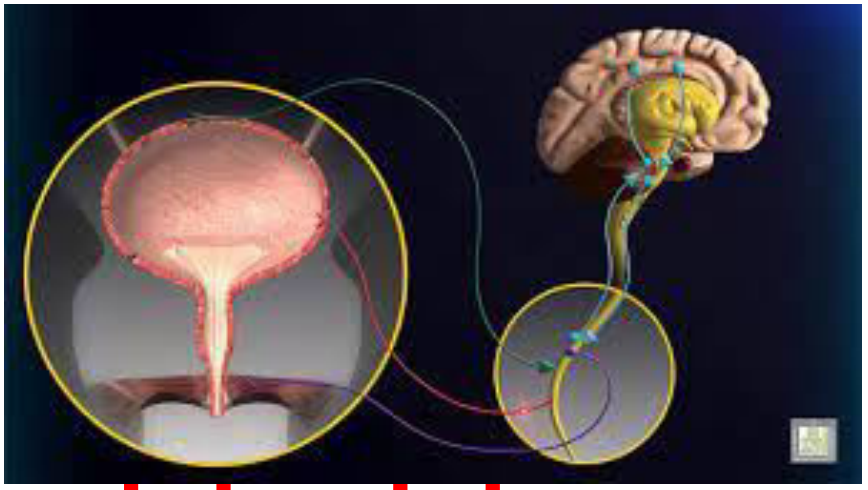
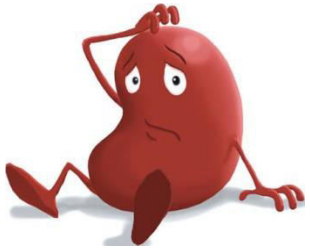


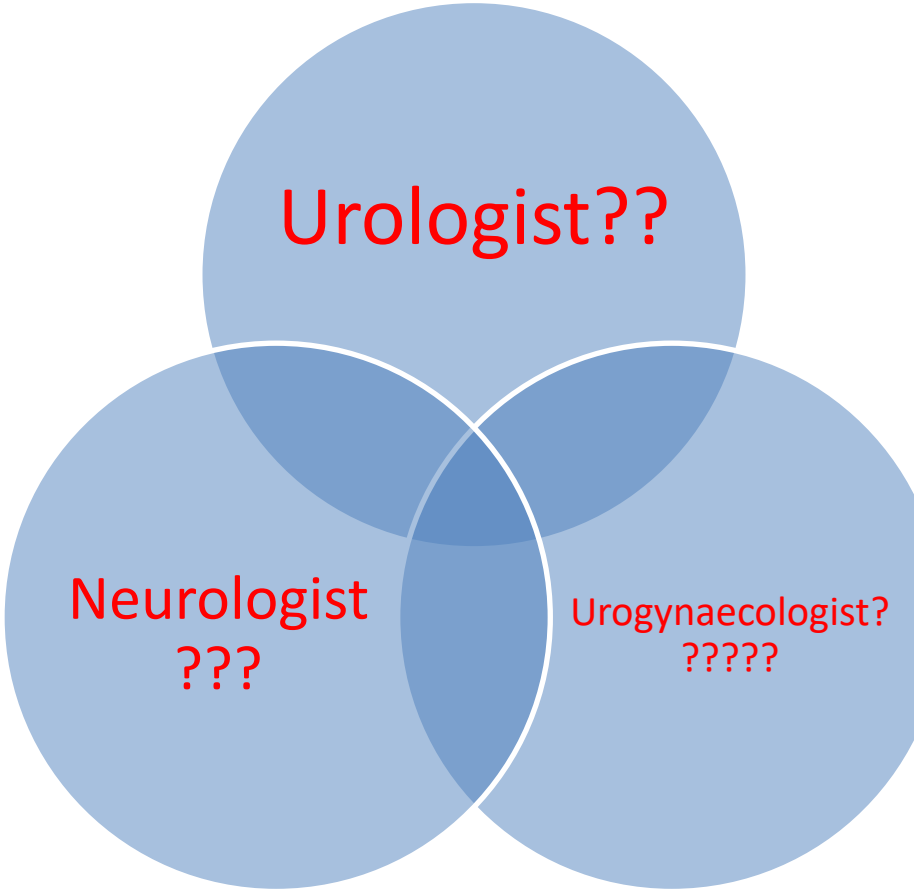
Neurogenic bladder

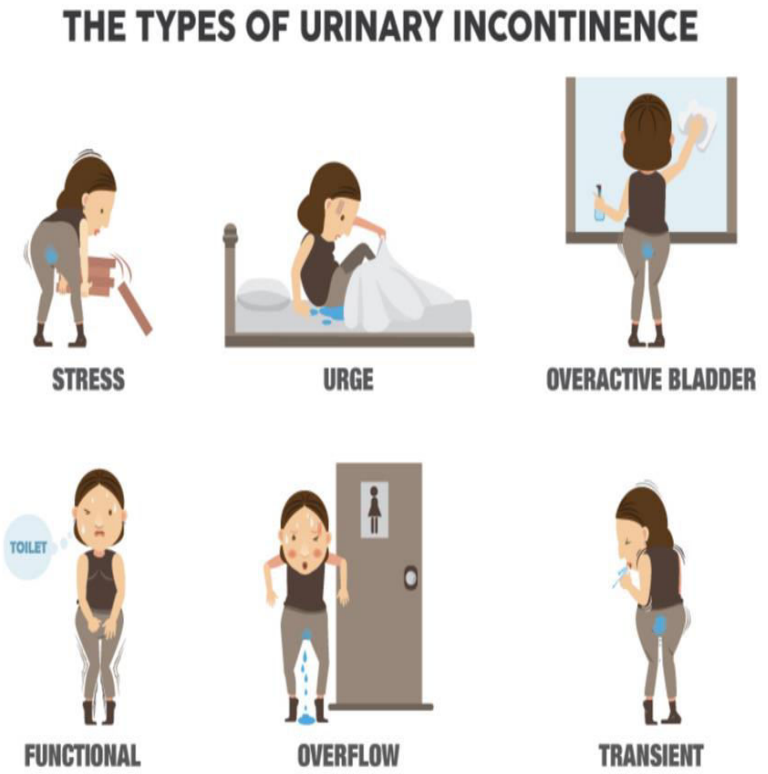
Dr.Hemalatha Ambati
senior resident
Department of neurology
Moderator: Dr.N.S.Sampath kumar

Who should treat? ???????????

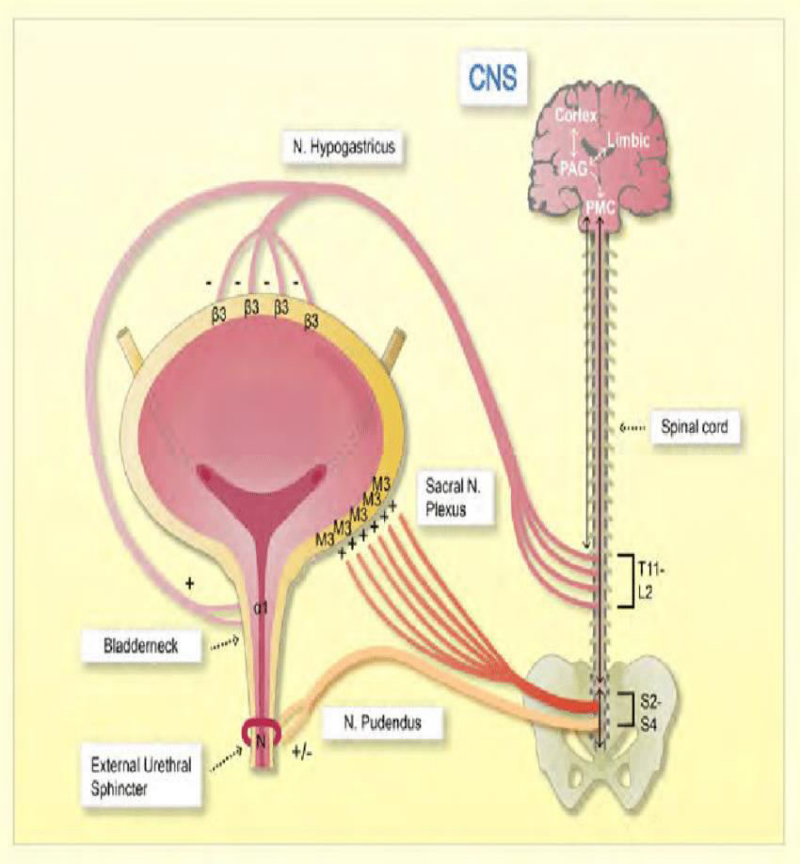
Urinary Bladder problems



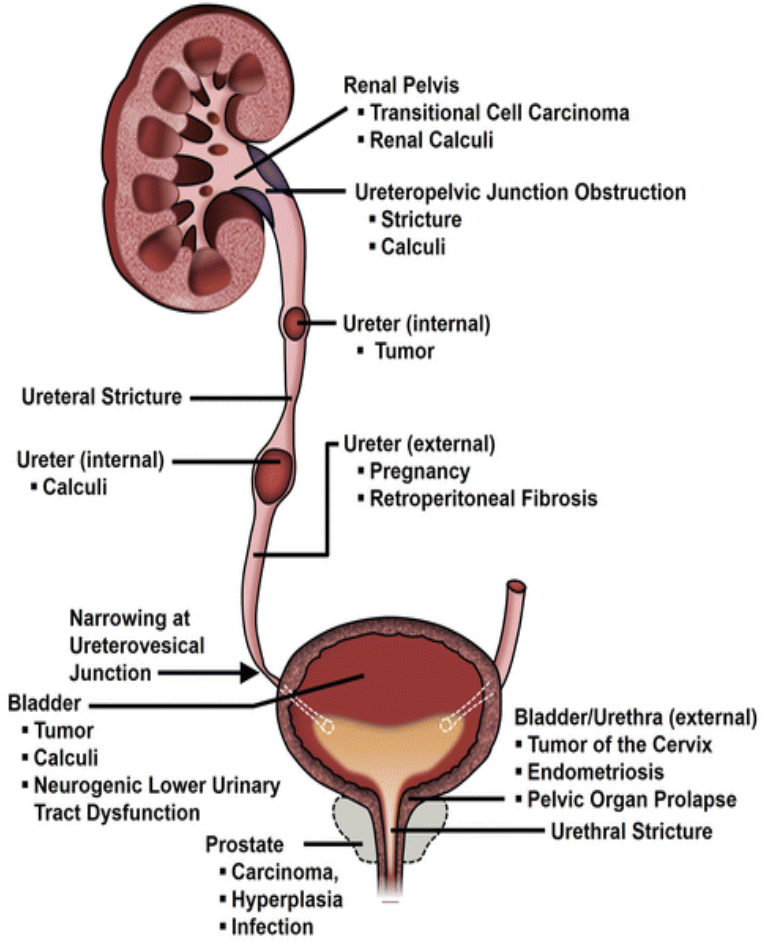




Neurogenic bladder: dysfunction of urinary badder due to disease of central nervous system or peripheral nerves involved in the control of micturition



Non neurogenic bladder: dysfunction of urinary bladder due to dynamic disturbance of genitourinary system

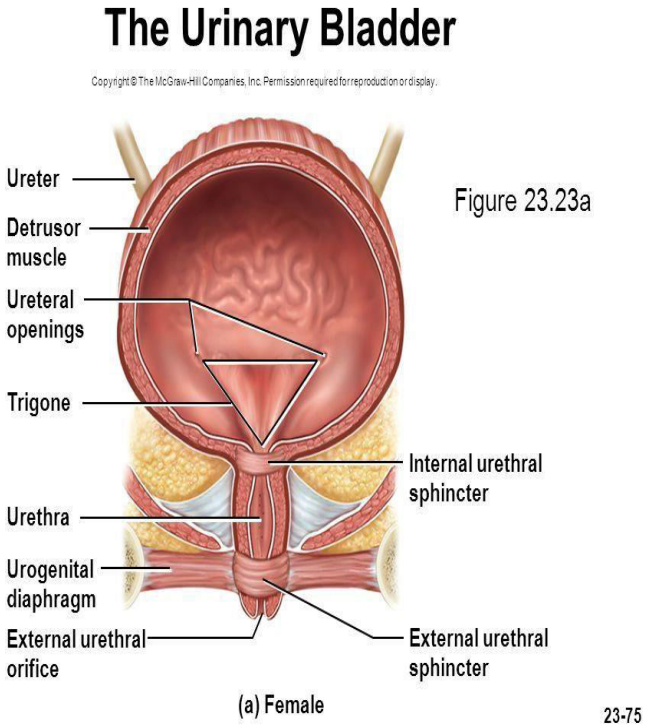


Outline of presentaion

- How the bladder is controlled through nerves and brain?
- Different types of bladder problems, we see according to level of dysfunction
- Investigations we do
- Treatment modalities

Anatomy

- **Urinary bladder is a *smooth muscle chamber***
- **2 parts : 1)body**
  2)neck
- **Body:made up of smooth muscle,called as detrussor muscle**
- **Bladder neck: 2-3 cm long ,composed of detrusor muscle interlaced with elastic tissue ,called as internal urethral sphincter.**
- **External urethral sphincter : voluntary skeletal muscle,situated in the pelvic diaphrgm**
- **Normal capacity is 300ml-500 ml.**



physiology

- Normal bladder function is:

  1) storage of urine(filling phase):

  detrussor should relax and sphincter should be contracting

  2) voiding at appropriate times (emptying phase):

  detrussor should contract and sphincter should relax

How this is appropriately executed?????????

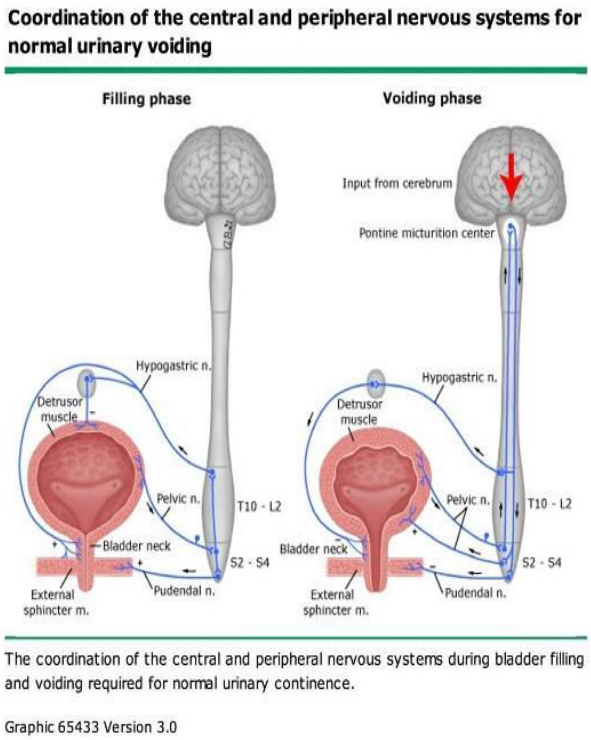
via 1) local spinal reflexes

2) central cerebral control

Mediated by 1)different nerves: of sympathetic, parasympathetic, somatic

2)Spinal cord regions

3)Brain centres



So…How the nerves reach the bladder????????

1) Parasympathetic nerves of bladder

originates from S2,S3,S4 sacral segments of spinal cord

↓

fibres travel via Anterior rami of S2,S3,S4 nerves

↓

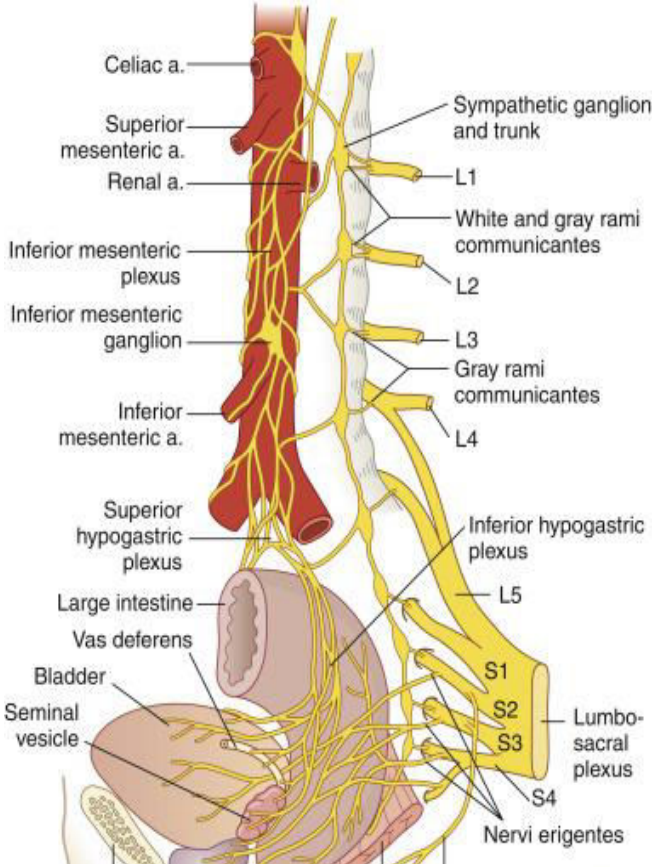
enters Pelvic plexus and ganglia on the surface of bladder

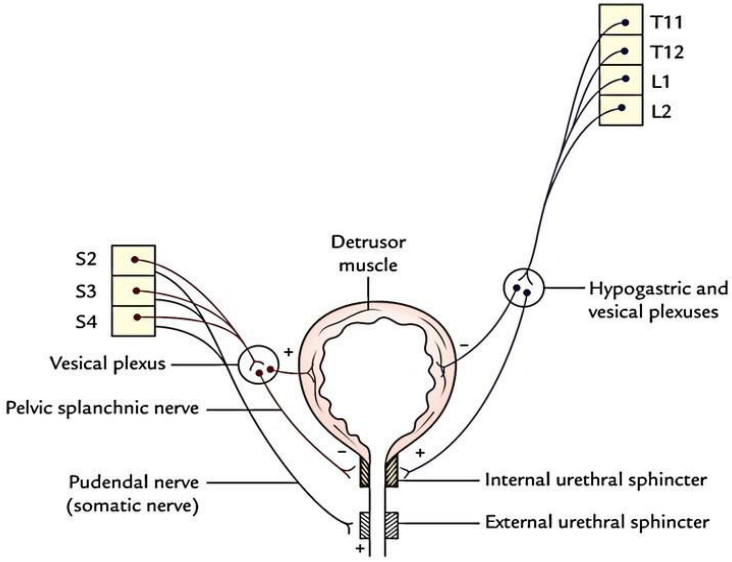
↓

Cholinergic post ganglionic fibres

↓

Detrussor contraction via M3 receptors & internal urethral sphincter relaxation





2)sympathetic nerves Of bladder

originates from T 10 –L2 segments of lower thoracic & lumbar spinal cord

↓

fibres enter Inferior hypogastric plexus

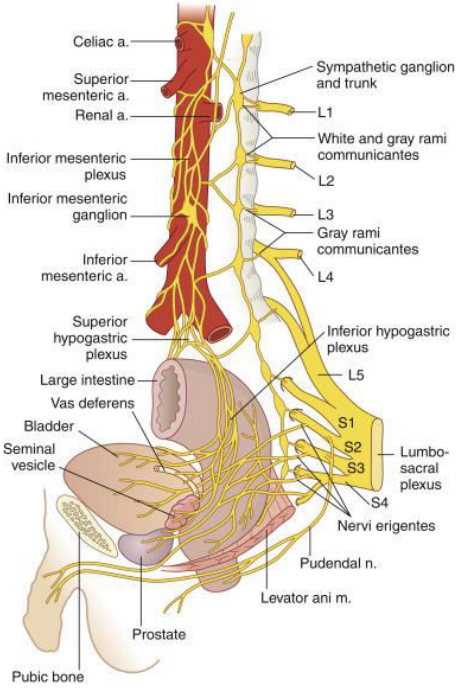
↓

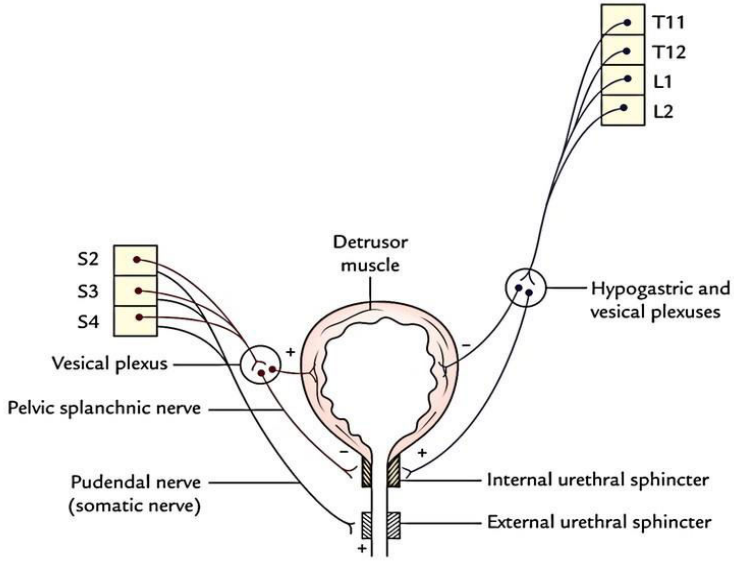
Noradrenergic postganglionic fibres

↓

Detrussor relaxation through beta 3 &

Internal urethral sphicter contraction via alpha 1 receptors





3)Somatic innervation of bladder

from onuf ‘s nucleus

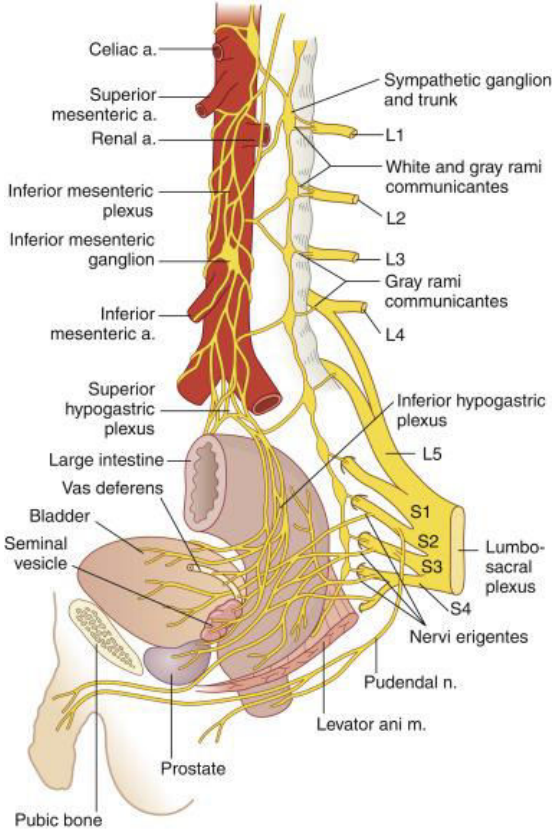
(anterior horn cells of S2,S3,S4 segments of sacral spinal cord)

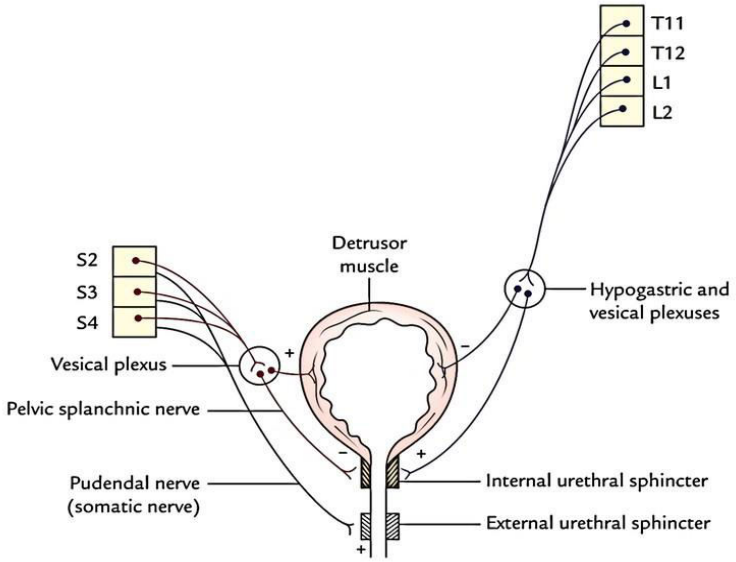
↓

pudendal nerve

↓

external sphincter contraction via nicotinic receptors





How the sensations are carried up????

- Afferents:
- A-delta fibres -stretch and fullness senstion,involved in micturition reflex
- C-fibres –noxious sensation
- *Carried through sympathetic and parasympathetic fibres.*

Through which columns of spinal cord ???????

- Sensation of pain,temp,urgency follows the anterolateral white columns of spinal cord
- Conscious sensations(bladder distention,ongoing micturition,tactile pressure) follow the posterior columns of spinal cord.

What are the Brain regions controlling bladder???????????

1)Medial frontal cortex

2)cingulate gyrus

3)periaqueductal grey matter

mainly execute socially appropriate voiding

act in storage & voiding of urine, via Inhibiting /disinhibiting Pontine micturition centre and Exciting the Onuf's nucleus

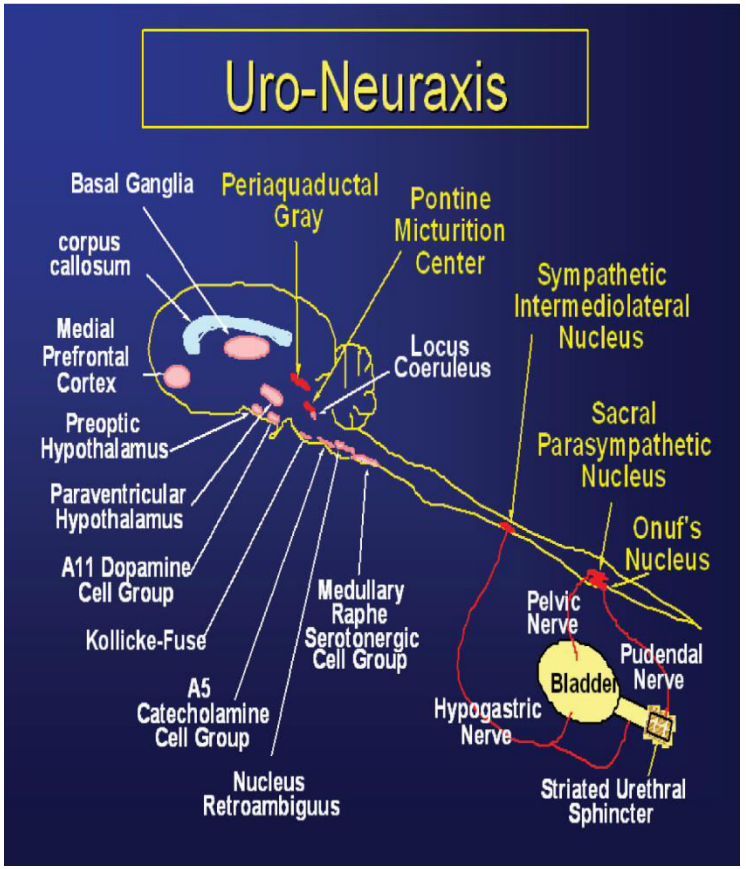
4) Pontine micturition centre:

executor of micturition

present in pons .

when it is activated ,causes micturition(detrussor should contract& sphincter should relax)

executes by Exciting parasympathetic neurons and Inhibiting sympathetic neurons & Onuf's nucleus



During storage ..what happens????

Local spinal reflex mechanism especially in infants

Gradual stretch of bladder

↓

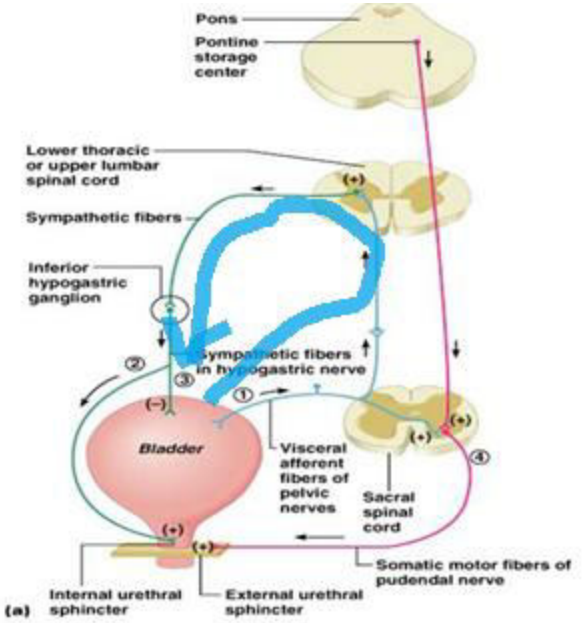
Low level firing of A delta afferents

↓

Activation of sympathetic fibres :
causing relaxation of detrusor
contraction of internal sphincter

↓

Filling up of bladder & storage



During storage ..what happens??in adults

Gradual stretch of bladder

↓

Low level firing of A delta afferents

↓

Pontine storage centre activated

1)Activation of sympathetic fibres :

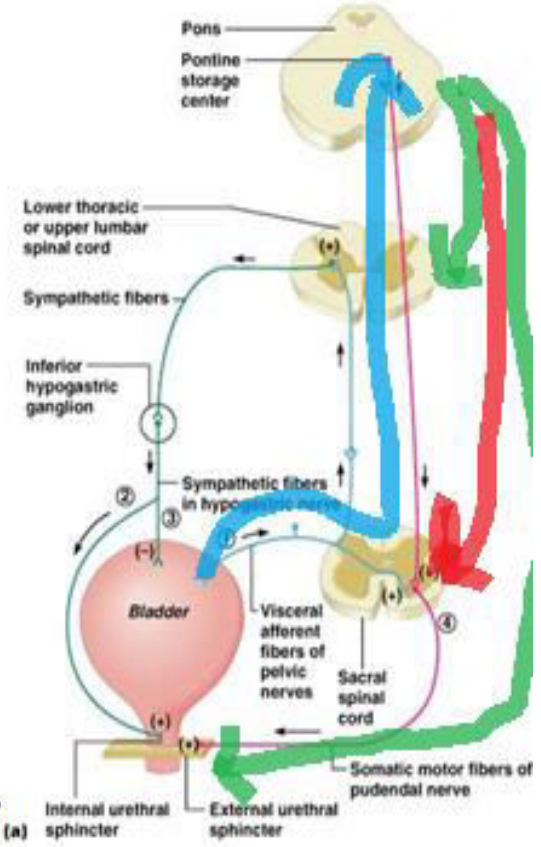
causing relaxation of detrusor

contraction of internal sphincter

2)Activation of onuf nucleus:

causing contraction of external sphincter

3)Inhibition of parasympthetic fibres:



During voiding ..what happens????

Local spinal reflex mechanism especially in infants

increased stretch of bladder

↓

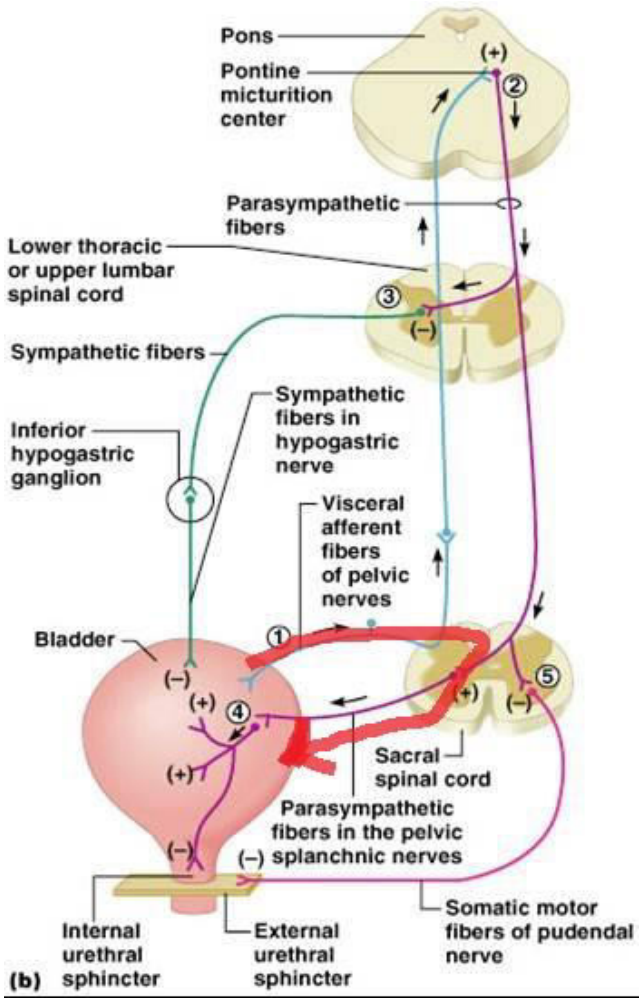
high level firing of A delta afferents

↓

Activation of parasympathetic fibres :
causing contraction of detrusor&
relaxation of internal sphincter

↓

emptying of bladder



During voiding what happens ..in adults?

A delta afferents

↓

PAG(periaqueductal grey matter)

↓

Pontine Micturition Centre

↓

Via spinal cord

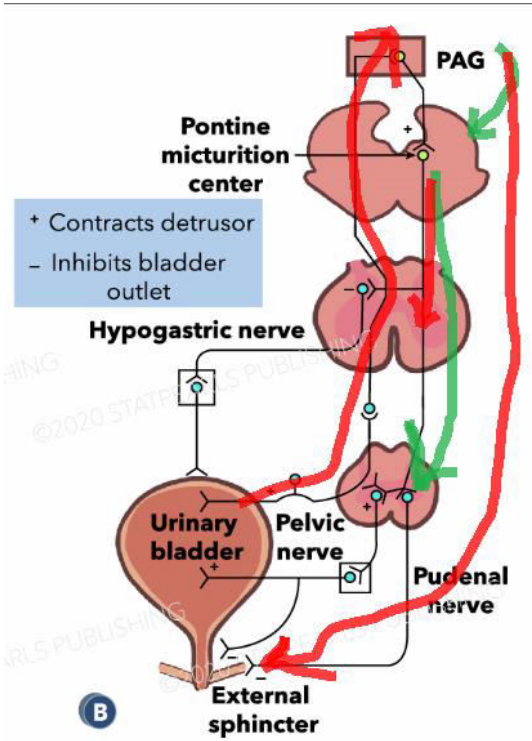
↓

Activates Parasympathetic &inhibits onuf nucleus ,sympathetics.

Hypothalamus,right insula,dorsal anterior cingulate,lateral prefrontal cortex

↓

medial prefrontal cortex



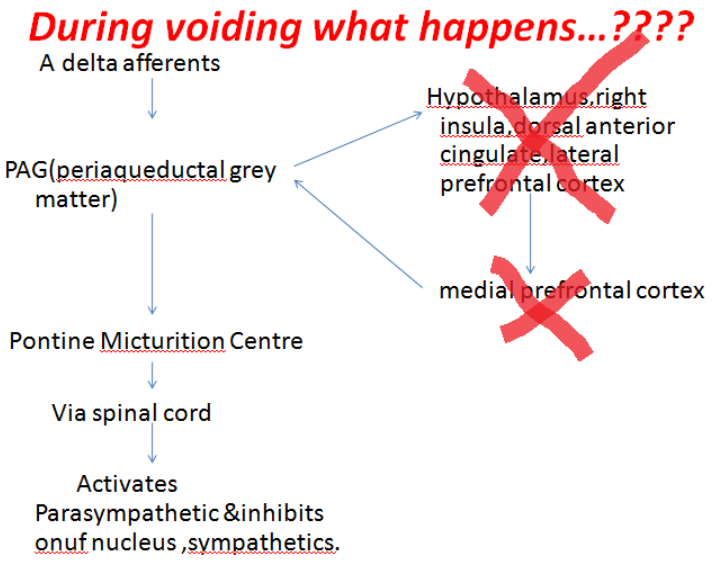
Types of neurogenic bladder..

1) **Uninhibited bladder:** cortical bladder
2) **automatic bladder :** pontine & suprasacral bladder
3) **autonomous bladder :** Spinal cord lesion involving sacral level
4) **Sensory neurogenic bladder**
5) **Motor paralytic bladder**

1)Uninhibited bladder

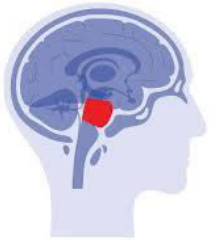
(cortical bladder)

- From injury or disease to the cortical centres: CVA, brain tumors, parkinson disease, multiple sclerosis
- Cortical centres normally exert an inhibitory influence on sacral micturition reflex centre.
- Destructive lesion in this tract leads to overfacilitation of micturition reflex
- So, the patient will have frequency, urgency, urge incontinence.
- So, once the bladder reaches maximum filling capacity, patient has to void, even if it is socially appropriate or inappropriate,as he can not hold it
- If it is submaximal filling, he can hold and can void when ever he wants



2)Reflex /Automatic bladder

(pontine/suprasacral spine lesion)



- **Complete interruption of sensory and motor pathways between cortex and sacral spinal centre**
- **Seen in pons lesions, spinal cord trauma,transverse myelitis,extensive demyelinating diseases,any process that produces significant spinal cord destruction**
- **No bladder sensation,along with inability to initiate voluntary micturition.**
- **Bladder automatically fills and empties by itself ,but not properly**
- **Detrussor-sphincter dyssnergia, due to loss of executor.**
- **Incontinence with out sensation results because of low volume invountary bladder contraction**

During voiding what happens…????

A delta afferents

PAG(periaqueductal grey matter)

Hypothalamus,right insula,dorsal anterior cingulate,lateral prefrontal cortex

medial prefrontal cortex

Pontine Micturition Centre

Via spinal cord

Activates Parasympathetic &inhibits onuf nucleus ,sympathetics.

3)Autonomous bladder (sacral spinal cord lesion)

- Complete motor and sensory seperation of bladder from the sacral spinal cord
- Cause: Any disease that destroys sacral spinal cord or causes extensive damage to the sacral roots or pelvic nerves
- , loss of bladder sensation,Inability to voluntarily initiate micturition,absent bladder reflex activity
- Large bladder capacity at low intravesical pressure.

During voiding what happens...????

A delta afferents

PAG(periaqueductal grey matter)

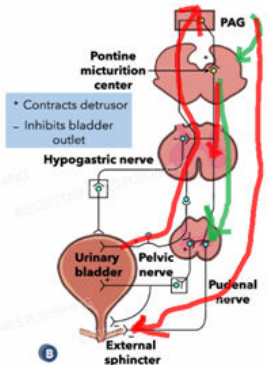
Hypothalamus,right insula,dorsal anterior cingulate,lateral prefrontal cortex

medial prefrontal cortex

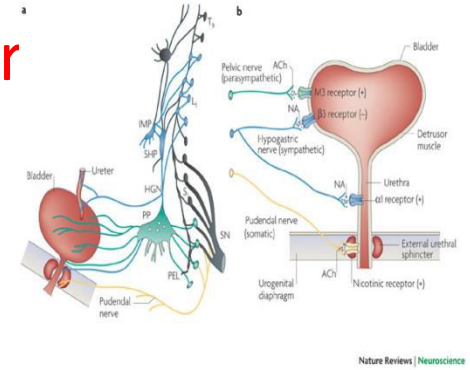
Pontine Micturition Centre

Via spinal cord

Activates Parasympathetic &inhibits onuf nucleus ,sympathetics.

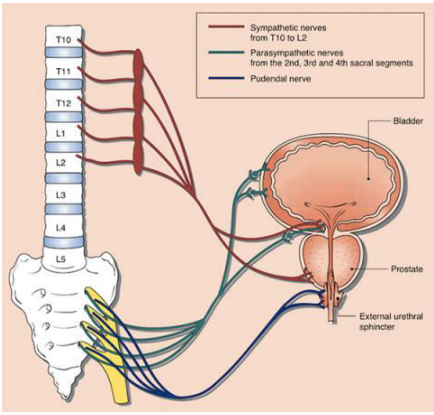


4)Sensory neurogenic bladder
(peripheral nerve lesion)



- **From disease that selectively interrupts the sensory fibres between the bladder and the spinal cord or the afferent tracts to the brain**
- **Diabetes, tabes dorsalis,pernicious anemia**
- **Impaired sensation of bladder distenstion**
- **Unless voiding is initiated on a timed basis,varying degrees of overdistension result.**
- **Patient will have overflow incontinence**

5)Motor paralytic bladder (motor nerve lesion)



- **Disease that destroys parasympathetic motor innervation of bladder**
- **Extensive pelvic surgery or trauma**
- **Symptoms vary from inability to initiate and maintain normal micturition to severe painful retention.**

How we should evaluate???????????

Clinical evaluation: history

- **Urinary symptoms: urgency/precipitancy/hesitancy/dribbling**
- **Onset: etiology help**
- **Sense of bladder filling : motor/sensory/cortical**
- **Can they feel urine passing: afferent neuraxis**
- **Can they stop urine passing in midstream at will: efferent neuraxis**
- **Does bladder leak continually or suddenly pass large volume:OI/DSD/Sensory**
- **Frequency:non neurogenic/neurogenic**
- **Initiation: CORTEX/OUTLET**
- **Termination:CORTEX/OUTLET**
- **Ability to stop on command:CORTEX**
- **Volume of urine passed:LMN/UMN**

Clinical evaluation: history

- **H/O spinal injury or surgery and meningomyelocoele,**
- **PD,CVA,MS,**
- **low backache, lower limb paresis, Sensory symptoms,**
- **drug usage : anticholinergics,alpha adrenergics,**
- **sexual and bowel dysfunction and other autonomic symptoms,**
- **genitourinary history : UTI,reflux,stones,surgery**
- **Obstetric history: no of deliveries,uterine prolapse**

Examination ,in a case of neurogenic bladder

1)in case of cortical bladder/ uninhibited bladder:

assess any hemiplegia/other findings of stroke/altered higher mental functions

2) in case of suprasacral spine bladder/automatic bladder:

assess upper & lower limbs

weakness, sensory loss, reflexes

3) in case of sacral spine bladder/autonomous bladder:

Inspection of lumbosacral spine: congenital malformations, dimpling, tuft of hair, nevus or sinus in the sacral region

Saddle anaesthesia in the buttocks region,absence of anal reflex/bulbocavernous reflex

4) in case of sensory bladder esp in Diabetics

assess features of peripheral neuropathy : sensory loss in limbs etc.

investigations

- Complete urine examination for UTI
- Ultrasound scan of bladder and kidney
- Urodynamic studies:
- Uroflowmetry
- Cystometry
- Uroneurophysiology studies

Uroflowmetry: non invasive

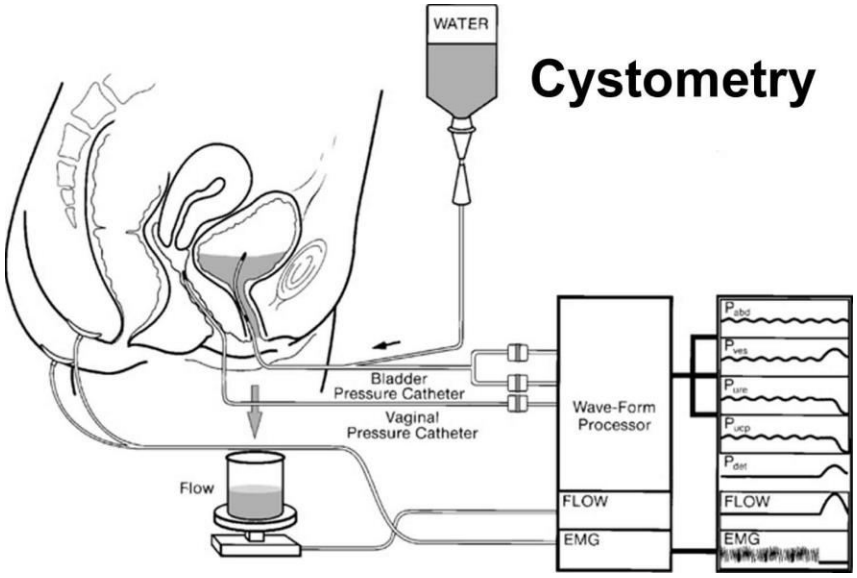
- **Flow meter consists of a urinal ,into which the patient passes urine as naturally as possible**

- **Time taken to reach maximum flow,maximum and average flow rates, and also the voided volume are analysed.**

UROFLOWMETRY

Cystometry: invasive

- Evaluates pressure – volume relationship during nonphysiological filling of bladder and during voiding



videocystometry

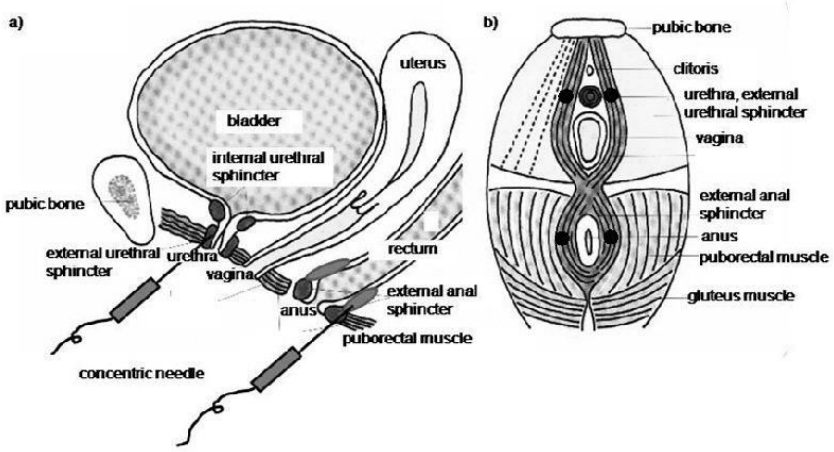
- Using a contrast filling medium,cystometry procedure is visualized radiographically

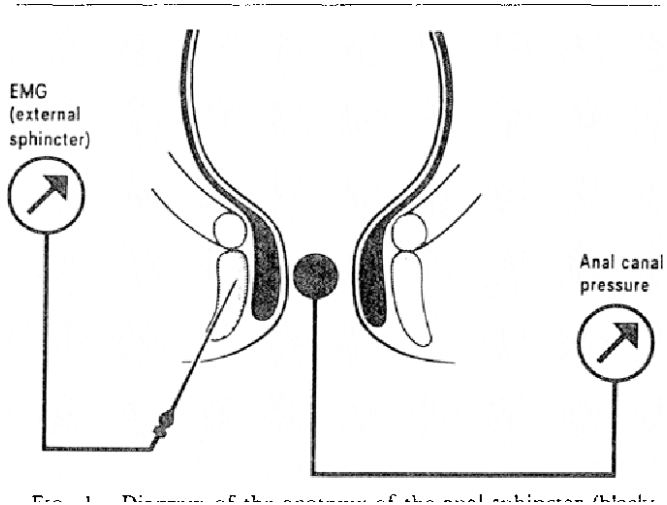
Uroneurophysiology: electromyography

- **Pelvic floor electromyography**
- **Sphincter EMG**
- **Pudendal nerve terminal motor latency**
- **Pudendal somatosensory evoked potentials**

Sphincter EMG

- IN SUSPECTED CAUDA LESIONS:
- Changes of chronic reinnervation
- Reduced interference pattern and enlarged polyphasic motor units
- IN Multi System Atrophy:
- Changes of reinnervation
- In fowler syndrome(isolated ext sphincter problem in females)
- Complex repetitive discharges,akin to ” the sound of helicopters”
- Decelerating bursts,a signal some what like myotonia and akin to the “sound of underwater recording of whales”





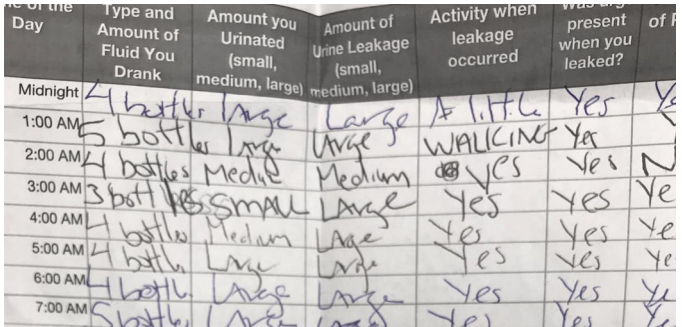
How to treat….???????

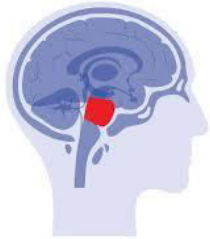
1)Treatment of cortical bladder

- Symptoms: Patient will have urge incontinence, urgency,frequency
- Sense of bladder/stream/voluntary initiation of micturition is intact

Rx:

- Fluid balance,maintaining a bladder diary
- Caffeine reduction: to reduce urgency and frequency
- Bladder retraining : patients void by the clock





2)Treatment of pontine/suprasacral bladder

Symptoms:

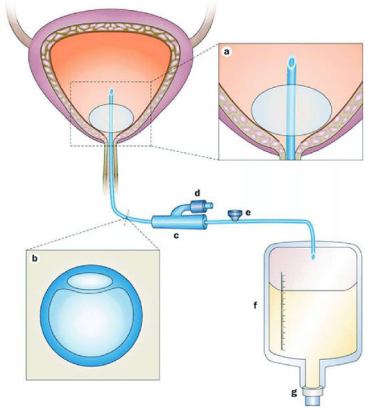
- **No bladder sensation,along with inability to initiate voluntary micturition.**
- Detrussor-sphincter dyssynergia
- Frequency,incontinence ,hesitancy,interrupted stream

Rx:

- Antimuscarinics/

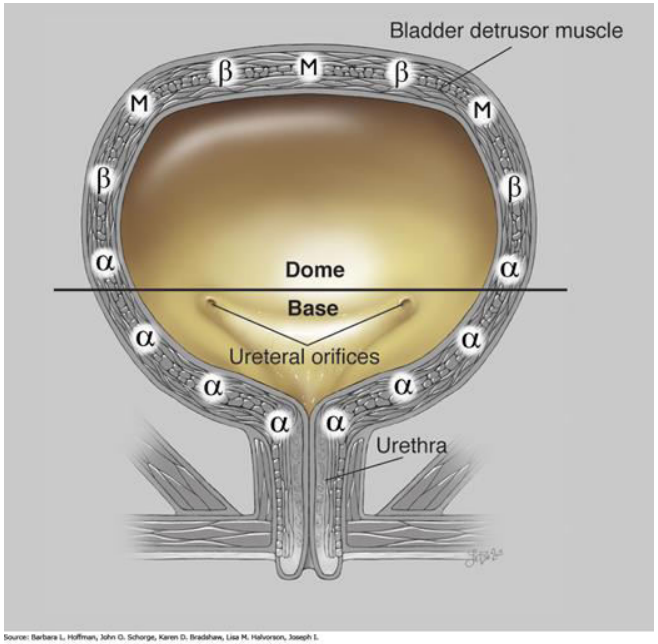
  Beta 3 agonists: to relax detrussor(for detrussor hypersensitivity)

Combined with intermittent catheterization : for non relaxing sphincter



- **Anti muscarinics:M3 blockers**

  Inhibit destrussor contraction,there by preventing detrussor over reactivity
- **S/E: dry mouth,blurred vision for near objects,tachycardia,constipation, impairment of cognition.**



Contraindications:

- Narrow angle glaucoma
- Severe gastroparesis
- Myasthenia gravis

Table 1 Medications that assist with storage

Medication	Dose range	Side effects
Antimuscarinic	–	All have dry mouth, constipation, dry eyes, blurry vision, urinary retention, confusion, dyspepsia
Oxybutynin	IR 5–30 mg divided TID (up to 45 mg daily tolerated)	The most side effects of any of the class and worst cognitive side effects
Oxybutynin	ER 10–30 mg daily Patch (Oxytrol) 3.7 mg Q3 days Gel (Gelnique)	ER less side effects than IR; skin irritation with patch
Tolterodine	IR 2–8 mg divided BID ER 2–8 mg daily	IR side effects > ER
Solifenacin	5–10 mg daily	Most constipation of any in class
Darifenacin	7.5–15 mg daily	–
Fesoteridine	4–8 mg daily	–
Trospium	IR 20–60 mg BID divided ER 20–60 mg daily (up to 120 mg tolerated)	IR side effects > ER
β3 selective receptor agonist		
Mirabegron	25–50 mg daily	HR rise 1–2 beat sper minute, BP rise 1–2 mmHg, dyspepsia
Tricyclic antidepressants		
Imipramine	10–45 mg divided BID or TID	Dizziness, drowsiness, dry mouth, constipation, blurred vision, nightmares, dyspepsia, breast swelling, lethal cardiac arrhythmia at high doses (overdose)

- Beta 3 agonists:

Miragebron:

Beta 3 receptors cause relaxation of detrussor

- Useful in detrusor overactivity
- Dose: 25-50 mg
- S/E:cardiovascular with mean rise in BP of 1.2-2.4 mm Hg and small increase in heart rate
- Not prescribed in patients with uncontrolled hypertension

3)Treatment of sacral spinal bladder (autonomous)

- Symptoms:

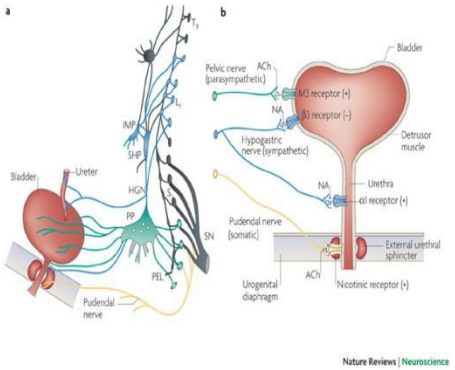
  loss of bladder sensation,Inability to voluntarily initiate micturition,absent bladder reflex activity

- Patient will have Large painless bladder with leakage

Rx:

- Intermittent/Continuous catheterization, depending on the patient condition

Treatment of sensory neurogenic bladder (in diabetics esp)



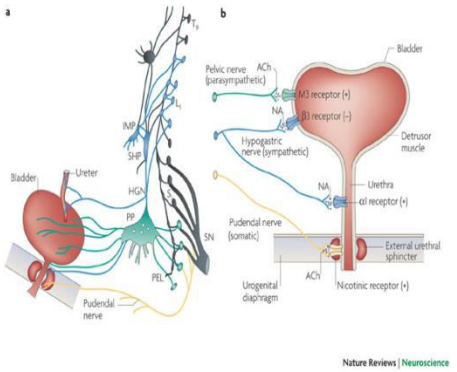
Symptoms:

- No sensation of filling
- Overflow incontinence

Rx:

- Scheduled voiding

5)Treatment of motor paralytic bladder

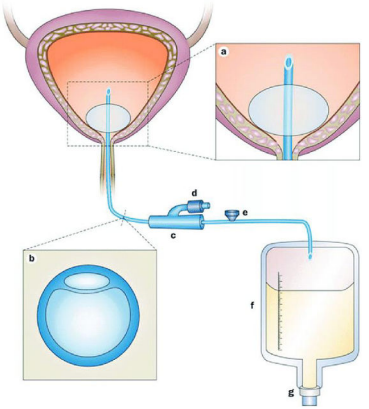


Symptoms:

- **inability to initiate and maintain normal micturition to severe painful retention.**

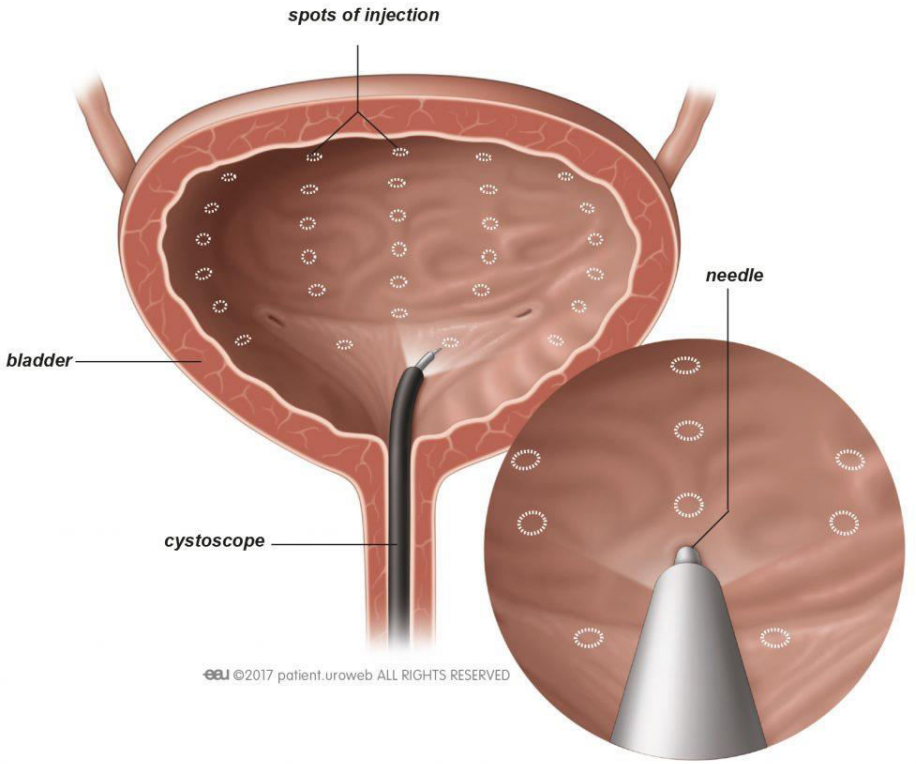
Rx:

Intermittent/continuous catheterization



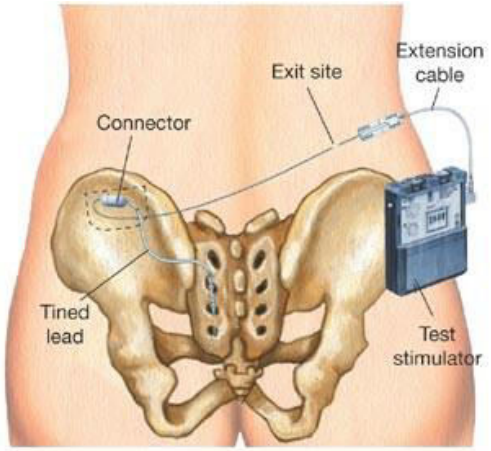
Advanced treatments are…..

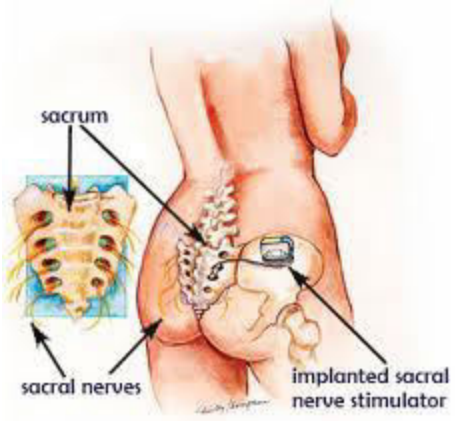
- Botulinum toxin:for detrussor over reactivity
- Blocks the release of acetyl choline from the parasympathetic nerve endings and produces paralysis of detrusor muscle
- 200-300 U of onabotulinum toxin type A ,is injected into detrusor muscle under cystoscopic guidance



peripheral nerve stimulation: sacral neuromodulation

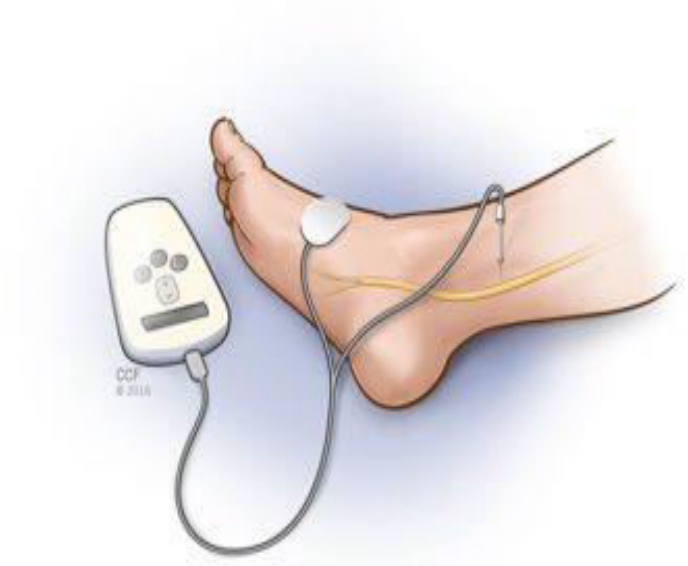
- **Extra dural sacral nerve stimulator lessens detrusor overactivity,which is refractory to anti muscarinic drugs**
- **Implanting the stimulator is a 2 stage process:**
- **1 st stage:test stage:stimulating lead is inserted through the S3 foramen and connected to external stimulator**
- **If the patient symptoms reduced,as judged by bladder diaries and measurement of residual volumes**
- **2 nd stage:permanent stimulator is implanted into a subcutaneous pocket**

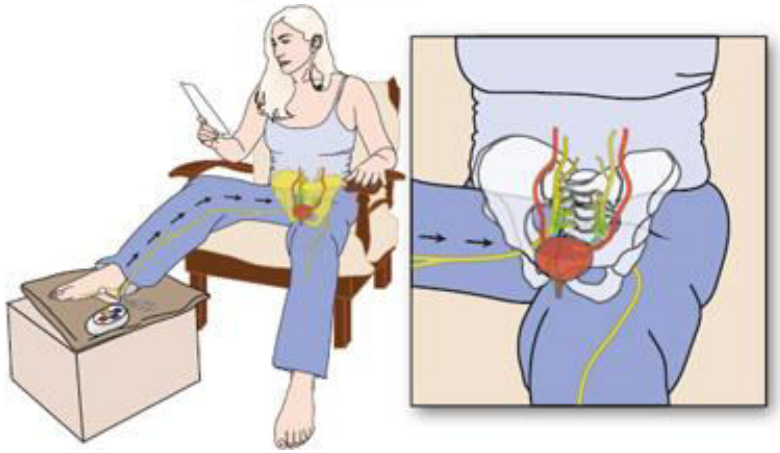




Percutaneous tibial nerve stimulation

- Electrical stimulation of tibial nerve,supresses detrussor over reactivity
- Mechanism unknown
- Stimulation of nerve once a week for 30 min for 8 to 12 weeks,through a fine gauge stainless steel needle using a fixed frequency,variable current strength.





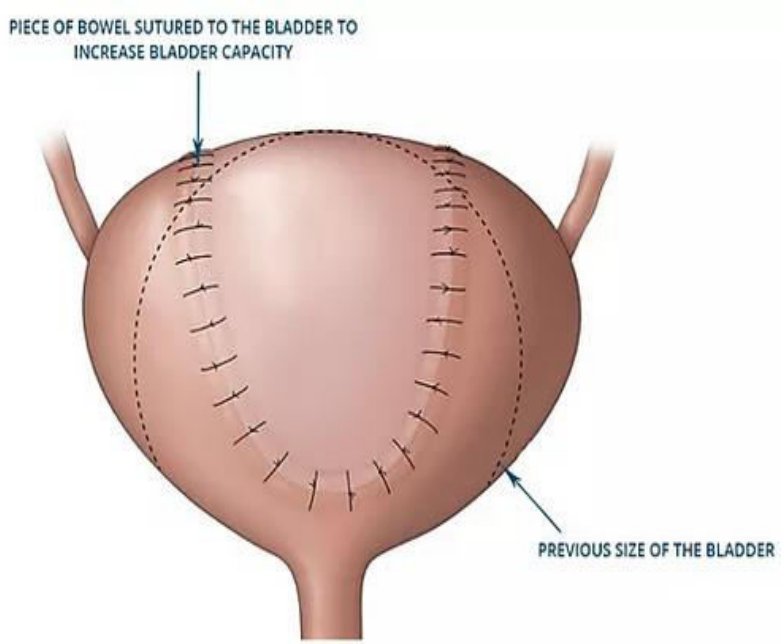
- ***If not amenable to medical management …….***

…… surgical procedures

Surgical procedures of management:

- For Urinary incontinence due to detrusor overreactivity:

  1)augmentation cystoplasty



Thank you……