

Neurogenic Bladder Management After Spinal Cord Injury

Department of PMR

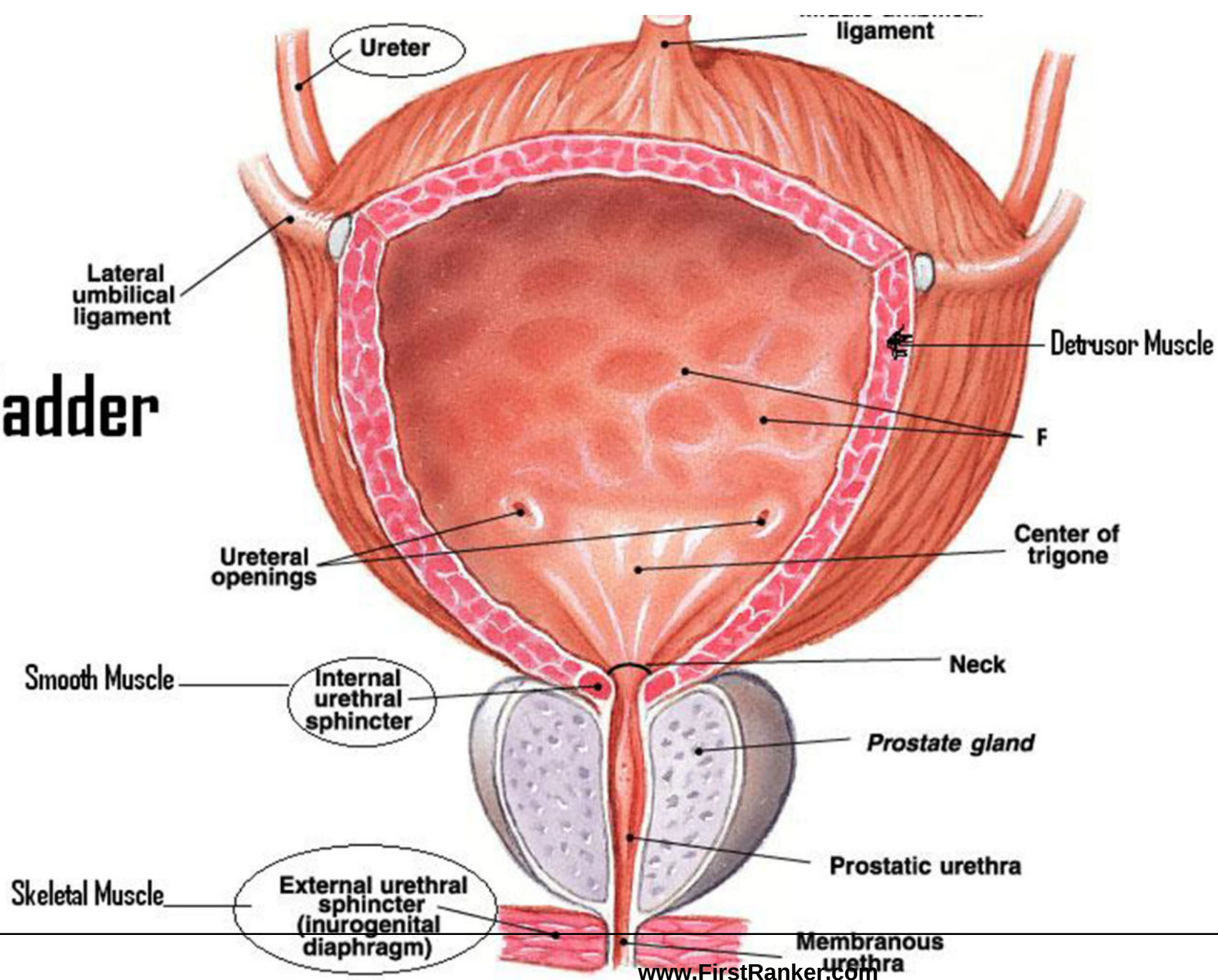
Overview

- A. Introduction
- B. Functional anatomy of the lower urinary tract
- C. Bladder impairment following spinal cord injury
- D. Bladder management
- E. Recommendations for bladder evaluation and follow-up

Introduction

- ▶ Neurogenic bladder is a general term applied to a malfunctioning urinary bladder due to neurologic dysfunction, or insult, resulting from internal or external trauma, disease or injury.
- ▶ The majority of people with spinal cord injury (SCI), even those who have very incomplete impairment, have abnormalities in bladder function which may cause upper and lower urinary tract complications.

Bladder

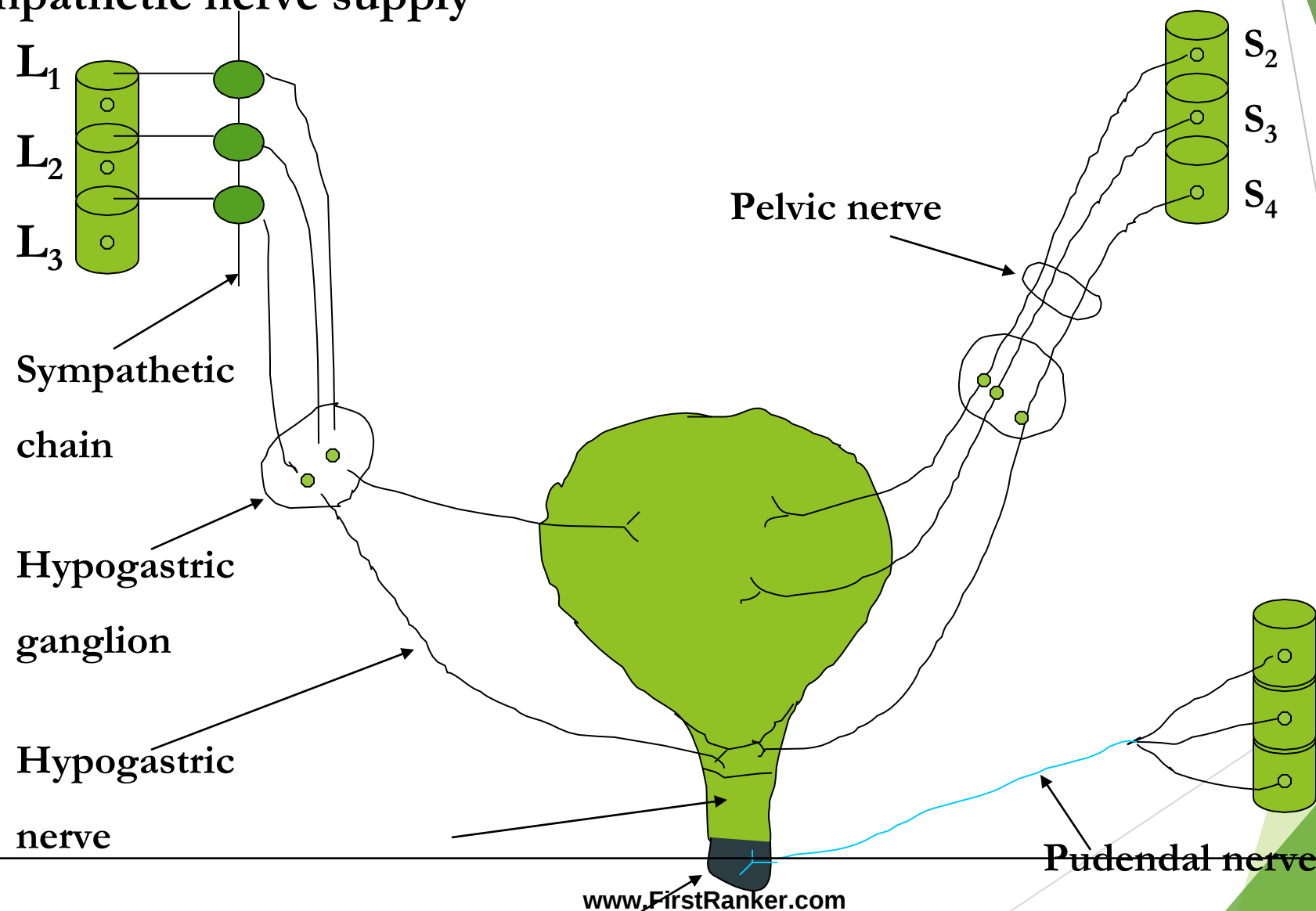


Functional anatomy of LUT

- ▶ Bladder filling and emptying involve the bladder (detrusor muscle) and its outlet (bladder neck, proximal urethra and striated muscles of pelvic floor) acting reciprocally.
- ▶ During storage of urine, the bladder neck and proximal urethra are closed to provide continence with the detrusor relaxed to allow low pressure filling.
- ▶ During voiding initial relaxation of the pelvic floor with opening of the bladder neck is followed by detrusor contraction until the bladder is completely emptied.

Innervation of the bladder

Sympathetic nerve supply



Autonomic control of micturition

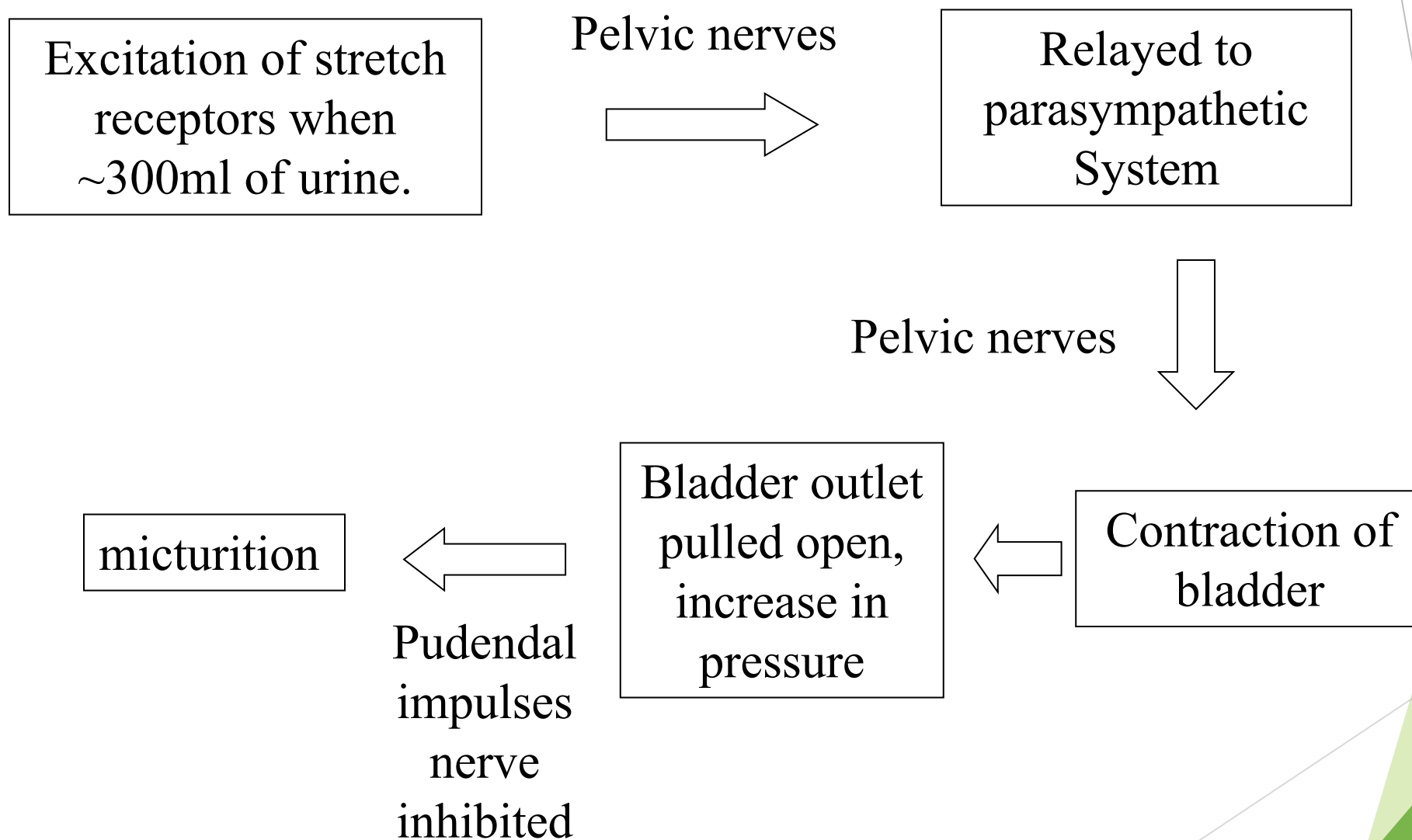
Type of nerve	Name of nerve	Spinal Innervation	Action
Somatic	Pudendal nerves Nerve to the levator ani	S2-4	Sensory and voluntary motor to external sphincter PFM
Sympathetic	Hypogastric nerves	T11-L2	Detrusor relaxation Internal sphincter contraction
Parasympathetic	Pelvic nerves	S2-4	Inhibit sympathetic system causing detrusor contraction Internal sphincter relaxation

Micturition centers

Co-ordination of micturition involves three main centers:

1. The *sacral micturition center*, located in the sacral spinal cord (S3-S4 levels), which is a reflex center in which efferent parasympathetic impulses to the bladder cause a bladder contraction and afferent impulses provide feedback on bladder fullness.
2. The *pontine center* in the brainstem, which is responsible for coordinating relaxation of the external sphincter with bladder contractions
3. The *cerebral cortex*, which exerts the final control by directing micturition centers to initiate or delay voiding, depending on the social situation.

The micturition reflex



Definitions and terminology

Intermittent catheterisation: as drainage or aspiration of the bladder or a urinary reservoir with subsequent removal of the catheter either performed by the person or an attendant.

Bladder reflex triggering: maneuvers performed in order to elicit reflex detrusor contraction by exteroceptive stimuli Like.. suprapubic tapping, thigh scratching and anal/rectal manipulation.

Bladder expression: manoeuvres aimed at increasing intravesical pressure in order to facilitate bladder emptying Like.. abdominal straining, Valsalva's manoeuvre and Crede manoeuvre.

Definitions and terminology

Urodynamic studies: Normally take place in the laboratory and usually involve artificial bladder filling and measurements of various bladder parameters such as intra-vesical pressure.

Detrusor overactivity: Is a urodynamic observation characterized by involuntary detrusor contractions during the filling phase which may be spontaneous or provoked.

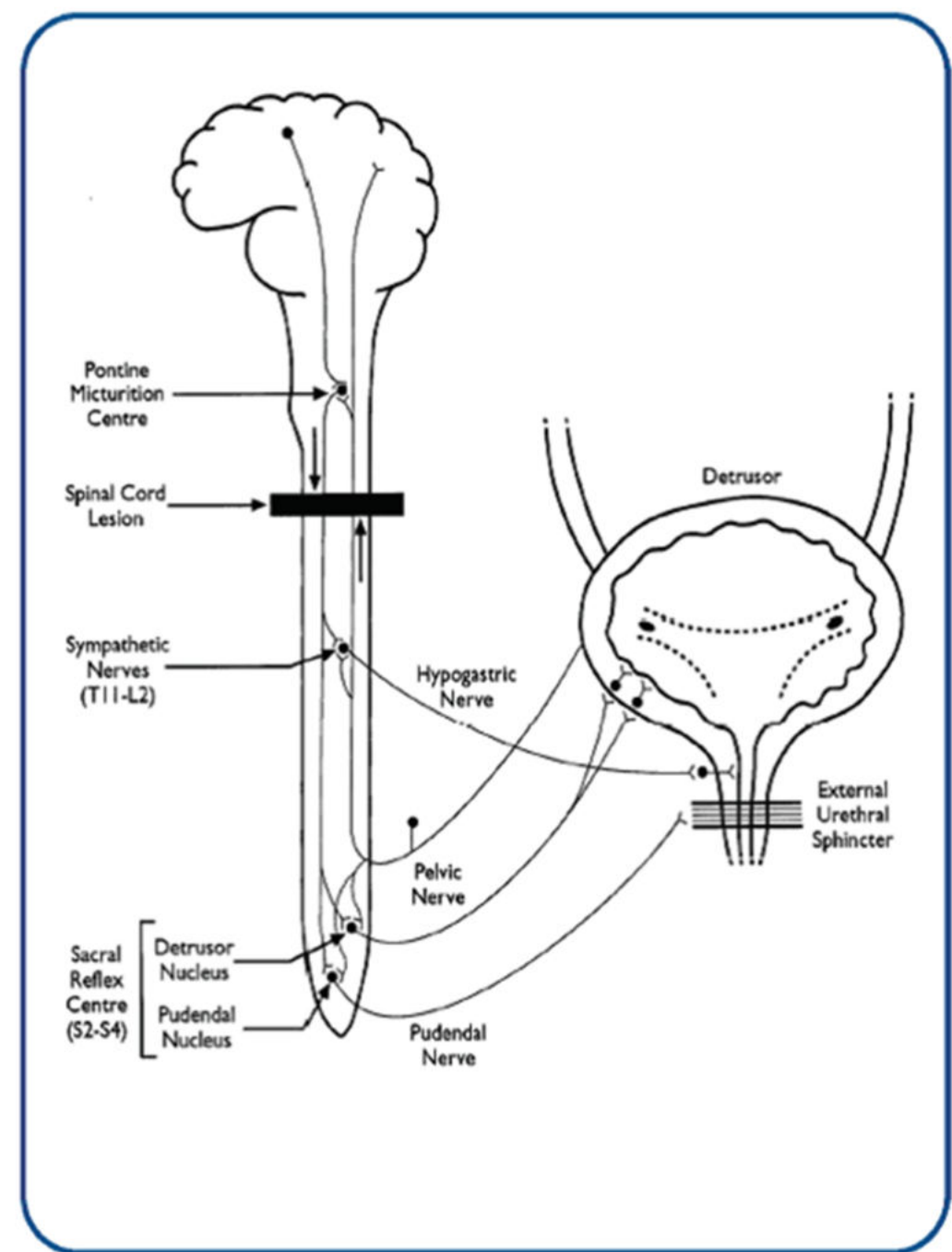
Detrusor underactivity: Is defined as a contraction of reduced strength and/or duration, resulting in prolonged bladder emptying and/or a failure to achieve complete bladder emptying within a normal time span.

Definitions and terminology

- ▶ **Bladder compliance:** Describes the relationship between change in bladder volume and change in detrusor pressure.
- ▶ **Detrusor sphincter dyssynergia:** Is defined as a detrusor contraction concurrent with an involuntary contraction of the urethral and/or peri-urethral striated muscle. Occasionally, flow may be prevented altogether.
- ▶ **Indwelling catheterisation:** An indwelling catheter remains in the bladder, urinary reservoir or urinary conduit for a period of time longer than one emptying.

Bladder impairment following spinal cord injury

SCI disrupts descending motor and ascending sensory pathways, preventing normal control of micturition



Types of Neurogenic Bladder Impairment

Suprasacral (Infrapontine) Bladder

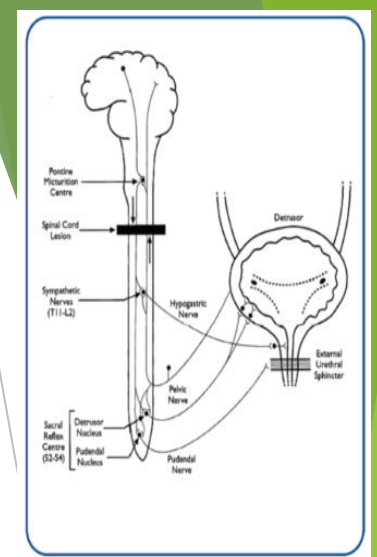
An upper motor neuron lesion results in:

- detrusor hyperreflexia (overactivity).
- detrusor-external sphincter dyssynergia (DESD), inappropriate co-contraction of the external urethral sphincter (EUS) with voiding detrusor contraction.

Mixed Neurogenic Bladder (Type A)

A lesion in the conus medullaris with damage to detrusor (parasympathetic) nucleus causes:

- detrusor hyporeflexia (underactivity) with external sphincter hyperreflexia.
- characteristically large volume with overflow incontinence.



Types of Neurogenic Bladder Impairment

Mixed Neurogenic Bladder (Type B)

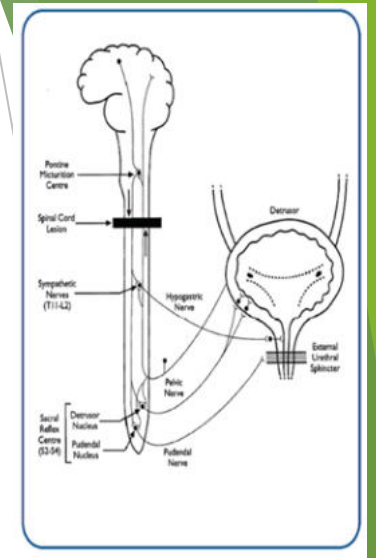
A lesion in the conus medullaris involving pudendal (somatic) nucleus causes:

- Detrusor hyperreflexia with external sphincter hypotonia.
- Small volume, high frequency, incontinence.

Infrasacral Bladder

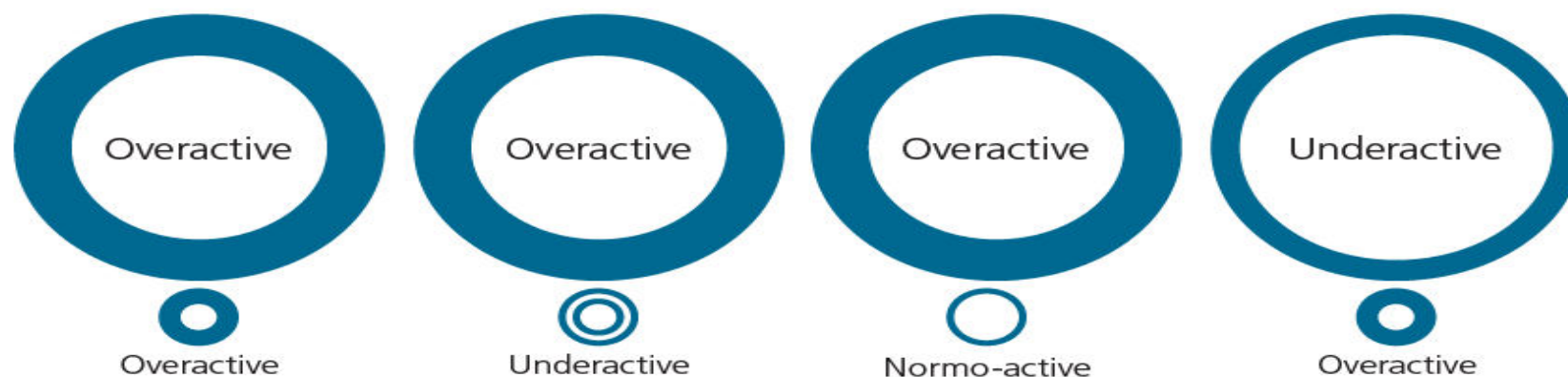
A Lower Motor Neurone lesion from conus medullaris and/or cauda equina damage results in:

- Areflexia of detrusor with atonia of pelvic floor muscles.
- May have isolated increase in bladder neck/internal sphincter resistance (intact T11-L2 sympathetics).
- Non-contractile bladder with leakage from overflow.



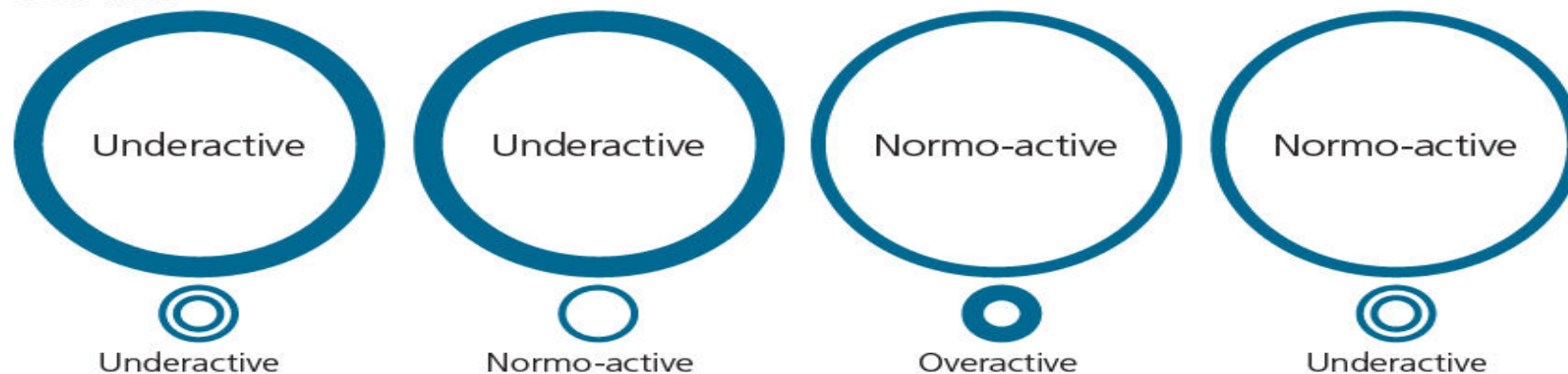
Madersbacher functional classification system

Detrusor



Urethral Sphincter

Detrusor



Urethral Sphincter

Functional Classification

- ▶ Failure to store
 - ▶ Because of bladder
 - ▶ Because of outlet
- ▶ Failure to empty
 - ▶ Because of bladder
 - ▶ Because of outlet

Bladder Management

Goals:

- ▶ Protecting upper urinary tracts from sustained high filling and voiding pressures (i.e. >40cm water)
- ▶ Achieving regular bladder emptying, avoiding stasis and bladder overdistension and minimising post-voiding residual volumes.
- ▶ Preventing and treating complications such as urinary tract infections (UTIs), stones, strictures and autonomic dysreflexia
- ▶ Maintaining continence and avoiding frequency and urgency
- ▶ Choosing a technique which is compatible with person's lifestyle

Management methods

Any type of neurogenic bladder management can be divided into four parts:

- ▶ Behavioral
- ▶ Pharmacological
- ▶ Surgical
- ▶ Supportive

Behavioral

- ▶ Timed voiding: Pts are told to void before they reach their full capacity.

Individuals with cognitive deficits are helped by timed voiding.

- ▶ Bladder training: Progressively increasing the time between voiding by 10 to 15 minutes every 2 to 5 days.

Helpful in persons recovering from head injury/ stroke

Pharmacological

- ▶ Main goal is to block the ACh receptors on the bladder wall there by reducing the uninhibited contractions.

ORAL AGENTS

- ▶ Anticholinergic drugs such as Propantheline, Oxybutynin, Tolteridone, Tropsium etc can be used orally
- ▶ Oxybutynin has some local smooth ms. relaxing and local anesthetic effect
- ▶ Tolterodine (comp. antagonist) & Tropsium (selective antagonist) have fewer anticholinergic adverse effects
- ▶ TCAs- They have additional effect on the internal sphincter by preventing NER reuptake- Caution AD
- ▶ Darifenacin- Muscarinic receptor antagonist

Contd.

INTRAVESICAL DRUGS

- ▶ Lidocaine- Short duration of action
- ▶ Oxybutynin- Effective for 4-6 hours, still labour intensive.
- ▶ Capsiacin- C-fibre neurotoxin. Effect can last upto several months

A/E- suprapubic pain, haematuria, urgency, AD can last upto 2 wks

- ▶ Resiniferatoxin- 1000 times more potent than Capsiacin longer acting. Minimal side effects due to rapid onset of action.

Surgical

- ▶ Bladder augmentation- to create a large bladder capacity with low intravesical pressure. Distal ileum is commonly used

INDICATIONS

1. Inability to tolerate/ unwillingness for drugs
2. Detrusor hyperreflexia or low compliance
3. Recurrent UTIs or AD
4. Upper tract damage

Supportive

1. Diapers
 2. External condom catheter
 3. Indwelling catheters
- ▶ Diapers- one of the easiest methods mainly for back up. They have many disadvantages like.. Expenses, potential skin breakdowns

External Condom Catheters

Men with detrusor hyperreflexia

Normal bladder function with incontinence secondary to mobility or cognitive factors.

Major drawbacks:

leg bag, penile skin breakdown,

condom catheter falling off

slight increase in bladder infections.



Condom Catheter

Intermittent Catheterisation

- ▶ During the first few weeks after injury, over distension of the bladder should be avoided by continuous drainage (usually 7-10 days after injury).
- ▶ After this period, regular intermittent catheterization.
- ▶ Long term in both male and female patients with paraplegia or males with tetraplegia and sufficient hand function, **clean intermittent self catheterization (CISC)** is the preferred method.



Clean intermittent self catheterization

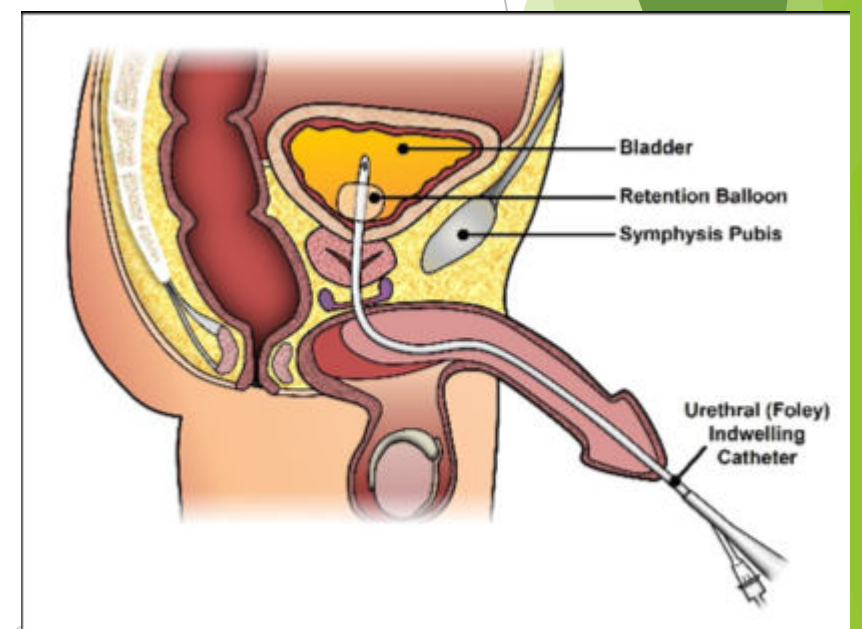
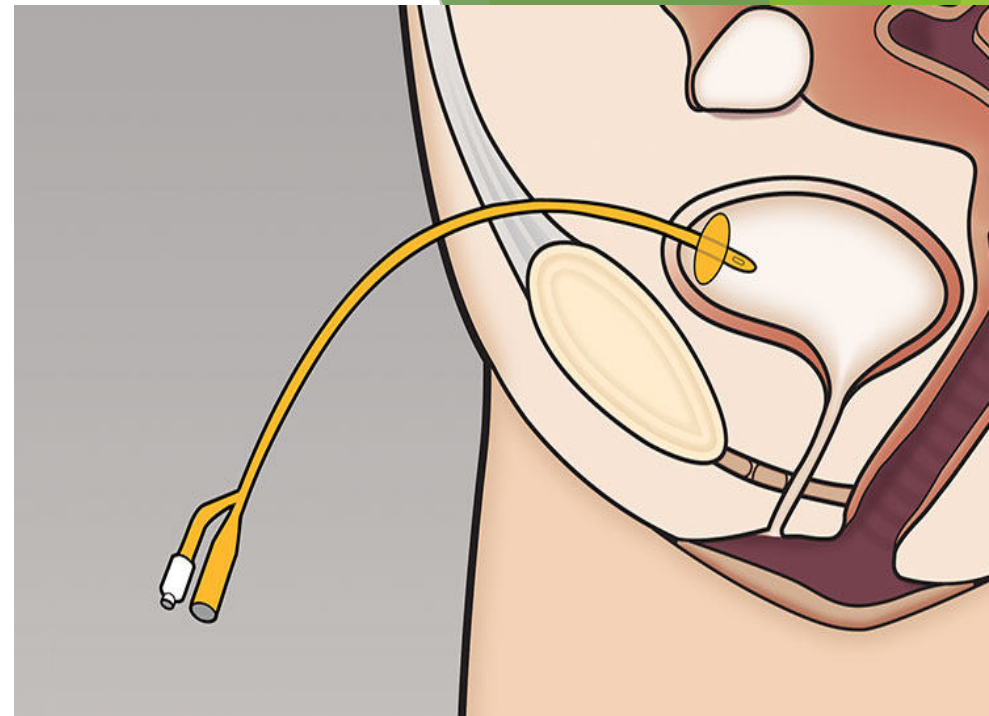
- ▶ Perform every 4-6 hours
- ▶ Prerequisites: well-controlled detrusor activity, include good bladder capacity, adequate bladder outlet resistance, absence of urethral sensitivity to pain with catheterization and patient motivation.
- ▶ Contraindications: abnormal urethral anatomy such as stricture, false passages, and bladder neck obstruction, poor cognition, little motivation, unwillingness to adhere to the catheterisation time schedule.
- ▶ CISC has the lowest complication rate.

Reflex Voiding and Bladder Expression Techniques

- ▶ In males with tetraplegia and insufficient hand dexterity to perform CIS, drainage by reflex voiding with triggering maneuvers and use of an external urinary collection device is possible.
- ▶ Valsalva or Crede (pressing over the bladder) are discouraged as they may produce high intra-vesical pressure, increasing the risk for long-term complications.
- ▶ However, this technique is **generally no longer recommended**.

Indwelling Catheterisation

- ▶ In long-term use a **suprapubic catheter** is generally preferred to avoid creation of fistulous tracts, damage to the sphincter muscles, dilation of the urethra, penile tip erosion and splitting of the penis, called traumatic hypospadias.
- ▶ Female patients with tetraplegia generally use either a suprapubic or an indwelling urethral catheter, suitable in some women with paraplegia also.
- ▶ Males with tetraplegia suprapubic catheters are being recommended.



Evaluation and Follow-up

- ▶ There is no clear consensus on the appropriate urological follow-up of individuals after spinal cord injury.
- ▶ Upper tract evaluations include tests that evaluate function such as renal scans, ultrasound, CT scan and intravenous pyelogram (IVP).
- ▶ Lower tract evaluations include urodynamics to determine bladder and sphincter function, cystograms to evaluate for vesicoureteral reflux and cystoscopy to evaluate bladder anatomy.