MICTURITION

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- Bladder-anatomy and innervation
- Sphincters
- Filling of the bladder
- Emptying of the bladder-Micturition
- Abnormalities in micturition

Bladder - Detrusor muscle

- Muscular organ
- Smooth muscles arrange in bundles
- Longitudinal & Circular

Sphincters

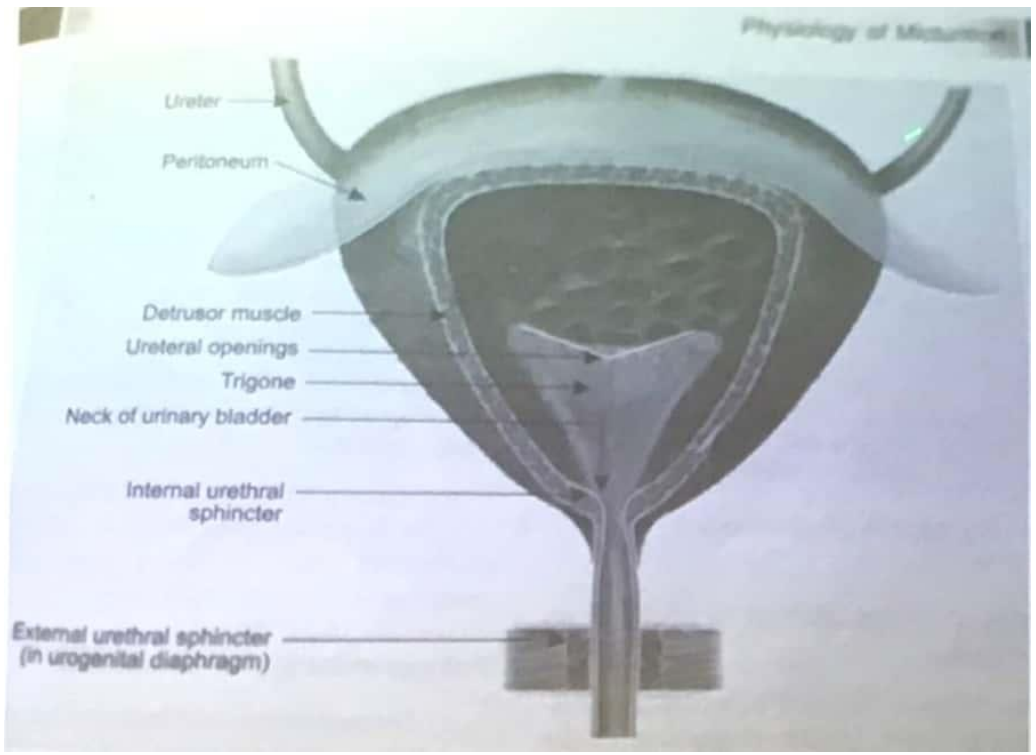
Internal Urethral Spincter

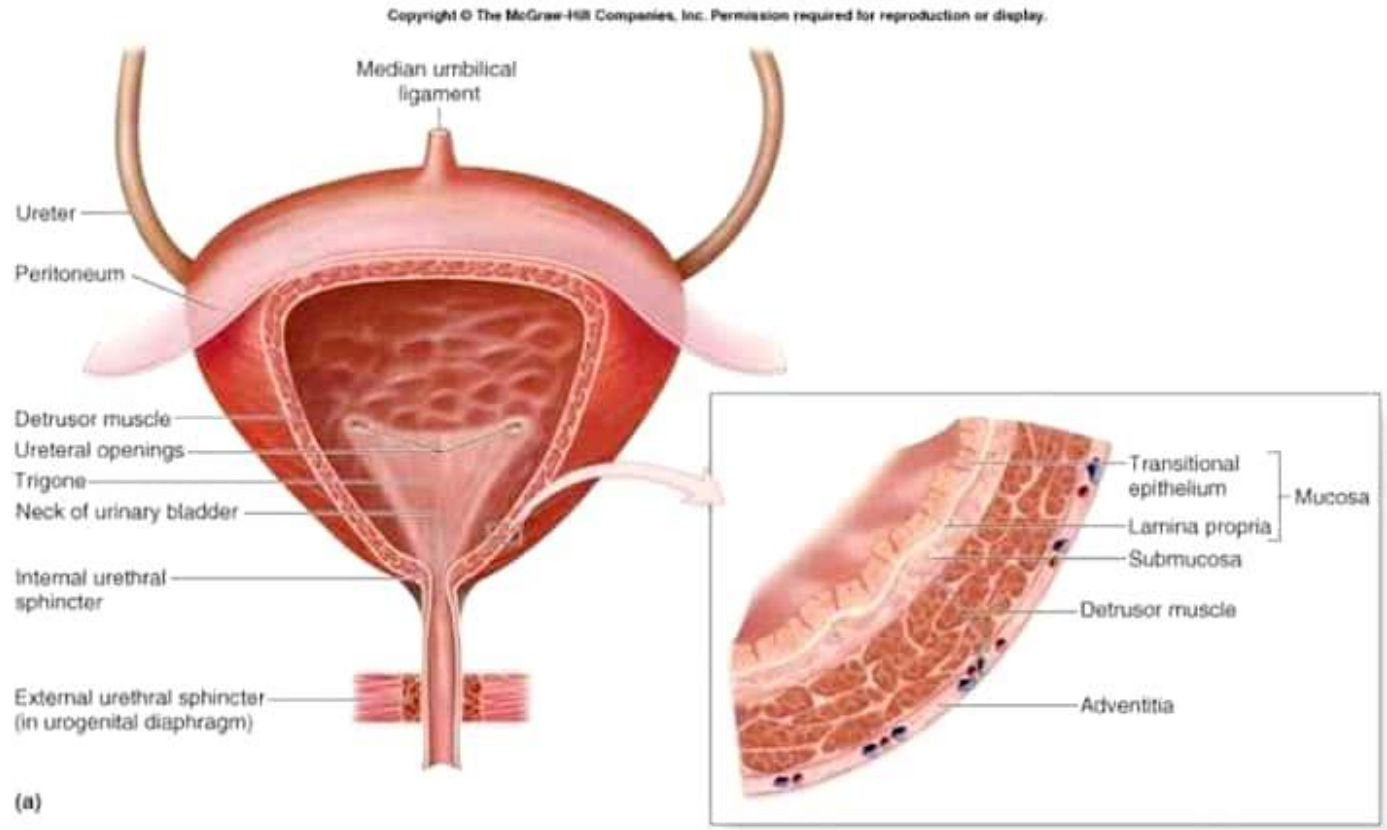
- Smooth muscles of the neck of the bladder
- Keep bladder neck closed
- Preventing passage of urine
- Involuntary

External Urethral Spincter

- As urethra passes through urogenital diaphragm
- Encircled by ring of skeletal muscle
- Can control (voluntary)
- Supplied by pudendal nerve

URINARY BLADDER





Filling of bladder

- Bladder

  has property of plasticity of smooth muscle and law of Laplace
- Therefore, it can accumulate fairly large volume of urine without significant increasing pressure
- The pressure and the volume can be studied and recorded
- The record is called cystometrogram

Bladder volume and pressure

- Bladder empty - pressure zero
- Adding 50 ml – raises the pressure to 10 cm of water
- Additional filling 200-300 ml – no significant rise in pressure
- Beyond 400 ml – the pressure rise markedly
- Triggers the micturition reflex
- First urge to void comes around 150 ml of volume but can be voluntarily suppressed easily
- Beyond 600 ml urge to void is unbearable

Emptying of the bladder-micturition reflex

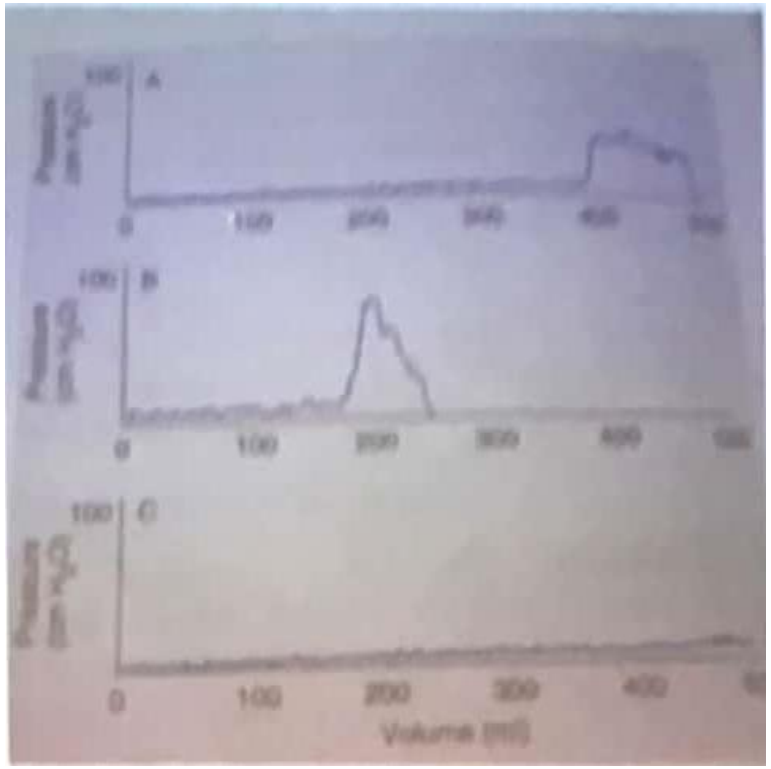
- It is a spinal reflex
- Initiated by stimulation of stretch receptors
- Around 300-400ml of bladder volume is an adequate stimulus
- The reflex is self-regenerating once initiated
- Initial contraction -> Further active stretch receptors
- Strong contraction and marked rise in intravesical pressure
- This open bladder neck
- The external sphincter is reflex initiated
- The urine escape through the urethra

Innervation

1. The pelvic nerves
   - Contain parasympathetic efferent S_2 and S_3 spinal segments
   - Carry motor impulses to the bladder
   - Contain the detrusor muscle
   - Also carry sensory fibers from the bladder to spinal cord
2. Sympathetic innervations
   - From L_1 and L_2 segments
   - Inhibitory to detrusor muscle
   - Contracts the internal sphincter
3. Somatic innervations from pudendal nerve
   - S_2 and S_3 segments
   - Give efferents to external sphincter

Emptying of the bladder-micturition reflex

- The integration center lies in the S_2 and S_3 segments
- The pelvic nerves contain both sensory and parasympathetic motor fibers



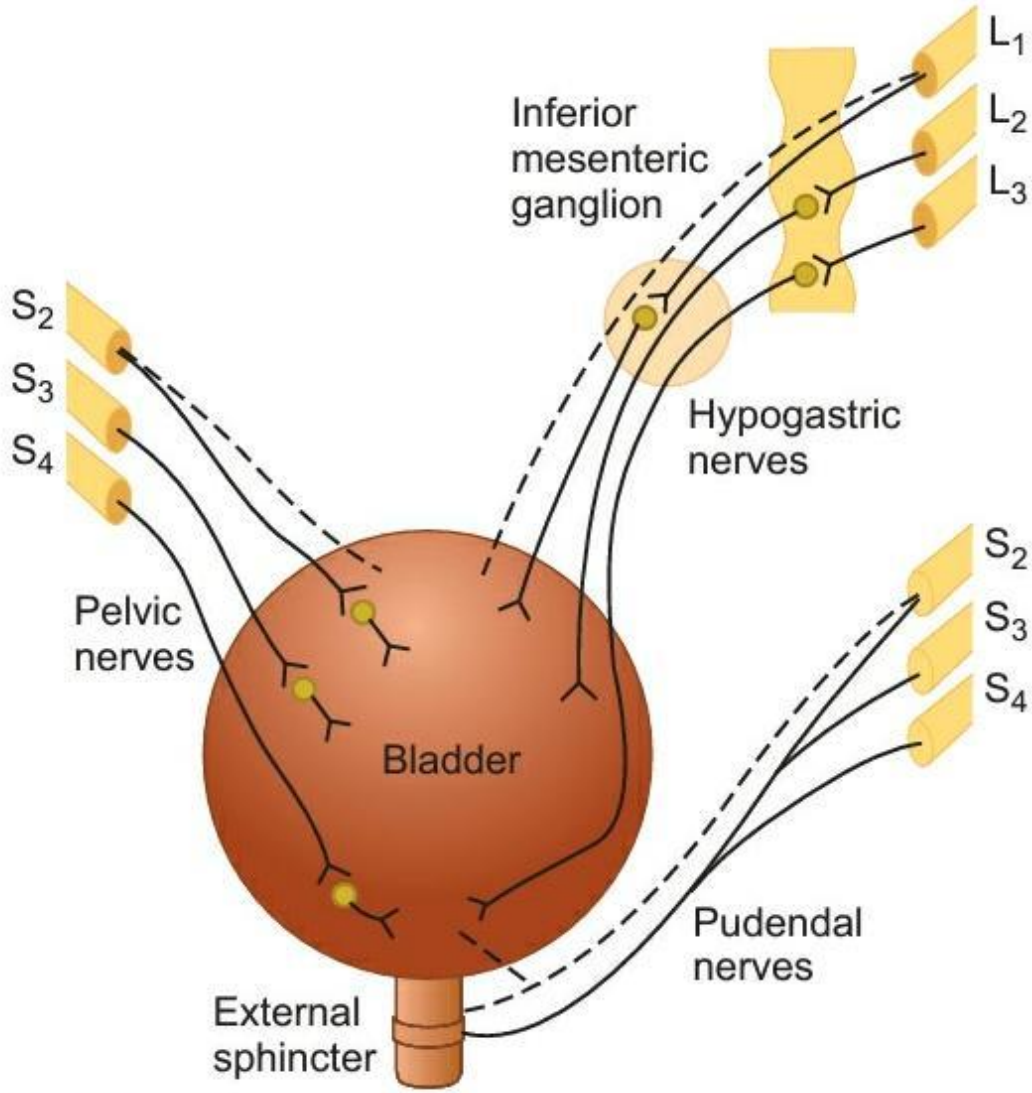


FIGURE 38–20 **Innervation of the bladder.** Dashed lines indicate sensory nerves. Parasympathetic innervation is shown at the left, sympathetic at the upper right, and somatic at the lower right.

Pontine micturition center

- Pontine center is modulator center
- It coordinates the
  - Contraction of detrusor by parasympathetic discharge
  - Relaxing of internal sphincter by inhibition of sympathetic discharge
- Micturition reflex – spinal reflex
- Can be influence by inhibitory area

Voluntary control

- It acquired by bearing ability by training
- Cortical micturition center
  - Motor cortex in the medial aspect
- Keeps
  - The reflex partially inhibited
  - External sphincter highly controlled all the time
  - Expect at desired time
- Can also inhibit the reflex even after urine flow has began by strong contraction of the external sphincter
- Can also initiates reflex even with few millilitres of urine in the bladder
- Voluntary abdominal muscle contraction also aids the reflex but not essential

Emptying the bladder- micturition reflex

- The integration center lies in the S2 and S3 segments
- The pelvic nerves contain both sensory and parasympathetic motor fibers.

Abnormalities

- BOO- Bladder outflow obstruction
  - Common in males wit prostatic hypertrophy
    - Either benign or malignant
- Results
  - Frequency
  - Nocturia
  - Hesitancy and urgency
  - Straining
  - Terminal dribbling
- Results
  - Acute retention of urine
  - Chronic retention with incontinence

Abnormalities

- Incontinence
  - Involuntary leakage of urine
- Stress incontinence- due to poor tone in external sphincter
  - Involuntary leakage with incased intra-abdominal pressure
    - Coughing, Sneezing, Laughing
- Urge incontinence
  - Leakage of urine with urge
  - Due to lack of cortical or pontine control
  - Causes
    - Cerebral stroke
    - Cerebral SOLs
    - Neurodegenerative disorders – ex. Parkinson disease
    - Spinal cord injuries above sacral segments

Abnormalities

- Retention and overflow incontinence
- Overfills and overflows
- Due to loss of sensation of the bladder
- Has no sensation of filling
- Overflows without detrusor contraction
- Causes
  - Spinal injuries and lesions at sacral segments
  - Diabetic autonomic neuropathy
  - Tabes dorsalis

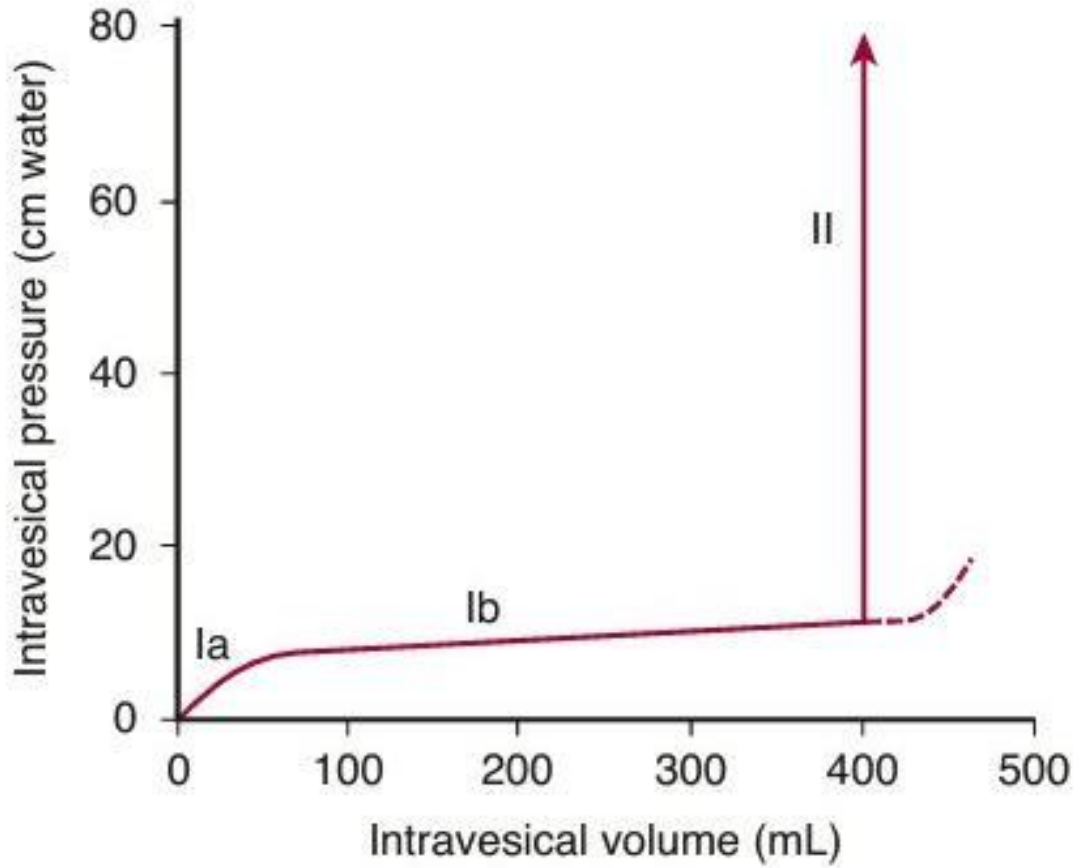


FIGURE 38–21 **Cystometrogram in a normal human.** The numerals identify the three components of the curve described in the text. The dashed line indicates the pressure–volume relations that would have been found had micturition not occurred and produced component II. (Modified and reproduced with permission from Tanagho EA, McAninch JW: *Smith's General Urology,* 15th ed. McGraw-Hill, 2000.)