

THE RENAL SYSTEM(L5)

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Urine collection and Micturition

Passage of urine from kidney to bladder

- Urine moves from the **collecting ducts** of the renal tubules to the **renal pelvis** by hydrostatic pressure.
- Urine moves from the **pelvis** into the **ureter** by the smooth muscles contraction.
- The peristaltic wave which propagates along the ureters length propels urine into the bladder to store the urine.

Micturition

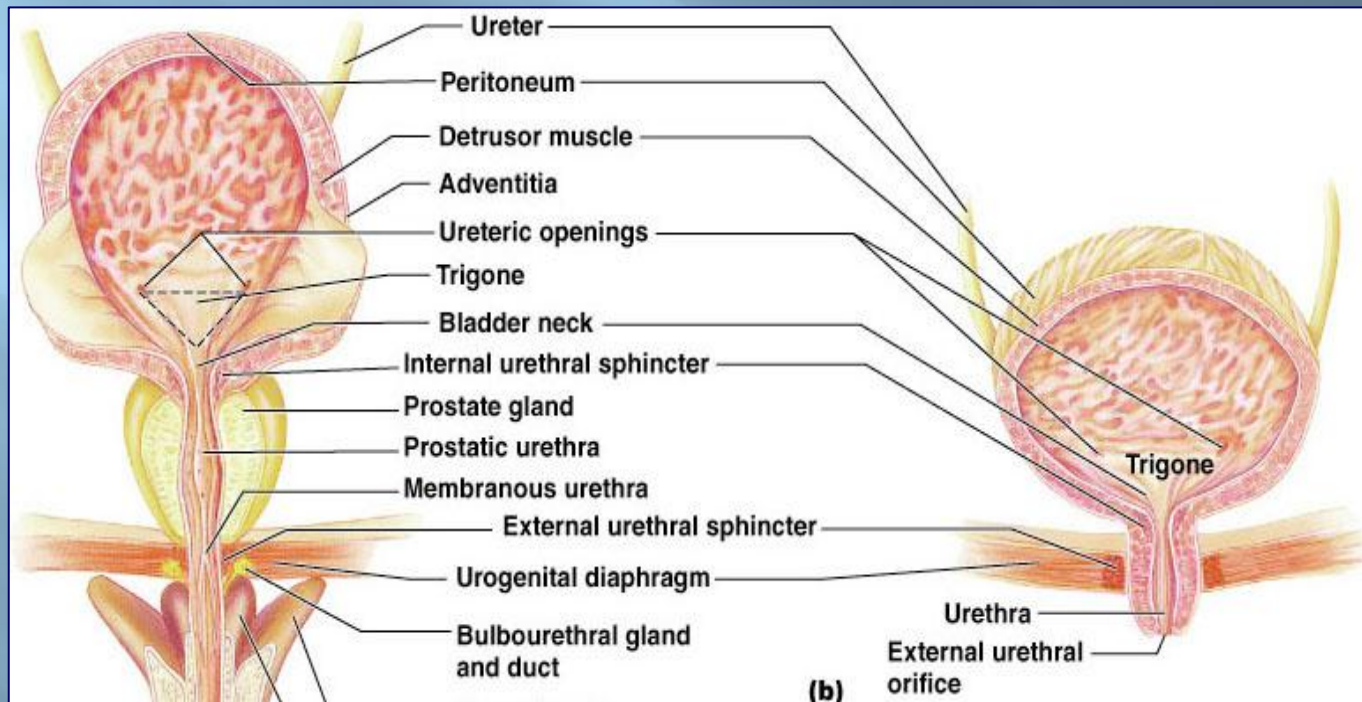
- The flow of urine to the urinary bladder is relatively continuous.
- The urinary bladder acts as a reservoir for urine until it can be eliminated at appropriate time.
- The bladder can distend to accommodate the large volume of fluid .The maximum volume it can contain is **1L**, and discomfort begins when urine volume exceeds **500ml**.

The capacity of the urinary bladder to distend is due to the following factors:

- The walls of the bladder contain large folds, which unfold to enlarge the lumene of the urinary bladder.
- The lining of urinary bladder is stretchable transitional epithelium.
- Smooth muscle wall of the urinary bladder stretch to accommodate the fluid volume.
- The bladder expands as the urine flows into it , but the internal pressure does not increase(because its structure) until the bladder volume becomes large.
- The triangular area of bladder's wall between the two ureters posteriorly is called **trigone** which is histologically distinct from other region

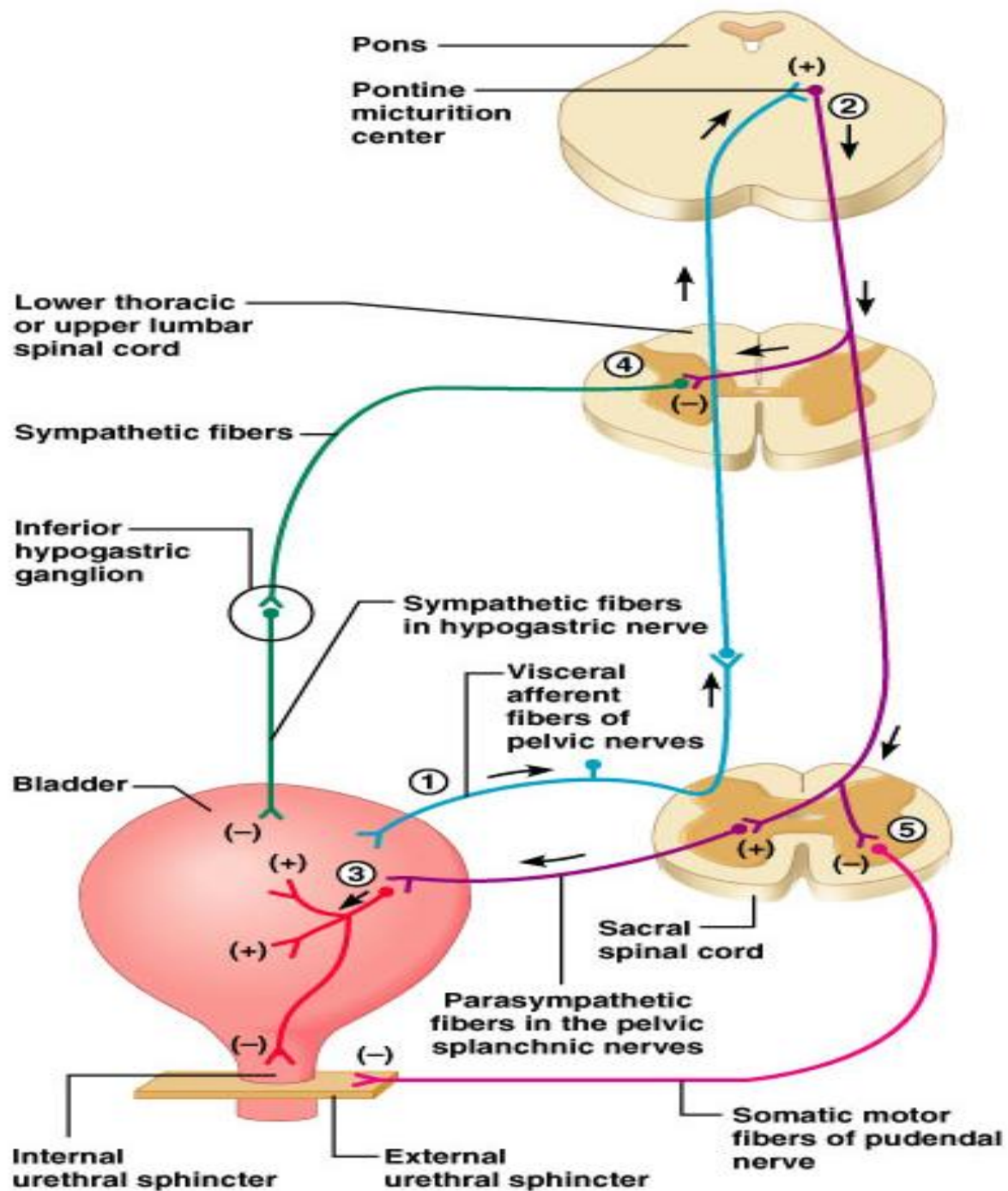
The outlet of the bladder into the urethra is graduated by two sphincters:

- 1. Internal sphincter** involuntary sphincter of smooth muscle.
- 2. External sphincter** is skeletal muscle surrounds the urethra as it extends through the pelvic floor. It acts as a valve that controls the flow of urine through the urethra.



Micturition reflex

- Micturition reflex is activated when the bladder wall is stretched resulting in elimination of urine from the urinary bladder (**micturition**).
- Integration of the micturition reflex occurs in the **sacral region** of the spinal cord and modified in the pons of cerebrum.
- When urine fills the bladder stimulates **stretch receptors** which produce action potential:
- Action potential is carried by sensory neurons to **spinal cord** through the **pelvic nerves**.
- Action potential is carried to the bladder through parasympathetic fibers
 - **Parasympathetic stimulation** causes contraction of smooth muscles of the bladder and decrease somatic motor action potentials causing the **external urinary sphincter** to relax.
- Urine flows from the bladder to the **urethra** by increase the pressure.
- The micturition reflex produces a series of contractions of the urinary bladder.



Diuretics

Diuretics are agents that increase the rate of urine formation.

Diuresis is an increase in urine volume with loss of water and solutes.

Mechanism of action:

Diuretics are ions transport inhibitors that decrease the reabsorption of Na^+ at different site of nephron.

Sodium and other ions (Cl^-) enter in greater amounts than normal ,along with water to maintain osmotic equilibrium.

- Diuretics are used to treat different disorders such as hypertension, several types of edema and liver cirrhosis.
- The use of diuretics may cause complications such as electrolytes imbalance and dehydration.
- There are different classes of diuretics act at different sites of nephron ,because each class interacts with luminal sodium transport.

Classes of diuretics

Class of diuretics	Site of action	Mechanism	Clinical uses
Carbonic anhydrase inhibitors	Proximal convoluted tubule	↑bicarbonate excretion	High altitude sickness, glaucoma
Thiazide diuretics (HCTZ metolazone)	Distal convoluted tubule	↓activity of Na ⁺ ,Cl ⁻ cotransporter	Hypertension, diabetes insipidus
K⁺ sparing diuretics	Collecting tubule	↓NO.of open Na ⁺ channels in the tubular cells	Liver cirrhosis
Loop diuretics (furosemide)	Loop of Henle	↓Na ⁺ -K ⁺ -2Cl ⁻ in the thick ascending loop of Henle	Pulmonary edema associated with congestive heart failure
Osmotic diuretics(mannitol)		Osmotic diuresis	Cerebral edema

Outcomes:

- ▣ Anatomical & histological considerations of renal system.
- ▣ Functions of renal system
- ▣ Urine production process
 - 1-glomerular filtration
 - 2- tubular reabsorption
 - 3-tubular secretion
- ▣ Control of urine formation:
(blood volume & blood pressure)
- ▣ Ionic homeostasis
- ▣ Micturition
- ▣ Micturition reflexes
- ▣ Diuretics

THANKS