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THE ACUTE EFFECTS OF TRANSCUTANEOUS ELECTRICAL STIMULATION OF THE SACRAL DERMATOMES IN MULTIPLE SCLEROSIS PATIENTS WITH NEUROGENIC DETRUSOR OVERACTIVITY

Hypothesis / aims of study

Conditional transcutaneous electrical stimulation of the dorsal penile/clitoral nerve (DPN) has been shown to suppress detrusor contractions in patients with neurogenic detrusor overactivity [1][2]. However, the use of surface electrodes in the genital region may not be well tolerated and may cause hygienic problems. For this reason non-invasive S3 dermatomal stimulation may be a promising alternative [3]. The aim of this study was to compare the acute effects of DPN stimulation with stimulation of the sacral dermatomes in patients with Multiple Sclerosis (MS).

Study design, materials and methods

The study was approved by the local ethical committee, and informed consent was obtained from all patients. A total of 14 MS patients (8 M, 6 F) with low bladder capacity (< 300ml) and a recent urodynamic study showing detrusor overactivity incontinence participated in the study. Four successive slow fill cystometries (16 ml/min.) were carried out in each patient. The first and last filling served as control fillings where no stimulation was applied. In the second and third filling electrical stimulation of either the DPN or sacral dermatomes was applied automatically whenever the detrusor pressure exceeded 10 cmH_2O. Charge compensated 200 micro-second pulses with a repetition frequency of 20 Hz were used for DPN stimulation, while 500 micro-second pulses were used for stimulation of the sacral dermatomes. The stimulation amplitude was set at the maximum tolerable level for the patient under investigation, which was typically 50-60 mA in both cases. Self-adhesive round 32mm PALS stimulation electrodes were used for DPN stimulation and were placed on the dorsum penis or clitoris. For stimulation of the sacral dermatomes 4x6.4 cm oval electrodes were placed on the S2-S3 dermatomes.

Results

The control filling showed detrusor overactivity in 12 of the 14 patients. In 10 of the 12 patients one or more detrusor contractions could be inhibited with DPN stimulation resulting in an increase in bladder capacity. Electrical stimulation of the sacral dermatomes failed to suppress an ongoing detrusor contraction in any patient. Electrical stimulation was generally well tolerated and DPN stimulation resulted in an immediate suppression of urgency at the onset of stimulation, which was not the case with stimulation of the sacral dermatomes. Fig. 1 shows an example of the data recorded in a patient during the four repeated bladder fillings. The detrusor pressure and estimated bladder volume is shown at each point in time. During the first control session (without stimulation) three detrusor contractions occurred that all resulted in leakage. During the session with conditional DPN stimulation 11 detrusor contractions were successfully inhibited before stimulation was no longer effective and leakage eventually occurred. The first detrusor contraction occurred at a bladder volume of 114 ml in the stimulation session and the patient was continent until a bladder volume of 446 ml was reached (391% increase in bladder capacity).

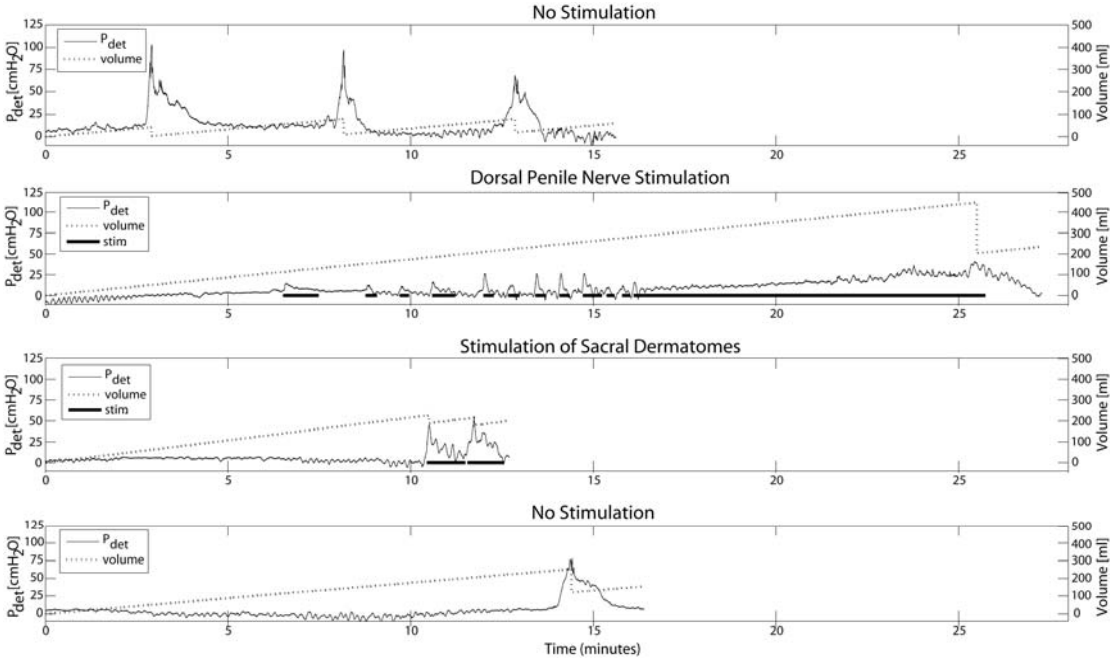

Figure 1: Detrusor pressure and estimated bladder volume during four repeated bladder fillings in a single patient with and without electrical stimulation applied to either the DPN or the sacral dermatomes.

Interpretation of results

This study reproduces the finding that DPN stimulation can be used for acute suppression of an ongoing detrusor contraction in patients with neurogenic detrusor overactivity [1][2]. Dorsal penile stimulation was found to increase bladder capacity and reduce the number of incontinence episodes in 10 of the 12 stimulated patients. In two patients however, no detrusor inhibition could be obtained with DPN stimulation, which was probably caused by low stimulation amplitude (20-30 mA) due to hypersensitivity to stimulation. A similar inhibitory effect as found with DPN stimulation could not be obtained with stimulation of the sacral dermatomes.

Concluding message

Although therapeutic effects may be present from stimulation of the S3 dermatomes, we were unable to demonstrate any acute effects during urodynamics. For this reason stimulation of the sacral dermatomes is not an alternative to DPN stimulation in a system that relies on the acute inhibition of an ongoing detrusor contraction. Implantable electrodes should be considered in such a system to avoid the disadvantages of using surface electrodes in the genital region.

1. The acute effects of continuous and conditional neuromodulation on the bladder in spinal cord injury. Spinal Cord 2001;39:420-428.
2. Electrical Stimulation on the dorsal penile/clitoral nerve as treatment to increase bladder capacity in spinal cord injured patients. Neurourol Urodyn 2003;22(2):130-7.
3. Non-invasive Antidromic Neurostimulation: a simple effective method for improving bladder storage. Neurourol Urodyn 2001 22:73-84.