Neurogenic voiding dysfunction

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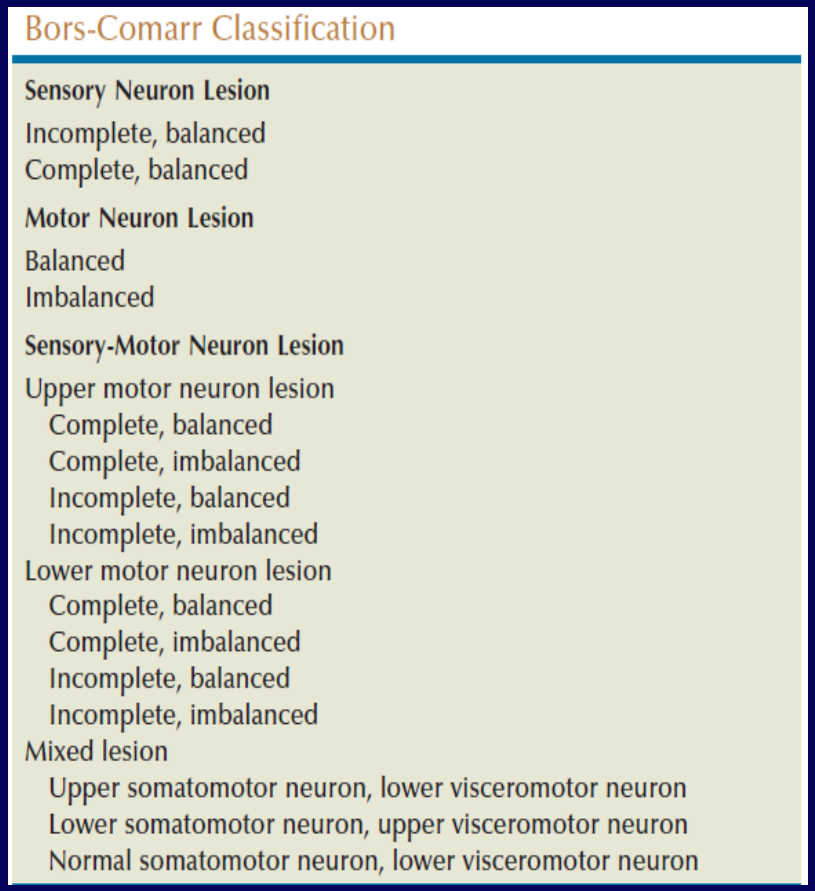
Classification of neurogenic voiding dysfunction

1. Bors-Comarr Classification (1971)
2. Hald-Bradley Classification (1982)
3. Urodynamic Classification (1984)
4. International Continence Society Classification (2002)

Bors-Comarr Classification (1971)



Bors-Comarr Classification

Sensory Neuron Lesion

Incomplete, balanced
Complete, balanced

Motor Neuron Lesion

Balanced
Imbalanced

Sensory-Motor Neuron Lesion

Upper motor neuron lesion
- Complete, balanced
- Complete, imbalanced
- Incomplete, balanced
- Incomplete, imbalanced

Lower motor neuron lesion
- Complete, balanced
- Complete, imbalanced
- Incomplete, balanced
- Incomplete, imbalanced

Mixed lesion
- Upper somatomotor neuron, lower visceromotor neuron
- Lower somatomotor neuron, upper visceromotor neuron
- Normal somatomotor neuron, lower visceromotor neuron

This system considers three factors:

(1) the anatomic localization of the lesion

(2) the neurologic completeness or incompleteness of the lesion

(3) whether lower urinary tract function is *balanced or unbalanced.*

Unbalanced signifies the presence of greater than **20% residual urine in a patient with a UMN lesion or 10% in a patient with an LMN** lesion

Hald-Bradley Classification (1982)

Hald-Bradley Classification
Suprasacral lesion
Suprasacral spinal lesion
Infrasacral lesion
Peripheral autonomic neuropathy
Muscular lesion

Urodynamic Classification (1984)

Urodynamic Classification
Detrusor Hyperreflexia (or Normoreflexia)
Coordinated sphincters
Striated sphincter dyssynergia
Smooth sphincter dyssynergia
Nonrelaxing smooth sphincter
Detrusor Areflexia
Coordinated sphincters
Nonrelaxing striated sphincter
Denervated striated sphincter
Nonrelaxing smooth sphincter

International Continence Society Classification (2002)

International Continence Society Classification

STORAGE PHASE	VOIDING PHASE
Bladder Function	**Bladder Function**
Detrusor activity	Detrusor activity
Normal or stable	Normal
Overactive	Underactive
Neurogenic	Acontractile
Idiopathic	Areflexic
Bladder sensation	**Urethral Function**
Normal	Normal
Increased or hypersensitive	Abnormal
Reduced or hyposensitive	Mechanical obstruction
Absent	Overactivity
Bladder capacity	Dysfunctional voiding
Normal	Detrusor sphincter dyssynergia
High	Non-relaxing urethral sphincter dysfunction
Low	
Urethral Function	
Normal closure mechanism	
Incompetent closure mechanism	

Neurogenic voiding dysfunction

Failure to store – Detrusor hyperreflexia

Urethral incompetence

Failure to empty – Detrusor areflexia

Bladder neck dysfunction, BPO, External sphincter dyssynergia

Combined failure to store and empty –

DESD, DHIC

Symptomatology of (1997-2002) Neurogenic Voiding dysfunction

	Urine retention	Incontinence	Frequency urgency	Dysuria	UTI
Intracranial Lesion (n=141)	43 (30.5%)	69 (48.9%)	41 (29.1%)	79 (56%)	58 (41.1%)
SCI (n=195)	44 (22.6%)	80 (41%)	16 (8.2%)	79 (39%)	103 (52.8%)
Cauda equina lesion (n=17)	4 (23.5%)	10 (58.8%)	4 (23.5%)	9 (52.9%)	4 (23.5%)
Peripheral neuropathy (n=57)	7 (12.3%)	31 (54.4%)	17 (29.8%)	36 (63.2%)	19 (33.3%)
DM (n=109)	36 (33%)	45 (41.3%)	35 (32.1%)	56 (51.4%)	63 (57.8%)

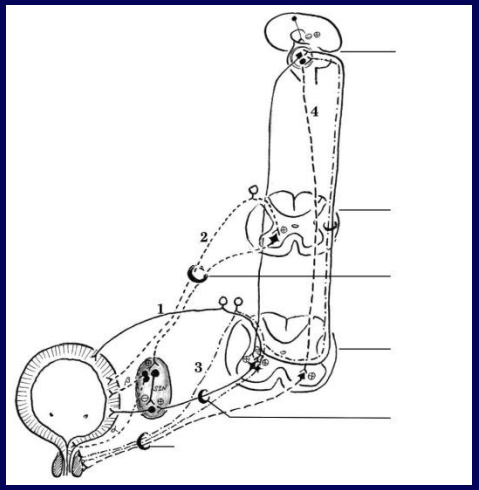
Complications of Neurogenic voiding dysfunction

- Urinary tract infection: APN, cystitis, prostatitis, epididymitis
- Renal function impairment: hydronephrosis, vesicoureteral reflux, renal scarring, ESRD

Priority of Management of Neurogenic voiding dysfunction

1. Preservation of renal function
2. Freedom of urinary tract infection
3. Efficient bladder empty
4. Freedom of indwelling catheter
5. Achievement of urinary continence
6. Patient’s will of management
7. Avoid medication after management

Normal Micturition



- Cortical arousal and initiation of voiding
- Normal detrusor contractility
- Normal cortical inhibition before voiding
- Patent bladder outlet and urethra
- Coordinated external sphincter during detrusor contraction
- Volitional contraction of sphincter and interruption of voiding

Treatment of NVD

- Based on pathophysiology of NVD
- Patient’s self-handling capability
- Family support
- Convenience of medical care
- Patient’s will of management

Management of NVD

Management of NVD following stroke and Intracranial disease

- Indwelling Foley catheter in initial stage
- Clean intermittent catheterization
- Urodynamic test after recovery of motor function
- Avoid bladder overdistention to 500ml
- Trocar cystostomy in male patients

Urinary tract symptoms in acute spinal cord injury

- Spinal shock stage: detrusor areflexia, complete anesthesia of fullness or voiding
- Recovery of micturition reflex gradually about 1-3 months after recovery of somatic reflexes
- Prolonged recovery of voiding reflex may be due to overdistension of the bladder after injury or complication

Chronic spinal cord injury and urinary tract dysfunction

- Autonomic dysreflexia – SCI above T5,6 (sympathetic nucleus)
- Detrusor external sphincter dyssynergia (DESD) – lesion above S2-4
- Detrusor hyperreflexia – complete or incomplete SCI above sacral cords
- Detrosor areflexia – sacral cord SCI or cauda equina lesions

Medical Treatment

- Increase detrusor muscle tone -- bethanechol
- Decrease detrusor hyperreflexia – oxybutynin, tolterodine, imipramine, vesicare, b3 agonist
- Decrease outlet resistance – alpha-adrenergic blocker, skeletal muscle relaxant, nitric oxide donors
- Increase outlet resistance – methylephedrine, imipramine

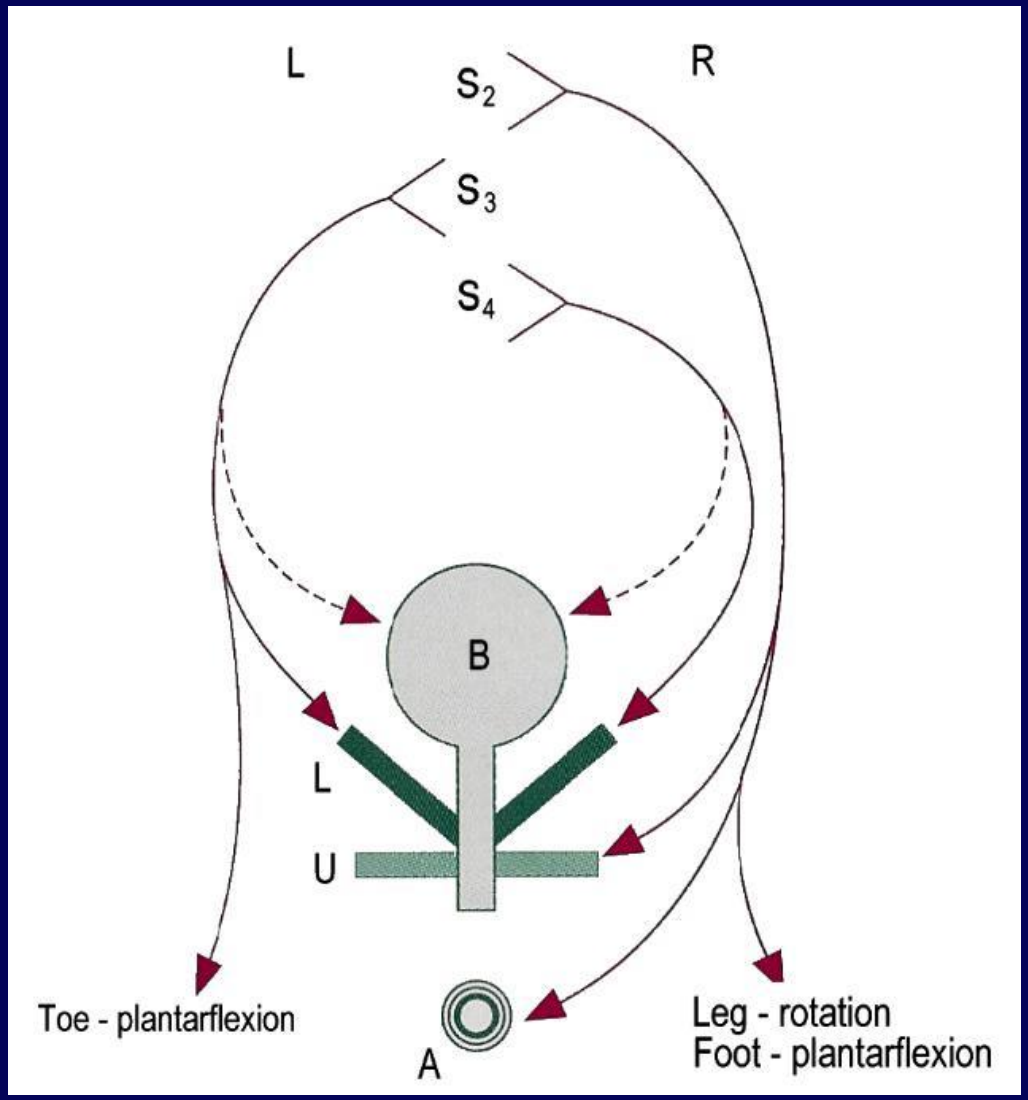
Detrusor leak-point pressure

- The intravesical pressure (detrusor pressure) at the end of filling or urinary incontinence
- A detrusor LPP of over 40cm water will endanger the upper tract
- Reduction of detrusor LPP can improve renal function, reduce the risk of UTI, decrease the degree of hydronephrosis, improve vesicoureteral reflux and restore continence

Electrostimulation and electromodulation for NVD

- **Sacral neuromodulation for treating neurogenic bladder dysfunction: 66.1% had more than 50% improvement on on urodynamic evaluation and bladder diary**
  - Neurourol Urodyn. 2011 Apr;30(4):547-50
- **Transcutaneous electrical nerve stimulation reduced UUI**
  - J Urol. 2009 Oct;182(4 Suppl):2072-8.
- **Transdermal amplitude-modulated signal (TAMS) reduced DO in SCI rats**
  - Can Urol Assoc J. 2012 Aug;6(4):227-30

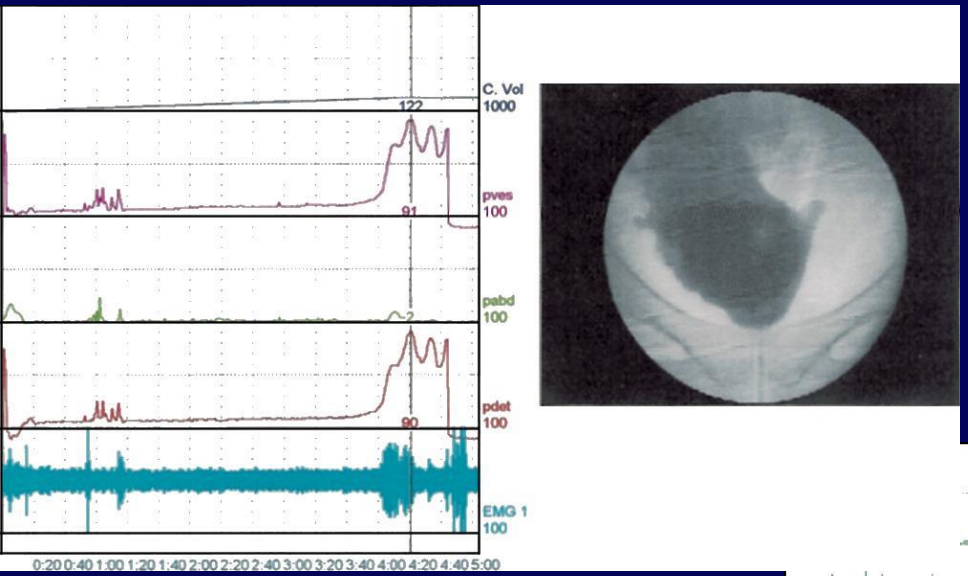
Correct placement of electrode on Sacral nerves

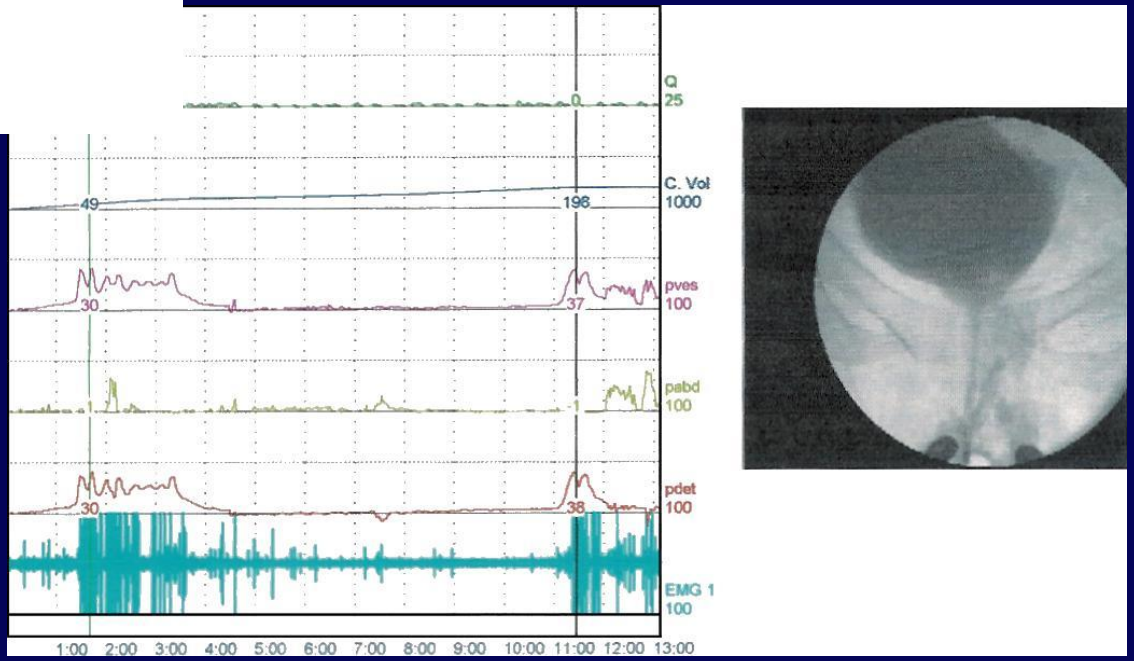


Intravesical therapy for DH

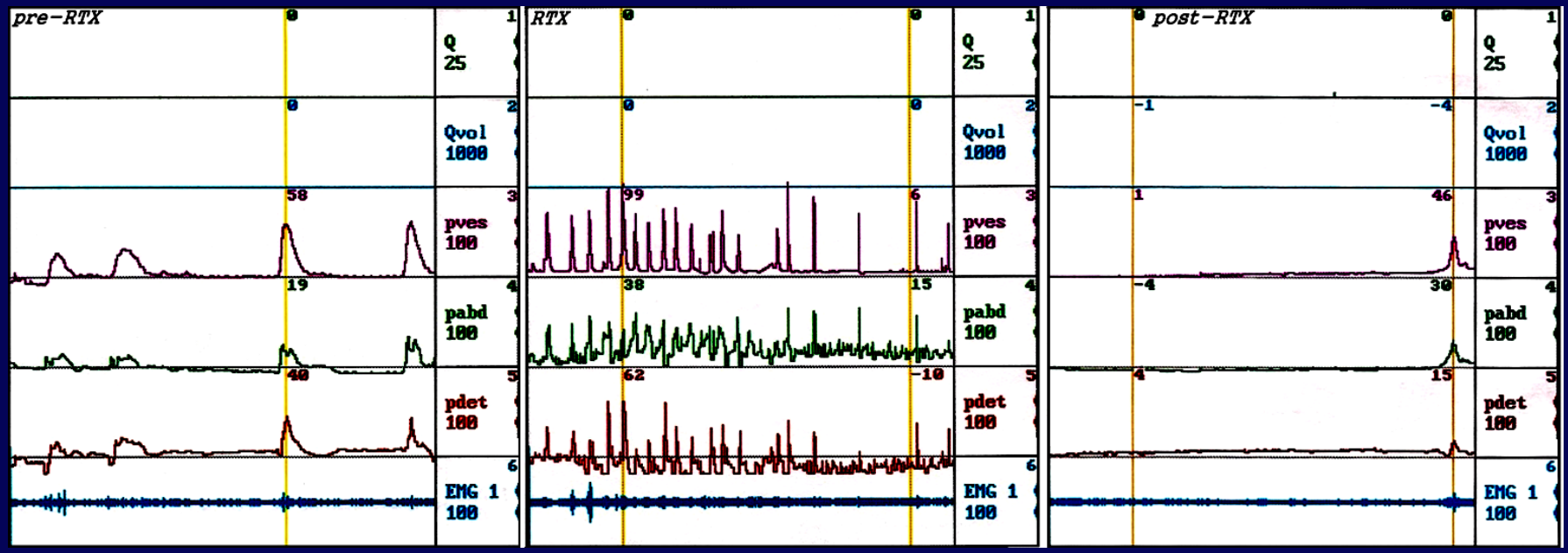
- Intravesical oxybutynin (ditropan)
- Resiniferatoxin therapy (10^{-6} ~ $^{-7}$M RTX)
- Detrusor injection of botulinum toxin – 200-300 IU Botox at 20-30 sites

Reduced voiding pressure after botulinum A toxin injection





Urodynamic results after RTX therapy in Neurogenic detrusor overactivity



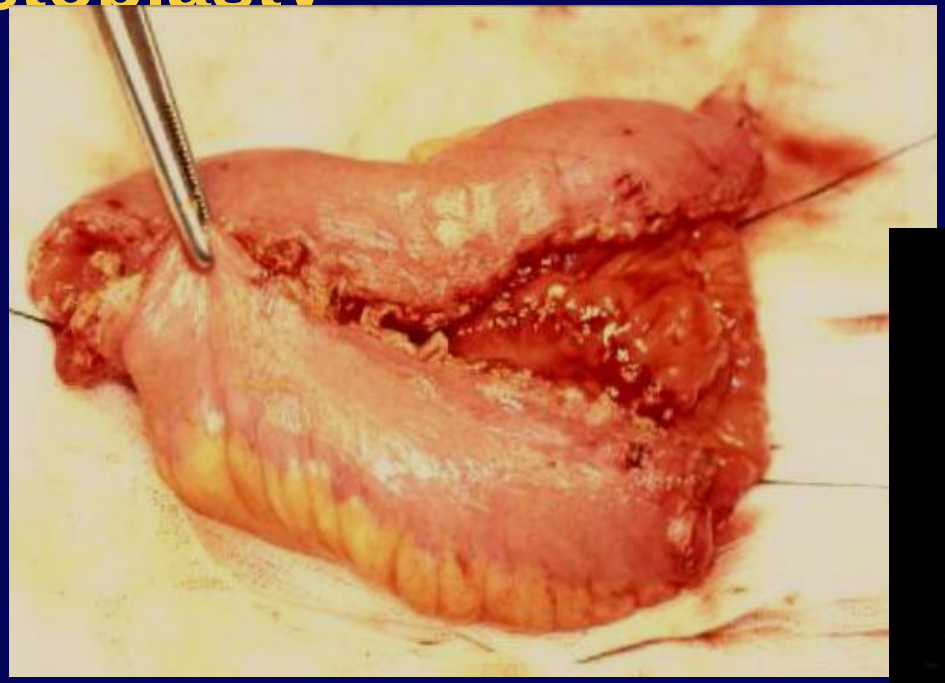
Treatment of neurogenic detrusor underactivity

- Search for bladder outlet obstruction & Peripheral neuropathy, especially in old women
- CISC or trocar cystostomy
- Urecholine & alpha-blocker
- Try nitric oxide donors to facilitate void
- Periurethral botulinum toxin injection 50- 100 units to avoid catheterization

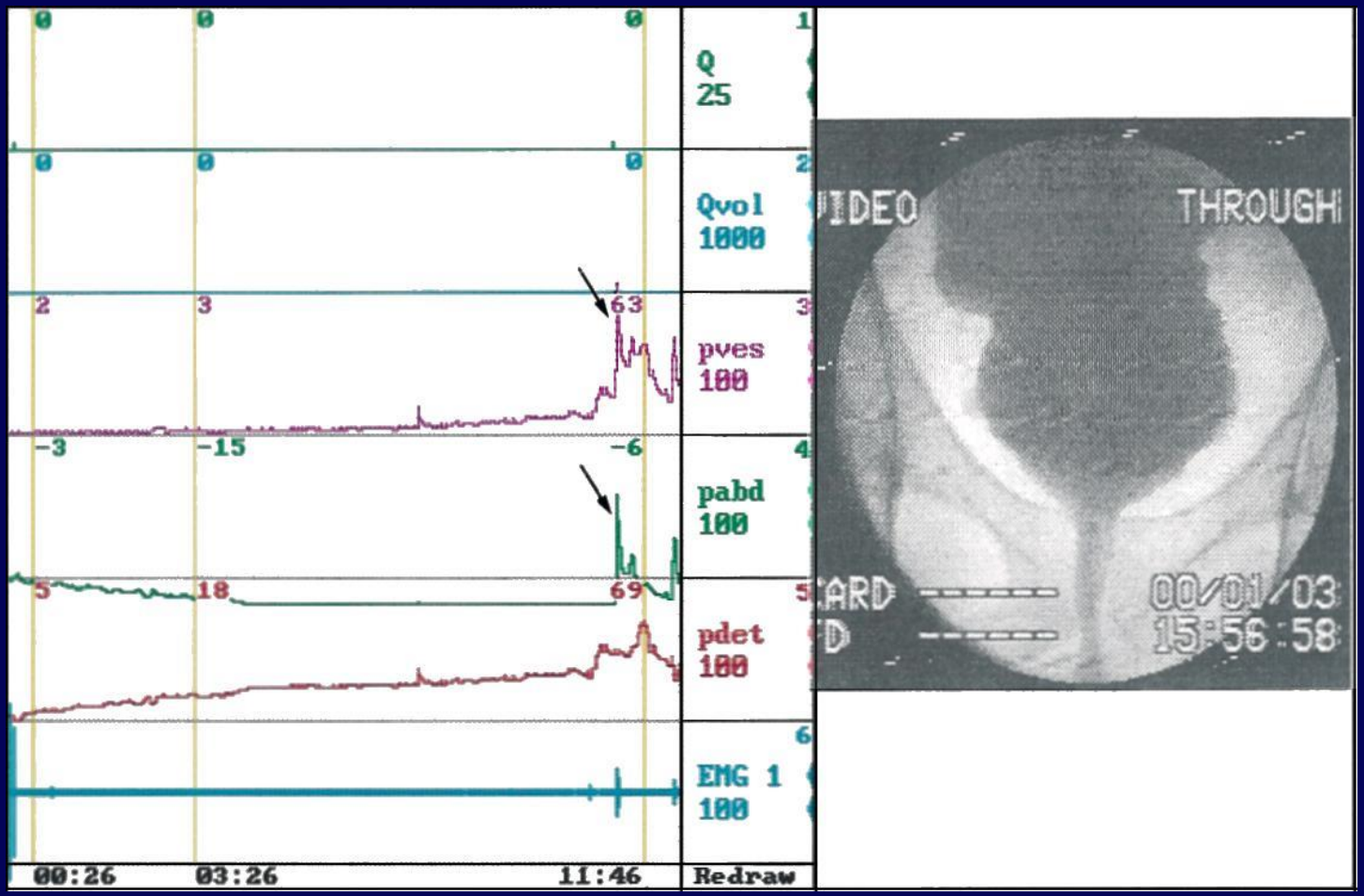
Surgical Treatment for Neurogenic Voiding Dysfunction

- Detrusor hyperreflexia –
- Augmentation cystoplasty
- Bladder autoaugmentation
- Sacral posterior root rhizotomy
- Detrusor areflexia –
- TUI-bladder neck, TUR-prostate
- External sphincterotomy
- Urethral stent

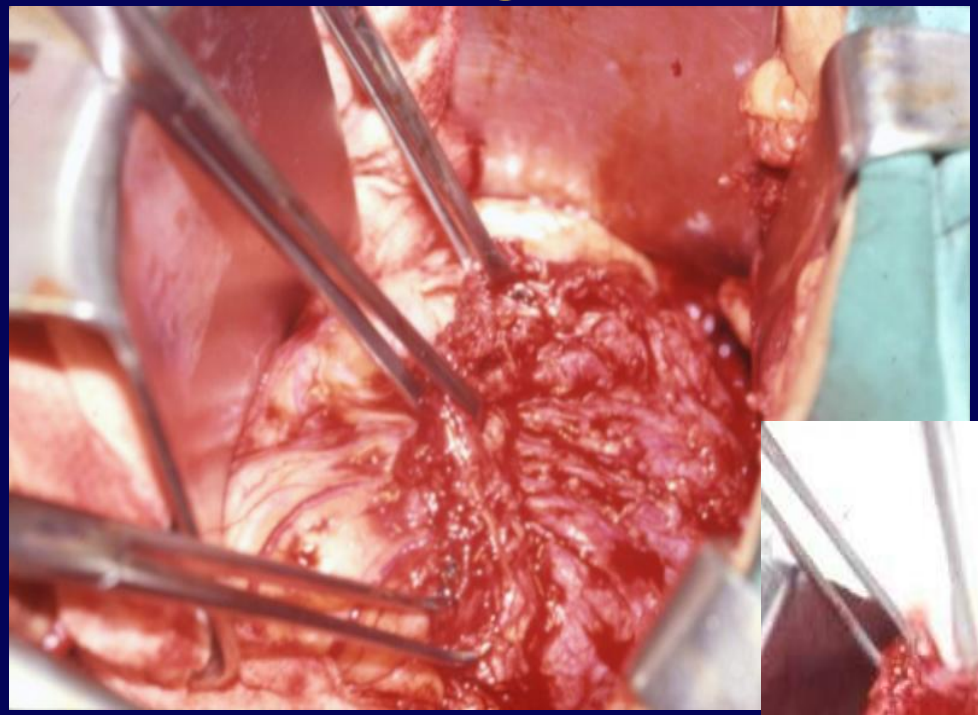
Surgical technique of augmentation cystoplasty



Abdominal straining to void after Enterocystoplasty

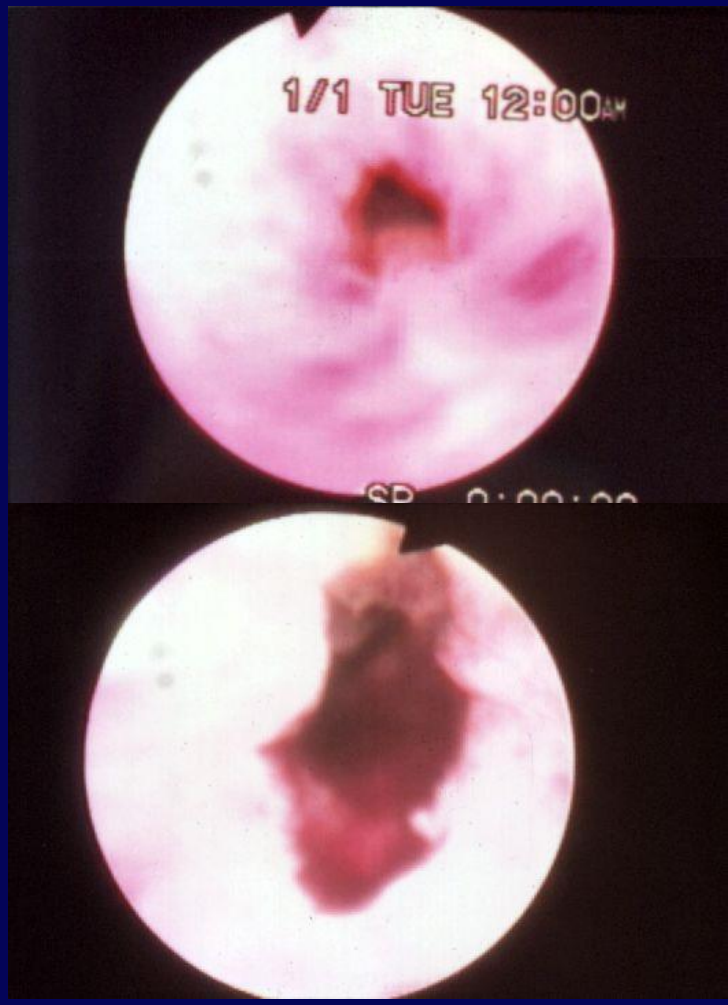


Bladder Autoaugmentation

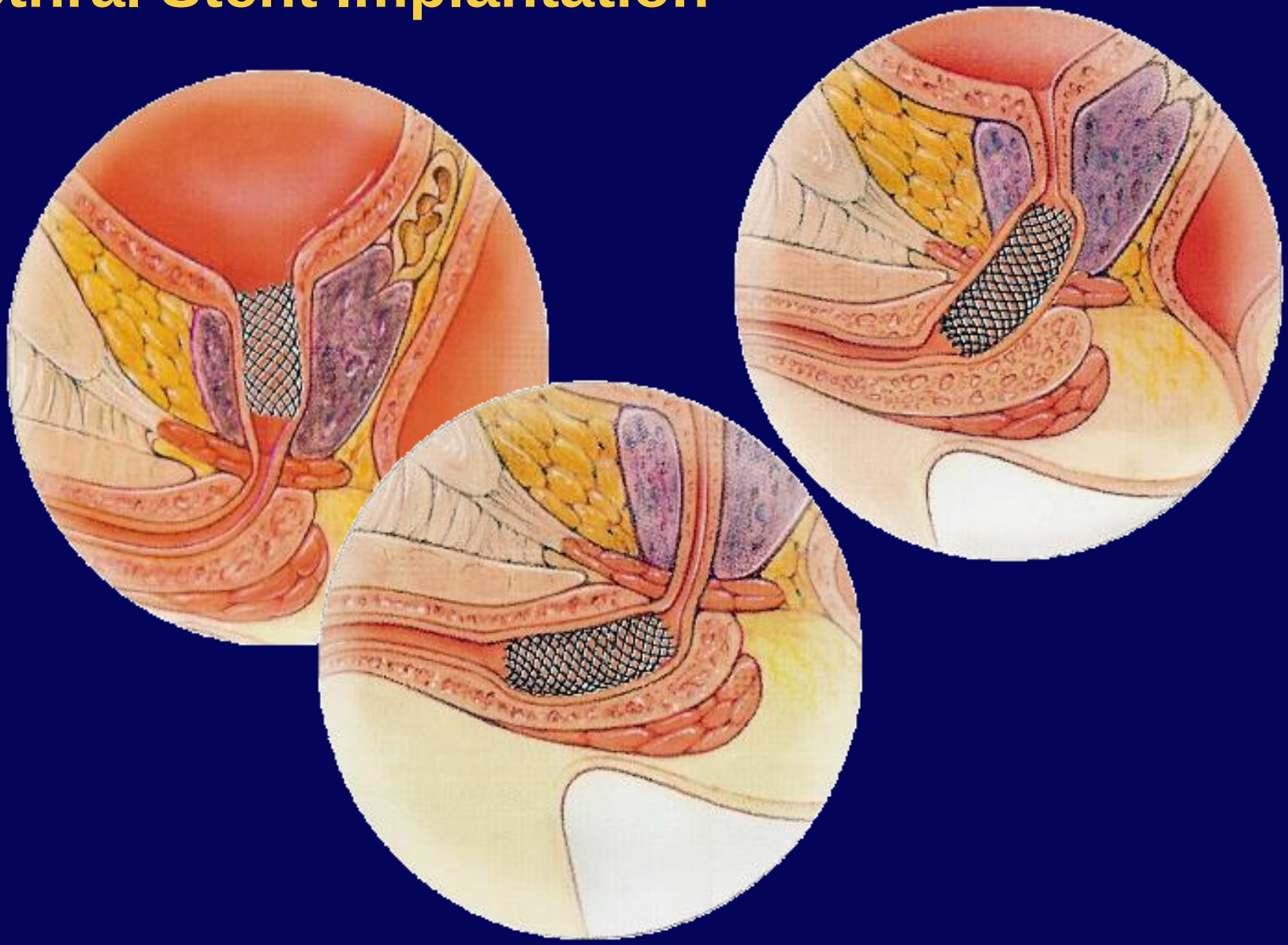


Technique of Sphincterotomy

12 o’clock position
Incision from BN to bulbous
Cutting deep to fat & vessel
Bleeding can be controlled
Avoid diffused coagulation
On Foley catheter for 2 days



Urethral Stent Implantation



Surgical procedures for Neurogenic urethral incontinence

- Pubovaginal sling procedure for women
- Periurethral collagen or Teflon injection for urethral sphincteric deficiency
- Artificial sphincter implantation
- Closure of bladder outlet and continent cystostomy using appendix or ileum

Considerations in management of neurogenic voiding dysfunction

- Lower urinary tract dysfunction changes with time
- Avoid overdistention and recurrent cystitis during recovery period
- Avoid unnecessary surgery
- Regular urodynamic follow-up and determine proper volume in CIC
- Do not abandon patients with NVD

Reasons to Change or Augment a Given Regimen

- Upper urinary tract deterioration
- Recurrent sepsis or fever of urinary tract origin
- Lower urinary tract deterioration
- Inadequate storage
- Inadequate emptying
- Inadequate control
- Unacceptable side effects
- Skin changes secondary to incontinence or collecting device

Thank You
for Your Attention