pelvic floor dysfunction (PFD)

- history
- symptoms
- previous treatment
- signs
- diary
- scores

which tests can be useful, and to find out what?
which therapy?

to define “sacral area” dysfunction from a neurophysiologic point of view
- sensory pathway
- motor pathway
- somatic/autonomic
- peripheral/central

usefulness of neurophysiologic investigation
- to clarify normal physiology / anatomy
- to diagnose individual patients: diagnostic purpose
- for intraoperative “mapping” and “monitoring”
- to assist in therapy with electrical stimulation
- to study pathophysiology of sacral dysfunction: research purpose

1- for diagnostic purpose
allows to:
1. to assess the functional status of “sacral area”,
2. to clarify the underlying pathophysiology of neurogenic sacral area dysfunction (bladder, bowel, sexual and pain of neurogenic origin), and
3. to define Residual Functional Potential (RFP).
“residual functional potential” refers to the substrate for the adaptive events in the central nervous system that occur to specific rehabilitation of impaired function.

“not only what is left but what can be modulated”

**aim of neurophysiologic investigation**
- lesion
  - site, side, degree
  - in/completeness
  - motor/sensory
  - somatic/autonomic
- residual functional potential
  - spinal/sovrasspinal
  - afferent/efferent pathway
- suggestion for Therapy

**perineal muscle CNEMG**

**EXTERNAL ANAL SPHINCTER**

Beck A (1930) Elektromyographische Untersuchungen am Sphincter ani. (Ein Beitrag zur Tonusfrage). Pflugers Arch, 224, 278-292


Levator ani
Bulbocavernosus
External urethral sphincter

**SACRAL REFLEXES**

bulbo-cavernosus R.
Dorsal nerve
BC muscle
level S3-S4

pudendus-anal R.
Dorsal nerve
EAS
level S3-S4

**Spinal reflexes**


**intrarectal stimulation of PN**

normal PNTML< 2ms

**Neurophysiologic Investigation of the Pelvic Floor in PBS/IC – S. Malaguti**
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**ESSIC 2008 Annual Meeting - Rome**

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**Somatosensory Evoked Potentials**
- Sacral SEPs
  - N. dorsal penis or clitoral
  - S2-S4 and central afferent pathway

**Sympathetic Skin Responses (SSR)**

**Perineal SSR**
- Colinergic mediated response

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**Magnetic Stimulation of the Sacral Roots**

To test the efferent motor pathway from sacral root to EAS, EUS or BC muscles.

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**2-as intraoperative guidance**
- To minimize neurological morbidity from operative manipulations
- And for its effectiveness in localizing anatomical structures, including peripheral nerves

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Intraoperative monitoring in SNS

With the introduction of the minimally invasive method to implant the definitive quadrupolar lead near S3, the motor and sensory responses can be recorded during the implant.

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Cortical latency (corresponds to cortical awareness)

To confirm a specific action on cortical site, we study SEPs before, during and after the implant.

SNS intra-operative monitoring

- Spinal SEPs: an afferent response (mean latency 8 msec)
- EAS EMG: a direct motor response (11 msec)
- A segmental reflex (38 msec)
- A late response polysegmental level (90 msec)

Out of 406 pts addressed to SNM (240 f, 166 m) 45 yrs. (12-80)
140 pts (34.48%) with Nphys baseline, intraoperative and mean f.u. 18 months evaluation: 92% stability results.
Chronic Pudendal Nerve Stimulation (CPNS)

- in attempt to stimulate pudendal nerve in a chronic setting we developed a method to implant the lead percutaneously under neurophysiological guidance
- among the indication for CPNS are neurogenic overactive bladder, constipation, erectile dysfunction


in pudendal neuralgia we use the same approach to the nerve and we deliver precisely to the target the therapy (steroids and anaesthetics)


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nociceptive flexion RIII reflex (NFR)

- RII (Aδ) short latency <80 msec (low threshold cutaneous fibers)
- RIII (A, C) long latency <150 msec (nociceptive impulses)

Sherrington, 1910

nociceptive flexion RIII reflex (NFR)

- electric stimulation of sural nerve with a train of 5 unipolar rectangular 1 ms pulses, with 200 Hz of rate, with intensity 1.2 times the subjective pain threshold
- recording from biceps femoris

(Walker 1977)
cold pressor test (CPT)

- painful heterotopic conditioning stimuli (thermal, mechanical or chemical) depress both the RIII reflex and the associated painful sensation for pain control mechanism

“pain inhibits pain effect”

- Cold Pressor Test effect depends on diffuse noxious inhibitory controls (DNIC) which modulate the spinal transmission of nociceptive signals
- not seen in tetraplegic patients

results in sensory LUTD

both N/OFQ and DNIC were able to modify the perception of pain

DNIC and N/OFQ use the same descending inhibitory pathways to control pain

BUT………..

- under normal conditions the N/OFQ modulation of the nociceptive reflex is not functionally active
- whereas in neurogenic LUTD the N/OFQ exert a tonic inhibitory modulation of the nociceptive reflex which is mediated by descending pathways
- the presence and the level of SCI seems to be a critical factor in N/OFQ modulation of nociceptive pathway
take home message

Neurophysiological tests in sacral area dysfunction can be useful tool to

1. select and address pts to therapy considering RFP (diagnostic purpose)
2. to localize peripheral nerves and assist with application of electrical stimulation and to guide application of drugs (intraoperative monitoring)
3. to increase the success rate and to verify the mechanism of action of new therapy (as a predictive factor)