

CONDITIONAL ELECTRICAL STIMULATION OF THE DORSAL PENILE/CLITORAL NERVE FOR MANAGEMENT OF NEUROGENIC DETRUSOR OVERACTIVITY IN MULTIPLE SCLEROSIS

Hypothesis / aims of study

Conditional electrical stimulation of pudendal afferents has been shown to suppress detrusor contractions in patients with neurogenic detrusor overactivity [1][2]. The aim of this study was to investigate whether the involuntary detrusor contractions could effectively be inhibited with event driven electrical stimulation, hereby increasing bladder capacity and reducing storage pressure in patients with Multiple Sclerosis (MS).

Study design, materials and methods

A total of 10 MS patients with low bladder capacity (< 300ml) and a recent urodynamic study showing detrusor overactivity incontinence participated in the study (6 M, 4 F). The patients were asked to discontinue any pharmacological treatment of NDO a week prior to the experiments.

Two natural bladder fillings were carried out in each patient starting with a control filling where no stimulation was applied. Intravesical and abdominal pressures were measured with a fluid-filled CH8 catheter and a rectal balloon catheter. The pressures were sampled at 20 Hz by a portable urodynamic monitoring device [3]. In the second filling automatic conditional stimulation of the dorsal penile/clitoral nerve was applied with surface electrodes whenever the detrusor pressure exceeded 10 cmH₂O. When enabled, charge compensated 200 μ s pulses were applied at 20 Hz at the maximum tolerable amplitude according to the subject under investigation, which was usually 1.5-2 times the threshold for evoking the bulbocavernosus reflex (50-60 mA).

Leaked urine was collected in a diaper and the volume was measured by weighing the diaper. Recording was terminated when leakage had occurred and subsequently the bladder was emptied in order to determine the residual volume. The increase in bladder capacity that could be obtained with electrical stimulation was determined from the volume at first successfully treated contraction and the volume at which leakage occurred. The bladder volume at each point in time was estimated by assuming a constant filling rate during the filling.

Results

The control filling showed detrusor overactivity in 8 of the 10 patients and in all cases the first untreated detrusor contraction resulted in leakage. In 7 of the 8 patients one or more detrusor contractions could be inhibited by stimulation. Fig. 1 shows an example of the data recorded in a female MS patient with and without conditional electrical stimulation during natural bladder filling. The detrusor pressure and estimated bladder volume is shown at each point in time. During the control session three detrusor contractions occurred that all resulted in leakage (Fig. 1A). During the session with conditional electrical stimulation 89 detrusor contractions were successfully inhibited before stimulation was no longer effective and leakage occurred (Fig. 1B). The first detrusor contraction occurred at a bladder volume of 63 ml in the stimulation session and the patient was continent until a bladder volume of 310 ml was reached. The time from first contraction until leakage was about 40 minutes.

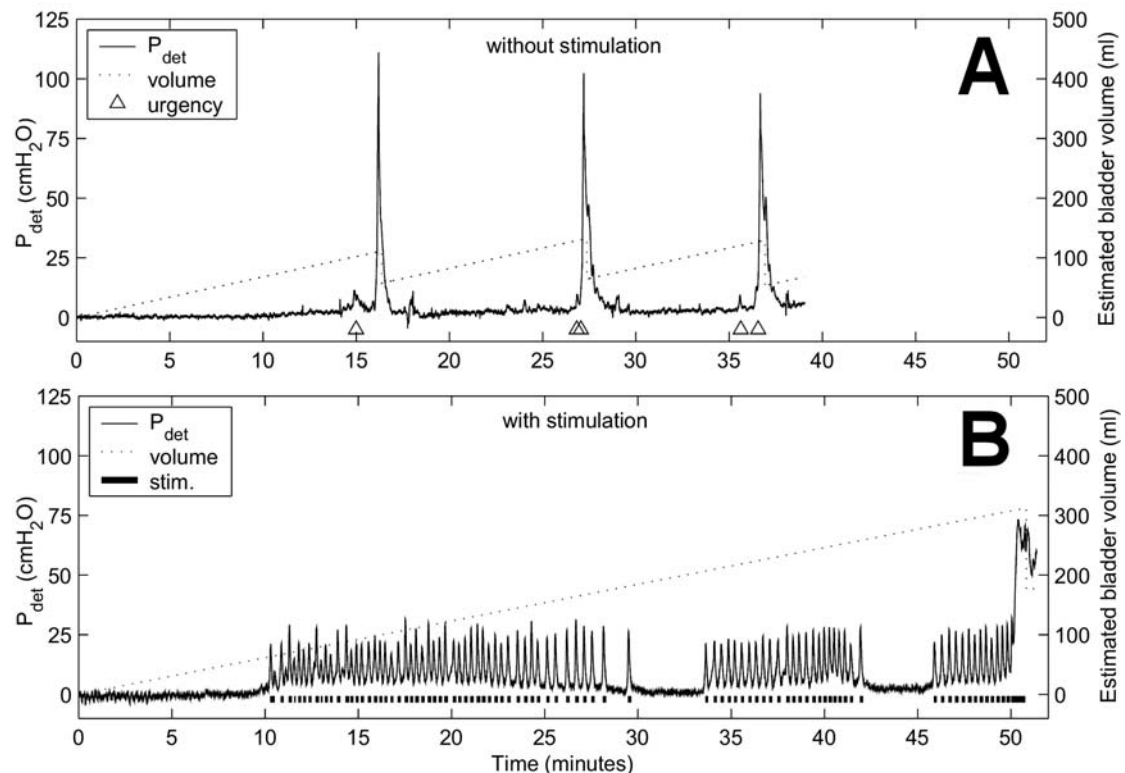


Figure 1: Detrusor pressure and estimated bladder volume during natural bladder filling with (B) and without (A) electrical stimulation.

In the 7 patients where bladder inhibition was demonstrated, the average increase in bladder volume from first suppressed detrusor contraction to leakage was 94% (range: 22-366%). In each patient an average of 12 detrusor contractions could be inhibited before leakage occurred. On average, the time from first suppressed contraction until leakage was 15 minutes and 50 s (range: 5 min. – 40 min.) with an average physiological filling rate of 8 ml/min. In all cases urgency was effectively suppressed at the onset of stimulation.

Interpretation of results

The results indicate that involuntary detrusor contractions in MS patients can effectively be inhibited with conditional stimulation, hereby improving bladder capacity and reducing the number of incontinence episodes. The fact that stimulation is applied may warn the patient that it is time to empty the bladder and bladder emptying can then be planned according to this. The average time of 15 minutes and 50 s from first contraction to leakage would probably suffice in most cases.

Concluding message

This study shows that the neurogenic overactive bladder can be inhibited using conditional dorsal penile/clitoral nerve stimulation hereby increasing bladder capacity and reducing the number of incontinence episodes in MS patients. Because the neurological symptoms of MS change over time together with the urological disorders, conditional electrical stimulation of pudendal afferents may prove to be a promising non-destructive treatment option that can be used to avoid or postpone destructive surgery.

References

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. A Portable Device for Experimental Treatment of Neurogenic Detrusor Overactivity. *Neuromodulation* 2003;6(3):158-165.

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