

Tikrit University

College of Nursing

Basic Nursing Sciences



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Physiology

Urinary system

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Urinary System

Thousands of metabolic processes in myriad body cells produce hundreds of waste products.

The urinary system removes them by filtering and cleansing the blood as it passes through the kidneys.

Another vital function is the regulation of the volume, acidity, salinity, concentration, and chemical composition of blood, lymph, and other body fluids.

Under hormonal control, the kidneys continually monitor what they release into the urine to maintain a healthy chemical balance.

Disorders of the system can be subtle, so urination-related symptoms should be promptly reported.

The urinary system is composed of a pair of kidneys, a pair of ureters, a bladder, and a urethra. These components together carry out the urinary system's function of regulating the volume and composition of body fluids, removing waste products from the blood, and expelling the waste and excess water from the body in the form of urine.

The two kidneys are reddish organs resembling beans in shape that are situated on either side of the abdomen just above the waist and towards the back of the body.

The kidneys contain microscopic filtering units that remove waste, unwanted minerals, and excess water from the blood as urine.

Each kidney is connected to the bladder by a long tube called a ureter, which transports urine away.

The bladder is a hollow, muscular organ situated centrally in the pelvis; it stores urine until it is convenient to release it.

At a certain volume, stretch receptors in its wall transmit nervous impulses that initiate a conscious desire to urinate. The urethra then conducts urine from the bladder to the outside.

Kidneys

The kidneys sit at the back of the abdominal wall and at the start of the urinary system.

These organs are constantly at work:

- Nephrons, tiny structures in the renal pyramids, filter gallons of blood each day.
- The kidneys reabsorb vital substances, remove unwanted ones, and return the filtered blood back to the body.
- As if they weren't busy enough, the kidneys also create urine to remove all the waste.

The kidneys are located behind the peritoneum, and so are called **retroperitoneal organs**. They sit in the back of the abdomen between the levels of the **T12** and **L03** vertebrae.

The right kidney is slightly lower than the left kidney to accommodate the liver. Both kidneys are bean-shaped and about the size of an adult fist.

Blood enters the kidneys through renal arteries. These arteries branch into tiny capillaries that interact with urinary structures inside the kidneys (namely the **nephrons**) ; here the blood is filtered.

Each kidney contains over 1 million tiny structures called nephrons.

The nephrons are located partly in the cortex and partly inside the renal pyramids, where the nephron tubules make up most of the pyramid mass.

Nephrons perform the primary function of the kidneys: regulating the concentration of water and other substances in the body.

They filter the blood, reabsorb what the body needs, and excrete the rest as urine.

Waste is removed and vital substances are reabsorbed back into the bloodstream. The filtered blood leaves through the renal veins.

All the blood in the body moves in and out of the kidneys hundreds of times each day—that's about 200 quarts of liquid to be filtered every 24 hours.

The kidneys filter unwanted substances from the blood and produce urine to excrete them. There are 3 main steps of urine formation:

- a) Glomerular filtration,
- b) Tubule Reabsorption
- c) Tubule Secretion

These processes ensure that only waste and excess water are removed from the body.

Each nephron has a glomerulus, the site of blood filtration. The glomerulus is a network of capillaries surrounded by a cuplike structure, the glomerular capsule (or Bowman's capsule).

As blood flows through the glomerulus, blood pressure pushes water and solutes from the capillaries into the capsule through a filtration membrane. This glomerular filtration begins the urine formation process.

The nephrons of the kidneys process blood and create urine through a process of filtration, reabsorption, and secretion. Urine is about 95% water and 5% waste products.

Nitrogenous wastes excreted in urine include urea, creatinine, ammonia, and uric acid. Ions such as sodium, potassium, hydrogen, and calcium are also excreted.

Urine produced in the kidneys travels down the ureters into the urinary bladder.

The bladder expands like an elastic sac to hold more urine. As it reaches capacity, the process of micturition, or urination, begins.

Involuntary muscle movements send signals to the nervous system, putting the decision to urinate under conscious control.

The **internal urethral sphincter** and the **external urethral sphincter** both provide muscle control for the flow of urine.

The internal sphincter is **involuntary**. It surrounds the opening of the bladder to the urethra and relaxes to allow urine to pass.

The external sphincter is **voluntary**. It surrounds the urethra outside the bladder and must be relaxed for urination to occur.

Micturition (urination) :

Smooth muscle stretch initiates the micturition reflex by activating stretch receptors in the bladder wall. This autonomic reflex causes the detrusor

muscle to contract and the internal urethral sphincter muscle to relax, allowing urine to flow into the urethra.

The stretch receptors also send a message to the thalamus and the cerebral cortex, giving voluntary control over the external urethral sphincter.

We usually gain this control of urination between the ages of 2 and 3, as our brains develop.