Vibratory Perception and Female Stress Urinary Incontinence

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Purpose: We investigated the value of measuring the vibratory perception threshold with a biothesiometer to clinically evaluate women with stress urinary incontinence.

Materials and Methods: The study consisted of 3 groups, including group 1—66 women with stress urinary incontinence, group 2—44 age matched women without stress urinary incontinence and group 3—60 younger women without stress urinary incontinence. A total of 50 patients with stress urinary incontinence underwent videourodynamics. Using a biothesiometer the vibratory perception threshold was measured over the middle finger, middle toe and clitoris in all study subjects. A higher threshold indicated lower sensitivity to vibratory stimulation. Motions leading to stress urinary incontinence were also determined.

Results: The stress urinary incontinence and age matched control groups were older than the younger control group and had greater parity. The incontinence group had a higher vibratory perception threshold than the younger control group but there was no difference between women with incontinence and age matched women without incontinence. Women in whom incontinence was induced by walking upstairs or downstairs had a higher finger and toe vibratory perception threshold than those without incontinence. The threshold in the groups with and without intrinsic sphincter deficiency did not differ significantly.

Conclusions: Vibratory perception is not related to stress urinary incontinence in females. Finger and toe vibratory perception is less sensitive in patients with stress urinary incontinence while walking upstairs or downstairs.

Key Words: urinary bladder; urinary incontinence, stress; female; vibration; perception

Abbreviations and Acronyms

ISD = intrinsic sphincter deficiency

MBND = maximal bladder neck descent distance

SUI = stress urinary incontinence

VPT = vibratory perception threshold

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MULTIPLE risk factors are associated with SUI in females, such as parity, obesity, gynecologic-obstetric history, etc.[1] SUI is believed to be due to impaired urethral support from the pelvic floor (urethral hypermobility) and/or ISD.[2] Neurogenic pathology is thought to have an important role in SUI and the pudendal nerve that innervates the pelvic floor muscles and periurethral striated sphincter muscle is considered important.[3] The afferent pathway from the bladder and urethra conveyed by the pudendal nerve also has a role in the urethral continence reflex mechanism.[4]

To evaluate nerve integrity requires complex neurophysiological examinations by expertly trained specialists. Thus, it cannot be performed in a regular clinician office with simple equipment. Biothesiometry is used to assess peripheral nerves by measuring VPT.[5,6] In urology biothesiometry has been used to evaluate premature ejaculation and erectile dysfunction in males and sexual dysfunction in females because it is simple, noninva-

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sive and quantative.[7–9] We further assumed that if there is neuropathy in the pudendal nerve, motor as well as sensory function would be involved. We could assess an aspect of the sensory function (vibratory perception) to screen pudendal nerve function.

We measured VPT conveyed by the superficial branch (clitoral nerve) of the pudendal nerve as a representative to screen pudendal nerve function. In addition, VPT was measured over the fingers and toes for comparison. We determined whether there is any relationship between VPT and SUI, and whether VPT measurement is valuable for clinically evaluating SUI in females.

PATIENTS AND METHODS

A total of 177 women were recruited into this study. They were divided into 3 groups. Group 1 consisted of 66 women with clinical complaints of SUI who were surveyed before sling surgery. All patients underwent biothesiometry and 50 underwent videourodynamics to determine urethral mobility and leak point pressure. The remaining 16 women underwent conventional urodynamics. SUI was objectively confirmed by a positive cough test in all patients with SUI. Also, each completed a questionnaire on motions that induced SUI, SUI severity and voiding/storage symptoms, including coughing, laughing, lifting objects, standing up from chairs, standing up from a squat position, squatting from a standing position, walking, running and walking upstairs or downstairs. Detailed medical, neurological and gynecologic-obstetric histories were reviewed. Significant neurological conditions and a history of nervous system disorders, such as cerebral vascular accident, spinal cord injury, multiple sclerosis, Parkinsonism and peripheral neuropathy, including diabetic neuropathy, were specifically identified and excluded from analysis. Group 2 consisted of 44 female volunteers without SUI who underwent biothesiometry as age matched controls. Group 3 consisted of 60 younger female volunteers without SUI who underwent biothesiometry as controls. Each woman in the 2 control groups completed our questionnaire and denied urinary incontinence under any type of motion or circumstance. No age matched or younger controls had diabetes mellitus. This study was approved by the institutional review board at our hospital.

Videourodynamics

Videourodynamics were done to determine cystometry, bladder capacity, urine flow rate, bladder neck position, MBND on abdominal straining, Valsalva leak point pressure and volume, and cough leak point pressure and volume. ISD was defined as Valsalva leak point pressure less than 60 cm H_2O and urethral hypermobility was defined as MBND greater than 2 cm.[10,11]

Vibratory Perception Threshold

VPT was measured using a biothesiometer (Bio-Medical Instrument, Newbury, Ohio) with a fixed stimulus frequency of 120 Hz. Intensity was approximately proportional to the square of the applied voltage. We measured VPT at 3 distinct sites, including the middle fingers of each hand, the clitoris and the middle toes of each foot. With gradually increasing stimuli at each site VPT was determined when the patient indicated the minimal energy needed to distinguish between vibration and static touch. VPT values at the hands or feet were averaged. Higher VPT indicated lower sensitivity to vibratory stimulation and poorer neural function.[6]

Data Analysis

Data were analyzed using SPSS®, version 14.0. Descriptive data are shown as the median and IQR. Nonparametric tests, including Kruskal-Wallis 1-way analysis and the Wilcoxon rank sum test, were used to compare VPT differences in women with and without SUI. Nonparametric correlations between MBND and VPT were tested using the Kendall τ rank correlation test. Statistical significance was considered at $p < 0.05$.

RESULTS

Group 1 with SUI with a median age of 58.0 years (range 50.3 to 70.8) and the corresponding age matched control group 2 with a median age of 61.0 years (range 51.0 to 70.0) were significantly older than group 3 younger controls with a median age of 37.0 years (range 33.0 to 41.0) (each $p < 0.001$). Group 1 and control group 2 had greater mean parity than younger control group 3 at a median of 3.0 (range 2.0 to 4.0), 3.0 (range 2.8 to 4.0) and 2.0 (range 1.0 to 2.0), respectively ($p < 0.001$).

The SUI and age matched control groups had significantly higher median VPT than the younger control group (table 1). However, VPT in SUI group 1 and nonSUI, age matched control group 2 did not differ significantly (table 1). While biothesiometry showed VPT differences in the different age groups, there were no VPT differences between the SUI and nonSUI groups of similar age.

We divided group 1 into subgroups according to motions that led to SUI, such as walking upstairs or downstairs, coughing, laughing and others. Only 12 women in whom SUI was induced by walking upstairs or downstairs had higher VPT over the fingers and toes than the 43 in whom SUI was induced by other motions (each $p = 0.005$, table 2). When women in the SUI group were divided into 22 with and 28 without ISD according to Valsalva leak point pressure, VPT did not differ between the groups (table 2).

Table 1. *VPT in groups 1 to 3*

	Median VPT (IQR)			p Value*
	Group 1	Group 2	Group 3	Group 1 vs 2
No. pts	66	44	60	
Finger	5.0 (3.0–6.8)	6.0 (4.0–7.3)	3.0 (2.0–4.0)	0.31
Clitoris	6.5 (4.0–9.0)	7.0 (5.0–11.3)	4.5 (3.0–5.0)	0.47
Toe	7.0 (5.0–11.8)	9.0 (6.3–12.8)	6.0 (5.0–7.0)	0.12

* Group 1 vs 3 $p < 0.001$.