rise to numerous complexities within the body. This is indicative of some serious urinary disorders. Again, epidemiological studies by the American Society of Colon and Rectal Surgeons suggest that nearly 5% of the general population suffers from bowel incontinence problems, which is clearly indicative of rectal disorders. In this article we studies Physiology of Excretion, Various part of excretory system, various diseases associated with excretory system. Kidney, Liver, Skin, Intestine play an important role in Excretion. Kidneys are important organs that perform many important functions of the body. Kidney performs several important functions whether it is formation of urine or elimination of nitrogenous substance from the body. Kidney disorders have always remained a major area of concern for Unani Scholars since a long time. The kidney disorders is a term with broad meaning which is applied when kidney does not function properly and these disorders are listed by various names in Unani classical texts viz, renal hypertrophy, weakness of Kidney, nephritis, renal ulcer ,Nephrolithiasis, renal dystrophy, renal atrophy, Renal obstruction.

Key Words: Physiology of Excretion, Excretory organ, Urine formation, Function of kidney, Kidney disorders,

1. Excretory Organ of Human Body.

Excretion is the process of removing wastes and excess water from the body. It is an essential process in all living things, and it is one of the major ways the human body maintains homeostasis. It also helps prevent damage to the body. Wastes include by-products of metabolism some of which are toxic — and other non-useful materials, such as used up and broken down components. Some of the specific waste products that must be excreted from the body include carbon dioxide from cellular respiration, ammonia and urea from protein catabolism, and uric acid from nucleic acid catabolism.

2. Excretory Organs

Organs of excretion include the skin, liver, large intestine, lungs, and kidneys. Together, these organs make up the excretory system. They all excrete wastes, but they don't work together in the same way that organs do in most other body systems. Each of the excretory organs "does its own thing" more-or-less independently of the others, but all are necessary to successfully excrete the full range of wastes from the human body.

I. Skin

The skin is part of the integumentary system, but it also plays a role in excretion through the production of sweat by sweat glands in the dermis. Although the main role of sweat production is to cool the body and maintain temperature homeostasis, sweating also eliminates excess water and salts, as well as a small amount of urea. When sweating is copious, ingestion of salts and water may be helpful to maintain homeostasis in the body.

Fig. 1 Excretion via skin

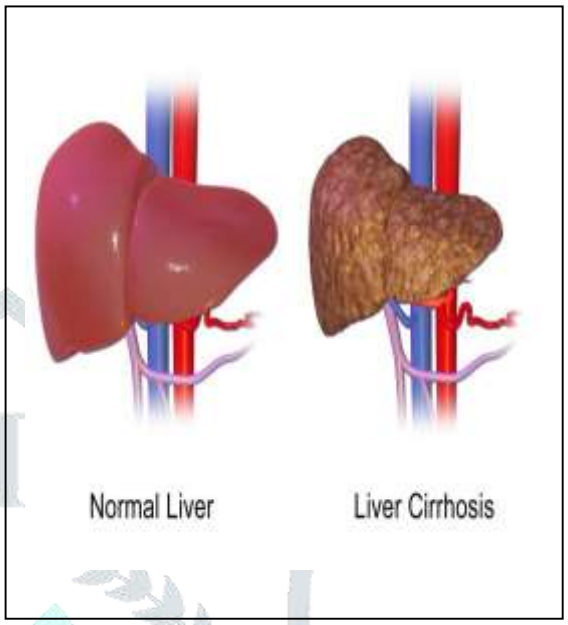

Fig. 2 Excretion via Liver

II. Liver

The liver has numerous major functions, including secreting bile for digestion of lipids, synthesizing many proteins and other compounds, storing glycogen and other substances, and secreting endocrine hormones. In addition to all of these functions, the liver is a very important organ of excretion. The liver breaks down many substances in the blood, including toxins. For example, the liver transforms ammonia a poisonous by-product of protein catabolism — into urea, which is filtered from the blood by the kidneys and excreted in urine. The liver also excretes in its bile the protein bilirubin, a byproduct of hemoglobin catabolism that forms when red blood cells die. Bile travels to the small intestine and is then excreted in feces by the large intestine.

III. Large Intestine

The large intestine is an important part of the digestive system and the final organ in the gastrointestinal tract. As an organ of excretion, its main function is to eliminate solid wastes that remain after the digestion of food and the extraction of water from indigestible matter in food waste. The large intestine also collects wastes from throughout the body. Bile secreted into the gastrointestinal tract, for example, contains the waste product bilirubin from the liver. Bilirubin is a brown pigment that gives human feces its characteristic brown colour.

Fig. 3 Excretion via Lings

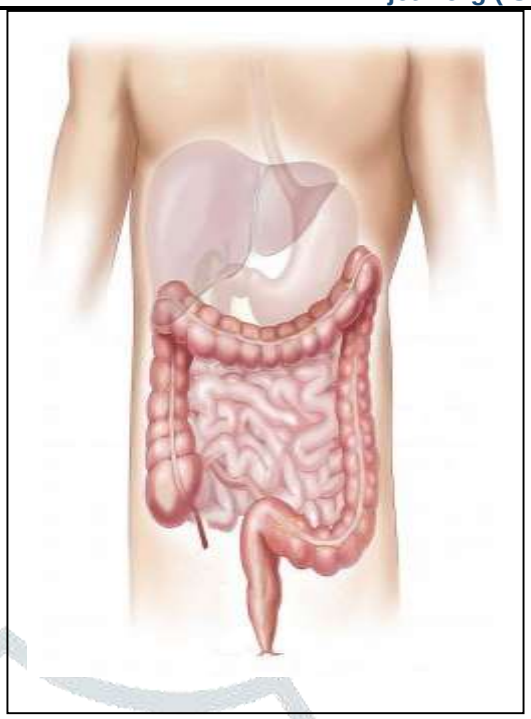

Fig. 4 Excretion via Intestine

IV. **Lungs**

The lungs are part of the respiratory system, but they are also important organs of excretion. They are responsible for the excretion of gaseous wastes from the body. The main waste gas excreted by the lungs is carbon dioxide, which is a waste product of cellular respiration in cells throughout the body. Carbon dioxide is diffused from the blood into the air in the tiny air sacs called alveoli in the lungs. By expelling carbon dioxide from the blood, the lungs help maintain acid-base homeostasis. In fact, it is the pH of blood that controls the rate of breathing. Water vapor is also picked up from the lungs and other organs of the respiratory tract as the exhaled air passes over their moist linings, and the water vapor is excreted along with the carbon dioxide. Trace levels of some other waste gases are exhaled, as well.

V. **Kidneys**

The paired kidneys are often considered the main organs of excretion. The primary function of the kidneys is the elimination of excess water and wastes from the bloodstream by the production of the liquid waste known as urine. The main structural and functional units of the kidneys are tiny structures called nephrons. Nephrons filter materials out of the blood, return to the blood what is needed, and excrete the rest as urine. As shown in Figure 16.2.6, the kidneys are organs of the urinary system, which also includes the ureters, bladder, and urethra organs that transport, store, and eliminate urine, respectively.

By producing and excreting urine, the kidneys play vital roles in body-wide homeostasis. They maintain the correct volume of extracellular fluid, which is all the fluid in the body outside of cells, including the blood and lymph. The kidneys also maintain the correct balance of salts and pH in extracellular fluid. In addition, the kidneys function as endocrine glands, secreting hormones into the blood that control other body processes. You can read much more about the kidneys in

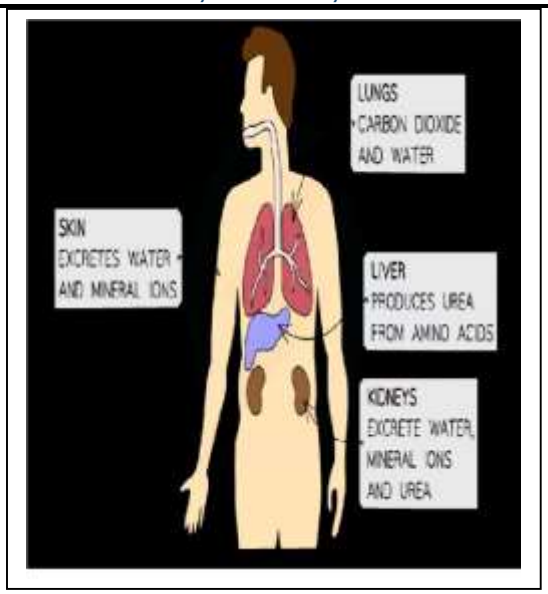

Fig. 5 Excretion via Kidneys

sectionhttp://humanbiology.pressbooks.tru.ca/chapter/18-4-kidneys/.

3. Introduction of Urinary system

The kidneys are large, bean-shaped organs which are present on each side of the vertebral column in the abdominal cavity. Humans have two kidneys and each kidney is supplied with blood from the renal artery. The kidneys remove from the blood the nitrogenous wastes such as urea, as well as salts and excess water, and excrete them in the form of urine. This is done with the help of millions of nephrons present in the kidney.

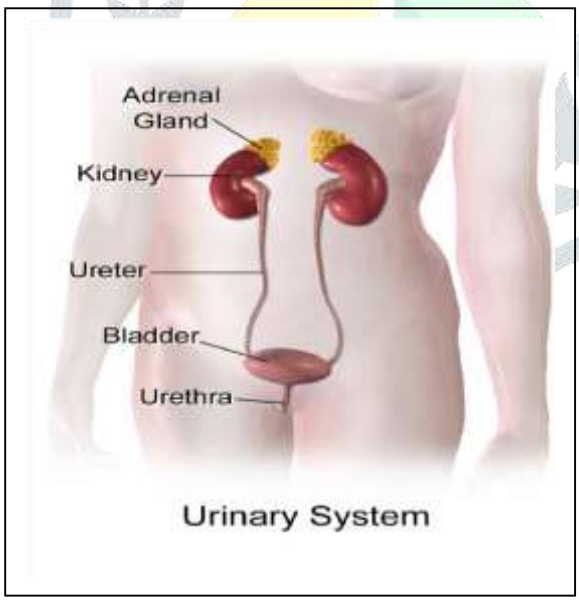

Fig. 6 Excretory product

The

filtrated blood is carried away from the kidneys by the renal vein (or kidney vein). The urine from the kidney is collected by the ureter (or excretory tubes), one from each kidney, and is passed to the urinary bladder. The urinary bladder collects and stores the urine until urination. The urine collected in the bladder is passed into the external environment from the body through an opening called the urethra.

I. Kidneys

The kidney's primary function is the elimination of waste from the bloodstream by production of urine. They perform several homeostatic functions such as:-

A. Maintain volume of extracellular fluid

B. Maintain ionic balance in extracellular fluid

C. Maintain pH and osmotic concentration of the extracellular fluid.

D. Excrete toxic metabolic by-products such as urea, ammonia, and uric acid.

The way the kidneys do this is with nephrons. There are over 1 million nephrons in each kidney; these nephrons act as filters inside the kidneys. The kidneys filter needed materials and waste, the needed materials go back into the bloodstream, and unneeded materials become urine and are gotten rid of. In some cases, excess wastes crystallize as kidney stones. They grow and can become painful irritants that may require surgery or ultrasound treatments. Some stones are small enough to be forced into the urethra.

II. Ureter

The ureters are muscular ducts that propel urine from the kidneys to the urinary bladder. In the human adult, the ureters are usually 25–30 cm (10–12 in) long. In humans, the ureters arise from the renal pelvis on the medial aspect of each kidney before descending towards the bladder on the front of the psoas major muscle. The ureters cross the pelvic brim near the bifurcation of the iliac arteries. This "pelviureteric junction" is a common site for the impaction of kidney stones (the other being the uteterovesical valve). The ureters run posteriorly on the lateral walls of the pelvis. They then curve anteriormedially to enter the bladder through the back, at the vesicoureteric junction, running within the wall of the bladder for a few centimeters. The backflow of urine is prevented by valves known as ureterovesical valves. In the female, the ureters pass through the mesometrium on the way to the bladder.

III. Urinary bladder

The urinary bladder is the organ that collects waste excreted by the kidneys prior to disposal by urination. It is a hollow muscular, and distensible organ, and sits on the pelvic floor. Urine enters the bladder via the ureters and exits via the urethra.

Embryo logically, the bladder is derived from the urogenital sinus, and it is initially continuous with the allantois. In human males, the base of the bladder lies between the rectum and the pubic symphysis. It is superior to the prostate, and separated from the rectum by the rectovesical excavation. In females, the bladder sits inferior to the uterus and anterior to the vagina. It is separated from the uterus by the vesicouterine excavation. In infants and young children, the urinary bladder is in the abdomen even when empty.

IV. Urethra

In anatomy, the (from Greek – ourethra) is a tube which connects the urinary bladder to the outside of the body. In humans, the urethra has an excretory function in both genders to pass.

4. Excretion in Humans

Excretion is the process where all the metabolic wastes are removed from the body. Excretion in humans is carried through different body parts and internal organs in a series of processes. Diffusion is the most common process of excretion in lower organisms. A human body is an exceptional machine, where different life-

processes (respiration, circulation, digestion, etc.) take place simultaneously. As a result, many waste products produced in our body are in various forms that include carbon dioxide, water, and nitrogenous products like urea, ammonia, and uric acid.

In addition to these, the chemicals and other toxic compounds from medications and hormonal products are also produced. Simple diffusion is not sufficient to eliminate these wastes from our body.

We need more complex and specific processes in order to eliminate waste products.

Blood contains both useful and harmful substances. Hence, we have kidneys which separate useful substances by reabsorption and toxic substances by producing urine. Kidney has a structural filtration unit called nephron where the blood is filtered. Each kidney contains a million nephrons.

Capillaries of kidneys filter the blood and the essential substances like glucose, amino acids, salts, and the required amount of water get reabsorbed and the blood goes into circulation.

Excess water and nitrogenous waste in humans are converted to urine. Urine thus produced is passed to the urinary bladder via the ureters. The urinary bladder is under the control of the Central Nervous System. The brain signals the urinary bladder to contract and through the urinary opening called the urethra, we excrete the urine.

5. Physiology of Excretion

Excretion in broad sense is elimination of waste products from the body. In particular excretion is elimination of nitrogenous waste from the body.

Nitrogenous waste is generated during metabolic processes. In animal kingdom various devices are available for excretion. Some of them enlisted are general body surface by osmosis, contractile vacuoles, flame cells, nephridia, Malpighian tubules, green gland, renal gland, Protonephridia and kidney.

Kidney in vertebrates developed from intermediate mesoderm. So the kidneys are excoelomic in position. If functional kidney develops from anterior part of mesoderm, then it is called as pronephric kidney. If it develops from middle part it is called mesonephric kidney. If it develops from posterior part, then it is metanephric kidney. Pronepric kidneys are found in larvae of cyclostomata, pisces and amphibian. Adult Pisces and amphibians show mesonephic kidneys while reptile's aves and mammals possess met nephric kidneys.

Based on the nitrogenous waste to be excreted the animals are ammonotelic excreting ammonia, ureotelic excreting urea and uricotelic excreting uric acid. In human a pair of metanephric kidneys is present closely associated with dorsal wall of abdominal cavity, on either side of vertebral column. **A. Gross structure of kidney**

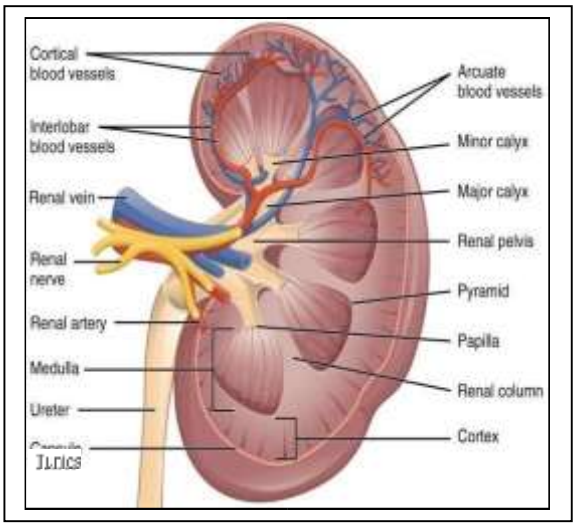

Fig. 7 Structure of Kidney

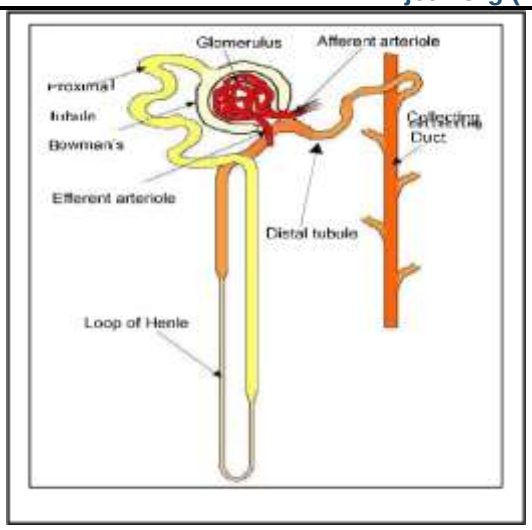

Fig. 8 Structure of Nephron

1. Kidney is externally covered by connective tissue capsule called tunica fibrosa. Gross structure of kidney can be well studied in longitudinal section. It encloses an excentric cavity called renal sinus on the middle side, surrounded by parenchyma.
2. Parenchyma is distinguished into peripheral cortex and inner medulla.
3. Renal sinus opens into hilus. It is mainly occupied by funnel shaped base of ureter called renal pelvis, major blood vessels of kidney pass through renal sinus. Rest of the sinus is filled by loose connective tissue.
4. Renal pelvis gives rise four to five out-pockets called major calyces. To the major calyces open few minor calyces.
5. Cortex is peripheral granular dark brown part. From cortex thick projections penetrate the medulla called renal column of Bertin.
6. Medulla is in the form of 6-20 conical subdivisions called medullary pyramids. Broad base of pyramids lie near the cortex while the apex lies unite to form papilla which opens into minor calyx. Papilla has several minute openings of collecting ducts. Extentions of medullary substances into the cortex are called medullary rays.
7. A medullary pyramid with the cap of cortex is considered as a renal lobe. Human kidney is multilobar while some other mammals like kangaroo, rodents, cat, dog, apes show unilobar kidney.
8. Functional unit of kidney is a nephron or uriniferous tubule. **B. Structure of Nephron:**

Renal parenchyma is composed of two types of tubules, nephrones and collecting tubules, sparse connective tissue and blood vessels. Each human kidney contains about 2 million nephrones. Those are arranged in cortex and medulla. Each nephrone comprises of four parts, Malpighian or renal capsule, proximal tubule, thin segment and distal tubule. Renal capsule, major part of proximal and distal tubules are present in cortex, while part of straight portion of proximal tubule, thin segment and part of straight portion of distal tubule are distributed in medulla. Renal capsule is restricted to cortex region. Each capsule has 200µ in diameter. Each capsule has two pars the Bowman's capsule and glomerular capillaries.

a. Bowman's capsule:

- It is two layered cup shaped structure. The two layers are separated by a crescent shaped cavity called capsular space.
- The outer layer is called parietal layer which is formed by flat squamous epithelial cells. This layer further continues as proximal tubule.
- Inner layer is visceral layer, made up of
- highly specialized cells called podocytes. This layer is closely associated with glomerular capillaries.
- The basement membranes of capillary endothelium and visceral layer are fused called lamina densa.
- The podocytes has a main cell body carrying a large nucleus. It is separated from the capillary by asmall subpodocytic space.
- From the cell body several cytoplasmic extensions radiate called primary processes. Primary processes give numerous secondary processes or foot processes. They are firmly attached to lamina densa and integrated with corresponding processes of adjacent podocytes. This arrangement creates numerous clefs among them called filtration slits.
- Associated with glomerular capillaries some stellate cells are present called mesangial cells. These are supportive and phagocytic cells.

b. Glomerulus:

- A fine branch of renal artery enters in Bowman's capsule called **afferent arteriole**. It breaks into anastomosing network of branched capillaries called glomerulus. These capillaries reunite to form efferent arteriole.
- The diameter of afferent arteriole is smaller than the diameter of efferent arteriole. Due to this in higher glomerular capillary blood pressure is generated.
- The side where two arterioles associated together is called vascular pole while the side from where proximal tubule initiated is called urinary pole or tubular pole.

2. Proximal tubule: This segment starts at urinary pole of reanl capsule. It is about 14 mm long and 60µ in diameter. It has two distinct parts viz pars convoluta and pars recta.

a. Pars convolute: This part form many loops. Last loop is largest which runs towards medulla and continues as pars recta.

b. Pars recta: It is straight part. It enters in medulla proper and then converted into thin loop.

c. Neck: The squamous epithelium of parietal layer of Bowman's capsule converts into cuboidal or low columnar epithelium at proximal tubule. The transient region appears narrow in some species termed as neck region. It is not found in human.

d. Histology: Proximal tubule is formed by single layer of cuboidal or low columnar cells enclosing a large lumen. It has prominent basement membrane as its outer limiting surface.

e. The cells of proximal tubule have a single spherical nucleus and acidophilic cytoplasm. Lateral margins of cells cannot be seen properly under light microscope as those are zig-zac.

f. Each cell has numerous rod shaped mitochondria present towards basal side arranged parallel to the long axis of the cells.

g. The apical region shows brush boarder. It shows numerous microvilli. At the base of some of the microvilli apical canaliculi are present which extends in apical cytoplasm.

Many pinocytotic vesicles can be observed in apical cytoplasm.

3. Thin segment:

a. It is also called as Loop of Henle. It is present only in mammals and birds.

b. This is a hair pin loop. It has a descending loop or straight portion of proximal tubule and an ascending loop or straight portion of distal tubule.

c. It is present in medulla. Proximal tubule continues with descending loop, while ascending loop continues to distal tubule.

d. Proximal tubule when enters in medulla suddenly narrows to 15µ. The cuboidal epithelium changes in squamous epithelium. It loses the brush boarder. The cells has little cytoplasm, nucleus bulged into lumen, poor cell organelle and moderately thick basement membrane.

4. Distal tubule

a. Loop of Henle continuous as distal tubule when enters in cortex.

b. It is shorter and thinner than proximal tubule. It has three parts,

- Thick portion of ascending loop
- Macula densa
- Convoluted portion.

c. Thick portion of ascending loop: thin segment abruptly changes to distal tubule. Diameter changes to 15µ to 35µ.

d. Macula densa: distal tubule enters in cortex and forms a loop towards its own renal capsule. It runs between the afferent and efferent arterioles.

e. Convoluted portion: Convoluted part consists of many short loops. It is shorter in length, about 5 mm. It connects to arched collecting tubule which continues as collecting tubule.

f. Cells of distal convolutes tubules are low columnar, with distinct boarder, without microvilli. They have prominent basement membrane, Basal infoldings of plasma membrane and long mitochondria.

5. Juxtraglomerular apparatus:

It is present at the vascular pole of renal capsule. It contains three types of cells. **a. Juxtraglomerullar cells:**

- These are the modified smooth muscle cells of afferent arteriole.
- The cells of afferent arteriole near the macula densa of distal tubule.
- They are barrow receptive cells and also secretary secretes renin and erythropoietin.
- Renin helps in maintaining the blood pressure. Erythropoietin stimulates the process of blood cells formation.

b. **Macula densa cells:** These are the modified cells of distal tubules. They help in maintaining the salt balance.

c. **Extraglomerular mesengeal cells:** These are the cells present in the gap between afferent arteriole, efferent arteriole and macula densa.

Nephrons are of two types depending on their position in kidney.

- **Cortical Nephrons:** These are most abundant type. Their capsules are present in cortex and their thin segment is smaller in length.
- **Juxtramedullary nrphrons:** The renal capsules of these nephrons present near medulla. Their thin segments are longer.

6. Physiology of Urine formation:

Human is ureotelic animal, excretes urea as major nitrogenous waste. Ammonia is generated during the deamination process of amino acids. It has to eliminate from the body immediately or has to convert into less toxic substance like urea. Urea is synthesized in liver from two molecules of ammonia and one molecule of CO_2. The metabolic pathway of urea formation is called Ornithine cycle. A key enzyme for this pathway is argenase which is present only in liver. So urea can only be synthesized in liver. It is then carried to the kidney foe excretion through blood. Three basic renal processes are involved in formation of urine. Those are

- Ultrafiltration,
- Tubular reabsorption and
- Tubular secretion.

1. **Ultrafiltration**: Ultrafiltration takes place in Malpighian body. During this process blood is filtered under pressure through glomerular membrane of renal capsule.

a. Glomerular membrane: The membrane across with the blood is filtered is the glomerular membrane. It has three layers.

- First layer is of glomerular capillary endothelium. The glomerular capillary wall is 100 times more porous than any other capillaries to facilitate filtration.
- Second layer is fused basement membrane. Basement membrane of capillary epithelium and visceral layer are fused forming lamina densa.
- Third layer is of podocytes. Primary and secondary processes of neighbouring podocytes form slits for filteration.

b. Forces involved in Ultrafiltration: following forces are responsible for ultrafiltration.

- **Glomerular capillary blood pressure**: It is 55 mm Hg in favour of filtration. The diameter of afferent arteriole is larger than efferent arteriole. This creates excess pressure, which help for ultrafiltration.
- **Plasma colloid osmotic pressure**: Plasma proteins remain in colloidal form. This contributes to osmotic pressure. This is about 30 mm Hg. Its direction is against filtration. It opposes filtration.
- **Bowman's capsule hydrostatic pressure**: This is the pressure exerted by the fluid in capsular space and upper proximal tubule. It opposes the filtration. It is 15mm Hg.

Thus net filtration pressure is 10 mm Hg. which is sufficient for proper filtration. The forces in both direction and their proper balance are essential to maintain the volume of filtrate, to avoid excessive filtration or less filtration. **c. Glomerular filtrate:**

- Under filtration pressure about 20% of plasma gets filtered to form glomerular filtrate. Total 125 ml of filtrate is formed per minute in all renal capsules. So 180t of glomerular filtrate is generated per day. Thus entire plasma is filtered about 65 times per day.
- The filtrate contains all constituents of blood except plasma proteins and blood corpuscles. It has water, nutrients, electrolytes, waste material, hormones etc.
- Ultrafiltration is non-selective.

d. Glomerular filtration rate: The amount of glomerular filtrate generated per minute is called glomerular filtration rate. It is depend on two factors viz glomerular blood pressure and blood volume.

2. **Tubular reabsorption:**

a. Glomerular filtrate contains many essential components along with nitrogenous Waste. It has large amount of water. So it cannot be eliminated as it is. So the Essential components are selectively reabsorbed in proximal tubule.

b. From the filtrate 124ml is reabsorbed per minute. Out of 180 liters of filtrate only 1.5 lit. is finally converted into urine. Remaining 178.5 lit are reabsorbed.

c. The cells of proximal tubules are characterized for the process of reabsorption.

d. Reabsorption may be passive or active. Water is mostly reabsorbed passively i.e. With-out spending energy. Glucose, amino acids, other organic nutrients, Na^+ and other electrolytes are reabsorbed actively by consuming ATP.

e. Mostly 99% water, 99.5 % Na^+, 100% glucose and 0% urea are absorbed Selectively during tubule reabsorption to maintain the homeostasis of body. **f.** This absorption takes place by trans epithelial transport in five steps:

- Lumen to cells: The material to be reabsorbed is first transported from lumen to the cells of tubule across the plasma membrane. It is carried out by pinocytosis and facilitated by microvilli and apical canaliculi.
- From apex of cell to the base through cytoplasm of the cells. No material is transported extra cellular through the gaps between the cells, as there are tight junctions to prevent it.
- From tubular cells to interstitial tissue surrounding the tubule. It is carried out Across the baso-lateral membrane.
- Diffusion in interstitial fluid: The material is diffused in interstitial fluid until it reaches to the blood capillaries.
- Penetrate in capillary wall: The material is transported from interstitial fluid to Blood capillaries.

3. **Tubular Secretion:**

a. Only 20% of plasma is filtered by ultrafiltration. Remaining plasma still carries Certain unwanted material. So as to remove this unwanted material tubular Secretion provides the second route.

b. It takes place in distal tubule. The wall of distal tubule is structurally suitable for Tubular secretion.

c. It also includes trans epithelial transport but in reverse direction than that of proximal tubule.

d. Major important substances secreted are H^+, K^+, organic anions and cations and foreign compounds enter in tubular lumen during this process.

Finally by these three processes results in formation of urine. Mass absorption in proximal tubule and tubule secretion in distal tubule ensure the elimination of waste material. Final amount of water, Na^+, K^+, and H^+ are determined by distal and collecting tubule to make up with the needs of body.

7. Countercurrent Multiplication

After ultrafiltration and tubular reabsorption the fluid enters in thin loop of Henle. About 65% of the filtrate has been reabsorbed. 35% fluid remained enters in thin loop of Henle has the same osmolarity as the body fluid. Another 15% of the filtered H_2O is reabsorbed from the loop of Henle. During this process vertical osmotic gradient is established and maintained. The properties of descending and ascending limbs of loop of Henle are crucially essential for establishing the vertical osmotic gradient. **A. Properties of descending limb:**

- It is highly permeable to H_2O.
- It is the only part of nephron which does not actively extrude Na^+. **B. Properties of ascending limb:**
- It actively transports NaCl out of the tubule into surrounding interstitial fluid.
- It is impermeable to H_2O.

C. Mechanism of Countercurrent multiplication:

The descending and ascending limbs of the loop are with close proximity with each other. The flow of fluid is in opposite direction in these limbs i.e. countercurrent. This leads to some important interactions between them results in vertical osmotic gradient. Following are the steps,

- The fluid entering in the loop is isotonic.
- The ascending limb actively transports NaCl out of the tubule into interstitial fluid but water cannot diffuse out as ascending limb is impermeable to water.
- This results in gradual decrease in the osmolarity of the tubular fluid from bottom to top in ascending limb.
- At the same time interstitial fluid receives NaCl. This causes increased osmolarity in this fluid.
- So when filtrate passes through descending limb water diffuses out of the tubule but salt does not extruded because of the property of descending limb. Thus osmolarity of the fluid goes on increasing gradually in descending limb.

- The diffusion of water from descending limb continues until interstitial fluid become isotonic with the fluid in descending limb.
- Thus in descending limb and interstitial fluid a gradient of osmolarity is develops increasing from top to bottom. Similar osmolarity gradient also develops in ascending limb decreasing from bottom to top.
- There is a difference of about 200 mosm/lit among the fluid in ascending limb and that in descending limb at any horizontal level. It is always high in descending limb and interstitial fluid than that in ascending limb.

The final result is development of a vertical osmotic gradient increasing from top to bottom in interstitial fluid of medulla. This gradient helps in passive reabsorption of water from collecting ducts which are running through the medulla. It helps to excrete hypertonic fluid than body fluid.

8. Functions of Kidney

- Kidney maintains water balance in the body.
- It maintains osmolarity of body fluid. This is essential to avoid swelling or shrinking of the cell due to gain or loss of excessive water.
- It regulates the quantity and concentration of ions in extracellular fluids. Ions like Na^+, Cl^-, K^+, H^+, HCO_3^-, Ca^{2+}, Mg^{2+}, SO_4^{2-}, and PO_4^{3-} are very precisely regulated, as any minor change in the concentration of these ions may leads to profound effect.
- It maintains proper plasma volume and thereby regulates arterial pressure.
- It helps in maintaining proper acid-base balance by balancing the urinary output of H^+ and HCO_3^-.
- It excretes waste products of body metabolism like urea, uric acid and creatinine.
- It excretes many foreign compounds like drugs, food additives, pesticides and others.
- It produces erythropoietin hormone that stimulates production of RBCs.
- It produces renin which helps in salt conservation by kidney and along with angiotensin regulates blood pressure.
- It converts vitamin D into active form.

9. Major Disorders of Excretory System

A list of the disorders of the excretory system are mentioned below:

A. Uremia

Under this condition, the urea accumulation is comparatively high. In such patients, excess urea is removed by hemodialysis. In hemodialysis, the blood is drained carefully from whichever artery is convenient and is sent to the dialyzing unit. The unit contains a porous membrane which allows passage of molecules on the basis of the concentration gradient.

B. Renal Failure

Renal failure is the decrease in the glomerular filtration in humans. Both the kidneys are damaged and stop working in case of acute renal failure. The main feature of acute renal failure is scanty urine production. The kidney transplant is the ultimate treatment for the correction of acute renal or kidney failure. The process is elaborate and relies heavily on the availability of a functioning kidney from donors. There are numerous complications that could occur. To avoid these, the kidney from a close or distant relative is preferred. But due to modern technology, the complications related to kidney transplant have been reduced to a greater deal.

C. Renal Calculi or Kidney Stones

Kidney stones are the result of the deposition of dissolved minerals or insoluble salts on the inner lining of the kidney. These increase in size and cause immense pain in the patients when passed.

D. Nephritis or Bright's Disease

Nephritis is generally the inflammation of the kidney. Glomerulonephritis is characterised by inflammation in the glomeruli of the kidney. In this case, the glomeruli are completely filled in blood.
If many glomeruli become non-functional, the patient needs an artificial kidney.

E. Hypertension due to Renin Secretion

Hyper-secretion of renin results in the formation of angiotensin which leads to hypertension.

F. Renal Tabular Acidosis

In this condition, the person is unable to secrete optimum quantities of hydrogen ions due to which a large amount of sodium bicarbonate ions are lost during urination.

G. Diabetes Insipidus

Diabetes Insipidus results due to the deficiency of Antidiuretic hormone. The hormone leads to the reabsorption of water by distal parts of the nephron and thus prevents diuresis (urine production).
Deficiency in ADH secretion results in excessive production of dilute urine and intense thirst.

H. Oedema

Oedema is the accumulation of excess fluid in the tissues. Excess sodium ions result in an increase in the volume of the interstitial fluid without a change in their osmolality. These were some of the common disorders of the excretory system.

Conclusion:

Excretion is the important function of Human Body. Due to failure of Excretion various diseases and disorder are produces serious problem in the body. These diseases are dangerous and converted from acute to chronic. Kidneys have numerous biological roles to play. The primary role is to maintain the homeostatic balance of bodily fluids by filtering and secreting metabolites (such as urea) and minerals from the blood and excreting the nitrogenous wastes along with water, as urine. Chronic renal failure (CRF) is a debilitating condition responsible for high morbidity and mortality. It is also a financial burden on government and society. Because of the complexity of its treatment and cost involved, proper care is available to very few patients in India. On the basis of clinical experience diseases were diagnosed and treated based on various principle and management composed by Urologist. Doctors described various drugs for the treatment of Weakness of Kidney, Uremia, Oedema, Kidney stone, Kidney failure and some of these have shown nephron-protective effects in scientific studies. Further research is need of an hour to explore hidden active chemical constituents and their

mechanism of action to validate the claims made by physicians in past. This review will be beneficial for young scientists, Unani physicians and other researchers interested in the subject of nephrology to develop & provide safe herbal medicine to the mankind. **References.**

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