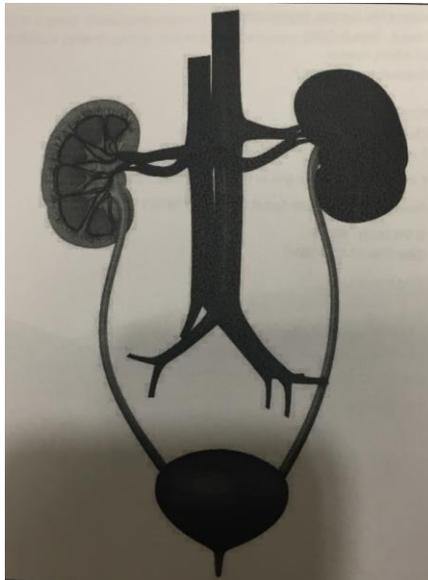
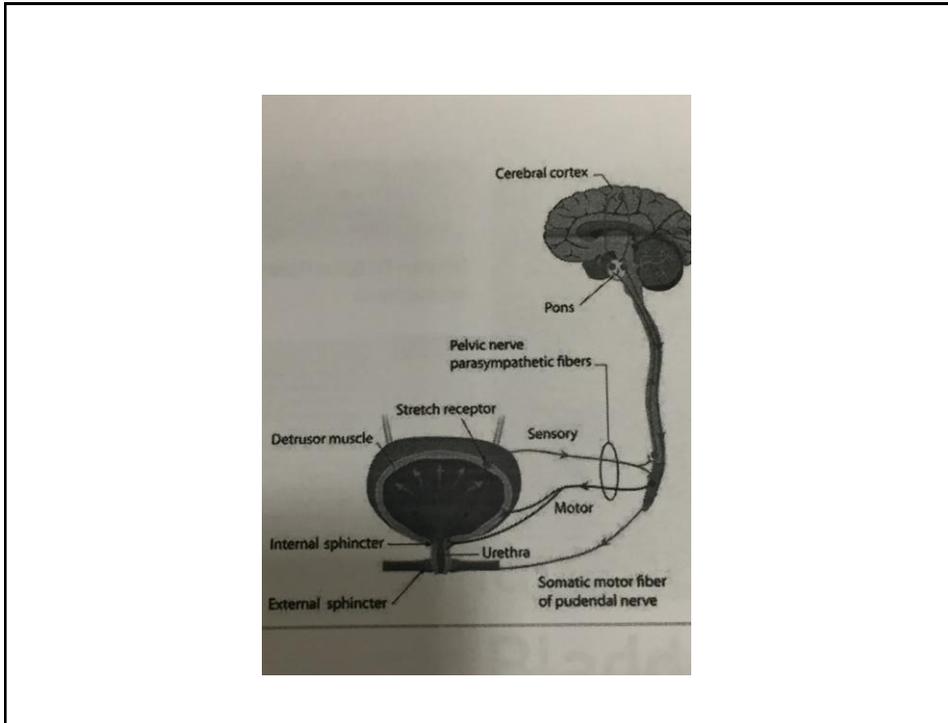


NEUROGENIC BLADDER AND BOWEL

Neuroanatomy and Physiology





Anatomy

- ◆ Bladder: balloon like reservoir – capacity 400 to 500ml
 - Bladder wall: detrusor muscle: smooth muscle: involuntary or autonomic control
 - Bladder neck: internal sphincter: smooth muscle: involuntary or autonomic control
 - external sphincter: voluntary control
- ◆ Storage phase:
 - detrusor relaxes to allow the bladder to fill
 - sphincter stays tight to allow the bladder to fill and prevent leakage of urine
- ◆ Emptying phase:
 - Detrusor contracts / Internal and External sphincters relax to allow the bladder to empty
- ◆ Neural control:
 - peripheral:
 - central

Physiology

- ◆ Peripheral neural control of the bladder
- ❖ Detrusor muscle: innervated by the parasympathetic input via the pelvic nerve
 - filling phase: the pelvic nerve is not activated: the detrusor is relaxed
 - emptying phase: the pelvic nerve stimulates the detrusor to contract
- ❖ Internal sphincter: innervated by the sympathetic input via the hypogastric nerve
 - filling phase: Alpha 1 receptors which cause contraction of the internal sphincter
 - emptying phase: Beta 2 receptors cause relaxation of the internal sphincter
- ❖ External sphincter: innervated by the somatic nervous system via the pudendal nerve
 - voluntary contraction of the external sphincter to prevent voiding

Physiology – contd.

- ◆ Central Control of the bladder
- ◆ Co ordination of micturition involves control by 3 main centres in the central nervous system
 - ❖ Sacral micturition centre: S2 to S4 spinal segments: reflex micturition centre
 - ❖ Pontine micturition centre: Pons [brainstem] – mediates the co ordinated contraction of the detrusor / relaxation of the sphincter, resulting in emptying of the bladder
 - ❖ Cortical control: several areas involved: medial frontal cortex, hypothalamus etc.
 - prevents voiding at inappropriate times

Physiology – contd.

- ◆ Activation of the stretch receptors in the bladder wall at a capacity of approx. 500ml
- ◆ Afferent / sensory nerves relay the message to the sacral micturition centre
- ◆ Impulses travel up to the pontine micturition centre
- ◆ Impulses travel up to the cortex which exerts the final control by directing the pontine and sacral micturition centres to initiate or delay voiding depending on the social situation

What happens in a person who has had a stroke?

What happens in a person who has a spinal cord injury?

Neurogenic bladder

- ◆ Cortical involvement – Stroke, MS, ABI, Dementia
- ❖ cortical control lost
- ❖ the pontine micturition centre is therefore the primary command centre for micturition

the capacity of the bladder remains the same, the sensory input from the stretch receptors in the detrusor passes to the sacral micturition centre and on to the pons
the pontine micturition centre is activated and since there is no central inhibition, irrespective of the social situation, when the person has to void, the bladder empties

Hence the strategy of offering the person a urinal q 2 to 3 hours to prevent uncontrolled voiding or urinary incontinence.

Neurogenic bladder – contd.

- ◆ Spinal Cord Injury:
 - ❖ The cortical and pontine control of micturition is lost
 - ❖ The sacral micturition centre is the only one still functioning [at the S2 to S4 segment]
 - ❖ The type of neurogenic bladder that a SCI pt. has depends on the level of injury
 - ◇ Spinal cord itself ends at the level of the L2 vertebral body
beyond this, all the lumbar nerves and the sacral nerves come off as a bunch of nerves resembling a horse's tail: Cauda Equina
 - ◇ Injury L2 and higher: the cord itself is damaged: Upper Motor Neurone Lesion
 - ◇ Injury below L2: the cauda equina / peripheral nerves are damaged: Lower Motor Neurone Lesion

Neurogenic bladder – contd.

- ◆ Upper Motor Neurone Lesion: Injury to the spinal cord [L2 vertebral segment or higher]
 - ❖ As the bladder fills, the afferent input to the sacral micturition centre triggers the detrusor to contract and the patient voids without voluntary control
 - the detrusor can be spastic, resulting in frequent voiding of small amounts of urine
 - ❖ Detrusor – Sphincter Dyssynergia:
 - As the detrusor contracts, the sphincter remains tight at the same time, due to loss of co-ordinated control by the pontine micturition centre
 - ◇ Pt. may go into retention
 - ◇ Pt. may be able to void small amts: incomplete emptying with high post void residuals
 - ◇ Risk of reflux of the urine into the ureters and eventually the kidneys causing kidney damage.

Neurogenic bladder – contd.

- ◆ Lower Motor Neurone Lesion [Injury to the cauda equina]
- ❖ Detrusor areflexia – the detrusor muscle continues to stretch as the bladder fills but because of damage to the nerves, no information relayed to the sacral micturition centres
 - bladder continues to fill upto volumes of 1000cc resulting in damage to the detrusor muscle interfering with its ability to contract appropriately in the future
 - overflow incontinence may result
- Pt. completely unaware

Goals of management

- ◆ Provide the person with a means of managing the bladder such that socially acceptable continence is achieved
- ◆ Regular emptying of the bladder with low residuals:
- ◆ Prevent renal complications
 - ❖ Recurrent urinary tract infections – lower urinary tract and/or pyelonephritis
 - ❖ Urolithiasis / nephrolithiasis
 - ❖ Hydronephrosis
 - ❖ Renal failure
 - ❖ Death

Goals of management – contd.

- ◆ Indwelling Foley catheter
- ◆ Intermittent catheterization – q 4 to 6h to avoid vol. > 500 cc
- ◆ Condom catheterization
- ◆ Suprapubic catheter
- ◆ Ileal conduit

Gut Anatomy and Physiology

- ◆ Anatomy of the bowel

Oral cavity – Esophagus – Stomach – Small intestine [Duodenum, Jejunum, Ileum] – Large intestine [Colon, Rectum]

Mouth and Stomach: Break down food and enable intestines to extract nutrients

Small Intestines: Absorb nutrients and push waste and water into the large intestine

Large Intestine: Absorbs water and forms waste into stool

Rectum: Collects and stores stool

Anal sphincter: hold anus closed until the rectum is full

Gut Anatomy and Physiology contd.

- ◆ When sufficient stool is collected in the rectum, the rectal wall gets distended.
- ◆ The stretch receptors in the rectal wall get stimulated and send sensory input into the sacral reflex centre situated in the S2 to S4 segments.
- ◆ The parasympathetic nerves send signals back to the bowel to contract the sigmoid colon, rectum. The internal sphincter remains relaxed but the external anal sphincter remains contracted so that the stool starts to fill the anal canal
- ◆ As the anal canal fills with the stool, signals go up to the brain and then back down, to allow the external anal sphincter to voluntarily relax to expel the stool
- ◆ If the person decides to delay defecation, the reflex gradually subsides and the external sphincter remains closed
- ◆ If defecation sufficiently delayed, further absorption of water – stool becomes hard: constipation

Neurogenic Bowel

- ◆ Effects of Spinal Cord Injury on the Bowel
 - ❖ Slowed peristaltic activity: from 24 – 36 hours to 65 – 85 hours
 - ❖ Increased potential for acid reflux, constipation, ileus
- ◆ 2 Types of Neurogenic bowel:
 - ❖ Upper Motor Neuron – UMN bowel: Lesions above T12 / L1
 - ◇ Spastic bowel, tight anal sphincter
 - ❖ Lower Motor Neuron – LMN bowel: Lesions below L1
 - ◇ Areflexic bowel, atonic sphincter

Neurogenic Bowel contd.

- ◆ Goal of bowel management

To ensure complete emptying of the bowel at regular intervals, while preventing episodes of incontinence

- ❖ Diet – enough fibre, fresh vegetables and fruit
- ❖ Adequate fluid intake
- ❖ To remain active if possible
- ❖ Medications
 - ◇ Stool softeners to keep the stool moving smoothly through the gut
 - ◇ Osmotic laxatives to pull water into the colon and keep the stool soft
 - ◇ Peristaltic agents to move the stool through the colon
 - ◇ Suppositories to promote expulsion of the stool from the rectum

Neurogenic bowel contd.

- ◆ Establish a regular time
- ◆ Do NOT hold the bowel program if patient is incontinent [may take 2 weeks for the bowel routine to be established]
- ◆ Perform bowel routine with the patient sitting up if possible
 - ❖ UMN bowel: Spastic bowel:
 - Will need a suppository or digital stimulation to stretch and relax the rectal sphincter.
 - Program may initially be performed daily but can be progressed to eod or 3/wk
 - ❖ LMN bowel: Flaccid or areflexic bowel:
 - Requires manual disimpaction od or bid