

## **NEUROPHYSIOLOGICAL ASSESSMENT DURING SACRAL AND PUDENDAL NERVE LEAD IMPLANT FOR NEUROMODULATION**

### **Hypothesis / aims of study**

Neuromodulation is the chronic electrical stimulation applied to sacral roots (Sacral Neuromodulation: SNM) and pudendal nerve, to treat lower urinary tract, anorectal and sexual dysfunction.

We normally use neurophysiological diagnostic evaluation to select patients candidates to neuromodulation, to study the best parameters of stimulation and to monitor the success rate after implant. Moreover clinical neurophysiological tests have been introduced to assist with some particular interventions related to the sacral neuromuscular system (1).

However the introduction of the minimally invasive method to implant a quadripolar lead near the third sacral root (S3) for SNM allows the motor and sensory responses to be recorded during the implant.

Furthermore despite the fact that the therapeutic effects of inhibition of overactive detrusor contractions may be attained with external application of electrical stimulation in perineal area (2), we decided to attempt to stimulate pudendal nerve in a chronic setting implanting the lead percutaneously under neurophysiological guidance (Pudendal Percutaneous Implant: PPI).

Therefore we established an intraoperative acute neurophysiological monitoring of afferent and efferent responses during the tined lead implant for SNM and PPI to optimize the implant and to choose the best configuration of the stimulation leads.

### **Study design, materials and methods**

Three patients, complete urinary retention in 2 and pelvic pain in 1, were submitted to SNM with Sacral Percutaneous Implant monolateral in S3, first stage with tined lead.

Four patients, all suffering from neurogenic overactive bladder due to incomplete upper motor neuron lesion, were submitted to PPI with tined lead.

A neurophysiological assessment during S3 lead implant was performed, measuring the spinal SEPs recorded via subcutaneous electrodes placed over 10<sup>th</sup> –12<sup>th</sup> dorsal vertebrae and the motor response via an EMG needle placed on external anal sphincter (EAS).

For PPI an intrarectal stimulation with St. Mark Hospital electrode before the implant allowed to record via an EMG needle inserted on EAS a compound motor action potential (CMAP) of Pudendal nerve used as referential motor response.

By stimulating the introduction system and the lead for PPI during the placement of the device we evoked pudendal nerve CMAPs that we compared to the previous CMAP recorded in order to detect the right position of the lead.

The stimulation of S3 or the pudendal nerve was delivered by a custom made cable used to connect the neurodiagnostic equipment.

### **Results**

For SNM spinal SEPs mean latency was 8 msec; using EMG needle on EAS we recorded 3 responses: a response with mean latency of 8 ms, correspondent to a direct efferent response, a response with a mean latency of 41 msec consistent with a sacral reflex, and a long latency response of 81 msec of mean latency (expression of a polysegmental level).

For PPI in all pts it was possible to reproduce a CMAP resembling the referential Pudendal CMAP (mean latency of 2.8 msec).

The analysis of different responses (in amplitude and latency) evoked by the stimulation of the four leads of the SNM and PPI device, allowed to choose the parameters of stimulation for neuromodulation.

### **Interpretation of results**

The neurophysiological responses evoked during an implant of a mixed nerve such as a sacral root or pudendal nerve are consistent with the activation of both afferent and efferent fibers implying that the modulation of nervous pathways controlling Lower Urinary Tract is depending upon the setting of parameters of stimulation.

### **Concluding message**

Neurophysiological monitoring during implant of tined lead for SNM and PPI is mandatory either to optimize the implant and to allow to set up the best stimulation parameters.

This is a preliminary experience in which the synergic collaboration of expertise in different field can lead to optimisation of a therapy, and establishing the genuine so-called neuro-urology.

### **References**

1. Vodusek DB. Interventional neurophysiology of the sacral nervous system. Neurophysiol Clin 2001 ; 31 : 239-46
2. Vodusek DB, Light JK, Libby JM. Detrusor inhibition induced by stimulation of pudendal nerve afferents. Neurourol and Urodyn 1986; 5: 381–389