

## CURRENT PERCEPTION THRESHOLDS OF PERINEAL AFFERENTS IN WOMEN WITH LOWER URINARY TRACT SYMPTOMS

### Hypothesis / aims of study

The sensory function of the lower urinary tract (LUT) is essential for its voluntary control and is mediated by the various peripheral nerves and spinal cord pathways to different brain areas. Increasing evidence suggests that alterations in afferent signaling in the LUT may have a crucial role in various LUT disorders, including overactive bladder (OAB) and urinary incontinence. The afferent components of these nerves consist of myelinated (A $\delta$  and A $\beta$ ) and unmyelinated (C) axons. The A $\delta$ -fibres respond to passive distension and active contraction and thus convey information about bladder filling. The "silent" C-fibres are insensitive to bladder filling under physiological conditions and respond primarily to noxious stimuli. Sensory input from the bladder neck and the urethra is partially carried in the pudendal nerve and its motor component is essential as a compensation mechanism in voluntary micturition control. Pudendal sensory dysfunction may therefore contribute to the pathogenesis of lower urinary tract symptoms (LUTS). Bladder filling sensations during urodynamic investigation can provide valuable information on filling-related sensory function whereas current perception thresholds (CPT) are testing theoretically selectively measures and quantify responses of different size afferent nerves. The neuroselectivity of CPT testing for the three different afferent fiber types has been demonstrated in neuropathies with good agreement compared to nerve conduction studies. No study has assessed perineal afferent sensation in women with LUTS. Our aim was to measure CPTs of the vulval area in patients who underwent urodynamics. Our study evaluated the intra-rater reliability of two test series and compared our results to normative current perception thresholds (CPTs) at different frequencies.

### Study design, materials and methods

Women with LUTS were recruited via the Outpatient Clinic of a tertiary referral hospital and referred for Urodynamic testing of their condition. The participants were asked to complete the King's Health Questionnaire (KHQ). Prior to cystometry, all volunteers underwent an evaluation using a Neurometer (Neurotron, Inc., Baltimore, MD). It delivers a bipolar, constant current electrical wave stimuli at three different frequencies, 2,000, 250, and 5 Hz which are thought to specifically depolarize the three types of sensory fibers, the large myelinated A $\beta$ , small myelinated A $\delta$ , and small unmyelinated C fibres respectively. Skin electrodes (Disposable Electrodes with Greenscan Ultraschall gel) were used and placed at the level of the labia majora with one electrode lateral of the clitoris. We compared our results to previously published normative data for pudendal nerve CPTs (2000 Hz: 224.8  $\mu$ A, 250Hz: 105.8  $\mu$ A; 5 Hz: 84.2  $\mu$ A). Lower CPTs were considered to be hyperesthetic and higher values hypoesthetic. Agreement between the two retest series was assessed using a two-way mixed-effects intra-class correlation (ICC) to determine intra-rater reliability. We performed a one sample t-test to demonstrate a difference between measured CPTs and normative values and subgroup analyses for patients with OAB, urodynamic stress incontinence (USI), detrusor overactivity (DO) and bladder pain syndrome (BPS).

### Results

50 women participated in our study. Their mean age was 51 years (SD 14) and median bladder impact score on the KHQ was 4 which was correlated with "a lot" of impact in the questionnaire's text. 86% (n=43) had OAB symptoms, 66% (n=33) had urodynamic stress incontinence (USI), 40% (n=20) had urodynamically proven DO and 18% (n=9) presented with bladder pain. Intra-rater reliability was very good at 5Hz (ICC 0.960; 95% confidence interval [CI] 0.931-0.977), 250Hz (ICC 0.956; 95% CI 0.924-0.975) and 2000Hz (ICC 0.954; 95% CI 0.920-0.974). In the overall cohort, LUTS women had CPTs which were significantly higher than normative values at 5 Hz (p<0.001), at 250 Hz (p=0.021) and at 2000 Hz (p=0.018). In OAB patients, perineal CPTs were significantly higher than normative values at 5 Hz (p=0.003) and at 2000 Hz (p=0.031). In USI patients perineal CPTs were significantly higher than normative values at 5 Hz (p=0.006), at 250 Hz (p=0.026) and at 2000 Hz (p<0.001). In DO women perineal CPTs were significantly higher than normative values at 5 Hz (p=0.002), at 250 Hz (p=0.027) and at 2000 Hz (p<0.001).

### Interpretation of results

We were able to confirm strong intra-rater reliability when using the Neurometer for the measurement of perineal CPTs, which was superior to the findings in previous studies. Our results suggest that the afferent sacral nerve root sensory thresholds of women suffering from LUTS, OAB, USI and DO are hypoesthetic compared to a healthy population. The affected women may therefore experience a reduction in the compensatory mechanism of the pudendal pathway which may be at the origin or triggering concomitant LUTS.

### Concluding message

This is the first study of the perineal sensory thresholds in women with LUTS using the Neurometer, which is a reliable tool for the assessment of CPTs in women presenting with LUTS. There is an abnormality in the sensory thresholds of the perineal afferent nerves of women with LUTS. Its use may help diagnosing concomitant pudendal neuropathies in order to better targeting patient's treatment. However, further studies are needed to confirm our findings and to better understand the role of the pudendal pathway in the pathophysiology of LUTS.

**Table : Comparison of Current Perception Thresholds of the perineal area between LUTS patients and healthy individuals**

	Perineal CPTs 5 Hz mean (SD)	Perineal CPTs 250 Hz mean (SD)	Perineal CPTs 2000 Hz mean (SD)
Overall cohort (n=50)	118.31 (64.51) (p≤0.001)*	122.98 (50.00) (p=0.021)*	378.68 (442.69) (p=0.018)*
Patients with Overactive Bladder Syndrome (n=43)	112.08 (58.67) (p=0.003)*	120.59 (52.50) (p=0.072)*	386.65 (474.61) (p=0.031)*
Patients with Stress Urinary Incontinence (n= 33)	125.30 (71.44) (p=0.002)*	127.67 (54.13) (p=0.027)*	316.82 (107.56) (p≤0.001)*
Patients with Detrusor Overactivity (n=20)	126.12 (60.49) (p=0.006)*	135.85 (55.86) (p=0.026)*	323.60 (87.53) (p≤0.001)*
Patients with Bladder Pain Syndrome (n=9)	81.94 (35.81) (p=0.855)*	83.05 (42.72) (p=0.149)*	246.39 (125.74) (p=0.620)*

\*Calculations performed with one-sample t-test

#### References

1. J Comput Neurosci DOI 10.1007/s10827-016-0597-5
2. Neurourology and Urodynamics 34:327–331 (2015) DOI 10.1002/nau.22565

#### Disclosures

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