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WRITE A SHORT NOTE ON MICTURITION

MICTURITION

Micturition (urination) is the process of urine excretion from the urinary bladder, micturition is also known as the voiding phase of bladder control and it is typically a short-lasting events. 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. Most of the time, the bladder (detrusor muscle) is used to store urine. As it fills, the rugae distend and a constant pressure in the bladder (intra-vesicular pressure) is maintained. This is known as the **stress-relaxation** phenomenon. The ability to voluntarily control micturition develops from 2 years as the CNS develops.

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. Both these sphincters are in a contracted state during the filling stage.

The process of micturition

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.

It is governed by both the nervous and muscular systems. 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.

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.

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.

Potential problems associated with micturition

For normal micturition to occur we need:

- Intact nerve pathways to the urinary tract;
- Normal muscle tone in the detrusors, sphincters and pelvic floor muscles;

- Absence of any obstruction to urine flow in any part of the urinary tract;

- Normal bladder capacity;

- Absence of environmental or psychological factors which may inhibit micturition.

Loss of any of these normal functions may result in incontinence or urgency to micturate.

Other associated problems

Neurological disorders may include

- stroke,

- Alzheimer's disease or any condition where nerve pathways to and from the spine and brain are blocked or injured. The neurotransmitter acetylcholine (ACh) is involved in the relaying of nerve signals in micturition. ACh can be blocked with the drug atropine, so the detrusor muscle will not contract and retention of urine will occur.

- Stress incontinence can occur at any age. It occurs when abdominal pressure rises, for example when sneezing or coughing. The normally acute angle between the bladder and urethra is lost when abdominal pressure rises slightly, causing pressure in the bladder to rise.

- Laxity and weakness of muscles at the bladder neck, around the urethra and in the pelvic floor will mean that incontinence occurs with relatively small pressure changes. Stress incontinence can occur in men following prostatectomy, and in women after childbirth and during the menopause due to decreased oestrogen secretions.

- Renal stones, inflammation and an enlarged prostate gland may all obstruct the flow of urine and may result in frequency of micturition and retention of urine. Bladder tumours and pregnancy also reduce normal bladder capacity. Environmental and psychological factors can also affect a patient's ability to pass urine.

Control of micturition

Children and adults have considerable control over when and where they pass urine. They can also increase or decrease the rate of flow and even stop and start again, so micturition is clearly more than just a simple reflex. This control is learnt in infancy and involves other sensory fibres in the bladder wall. These fibres convey information on the degree of bladder fullness via the spine to the higher centres of the brain, the thalamus and cerebral cortex. This causes us to become aware that we need to pass urine and of the urgency of the situation. These links between the spine and cerebral cortex are not established until about two years of age and it is suggested that toilet-training is therefore not physiologically possible until that time.

The brain is able to override the micturition reflex by inhibiting the parasympathetic motor nerve fibres to the bladder and reinforcing contraction of the external sphincter. The internal sphincter will not open until the external sphincter does. The increase in bladder volume

increases stretch receptor and nerve activity, making the sensation of pressure more acute. When it is convenient, the brain centres remove the inhibition and permit micturition under our conscious control. When the bladder contains about 500ml, pressure may force open the internal sphincter; this in turn forces open the external sphincter and urination occurs whether it is convenient or not. We can increase the rate of urine flow by contraction of the abdominal muscles and by the performance of Valsalva's manoeuvre (forced expiration against a closed glottis). Contraction of the strong pelvic floor muscles can stop urine in mid-flow. The sound of running water also encourages micturition but some people cannot urinate in the presence of others, no matter how great their need. After micturition, less than 10ml of urine remains in the bladder and the cycle begins again.