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Title: QUANTITATIVE MEASUREMENT OF URINARY SENSORY FUNCTION ASSESSED BY CURRENT PERCEPTION THRESHOLD IN THE BLADDER USING A NEUROMETER

Aims of Study

Decreasing afferent input peripherally would be an ideal treatment for sensory urgency and for detrusor instability or hyperreflexia. Capsaicin-sensitive afferent nerves exist in the human bladder and become functionally significant in the detrusor hyperreflexia. Differences in distribution of sensory nerve fibers could determine the therapeutic strategy for neurogenic bladder. However, the diagnostic technology for lower urinary tract dysfunction has mostly concentrated on the motor function of the detrusor and the sphincter, and so far the measurement of bladder sensory function has been difficult. The Neurometer (Neurotron Inc, Baltimore, USA) is a computerized automated neuro-diagnostic device that can measure peripheral sensory function quantitatively with micro-electronic stimulation of three different types of sensory peripheral nerve fibers, including A β , A δ , and C fibers, selectively using frequencies of 2000, 250, and 5Hz, respectively. For reasons of the selectivity of stimuli, reproducibility on various skin conditions, and ease of handling, this device has been reported to be appropriate for quantitative estimation of peripheral sensory nerve function (1). Here we report our initial experience in applying this new device for quantitative bladder sensory assessment to measure the current perception threshold (CPT) in the bladder using a special intravesical electrode.

Methods

In 33 patients, conventional urodynamic study including cystometry and ice water test (if necessary) as well as the measurement of CPT values in the bladder, was performed with patients in the supine position. CPT values were measured using a neurometer (Neuroton, Baltimore, MD), which emits graded alternating current stimuli at 2000, 250, and 5 Hz at digitally calibrated levels from 0 to 10 mA. The current output of the generator is maintained continuously by a feedback circuit during the procedure, so that alterations in resistance of object are automatically compensated for. CPT values at frequencies of 2000, 250, and 5Hz were determined on the skin of left index finger as well as on the bladder wall using an intravesical electrophysiology catheter (5 French size, fixed curve) (Cordis Webster Inc, Baldwin Park, CA). At each frequency the current was increased until the patient could perceive a sensation. The details of the Neurometer operating manual have been reported previously (2,3). Attachment of the electrode tip on the bladder wall was confirmed using trans-abdominal ultrasound. The measurement of the minimum threshold for perception was performed at least three points, of which the average was determined as a CPT value in the bladder.

Results

Like the determination of CPT values on the skin, the CPT values in the bladder were able to be determined using the device in all patients but three who had no sensation as a result of complete spinal injury. In normoactive bladders, the bladder CPT values were approximately half of CPT values on the skin of the index finger. In the 6 patients with detrusor hyperreflexia due to incomplete cervical or thoracic spinal diseases, the bladder CPT value (4.7 ± 3.1) at 5Hz was significantly lower ($p<0.01$) than that in the normoactive bladder (43.7 ± 31.5) diagnosed by the presence of uninhibited contraction and/or positive ice-

water test, which could suggest hypersensitivity caused by abundant C-afferent fibers. In the neurogenic bladder determined to be underactive (n=11, including post pelvic surgery and diabetic patients), the relatively higher CPT values at three kinds of stimuli (181.5 ± 105.9 , 86.4 ± 47.3 , 98.0 ± 97.1) might suggest hyposensitivity compared to those in the normoactive bladder (143.4 ± 84.7 , 58.2 ± 50.2 , 43.7 ± 31.5).

Conclusions

Quantitative measurement of CPT values could be successfully assessed in the human bladder using this device. The quantitative estimation of three different types of sensory peripheral nerve fibers ($A\beta$, $A\delta$, and C fibers) in the bladder might contribute to appropriate selection of therapeutic strategy in individual patients with neurogenic bladders. Further study is necessary for the clinical use of bladder CPT values as a tool for monitoring therapeutic responses or assessing the severity of diseases.

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8. J Occup Med 28: 1219, 1986
- (3) Arch Phys Med Rehabil 68: 210, 1987