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CAN BLADDER SENSATIONS RECORDED DURING AMBULATORY URODYNAMICS BE USED FOR CONDITIONAL NERVE STIMULATION IN SPINAL CORD INJURY PATIENTS?

Hypothesis / aims of study

Conditional electrical stimulation for neurogenic detrusor overactivity has been studied using involuntary detrusor pressure rises as a trigger to start stimulation. Detrusor pressure rises were detected by transurethral and transanal catheters for bladder and abdominal pressure registration. The use of these catheters is not suitable in daily life. Some spinal cord injury patients with neurogenic bladder overactivity can sense bladder fullness or involuntary detrusor pressure rises by normal bladder sensations or non-specific bladder sensations, like abdominal fullness or vegetative symptoms.
We studied the usefulness of bladder sensations for conditional electrical stimulation in spinal cord injury patients with neurogenic bladder overactivity.

Study design, materials and methods

11 Spinal cord injury patients who were supposed to have neurogenic bladder overactivity underwent conventional cystometry. Conventional cystometry was performed at a filling rate of 20 ml/min with water at room temperature. The patients also underwent ambulatory urodynamics (six hours) with a portable recording device at the same day immediately after conventional cystometry. Patients were instructed to do normal daily activities and to operate the buttons at the ambulatory device for registration of event markers: “activity”, “(non-specific) bladder sensations”, “micturition/intermittent catheterisation” and “urinary incontinence”. The presence of detrusor pressure rises (DPR) of ≥10 cmH2O were defined as detrusor overactivity. The time duration of a detrusor pressure rise above 40 cmH2O was registered separately.

Results

We included nine male and two female spinal cord injury patients with a mean age of 38 years and a lesion level between cervical 3 and thoracic 10; 5 complete and 6 incomplete lesions.
Nine of the 11 patients reported the presence of bladder sensations in daily life, including non-specific sensations. Six patients reported sensations during ambulatory urodynamics. Patient two sensed 8 of 47 DPR with an event marker registered at a mean of 9.5 seconds after DPR onset. Patient nine noticed one of 25 DPR 12 seconds after DPR onset. Patient five had one sensation at 33 seconds after DPR onset and two bladder sensations prior to micturition not related to a DPR. Patient three and 11 only had bladder sensations prior to micturition not related to a DPR. Patient seven had continuous bladder sensations and anal discomfort after insertion of the catheters. Incontinence was not registered well enough by event markers, because some patients were unaware of the exact incontinence time point due to the use of a condom catheter.

Interpretation of results

Sensation of involuntary detrusor pressure rises in spinal cord lesion patients with neurogenic detrusor overactivity is observed in some patients. In patients with sensations, only a small number of sensations related to detrusor pressure rises were registered. Regarding the feasibility of the use of bladder sensations in spinal cord patients, it is questionable whether detrusor pressure rises are sensed and registered in time to start electrical stimulation in conditional stimulation. It was not possible to measure the reaction time between actual bladder sensation and pressing the operating button. However, the handling of the buttons for event markers was suboptimal. Patients were wearing the portable device underneath their shirts or in a pocket or handbag. This surely lengthened the reaction rate for operating the button. Other, more practical and user-friendly techniques for activation of electrical stimulation in conditional stimulation could be possibilities for the use of bladder sensations for conditional stimulation in the future.

Concluding message

Sensation of involuntary detrusor pressure rises in spinal cord lesion patients with neurogenic detrusor overactivity is possible. However, the detrusor pressure rise detection ratio by sensations is too small and reaction time too long for application of bladder sensations for activation of electrical stimulation in conditional stimulation. With technical changes the use of sensations may be possible in the future.

Patient	1	2	3	4	5	6	7	8	9	10	11
Lesion											
Level	C4	C3	T8	T10	C5	T8	T3	T4	T2	T6	C4
Complete	+	-	-	+	-	+	-	+	+	-	-
Symptoms											
Spontaneous micturition	-	-	+	-	+	-	+	-	-	-	+
Urinary incontinence	-	+	+	-	+	+	-	+	-	-	-
Sensations	+	+	+	-	+	-	+	-	+	-	+
Vegetative symptoms	+	-	-	-	-	-	-	+	-	+	-
Conventional urodynamics											
Detrusor overactivity	-	+	+	-	+	-	+	+	-	-	-
Mean maximum amplitude (cmH2O)	-	69	12.8	-	67	-	51	69	-	-	-
DPR>40 cmH2O	-	+	-	-	+	-	+	+	-	-	-
Incontinence	-	+	-	-	+	+	-	-	-	-	-
Sensations	-	+	+	-	+	+	+	+	+	+	+
Ambulatory urodynamics											
Detrusor overactivity	-	+	+	-	+	+	+	+	+	+	+
DPR frequency (/hour)	-	7.7	2.6	5.4	0.6	4.4	46	10.7	4.3	0.9	7.0
Mean maximum amplitude	-	57	23	15	37	19	66	24	28	22	39

(cmH2O)											
Mean DPR duration (s)	-	40	25	18	59	19	29	17	34	77	43
DPR≥10 cmH2O (%)*	-	8.5	1.8	-	1.1	2.3	37	5.2	4.0	1.9	8.3
DPR>40 cmH2O (%)*	-	2.0	<0.1	-	<0.1	-	6.4	0.7	<0.1	-	1.6
Incontinence	-	+	-	-	+	+	+	-	-	-	-
Sensations	-	+	+	-	+	-	+	-	+	-	+

* Ratio of total registration time.

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Is this a clinical trial?	**Yes**
Is this study registered in a public clinical trials registry?	**Yes**
Specify Name of Public Registry, Registration Number	**The Central Committee on Research Involving Human Subjects (CCMO)**
What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**Yes**
Specify Name of Ethics Committee	**Commissie Mensgebonden Onderzoek regio Arnhem-Nijmegen (Committee on Research Involving Human Subjects, district Arnhem-Nijmegen)**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**