NAME: AKINBAMI JENNIFER OGECHI

MATRIC NUMBER: 18/MHS07/004

DEPARTMENT: PHARMACOLOGY

COURSE: RENAL PHYSIOLOGY

DATE: 16/05/2020

**ASSIGNMENT**

1. Discuss the renal handling of glucose and electrolytes
2. Discuss the physiology of micturition

**ANSWER**

1. **GLUCOSE HANDLING BY THE KIDNEY** Under normal circumstances, up to 180 g/day of glucose is filtered by the renal glomerulus and virtually all of it is subsequently reabsorbed in the proximal convoluted tubule. This reabsorption is effected by two sodium-dependent glucose cotransporter (SGLT) proteins.

The kidney contributes to glucose homeostasis through processes of gluconeogenesis, glucose filtration, glucose reabsorption, and glucose consumption. Each of these processes can be altered in patients with type-2 diabetes (T2DM), providing potential targets for novel therapies. Under normal circumstances, up to 180 g/day of glucose is filtered by the renal glomerulus and virtually all of it is subsequently reabsorbed in the proximal convoluted tubule. This reabsorption is effected by two sodium-dependent glucose cotransporter (SGLT) proteins. SGLT2, situated in the S1 segment, is a low-affinity high-capacity transporter reabsorbing up to 90% of filtered glucose. SGLT1, situated in the S3 segment, is a high-affinity low-capacity transporter reabsorbing the remaining 10%. In patients with T2DM, renal reabsorptive capacity maladaptively increases from a normal level of 19.5 to 23.3 mmol/l/min. Once glucose has been reabsorbed into the tubular epithelial cells, it diffuses into the interstitium across specific facilitative glucose transporters (GLUTs). GLUT1 and GLUT2 are associated with SGLT1 and SGLT2, respectively.

Maintenance of glucose homeostasis is vital to preserve a constant source of glucose to the brain, an organ that uses glucose as its principal metabolic fuel. Despite wide variations in glucose influx and efflux, plasma glucose levels are kept within a narrow band in healthy individuals, a situation achieved by a well-coordinated system of hormones, neural pathways, and glucose transport proteins that regulate dietary glucose absorption, renal glucose loss, and endogenous glucose production in combination with glucose uptake and release by peripheral tissues.

The kidney performs a distinctive role in glucose homeostasis. Not only is it involved in glucose utilization, but it is also increasingly recognized as having a significant role in gluconeogenesis and uniquely contributes to plasma glucose regulation by controlling glucose reabsorption from renal tubules following glomerular filtration.

**RENAL HANDLING OF ELECTROLYTES**

**What Are Electrolytes?**

Electrolytes are particles that carry an electric charge when they are dissolved in blood. The kidneys help to maintain electrolyte concentrations by regulating its concentrations in the body. Any disturbance in this process often leads to an electrolyte imbalance.

The different electrolytes are:

* Sodium
* Potassium
* Phosphorus
* Calcium
* Magnesium

Renal Failure is often complicated by elevated potassium, phosphate and magnesium and decreased sodium and calcium.

**CALCIUM BALANCE**

Alterations in calcium (re)absorption are present in many physiological and pathophysiological states including hypercalciuric stone disease, osteoporosis, chronic renal failure, diabetes, chronic administration of diuretics and immunosuppressors. The successful cloning by our team of the epithelial calcium channel TRPV5 offers a realistic approach to study the physiological, functional and regulatory aspects of this calcium influx pathway.

**MAGNESIUM BALANCE**

Magnesium is of great importance by its function in neuromuscular excitability, protein synthesis and nucleic acid stability. The epithelial magnesium channel TRPM6 was identified as the responsible gene in patients with severe hypomagnesemia. We aim to identify additional renal magnesium transporters by studying rare inherited forms of hypomagnesemia.

**SODIUM BALANCE**

Hypertension represents a health problem, affecting billions of people worldwide and is responsible for cardiovascular and end-stage renal disease. The aim is to further understand the molecular pathogenesis underlying the development of salt-sensitive hypertension.

1. **MICTURITION**

Micturition or urination is the process of expelling urine from the bladder. This act is also known as voiding of the bladder. The excretory system in humans includes a pair of kidneys, two ureters, a urinary bladder and a urethra. The kidneys filter the urine and it is transported to the urinary bladder via the ureters where it is stored till its expulsion. The process of micturition is regulated by the nervous system and the muscles of the bladder and urethra.

**STAGES OF MICTURITION**

The urinary bladder has two distinct stages or phases:

* Resting or filling stage
* Voiding stage

**RESTING OR FILLING STAGE**

It is in this phase of the bladder that the urine is transported from the kidneys via the ureters into the bladder. The ureters are thin muscular tubes that arise from each of the kidneys and extend downwards where they enter the bladder obliquely.

**VOIDING STAGE**

During this stage, both the urinary bladder and the urethra come into play together. The detrusor muscle of the urinary bladder which was relaxing so far starts to contract once the bladder’s storage capacity is reached.

The urethra is controlled by two sets of muscles: The internal and external urethral sphincters. The internal sphincter is a smooth muscle whereas the external one is skeletal. Both these sphincters are in a contracted state during the filling stage.

**PHYSIOLOGY OF MICTURITION**

The process of micturition is governed by both the nervous and muscular systems. Within the nervous system, the process is governed by the autonomous nervous system and the somatic system. Once the urinary bladder reaches its maximum capacity, the stretch receptors in the walls of the bladder send an impulse via the pelvic nerve to the brain via the spinal cord.

The micturition reflex is ultimately generated from the level of the spinal cord after it receivesreflexes from the pontine region in the brain. Once the bladder and the urethra receive the signals to empty the bladder, the two sphincters relax and the detrusor muscle causes the contractions of the bladder.

Along with these muscles, the muscles of the abdomen also play a role by putting pressure on the bladder wall. This leads to complete emptying of the bladder.