

1. • 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. Recent studies have indicated that the kidney is responsible for up to 20% of all glucose production via gluconeogenesis. In patients with T2DM, overall glucose production increases by as much as 300%, with equal contributions from hepatic and renal sources. This increased production contributes not only to increased fasting glucose in T2DM patients but also to raised postprandial glucose because, in contrast to the

liver, glucose ingestion increases renal gluconeogenesis. 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.

2. 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. The urinary bladder can store around 350-400ml of urine before it expels it out. We depend on micturition (urination)

to eliminate organic waste products, which are produced as a result of cell metabolism in the body. The urinary system also regulates the concentrations of sodium, potassium, chloride and other ions in the blood as well as helping to maintain normal blood pH, blood pressure and blood volume

Stages of Micturition

The urinary bladder has two distinct stages or phases:

1. Resting or filling stage
2. 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.

The oblique placement of the ureters in the bladder wall serves a very important function. The

opening of the ureter into the urinary bladder is not guarded by any sphincter or muscle.

Therefore, this oblique nature of opening prevents the urine from re-entering the ureters. At the same time, the main muscle of the urinary bladder, the detrusor muscle, is relaxing allowing the bladder to distend and accommodate more urine.

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. These sphincters are in a contracted state during the filling stage.

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 receives reflexes 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.

Formation of urine

There are two kidneys which are bean-shaped and are approximately 10cm long, 5.5cm wide and 3cm thick. Each kidney weighs about 150g and has a marked indentation medially - the hilus - where the renal artery and renal nerves enter and the renal vein and ureter leave. Between them, the kidneys make approximately 30ml or more of urine every hour.

Approximately 25 per cent of the cardiac output goes to the kidneys where organic waste products are removed in the million or so nephrons in each kidney. Normal urine production, therefore, depends on normal blood flow to the kidneys. The nephron is the functional unit of the kidney. Nephrons permit the passage of some substances out of the body but restrict the passage of others, for example, blood cells and large proteins.

Conclusion

Micturition requires the coordinated activity of sympathetic, parasympathetic and somatic nerves. It also requires normal muscle tone and freedom from physical obstruction and psychological inhibition. Control from our higher brain centres allow us to determine the right time and place to allow this important physiological function to occur.