Function of the urinary tract

The urinary tract begins at the renal pelvis and calices of the kidney, then the urine is moved to the bladder using the ureter, where the urine is stored and reflexively removed from the body through the urethra. After leaving the tubular system, urine has its definitive form and the composition of urine does not change here. We divide the outlet paths into upper and lower. The upper urinary tract includes the calyces, pelvis, and ureter. The lower urinary tract includes the bladder and the urethra.

Upper urinary tract function

The wall of the **kidney calyces** is made up of a smooth muscle system. This muscle contracts and relaxes rhythmically - we call it ***systole and diastole of the calyces***. During diastole, a negative pressure is created, by means of which urine is sucked from the papillae into the calyces. On the contrary, during systole, the pressure increases and thus urine is expelled into the renal pelvis.

The renal pelvis' is the *first reservoir* of the urinary tract. The capacity of one pan is approximately 5 ml. Unlike other parts of the urinary tract, the pelvis does not have its own muscle in the wall, but it is extensible. Its function is to collect urine and further direct its outflow into ureter.

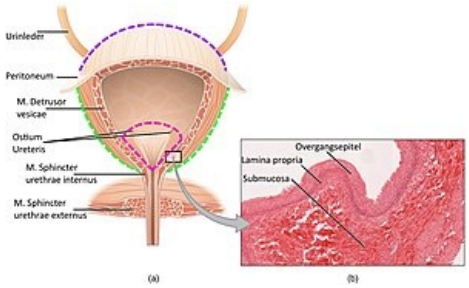
The **ureter** is a paired tubular organ that is 25-30 cm long. The ureters are equipped with **pacemaker neurons**, which create rhythmic activity of the smooth muscle in the wall of the ureter. Pacemaker activity triggers a contraction that travels peristaltically along the smooth muscle from the pelvis to the bladder. Urine transport is *not passive* and *unidirectional*. Therefore, peristaltic movements of the ureter take place, these movements are formed by *two contractions*, that*follow one after the other*(there is one relaxation between them). This movement is transported in one wave ***by the so-called urinary spindle***, which contains approximately 2 ml of urine. The frequency of contractions can vary depending on fluid intake. These two contractions act as valves to prevent the backflow of urine and prevent the spread of infection. The movement of the entire complex has a speed of approximately 1 to 6 cm/s and the movement disappears in the wall of the bladder.

Lower urinary tract function

Bladder acts as *a second reservoir*. Its wall is covered with *transitional epithelium* and is very pliable, easily expanding when filled due to the presence of folds. The bladder muscle is of the smooth type and is divided into three sections. The outer layer is *longitudinal*, the middle layer is *circular* and the inner layer is again *longitudinal*. All these layers together form ***the detrusor muscle***, which has an expulsion function.

Urinary bladder

The bladder is therefore very expandable, but the pressure in it does not increase in proportion to the increasing filling. The rise in pressure during the gradual filling of the bladder is *very small*.From 100 to 150 ml we start to feel the filling of the bladder. Around 200 to 300 ml, the mechanoreceptors in the bladder wall react to higher pressure and send a signal using the *pelvic nerves*to **the sacral spinal cord**, where the **micturition center** is located. This process triggers the micturition reflex. The efferent path is represented by the **sacral parasympathetic** nerve fibers, that innervate ***the detrusor muscle***, it subsequently contracts and the internal sphincter relaxes. During the contraction, the internal sphincter at the beginning of the urethra opens. Mechanoreceptors in its wall register the expansion of the wall and start sending signals to the sacral spinal cord that reinforce the stimulation of the bladder for further contraction. This process serves to completely empty the bladder. It is based on the principle of *positive feedback*. The external sphincter is made of striated muscle, its relaxation is necessary during micturition. Urine is carried out of the body through the urethra.



Bladder diagram

In an adult, the signals for emptying disappear after a while when the bladder is filled with about 300 ml, but when it is filled with about 700 ml, we are no longer able to hold the bladder and it is necessary to eliminate urine. If emptying does not occur, the contractions gradually speed up until they reach a critical point where urine cannot be held by will and there is a risk of urination. A child should be able to hold urine around the second to third year of life, but it is very individual.

The inability to hold urine is called **incontinence**.

When urine excretion stops completely, we speak of **anuria**. An increase in the volume of urine is referred to as **polyuria** (more than 2.5 liters of urine per day), the opposite is **oliguria**.

Urine

Definitive urine is clear, yellowish, and has a slightly aromatic odor that changes to an ammonia odor in the air.The physiological pH of urine is in the range of **5,0 - 6,5**. Daily diuresis is in the range of **500 to 1500 ml**.

Links

Related links

- Kidney
- Glomerular Filtration
- urine
- Urinary tract

References

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- SILBERNAGL, Stefan a Agamemnon DESPOPOULOS. *Atlas fyziologie člověka.* 3. vydání. Praha : Grada, 2004. ISBN 978-80-247-0630-6.