**Name: Oparaocha freda uloma**

**Matric number: 17lmhs01/268**

**Department: medicine and surgery**

**College: MHS**

**Assignment:PHS303**

**Date: 20/05/20**

**1.Discuss the role of kidney in glucose homeostasis?**

**Answer;**

 Homeostasis is the state of steady internal, physical, and chemical conditions maintained by living systems. This is the condition of optimal functioning for the organism and includes many variables, such as body temperature and fluid balance, being kept within certain pre-set limits (homeostatic range). Other variables include the pH of extracellular fluid, the concentrations of sodium, potassium and calcium ions, as well as that of the blood sugar level, and these need to be regulated despite changes in the environment, diet, or level of activity

 The kidneys play several important roles in maintaining homeostasis, including maintaining the proper blood volume and ion balance as well as removing nitrogenous wastes from the blood. The kidneys also play an important role in regulating the body’s pH. The kidney primarily accomplishes these tasks by filtering impurities, metabolic wastes and salt from the blood. the kidneys are able to maintain homeostasis in part by varying the concentration of urine. For example, when the amount of water in the blood plasma is low, the kidneys reabsorb water from the urine, returning it to the blood stream. Conversely, when the amount of water in the blood plasma is high, the kidneys do not reabsorb much water, which produces highly dilute urine. Both responses help to keep the body's water balance within the range of tolerance. The kidneys must compensate for other biological functions and stimuli that may alter the water balance of the body, thus disrupting homeostasis.

**2.Discuss the process of micturition?**

 **Answer;**

 Micturition is the process of discharging urine from the urinary bladder. Micturition is also a process where urine is expelled from the body. Animals and humans have a specialised system of organs known as the excretory system to eliminate the waste products from the body. The human excretory system consists of a pair of kidneys and ureters, a urinary bladder, and a urethra. The kidneys play a major role in the process of urine formation and its excretion. Urine is stored in the urinary bladder.

**Micturition processes**

Micturition process consists of two phases:

•Storage phase

•Voiding phase

**Storage Phase**

The urinary bladder is a balloon-shaped, hollow, muscular, organ that acts as the storage organ for urine. The urinary bladder in a healthy urinary system can store up to 16 ounces of urine for 2 to 5 hours easily. The circular sphincter muscles prevent leakage of urine. They close tightly around the opening of the bladder into the tube (urethra) that allows the passage of urine outside the body.

**Voiding Phase**

When the bladder is filled with urine, the nerves in it are triggered, which in turn stimulates the need to urinate. The brain signals urinary bladder to contract. The receptors of the urinary bladder send a signal to the central nervous system, in response to which the nervous system sends a signal that incites the contraction of the urinary bladder. Through the urinary opening at the urethra, the urine is eliminated, and the process is called micturition. The neural mechanism involved is called the micturition reflex.

**3.Explain juxaglomerular apparatus?**

 **Answer;**

The juxtaglomerular apparatus (also known as the juxtaglomerular complex) is a structure in the kidney that regulates the function of each nephron, the functional units of the kidney. The juxtaglomerular apparatus is named because it is next to (juxta-[1]) the glomerulus.

**The juxtaglomerular apparatus consists of three types of cells:**

1.the macula densa, a part of the distal convoluted tubule of the same nephron

2.juxtaglomerular cells, (also known as granular cells) which secrete renin

3.extraglomerular mesangial cells

**Structure**

The juxtaglomerular apparatus is part of the kidney nephron, next to the glomerulus. It is found between afferent arteriole and the distal convoluted tubule of the same nephron. This location is critical to its function in regulating renal blood flow and glomerular filtration rate.

 **Functions**

**Juxtaglomerular cells**

Renin is produced by juxtaglomerular cells. These cells are similar to epithelium and are located in the tunica media of the afferent arterioles as they enter the glomeruli.[2] The juxtaglomerular cells secrete renin in response to:

* Stimulation of the beta-1 adrenergic receptor
* Decrease in renal perfusion pressure (detected directly by the granular cells)
* Decrease in NaCl concentration at the macula densa, often due to a decrease in glomerular filtration rate

**Extraglomerular mesangial cell**

 Extraglomerular mesangial cells are located in the junction between the afferent and efferent arterioles. These cells have a contractile property similar to vascular smooth muscles and thus play a role in “regulating GFR” by altering the vessel diameter. Renin is also found in these cells.

**Macula densa**

 At the point where the afferent arterioles enter the glomerulus and the efferent arteriole leaves it, the tubule of the nephron touches the arterioles of the glomerulus from which it rose. At this location, in the wall of the distal convoluted tubule, there is a modified region of tubular epithelium called the macula densa.Cells in the macula densa respond to changes in the sodium chloride levels in the distal tubule of the nephron via the tubuloglomerular feedback (TGF) loop.

 The macula densa's detection of elevated sodium chloride, which leads to an increase in GFR, is based on the concept of purinergic signaling. An increase in the salt concentration causes several cell signals to eventually cause the adjacent afferent arteriole to constrict. This decreases the amount of blood coming from the afferent arterioles to the glomerular capillaries, and therefore decreases the amount of fluid that goes from the glomerular capillaries into the Bowman's space (the glomerular filtration rate (GFR)).

 When there is a decrease in the sodium concentration, less sodium is reabsorbed in the macular densa cells. The cells increase the production of nitric oxide and Prostaglandins to vasodilate the afferent arterioles and increase renin release.

 **Clinical significance**

Excess secretion of renin by the juxtaglomerular cells can lead to excess activity of the renin–angiotensin system, hypertension and an increase in blood volume. This is not responsive to the usual treatment for essential hypertension, namely medications and lifestyle modification. One cause of this can be increased renin production due to narrowing of the renal artery, or a tumour of juxtaglomerular cells that produces renin. These will lead to secondary hyperaldosteronism, which will cause hypertension, high blood sodium, low blood potassium, and metabolic alkalosis.

**4.discuss the role of kidney is regulation of blood pressure?**

**Answer;**

 The kidneys play a central role in the regulation of arterial blood pressure. A large body of experimental and physiological evidence indicates that renal control of extracellular volume and renal perfusion pressure are closely involved in maintaining the arterial circulation and blood pressure. Renal artery perfusion pressure directly regulates sodium excretion; a process known as pressure natriuresis, and influences the activity of various vasoactive systems such as the renin–angiotensin–aldosterone (RAS) system [9]. Along with vessel morphology, blood viscosity is one of the key factors influencing resistance and hence blood pressure. A key modulator of blood viscosity is the renin-angiotensin system (RAS) or the renin-angiotensin-aldosterone system (RAAS), a hormone system that regulates blood pressure and water balance..

**The kidney influences blood pressure by:**

• Causing the arteries and veins to constrict

• Increasing the circulating blood volume

Specialized cells called macula densa are located in a portion of the distal tubule located near and in the wall of the afferent arteriole. These cells sense the Na in the filtrate, while the arterial cells (juxtaglomerular cells) sense the blood pressure. When the blood pressure drops, the amount of filtered Na also drops. The arterial cells sense the drop in blood pressure, and the decrease in Na concentration is relayed to them by the macula densa cells. The juxtaglomerular cells then release an enzyme called renin.

Renin converts angiotensinogen (a peptide, or amino acid derivative) into angiotensin-1. Angiotensin-1 is thereafter converted to angiotensin-2 by an angiotensin-converting enzyme (ACE), found in the lungs. Angiotensin-2 causes blood vessels to contract -- the increased blood vessel constrictions elevate the blood pressure. When the volume of blood is low, arterial cells in the kidneys secrete renin directly into circulation. Plasma renin then carries out the conversion of angiotensinogen released by the liver to angiotensin-1. Angiotensin-1 is subsequently converted to angiotensin-2 by the enzyme angiotensin converting enzyme found in the lungs. Angiotensin-2m a potent vasoactive peptide causes blood vessels to constrict, resulting in increased blood pressure. Angiotensin-2 also stimulates the secretion of the hormone aldosterone from the adrenal cortex .

Aldosterone causes the tubules of the kidneys to increase the reabsorption of sodium and water into the blood. This increases the volume of fluid in the body, which also increases blood pressure. If the renin-angiotensin-aldosterone system is too active, blood pressure will be too high. Many drugs interrupt different steps in this system to lower blood pressure. These drugs are one of the main ways to control high blood pressure (hypertension), heart failure, kidney failure, and harmful effects of diabetes. It is believed that angiotensin-1 may have some minor activity, but angiotensin-2 is the major bioactive product. Angiotensin-2 has a variety of effects on the body: throughout the body, it is a potent vasoconstrictor of arterioles .

**5.discuss the role of kidney in calcium homeostasis**?

 Calcium is filtered at the glomerulus, with the ultrafilterable fraction of plasma calcium entering the proximal tubule. Within the proximal convoluted tubule and the proximal straight tubule, 60%–70% of the filtered calcium has been reabsorbed. No reabsorption of calcium occurs within the thin segment of the loop of Henle. The cortical segments of the loop of Henle reabsorb about 20% of the initially filtered load of calcium. Approximately 10% of the filtered calcium is reabsorbed in the distal convoluted tubule, with another 3%–10% of filtered calcium reabsorbed in the connecting tubule.

 The majority (approximately 85%) of phosphate reabsorption occurs in the proximal convoluted tubule. Approximately 10% of Pi reabsorption occurs in the loop of Henle, 3% occurs in the distal convoluted tubule, and 2% in the collecting duct via unidentified pathways. (C) Approximately 10%–30% of the filtered magnesium is absorbed in the proximal tubule, 40%–70% of filtered magnesium is absorbed in the thick ascending limb, and the remaining 5%–10% of magnesium is reabsorbed in the distal convoluted tubule. CD, collecting duct; DCT, distal convoluted tubule; PCT, proximal convoluted tubule.