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Write note on micturition

Micturition is a process where urine is expelled from the body. It is a complex act involving both autonomic & somatic nerve pathways & several reflexes that can be either inhibited or facilitated by higher centers in the brain. The kidneys play a major role in the process of urine formation and its excretion. The urine formed is stored in the urinary bladder. Micturition is also known as voiding phase of bladder control and lasts for a short time. Urinary flow rate in a full bladder is:

-20-25ml/s in men

-25-30ml/s in women

Whilst the capacity of the bladder varies from roughly 300-550ml, afferent nerves in the bladder wall signal the need to void the bladder at around 400ml of filling.

Micturition involves 2 important steps:

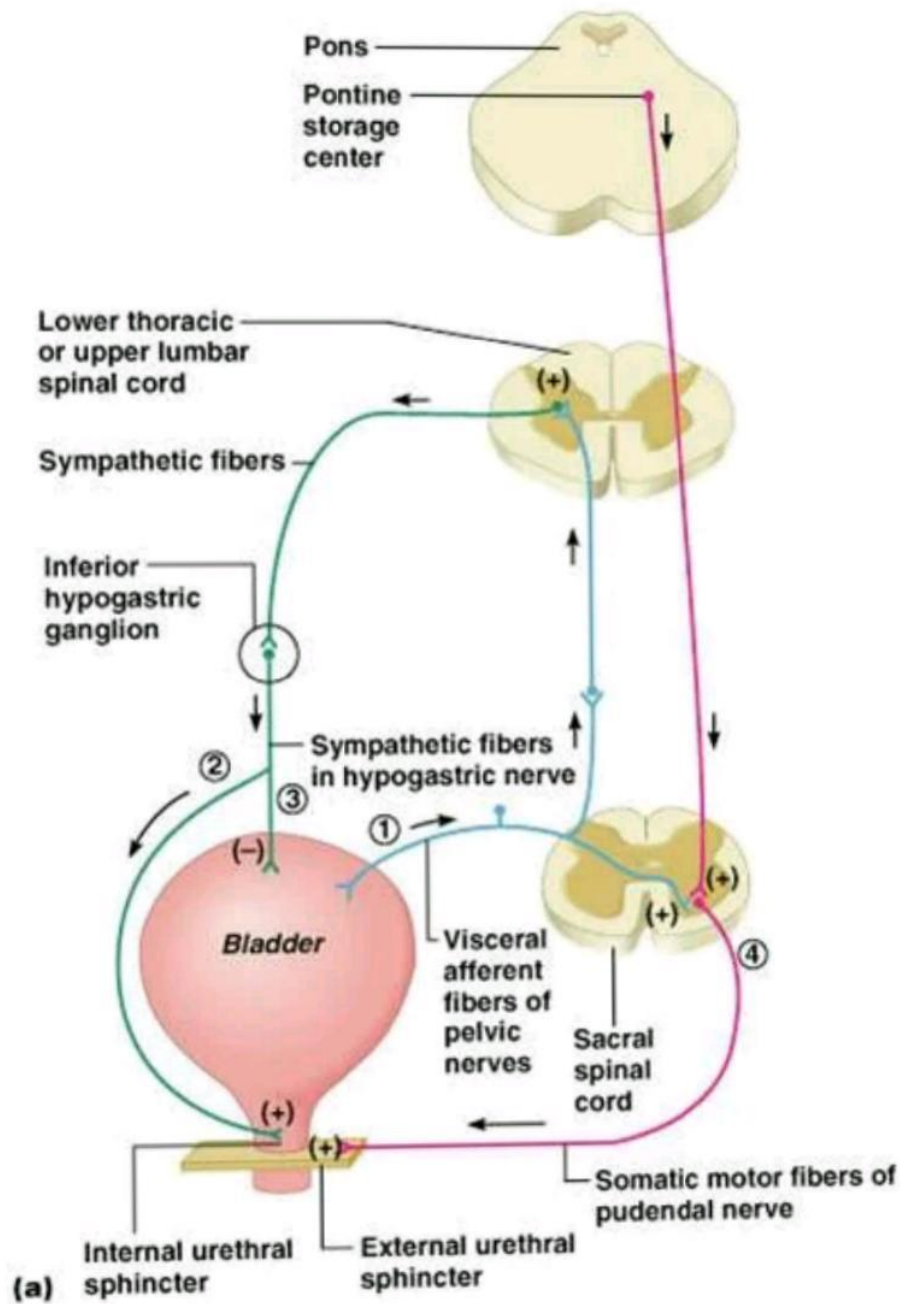
Bladder fills progressively: tension in bladder wall increases .

Initiates a nervous reflex

-micturition reflex: empties the bladder/causes conscious desire to urinate.

-Autonomic spinal cord reflex, inhibited/facilitated by centers in brain stem & cerebral cortex.

Physiology of Micturition



(Image Source: austincommunitycollege.com)

Regulation of Micturition

Passing of urine is under parasympathetic control. Bladder afferents signals ascend through the spinal cord and then project to the pontine micturition centre and cerebrum. Upon the voluntary decision to urinate, neurones of the pontine micturition centre fire to excite the sacral preganglionic neurones.

There is subsequent parasympathetic stimulation to the Pelvic Nerve (S2-4) causing a release of ACh, which works on M muscarinic ACh receptors on the detrusor muscle, causing it to contract and increase intra-vesicular pressure.

The pontine micturition centre also inhibits Onuf's nucleus, with a resultant reduction in sympathetic stimulation to the internal urethral sphincter causing relaxation.

Finally, a conscious reduction in voluntary contraction of the external urethral sphincter from the cerebral cortex allows for distention of the urethra and the passing of urine. In the female, urination is assisted by gravity, while in the male, bulbospongiosus contractions and squeezing along the length of the penis helps to expel all of the urine.

MICTURITION REFLEX

Micturition reflex is the reflex by which micturition occurs. This reflex is elicited by the stimulation of stretch receptors situated on the wall of urinary bladder and urethra. When about 300 to 400 mL of urine is collected in the bladder, intravesical pressure increases. This stretches the wall of bladder resulting in stimulation of stretch receptors and generation of sensory impulses.

Pathway for Micturition Reflex

Sensory (afferent) impulses from the receptors reach the sacral segments of spinal cord via the sensory fibers of pelvic (parasympathetic) nerve. Motor (efferent) impulses produced in spinal cord, travel through motor fibers of pelvic nerve towards bladder and internal sphincter. Motor impulses cause contraction of detrusor muscle and relaxation of internal sphincter so that, urine enters the urethra from the bladder. Once urine enters urethra, the stretch receptors in the urethra are stimulated and send afferent impulses to spinal cord via pelvic nerve fibers. Now the impulses generated from spinal centers inhibit pudendal nerve. So, the external sphincter relaxes and micturition occurs.

Once a micturition reflex begins, it is self-regenerative, i.e. the initial contraction of bladder further activates the receptors to cause still further increase in sensory impulses from the bladder and urethra. These impulses, in turn cause further increase in reflex contraction of bladder. The cycle continues repeatedly until the force of contraction of bladder reaches the maximum and the urine is voided out completely. During micturition, the flow of urine is facilitated by the increase in the abdominal pressure due to the voluntary contraction of abdominal muscles.

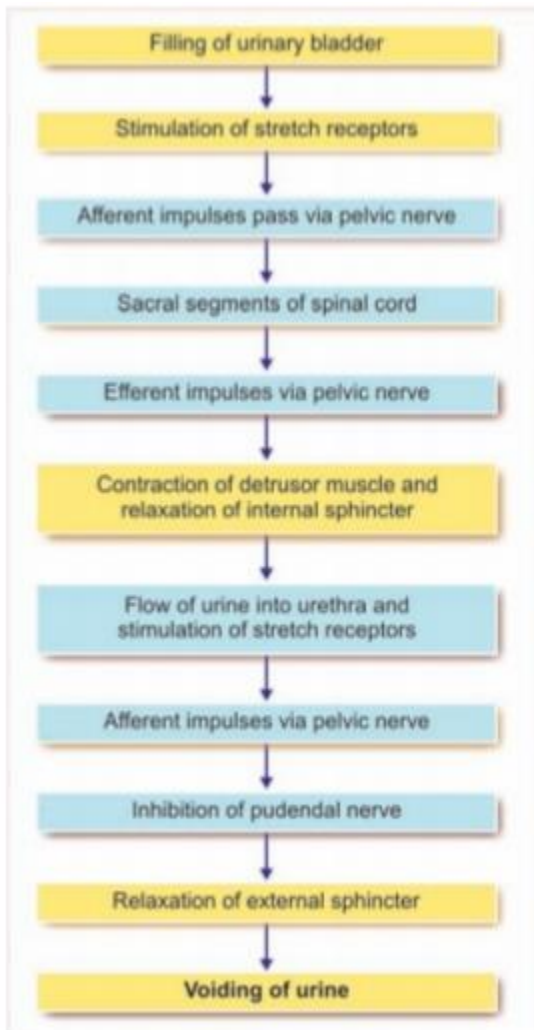


FIGURE 57.5: Micturition reflex

Higher Centers for Micturition

Spinal centers for micturition are present in sacral and lumbar segments. But, these spinal centers are regulated by higher centers. The higher centers, which control micturition are of two types, inhibitory centers and facilitatory centers.

Inhibitory centers for micturition

Centers in midbrain and cerebral cortex inhibit the micturition by suppressing spinal micturition centers.

Facilitatory centre's for micturition

Centre in pons facilitate micturition via spinal centre's. Some centre's in cerebral cortex also facilitate