**NAME : IHENSEKHIEN EBUNOLUWA PEARL MATRIC: 17/MHS01/151 DEPT: MEDICINE AND SURGERY (300L) ASSIGNMENT TITLE AND COURSE CODE : RENAL PHYSIOLOGY (PHS 303)**

1. DISCUSS THE ROLE OF KIDNEY IN GLUCOSE METABOLISM

The kidneys contribution to maintaining glucose homeostasis are significant and include such functions as release of glucose into the circulation via gluconeogenesis, uptake of glucose from the circulation to satisfy their energy needs, and reabsorption of glucose at the level of the proximal tubule. Renal release of glucose into the circulation is the result of glycogenolysis and gluconeogenesis, respectively involving the breaking down and formation of glucose-6-phosphate from precursors (e.g lactate, glycerol, amino acids). With regards to renal reabsorpton of glucose, the kidneys normally retrieve as much glucose as possible, rendering the urine virtually glucose free. The glomeruli filter from plasma approximately 180grams of D-glucose / day, all of which is reabsorbed through glucose transporter proteins that are present in cell membrane within the proximal tubules. If the capacity of these transporters is exceeded, glucose appears in the urine. The process of renal reabsorption of glucose is mediated by active (sodium-coupled glucose co-transporters) and passive (glucose transporters) transporters.

1. DISCUSS MCTURITION

Micturition is the process of emptying the urinary bladder. That is, process of urination.

Micturition reflex

It is the reflex by which micturition occurs. This reflex is elicited by the stimulation of stretch receptors situated on the wall of the urinary bladder and urethra. When about 300 to 400Ml of urine is collected in the bladder, intravesical pressure increases. This stretches the wall of the bladder resulting in stimulation of stretch receptors and generation of sensory impulses.

Pathway for micturition reflex

Sensory (afferent) impulses from the receptors reach the sacral segments of spinal cord via the sensory fibers of pelvic (parasympathetic) nerve. Motor (efferent) impulses produced in spinal cord, travel through motor fibers of pelvic nerve towards bladder and internal sphincter. Motor impulses cause contraction of detrusor muscle and relaxation of internal sphincter so that, urine enters the urethra from the bladder. Once urine enters the urethra, the stretch receptors in the urethra are stimulated and send afferent impulses to spinal cord via pelvic nerve fibers. Now the impulses generated from the spinal center inhibits the pudendal nerve. So, the external sphincter relaxes and micturition occurs.

Once micturiton reflex begins, it is self-regenerative, that is the initial contraction of bladder further activates the receptors to causes still further increase in sensory impulses from bladder and urethra. These impulses, in turn cause further increase in reflex contraction of the bladder. The cycle continues repeatedly until the force of contraction of bladder reaches the maximum and the urine is voided out completely. During micturition, the flow of urine is facilitated by the increase in the abdominal pressure due to the voluntary contraction of abdominal muscles.

1. DISCUSS THE JUXTAGLOMERULAR APPARATUS

In situ, the distal part of the ascending limb of henle passes between the V-shaped space between the afferent and efferent arterioles of the bowman’s capsule, before it becomes the distal convoluted tubule. At the point where the ascending limb passes between the two arterioles, the walls of the afferent arteriole is greatly thickened and has granules within it. These cells are called granular cells or polar cells or poikilsen cells. The cells of the ascending limbs at the point where it passes between these two arterioles has a dark-staining appearance and they are called the macula densa cells. These cells are bound to the granular cells by loose CT called mesangial cells and the macula densa cells is called juxtaglomerular apparatus(JGA).

 The JGA is supplied by sympathetic nerves and it is important in the renin-angiotensin-aldosterone system which play vital roles in blood pressure regulation and in fluid electrolyte homeostasis. The granular cells produce, store and release renin.

1. DISCUSS THE ROLE OF KIDNEY IN REGULATION OF BLOOD PRESSURE

Kidneys play an important role in the long term regulation of arteruial blood pressure by

1. By regulation of ECF

Blood pressure = cardiac output x peripheral resistance , blood pressure is maintained at constant level by ensuring that the product of the both parameters are constant.

When the blood pressure increases kidney excrete large amounts of water and salt, particularly sodium, by pressure dieresis and pressure natriuresis, pressure dieresis is the excretion of large quantity of water in urine because of increased blood pressure. Even a slight increase in blood pressure doubles the water excretion. Pressure natriuresis is the excretion of large quantity of sodium in urine. Because of dieresis and natriuresis, there is a decrease in ECF volume and blood volume, which in turn brings the arterial blood pressure back to normal level. When blood pressure decreases, the reabsorption of water from renal tubules is increased. This in turn, increases ECF volume, blood volume and cardiac output, resulting in restoration of blood pressure.

1. Through renin-angiotensin mechanism

When blood pressure and ECF volume decreases, renin secretion from kidneys is increased. It converts angiotensinogen or renin substrate to angiotensin I, which is then converted to angiotensin II by ACE (angiotensin-converting enzyme) produced in the lungs. The angiotensin II would act in two ways to restore blood pressure :

1. It causes constriction of arterioles in the body so that the peripheral resistance is increased and blood pressure rises, in addition, angiotensin II causes constriction of the afferent arterioles in the kidney, so that glomerular filtration reduces. This results in retention of water and salts, increases ECF volume to normal level. This in turn increases blood pressure to normal level.
2. Simultaneously, angiotensin II stimulates the adrenal cortex to secrete aldosterone. This hormone increases reabsorption of sodium from the renal tubules. Sodium reabsorption is followed by water reabsorption, resulting in increased ECF volume and blood volume.

Like angiotensin II, the angiotensin III&IV also increase the blood pressure and stimulate adrenal cortex to secrete aldosterone.

1. DISCUSS THE ROLE OF KIDNEY IN CLALCIUM HOMEOSTASIS
2. Kidney is critical important in calcium homeostasis, under normal blood calcium concertrations, almost all the calcium that enters glomerular filtreate is reabsorbed from he tubular system back into the blood, which preserves blood calcium level. If tubular reabsorption of calcium decreases, calcium is lost by excretion into urine.

Normally, about 95% of the calcium excreted is reabsorbed back into the body.

1. Another way would be through calcitriol( 1,25-dihydroxycholecalciferol. It is a steroid hormone synthesized in the kidney. It is the activated form of vitamin D. its main action is to increase the blood calcium level by increasing the calcium reabsorption from the small intestine.