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Association of Urinary Urgency and Delay Time of Micturition in Women With Overactive Bladder

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Purpose: Accurately measuring urinary urgency is important for diagnosing overactive bladder (OAB) and quantifying improvements in treatment outcome. Various methods have been recommended for evaluating urinary urgency, but these methods assess individual perceptions and preferences. To overcome the subjectivity in measuring urinary urgency, we evaluated the relationship between uroflowmetric parameters and urinary urgency in women with OAB.
Methods: Consecutive female patients with lower urinary tract symptoms (n = 110) were prospectively enrolled in this study between April 2011 and September 2012. Individuals with a history of using medications that are known to affect bladder function were excluded. All enrolled patients completed uroflowmetry with a delayed time to voiding (T2V). After urination was completed, patients were asked whether they experienced any urinary hesitancy or urgency at that time.
Results: The mean patient age was 56.1 years; 70 out of 110 patients reported some degree of urinary urgency. T2V decreased with increased urgency. Several uroflowmetric parameters were observed to have a significant correlation with urinary urgency. T2V had a meaningful correlation coefficient for individuals with urgency, regardless of the voided volume. There was no significant correlation between the presence of urinary hesitancy and T2V.
Conclusions: We believe that T2V would be a complementary tool for diagnosing and determining the degree of urinary urgency in women with OAB.

Keywords: Analysis; Women; Overactive urinary bladder; Questionnaire; Urodynamics

INTRODUCTION

Overactive bladder (OAB) is very common condition in older women. Accurately measuring the symptom of urgency is essential for diagnosing OAB and quantifying improvement in treatment outcome [1]. Questionnaires [2,3] or visual analog scales [4] are recommended for assessing urinary urgency; however, these methods are based on individual feelings, perceptions, or intentions. Therefore, new and effective methods to evaluate urgency symptoms are required. Uroflowmetry is an objective study that is considered both noninvasive and inexpensive. Kim et al. [5] reported differences in uroflowmetric parameters between patients with interstitial cystitis and OAB. Delayed time to voiding (T2V) is a uroflowmetric parameter that has been previously shown to correlate with urinary hesitancy in men with lower urinary tract symptoms (LUTS) [6]. However, we believe that a short delay in initiating micturition in women without obstructive voiding symptoms could result in severe urinary urgency rather than an absence of urinary hesitancy. Therefore, we evaluated the relationship between uroflowmetric parameters and urinary urgency symptoms in women with OAB.

MATERIALS AND METHODS

This study was approved by Yongin Severance Hospital's Institutional Review Board. A total of 110 women with LUTS and OAB (n = 70; mean age, 55.1 ± 10.4 years) or non-OAB (n = 40; mean age, 58.0 ± 8.2 years) were recruited from outpatient clinics between April 2011 and September 2012. OAB was diagnosed us-

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ing questionnaires (>8 points of OAB questionnaire) and based on the definition of the International Continence Society (ICS) [1]. Each enrolled subject provided informed consent.

Patients who had a history of active use of medication known to affect bladder function (i.e., α-blockers, anticholinergics, or cholinergics) within recent 3 months or had interrupted uroflow pattern, residual volume >150 mL, or any symptomatic urinary tract infection were excluded from this study. We also excluded individuals with a medical history of bladder surgery or pelvic radiotherapy, uncontrolled diabetes, any type of voiding dysfunction secondary to an underlying neurological disease, or any condition compromising mobility.

Intervention

Patients' uroflow patterns were objectively evaluated using methods that have been previously recommended [6]. All enrolled patients were instructed to enter the uroflow room when they felt the need to urinate. The door of the uroflow room was then locked and the patient was allowed to urinate. The patients were asked to press the start button in the uroflowmeter after removing their undergarments, which would initiate the measurement of micturition time. The results were recorded on an uroflowmetry sheet. T2V was defined as the period between preparing to void and the initiation of voiding itself into the funnel of the uroflowmeter. After each void, we measured the postvoid residual volume with a transabdominal ultrasonographic probe (BladderScan BVI 3000, Verathon Inc., Bothell, WA, USA). The patients completed urgency sensation scale (USS) questionnaires regarding their urgency symptoms during a single voiding at an uroflow room [3]. Symptom of urinary hesitancy was evaluated by asking the following question from each participant: "When you were ready to urinate, did you pass the urine immediately or did you wait?" Subjects who had to wait to urinate were considered to have urinary hesitancy, whereas those who immediately urinated were considered to have no hesitancy. To exclude psychological voiding inhibition, we asked all patients, "Was the urination process different during this study compared to your normal urination?" If patients reported an unusual urination delay in the uroflow room, they were excluded from the study. All methods, definitions, and units of urodynamics conform to the ICS recommended standards, except where specifically defined [1]. A rotating-disc flow meter (Medtronics Inc., URODYN 1000, Minneapolis, MN, USA) was used for all uroflowmetric measurements. All patients completed a frequency-volume chart for >2 days. The urine flow rate is known to be highly dependent on the total volume voided [7,8]. Consequently, patients with a void volume <100 mL were excluded from the study.

Statistics

A t-test (unpaired) was performed to evaluate the differences in the patient demographics between the OAB and non-OAB groups. To identify any associations between uroflowmetric parameters and the presence of urgency, Spearman correlation was used (GraphPad Prism ver. 5.00, GraphPad Software, San Diego, CA, USA). To confirm differences in T2V according to the severity of urinary urgency in both the OAB and non-OAB (control) groups, a two-way analysis of variance was used. *Post hoc* analysis included Bonferroni tests of multiple comparisons. A P-value<0.01 was defined as significant in all cases.

RESULTS

The mean age of the study population was 53.1 years (range, 40–75 years), and 70/110 patients reported some degree of urinary urgency. There were no significant differences in the age or proportion of stress urinary incontinence between the OAB and non-OAB groups. In the OAB group, T2V was significantly decreased and maximal flow rate (Qmax) increased according to the level of urgency (Table 1).

There were significant differences in T2V according to the USS in both OAB and non-OAB groups ($P<0.001$) (Fig. 1). The presence of urinary urgency was significantly correlated with T2V ($r=-0.607$, $P<0.001$; Table 2). However, the presence of urinary hesitancy was not significantly correlated with T2V in any patient ($r=-0.23$, $P=0.129$). A significant correlation was also observed in Qmax ($r=0.615$, $P<0.001$). However, unlike T2V, Qmax appeared to depend on voided volume (Fig. 2).

DISCUSSION

T2V may be a helpful parameter for distinguishing urinary urgency in women with OAB. We also observed a significant difference in T2V between the OAB and non-OAB groups. Similar to our initial hypothesis, T2V in women without decreased urine flow were associated with urinary urgency rather than hesitancy in this study. We found that both Qmax and T2V were positively correlated with urinary urgency. However, it is generally known that the urine flow rate is highly dependent on the volume voided [9]. Therefore, the relationship between the voided urine volume and both parameters (i.e., Qmax and T2V)

Table 1. Patient demographics and uroflowmetric variables (n = 110)

Variable	Non-OAB	OAB		
		G2	> G3	P-value
Demographics				
No. of patients	40	49	21	
Age (yr)	58.0 ± 8.2	57.3 ± 12.6	49.8 ± 13.5	0.347
No. of patients with associated disease				
Stress urinary incontinence	22 (55.0)	29 (59.2)	13 (61.9)	0.480
Urge incontinence	-	16 (32.7)	10 (47.6)	
Nocturia without OAB	8 (20.0)	-	-	
No. of patients with associated symptom				
Urinary hesitancy	11 (27.5)	6 (12.2)	2 (9.5)	0.293
Frequency volume chart				
Maximal voided volume (mL)	310 ± 24.9	270 ± 133.1	230 ± 99.8	0.281
No. of episodes				
Frequency	4.6 ± 0.8	6.3 ± 0.6	7.6 ± 0.7	0.345
Nocturia	2.3 ± 0.4	1.7 ± 0.5	3.3 ± 0.7	0.756
Uroflowmetry variable				
Qmax (mL/sec)	17.8 ± 5.5	24.2 ± 7.6	33.3 ± 12.7	< 0.001**
VV (mL)	165.6 ± 42.3	213.2 ± 84.9	229.1 ± 133.5	0.413
T2V (sec)	11.2 ± 5.1	5.8 ± 2.7	3.8 ± 2.1	< 0.001**
PVR (mL)	29.7 ± 31.5	19.2 ± 30.4	55.6 ± 62.2	0.088

Values are presented as mean ± standard deviation or number (%). Fisher exact test for categorical variables (composition of stress urinary incontinence between the OAB and non-OAB groups), Kruskal-Wallis test for continuous variables (age, maximal voided volume, uroflowmetry variables) were used.
OAB, overactive bladder; G2 (mild urgency), I could postpone voiding for as long as necessary without fear of wetting myself; G3 (moderate urgency), I could postpone voiding for a short while without fear of wetting myself; Qmax, maximal flow rate; VV, voided volume; T2V, time to voiding; PVR, postvoid residual volume.
**Statistically significant (P < 0.01). Analysis of variance between groups of Non-OAB, OAB (G2), and OAB (> G3).

Table 2. Factors affecting the presence of urgency

Variable	OAB	
	r	P-value
Qmax	0.613	< 0.001**
VV	–0.513	0.381
RV	0.602	0.479
T2V	–0.607	< 0.001**

OAB, overactive bladder; r, correlation coefficient; Qmax, maximal flow rate; VV, voided volume; RV, postvoid maximal flow rate; T2V, time to voiding.
**Statistically significant (P < 0.01).

should be further evaluated. In this study, Qmax was highly correlated with the voided urine volume, but the delay time did not.

Urinary urgency is a highly prevalent condition that lowers the patients' quality of life. Currently, ICS defines OAB as urgency, with or without urge urinary incontinence, usually associated with urinary frequency and nocturia [1]. Therefore, an accurate identification of urinary urgency is essential for managing patients with OAB.

Brown et al. [10] recommended the use of voiding diaries to properly evaluate urgency, as well as urinary frequency and urge incontinence. To overcome the test-retest reliability of their symptoms, they reommended that the diary should be completed for a minimum of 7 days. The diary method was suitable for assessing urinary frequency and the number of nocturia, urgency, or urge incontinence episodes; however, it was difficult to assess symptom severity. Also, due to practical limitations of acquiring a 7-day voiding diary, our study allowed voiding diaries taken for more than 2 days.

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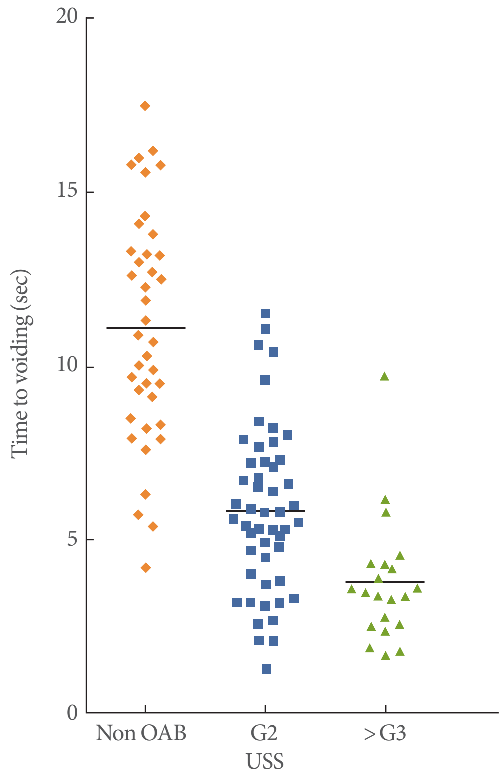

Fig. 1. The distribution of time to voiding in patients with and without overactive bladders (OABs) according to the urgency sensation scale (USS). G2 (mild urgency), I could postpone voiding for as long as necessary without fear of wetting myself; G3 (moderate urgency), I could postpone voiding for a short while without fear of wetting myself.

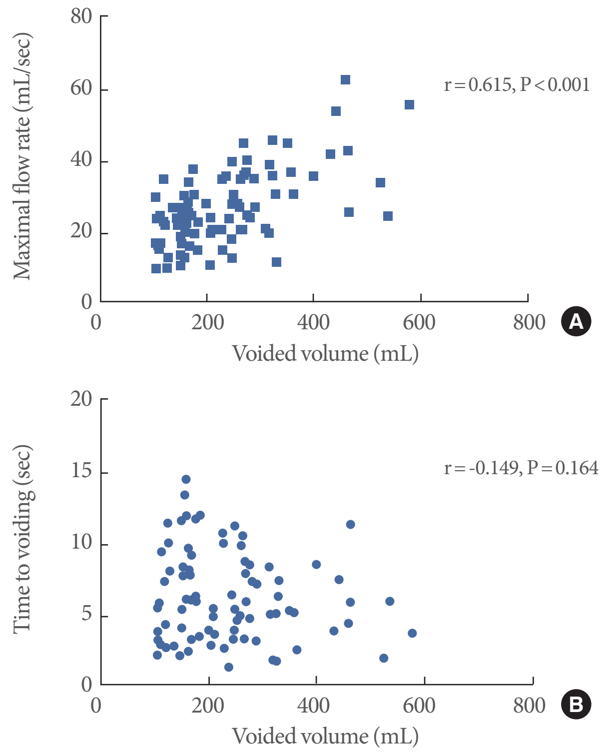

Fig. 2. Changes in uroflowmetric parameters according to the voided volume.

Various questionnaires have been developed by researchers to identify the severity of urinary urgency [11]. However, questionnaires have been well known to suffer from self-report bias. Therefore, we believed that complementary tools are needed to evaluate evaluating urinary urgency. Lukacz et al. [4] demonstrated a visual analogue scale for urinary urgency. The visual analogue scale uses animated visual contents, can be completed easily, and is known to have enhanced reliability. However, this scale also had a high possibility of being confounded with individual perceptions. Other studies [12,13] have reported that normal and abnormal urgency symptoms cannot be effectively discriminated. Therefore, many researchers calculate the sum, mode, or mean USS scores from the questionnaires [3]. Therefore, we used the USS questionnaire to compare urinary urgency with our new parameter, T2V.

The relationship between urinary urgency and bladder contractility has also been previously studied. Fall et al. [14] reported on using waiting time for measuring the severity of urgency by cystometry in patients with neurogenic or phasic detrusor overactivity (DO). Waiting time was defined as the period between experiencing a strong desire to urinate and micturition. Patients capable of having <2 minutes of suppressed micturition were identified as having a moderate degree of urinary urgency. Subsequently, Cucchi et al. [15,16] reported that a DO-related increase in bladder contractility might be further enhanced by severe urgency through a positive feedback mechanism in patients with idiopathic DO.

Urinary hesitancy is an under-evaluated symptom of LUTS prevalent in both men and women. Hesitancy in men may depend on detrusor contractility, bladder outlet obstruction, urethral factors (i.e., detrusor sphincter dyssynergia), and psychological factors. However, in women without decreased urine flow, extravesical etiologies of urinary hesitancy may be minimal [17]. Therefore, we believed that a delay in micturition is more closely related to urinary urgency rather than to urinary hesitancy. A cystometric evaluation is suitable for evaluating vesicourethral functions. However, cystometric evaluations are invasive and difficult to manipulate. In women without outlet obstruction, uroflowmetry is an appropriate method for identifying bladder function. Therefore, we evaluated patients using uroflowmetry in this study. T2V would be an effective tool for identifying OAB and the severity of urgency; we observed that T2V correlates more closely with urinary urgency rather than hesitancy in women.

There were some limitations to our study. First, we did not evaluate the test-retest reliability of T2V. We hope to conduct a study regarding the reliability of T2V in the future. Second, we did not evaluate baseline bladder functions using pressure-flow studies. It is possible that we may have included women with a slightly abnormal detrusor or sphincter function. However, we applied strict exclusion criteria to ensure that these factors only have a minimum effect on our results. Third, some degree of subjectivity likely influenced our results because we used the USS to compare uroflowmetric parameters. Finally, the study was conducted on patients with a limited spectrum of variability for the primary purpose of evaluating the relationship between symptoms of hesitancy and the putative factor of T2V, and may not be applicable to patients in general. Further studies investigating the feasibility of our results in clinical practice are necessary.

In conclusion, T2V can be used as a complementary tool for diagnosing and determining the degree of urinary urgency symptoms in women with OAB. Furthermore, T2V was observed to be associated with urinary urgency rather than hesitancy in women with OAB.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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