




## Perineal Electrophysiologic Tests

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### Perineal disorders and emg ...

- very frequent : women / men / old people / neurogenic and non neurogenic populations
- numerous and various : urinary, rectal, sexual symptoms ; pelvic pain. Often intricated +++
- secondary to : mechanical (urogynecological) or neurological alterations

### Storage and micturition, ano-rectal continence and sexual functions :

Pontine micturition center

- controlled by autonomic and somatic innervations
- sacral parasympathetic pathways : pelvic nerve ;
- thoraco-lumbar sympathetic pathways : hypogastric nerve ;
- sacral somatic pathways with pudendal nerve.

### Clinical evaluation

**Uro-gynecological evaluation**

### Neurological evaluation

### URODYNAMIC vs ELECTROMYOGRAPHY

UD : best way to precise pathophysiology of urinary symptoms

Water Column - Torricelli 1608-1647

## The different EMG tests : kinesiological and analytic EMG

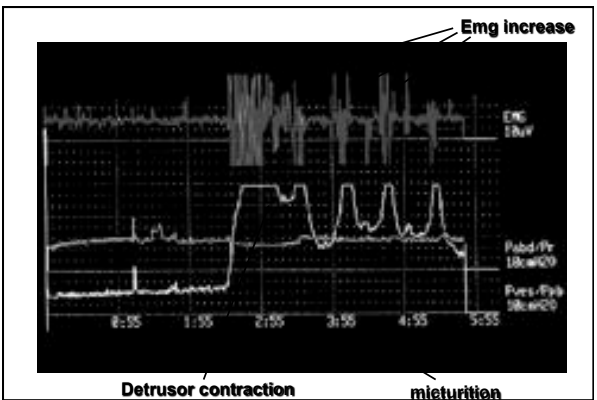
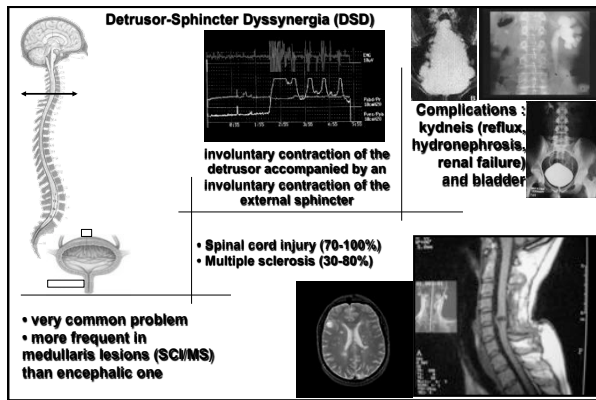
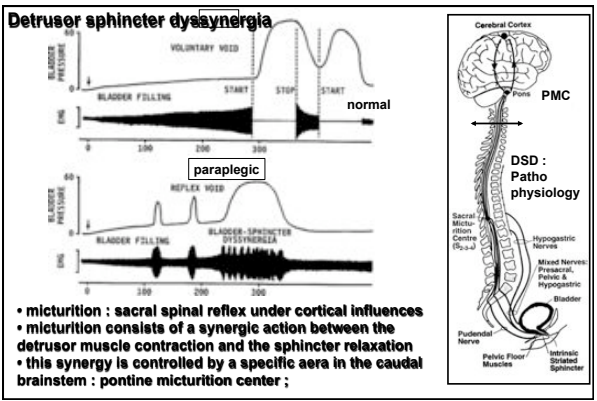
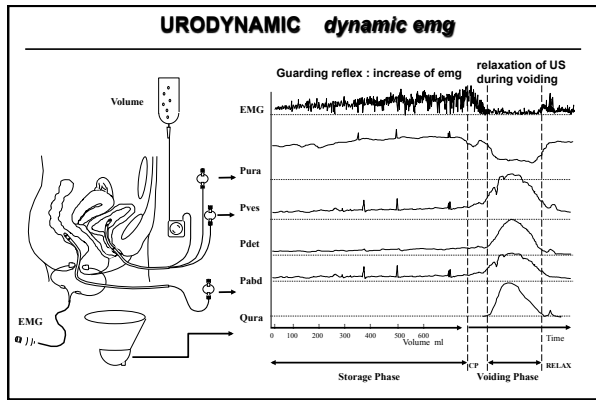
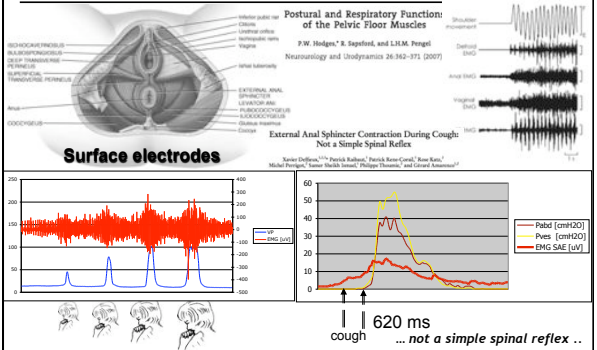
### • Kinesiological EMG :

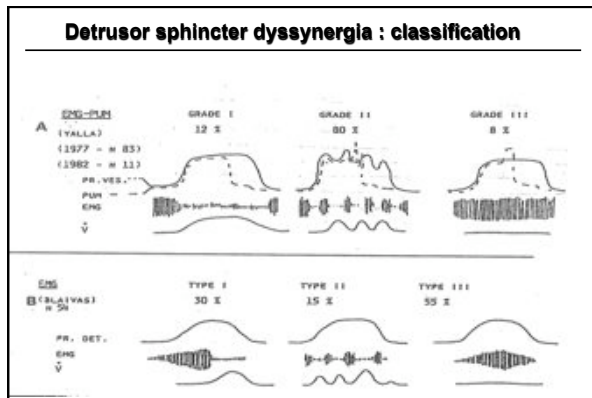
- to explore muscular activation patterns of pelvic floor research protocols ;
- study of detrusor sphincter dyssynergia during UD

• Analytic tests (electromyography, sacral evoked responses, pudendal nerve terminal motor latency, cortical evoked responses, sympathetic skin responses) to precise :

- diagnosis (and topography) of urinary, anorectal and sexual troubles ;
- prognosis of these troubles
- and ... forensic interest ...

## Kinesiological EMG : to explore activation patterns of pelvic floor

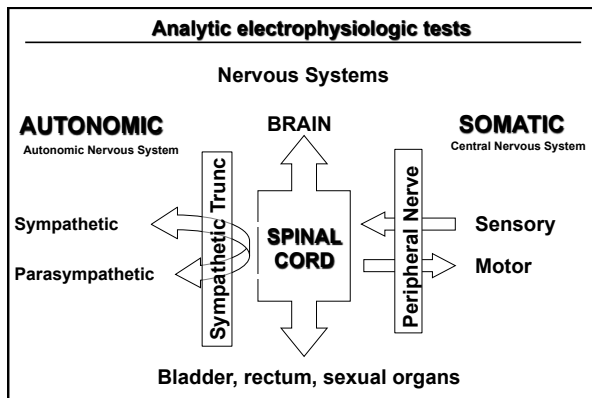




**Injection under cystoscopy**  
**Injection with emg guidance**

- 70 – 100 IU BOTOX®
- Diluted in 4 ml of 0.9% saline
- Schurch : 3 successive injections of 250 IU at 1 month

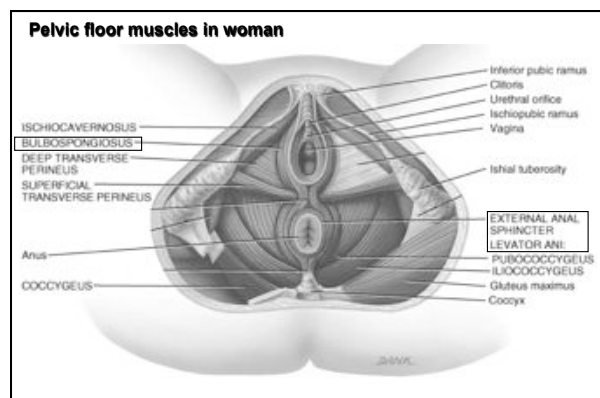
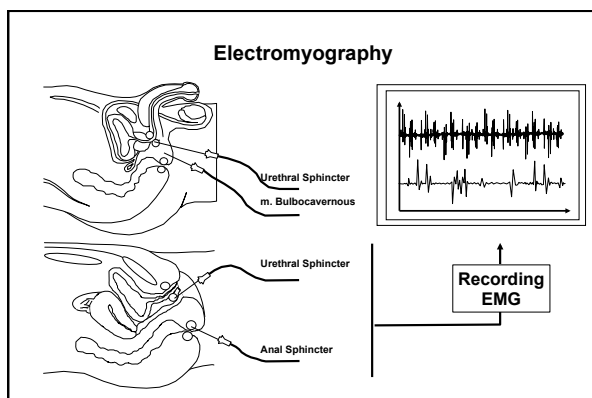
**Injection : transurethral or transperineal route**

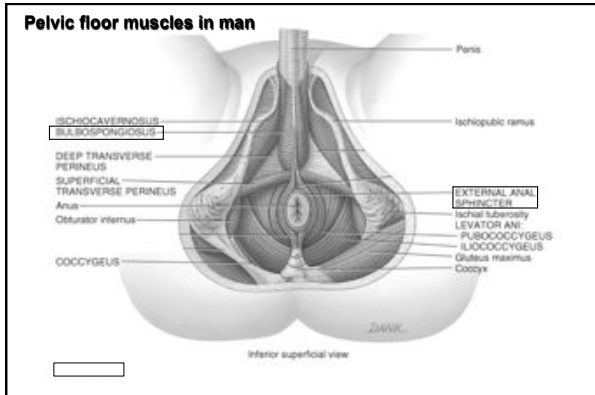


### electromyography

- The examination is conducted usually with a single use, disposable electrode.
- EMG is used to differentiate between normal, denervated, reinnervated, and myopathic muscle.
- Neurogenic changes may be attributable to injury at any level along the lower motor neuron supplying the external anal sphincter, extending from the sacral nerve roots to the small branches within the external sphincter.

The figure shows three EMG traces with scale bars of 100 ms, 20 ms, and 5 ms. The 5 ms trace shows a Motor Unit Potential (MUP). A diagram shows a Motor Unit (a single neuron) innervating a group of Striated Muscle fibers.





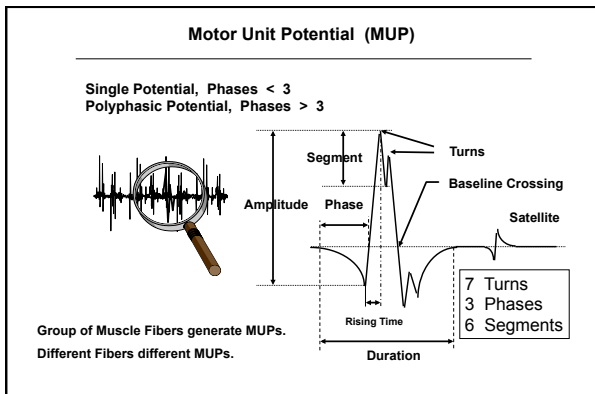
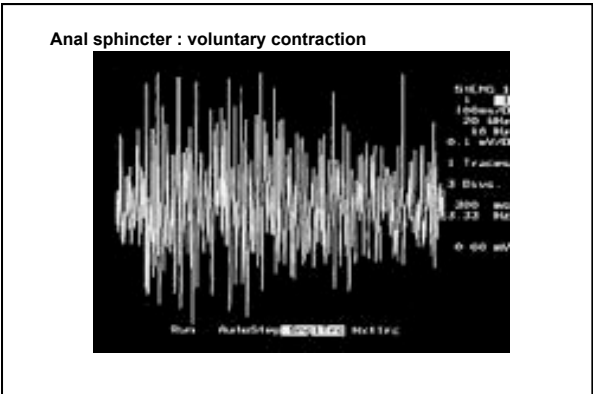
### Electromyography

- By analysing the interference pattern
- By analysing motor unit potentials (MUPs)

EMG can provide information on :

- Insertion activity
- abnormal spontaneous activity
- MUPs
- interference pattern

The amount of recruitable motor units during voluntary and reflex activation can also be estimated. Normally, MUPs should intermingle to produce an "interference" pattern on the oscilloscope during muscle contraction, and during a strong cough



### MUP Analysis

- Moderate Contraction
- Simple/Polyphasic Potentials Ratio
- Amplitude
- Duration

- 1 seconde EMG signal
- Concentric or Monopolar Needle
- Few sites in same muscle
- 20 measurements at diff. force
- Number of Turns > 100  $\mu V$
- Mean Amplitude of Turns

**Turns/Amplitude**

**Myopathy**  
Amplitude  $\uparrow$   
Turns  $\uparrow$

**Neuropathy**  
Amplitude  $\downarrow$   
Turns  $\downarrow$

A = Amplitude  
S = Segment

Change in signal direction = Turn  
Segment Amplitude > 100  $\mu V$

**Denervation - analysed in "relaxed" muscle**

Pathological spontaneous activity (fibrillation potentials, positive sharp waves) appear 2 - 3 weeks after the lesion.

**Pro:**  
Good Indicator of pathology

**Contra:**  
Difficult to identify in partial sphincter denervation -  
**Bulbocavernosus muscle!**

**Interest of emg in stress urinary incontinence**

Alteration of muscular component :  
- pudendal neuropathy  
- conus medullaris sd.

**Interest of emg in fecal incontinence**

Alteration of muscular component :  
- pudendal neuropathy  
- conus medullaris sd  
- diagnosis of neurogenic  
- prognosis for surgery

**Interest of emg in Parkinson disease**

denervation in anal/urethral sphincters

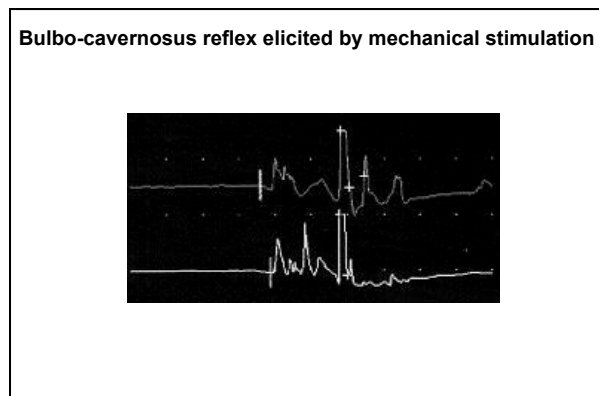
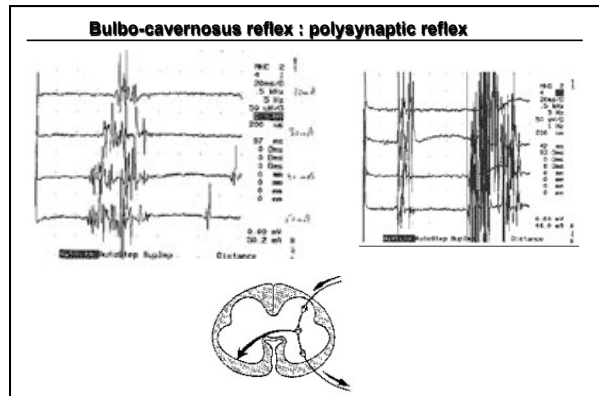
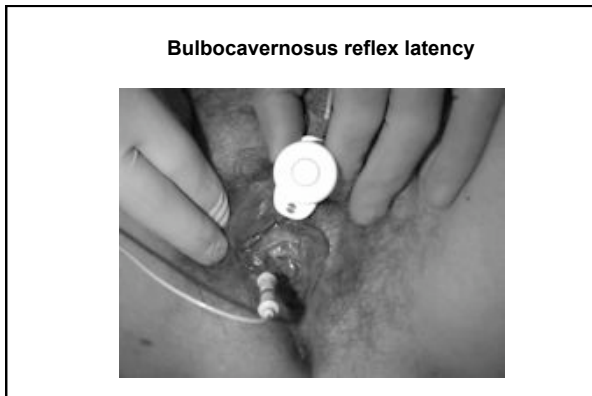
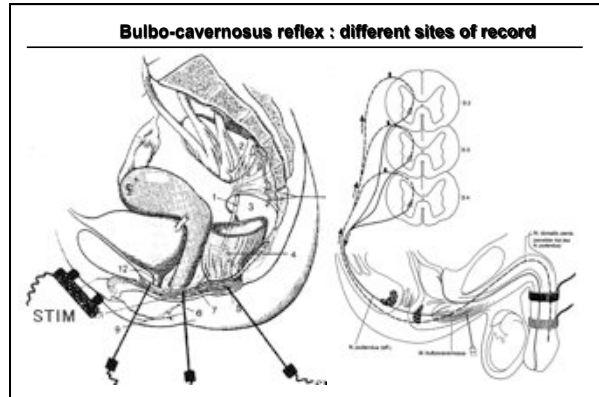
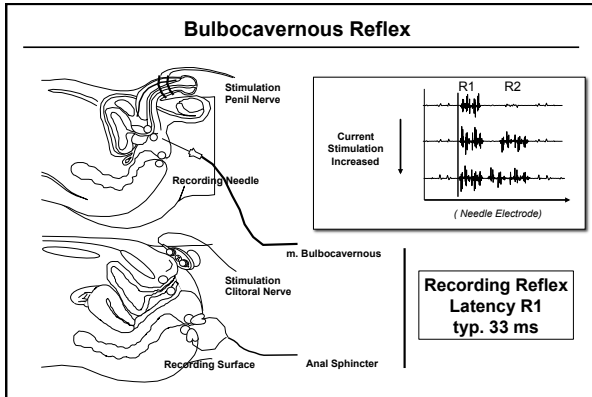
G. Wenning, I. Litvan and Coll., JNNP, 1999

**Interest of emg in C. Fowler syndrome**

Long-term results of sacral neuromodulation for women with urinary retention

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Access to publication on Nov 2006

**Pseudo-myotonic discharges in striated sphincter**



**Interest of bulbo-cavernosus reflex**

**Sacrum fracture**

**Sacral tumors Spinal tumors**

**Disk herniation**

- diagnosis  
- prognosis

**Pudendal nerve terminal motor latency**

**Stimulation of pudendal nerve**

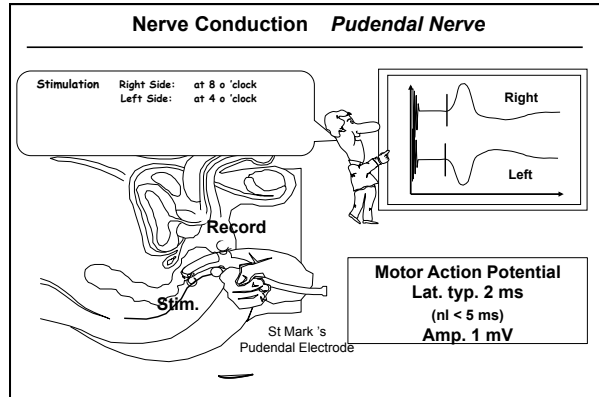
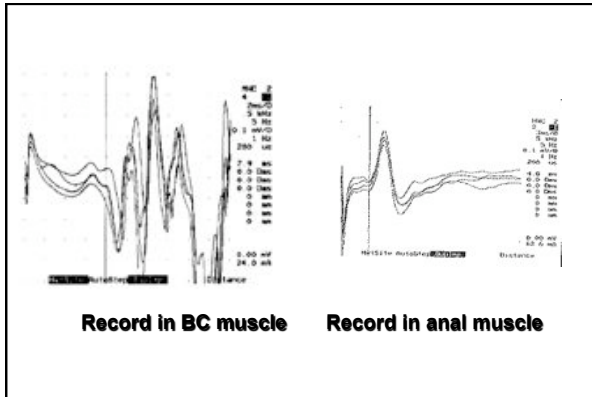
**Record : anus**

**St Marks electrode**

Ischial spine  
Pudendal n.  
Site of pudendal canal  
Obturator internus m.  
Dorsal n. of penis  
Deep transverse perineal m.  
Posterior scrotal n.  
Rectal n.  
Perineal n.  
Sacrospinous l.  
Sacrospinous f.

**Pelvis and Perineum Frontal Section**

Perineum  
Perineal pouch space  
Subperineal pouch space  
Superior fascia of pelvic diaphragm  
Inferior fascia of pelvic diaphragm  
Rectum  
Bladder  
Utricle  
Penis  
External anal sphincter muscle  
Rectus muscle  
Skin folds  
Obturator foramen  
Ligamentum line of tendons and muscle origin  
Obturator foramen in perineum  
Levator ani muscle  
Obturator internus muscle  
Pudendal canal (Dorsal)  
Internal pudendal vessels and nerves  
External anal sphincter muscle

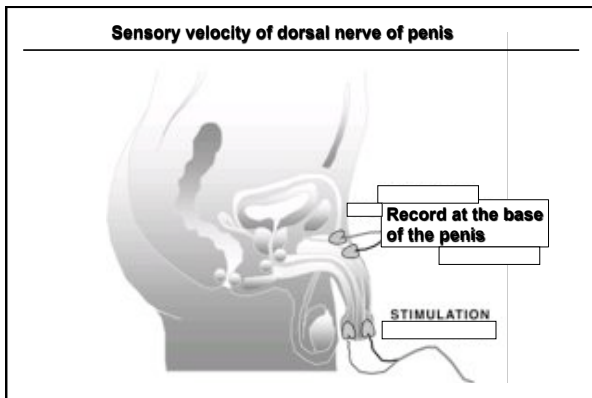


### Interest of pudendal nerve terminal motor latency

**ilio-inguinal nerve**      **pudendal nerve**      **ilio-hypogastric nerve**

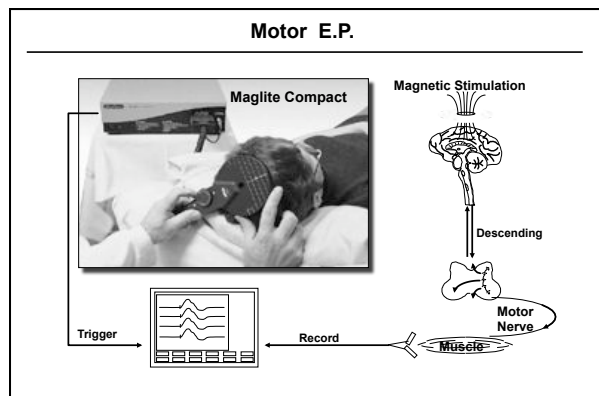
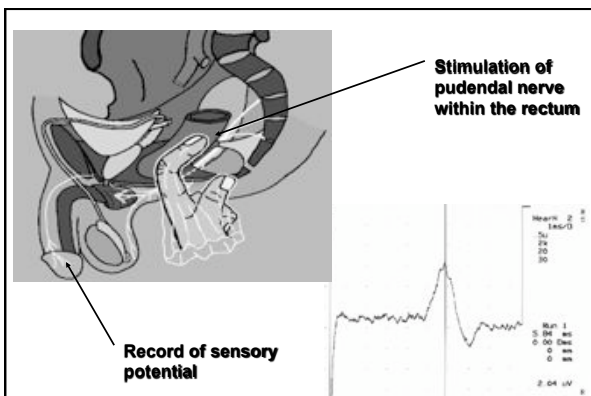
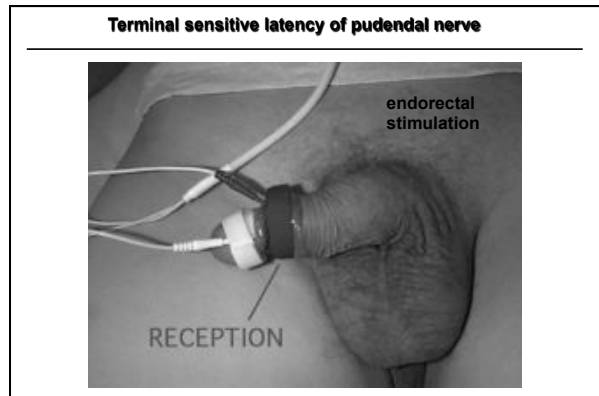
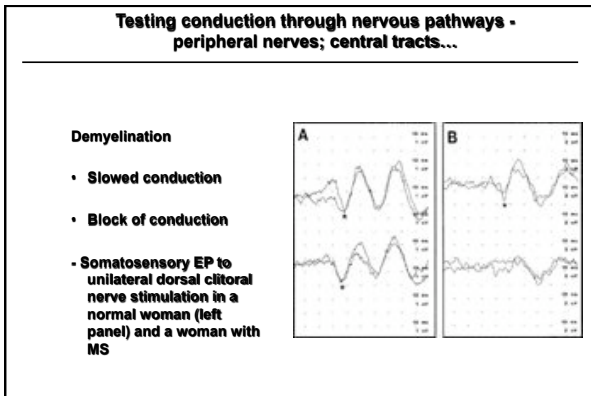
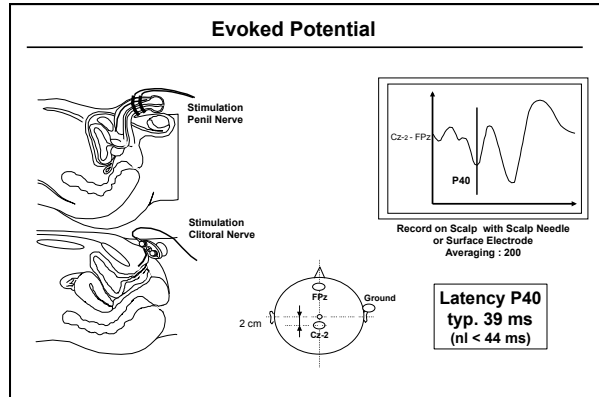
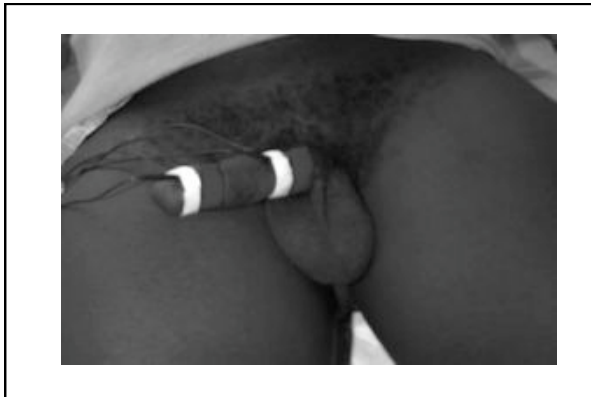
- reproducibility, sensitivity and specificity of the test are uncertain;
- interest = 0 in fecal and urinary incontinence.
- Real interest in pudendal neuralgia ?

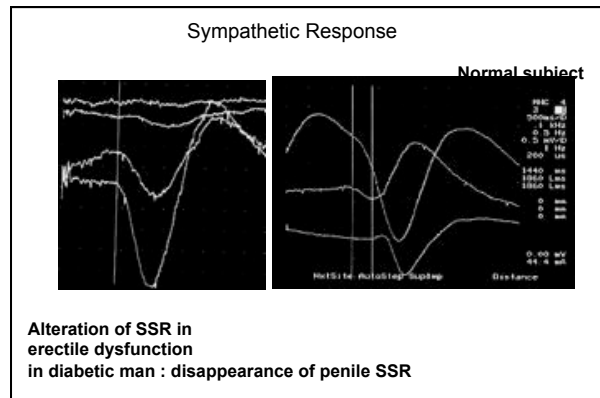
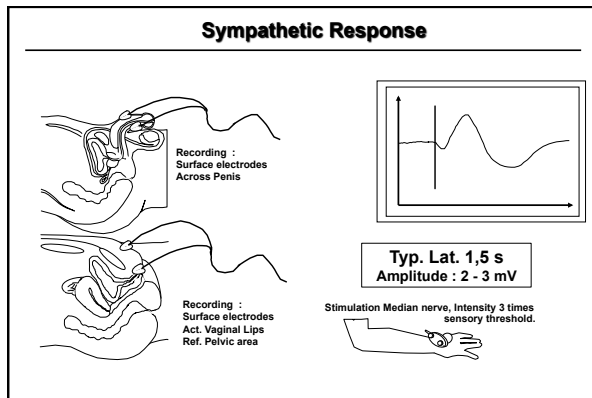
### Interest of PNTML in pudendal neuralgia



### Sensory velocity of dorsal nerve of penis







### Other electrophysiologic tests

- bladder and urethral sensory thresholds have been measured during electrical stimulation and mechanical traction on the trigone
- quantitative sensory testing (QST) of the urogenital system : vibration, temperature and electrical current (sensitivity and specificity not known)
- smooth muscle emg (detrusor, cavernosus m.) : technical problems
- cardiovascular autonomic function tests : heart rate variability : Valsalva, cold pressor test, 30/15, ...

### Conclusions

- importance of clinical evaluation
- role of urodynamic in urinary symptoms
- emg : somatic, motor/sensitive pathways
- difficult to analyse autonomic pathways
- helpful in diagnosis/prognosis
- further studies necessary to precise exact role