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FACTORS ASSOCIATED WITH THICKNESS, VASCULARIZATION AND BLOOD FLOW OF BLADDER WALL IN FEMALE PATIENTS WITH LOWER URINARY TRACT SYMPTOMS

Hypothesis / aims of study

Bladder wall thickness had been used to differentiate subgroups of lower urinary tract dysfunction, especially for overactive bladder syndrome but with conflict results [1,2]. Besides, we are interested if blood flow pattern can be used as a biomarker to differentiate subgroups of lower urinary tract dysfunction. Thus the aim of this study is to investigate factors associated with thickness, vascularization and blood flow of bladder wall in female patient with lower urinary tract symptoms (LUTS).

Study design, materials and methods

All women who were scheduled for urodynamic studies and pad testing were prospectively enrolled in this study. All enrolled women were questioned about their LUTS (including urgency, stress urinary incontinence [SUI] and voiding dysfunction [i.e. slow stream, intermittency, straining to void, position-dependent micturition, etc.]), and those without any LUTS were allocated to the control group.

Besides, patients were requested to complete perception of bladder condition (PBC), and overactive bladder symptoms score questionnaire (OABSS), and receive transvaginal 3-D power Doppler ultrasonography immediately after urodynamic studies and emptying their bladder. Bladder wall thickness (BWT) [1] and vascularization-flow index (VFI) were measured by VOCAL program [3]. Univariate and multivariate backward stepwise linear regression analyses were used to estimate the associated factors.

Results

Between 2010 and 2012, 308 women enrolled in thus study. SUI and voided volume were two independent factors associated with BWT (Table 1). BWT ≥ 6.4 mm was the most strongly predictive cut-off values for non-SUI, with receiver operating characteristic curve area of 0.54 (sensitivity = 35.7%, specificity = 75.0%). Postvoidal residual urine volume while performing 3-D power Doppler ultrasonograpy (PVRUS), body mass index, the score of the first question (Q1) of OABSS (i.e., daytime frequency) and the detrusor pressure at maximum flow were independent factors associated with VFI by multivariate linear regression analyses (Table 2).

Interpretation of results

Women with SUI had a thinner bladder wall, compared to LUTS women without SUI; but this phenomenon was not observed in women with urgency, a core symptom of overactive bladder syndrome. Nonetheless, clinical use of BWT may be limited due to poor sensitive and specificity. In addition, we found that daytime frequency was associated with VFI of bladder wall, but not nocturia, urgency and urgency incontinence, despite the causal relationship between daytime frequency and VFI remained to be determined.

Concluding message

Despite its limited role as a tool to differentiate subgroups of lower urinary tract dysfunction, the presence of SUI may be associated with a decrease of BWT; and daytime frequency may be associated with an increase of vascularization and blood flow of the bladder wall.

Table 1. Univariate and multivariate linear regression analyses of factors for bladder wall thickness among 308 women who underwent urodynamic studies

		Univariate		Multivariate	
Variables	N = 308	Coefficient	*P*	Coefficient	*P*‡
BWT (mm)	6.1±4.1	-	-	-	-
PVRUS (ml)	60±56	-0.003 (-0.011, 0.005)	0.47	-	-
Age (years)	54.7±16.0	0.004 (-0.03, 0.03)	0.80	-	-
Parity	2.8±1.4	-0.07 (-0.40, 0.26)	0.70	-	-
BMI (kg/m2)	24.7±4.3	0.03 (-0.08, 0.14)	0.55	-	-
Symptoms					
Urgency	193 (63)	0.41 (-0.53, 1.36)	0.39	-	-
SUI	216 (70)	-0.07 (-1.07, 0.93)	0.89	-0.45 (-0.79, -0.10)	0.01
VD	115 (37)	0.43 (-0.51, 1.37)	0.37	-	-
Control	25 (8)	-0.20 (-1.87, 1.47)	0.81	-	-
PBC	3.9±1.4	-0.07 (-0.39, 0.26)	0.69	-	-
OABSS-Q1	0.8±0.7	0.74 (0.05, 1.42)	0.04	-	-
OABSS-Q2	1.8±1.0	-0.11 (-0.57, 0.34)	0.62	-	-
OABSS-Q3	1.9±1.8	0.27 (0.02, 0.53)	0.04	-	-
OABSS-Q4	1.3±1.6	0.03 (-0.26, 0.33)	0.82	-	-
Qmax (ml/s)	21.5±13.6	0.005 (-0.007, 0.02)	0.38	-	-
VV (ml)	251±147	0.0009 (-0.0001, 0.002)	0.08	0.0011 (0.00006, 0.002)	0.04
PVR (ml)	130±107	0.0001 (-0.0014, 0.0017)	0.84	-	-
SD (ml)	287±160	0.0008 (-0.002, 0.004)	0.58	-	-
PdetQmax (cmH2O)	36.7±23.9	0.002 (-0.02, 0.02)	0.83	-	-
MUCP(cmH2O)	68.0±34.5	0.01 (-0.002, 0.03)	0.11	-	-
FPL (cm)	2.9±1.3	0.25 (-0.15, 0.64)	0.22	-	-
PTR (%)	93.5±45.7	0.0001 (-0.004, 0.004)	0.96	-	-

Pad weight (g)	28.5±51.7	-0.003 (-0.006, -0.0001)	0.04	-	-

R^2 = 0.03.

† Values are given as mean ± standard deviation, number (percentage) or coefficient (95% confidence interval). ‡ Multivariate backward stepwise regression analysis.

§BMI: body mass index; BWT: bladder wall thickness; MUCP: maximum urethral closure pressure; OAB: overactive bladder; OABSSQ1: the score of the first question of overactive bladder symptoms score; PBC: perception of bladder condition questionnaire; PdetQmax: detrusor pressure at maximum flow; PTR: pressure transmission ratio near MUCP; PVR: postvoidal residual; PVRUS: postvoidal residual urine volume while performing 3-D ultrasonograpy; Qmax: maximum flow rate; SD: the colume at strong desire to void; SUI: stress urinary incontinence; VD: voiding dysfunction; VV: voided volume.

Table 2. Univariate and multivariate analyses of factors for bladder wall vascularization-flow index (VFI) of among 308 women who underwent urodynamic studies

		Univariate		Multivariate	
Variables	N = 308	Coefficient	*P*	Coefficient	*P*
VFI (0-100)	0.16±0.27	-	-	-	-
PVRUS (ml)	60±56	-0.0005 (-0.001, 0.00002)	0.06	-0.0009 (-0.001, -0.002)	0.008
Age (years)	54.7±16.0	-0.002 (-0.004, 0.0003)	0.09	-	-
Parity	2.8±1.4	-0.01 (-0.03, 0.01)	0.33	-	-
BMI (kg/m2)	24.7±4.3	-0.01 (-0.02, -0.004)	0.003	-0.01 (-0.02, -0.002)	0.02
Symptoms					
Urgency	193 (63)	-0.02 (-0.08, 0.04)	0.56	-	-
SUI	216 (70)	-0.002 (-0.07, 0.06)	0.94	-	-
VD	115 (37)	0.04 (-0.02, 0.10)	0.23	-	-
Control	25 (8)	0.07 (-0.04, 0.18)	0.24	-	-
PBC	3.9±1.4	0.004 (-0.02, 0.03)	0.73	-	-
OABSS-Q1	0.8±0.7	0.05 (0.001, 0.09)	0.05	0.06 (0.004, 0.11)	0.04
OABSS-Q2	1.8±1.0	0.01 (-0.02, 0.04)	0.37	-	-
OABSS-Q3	1.9±1.8	-0.01 (-0.03, 0.007)	0.24		
OABSS-Q4	1.3±1.6	0.003 (-0.02, 0.02)	0.78	-	-
Qmax (ml/s)	21.5±13.6	-0.002 (-0.004, 0.002)	0.07	-	-
VV (ml)	251±147	-0.00002 (-0.0002, 0.0002)	0.88	-	-
PVR (ml)	130±107	-0.0001 (-0.0004, 0.0002)	0.59		
SD (ml)	287±160	-0.0001 (-0.0003, 0.00005)	0.15	-	-
PdetQmax (cmH2O)	36.7±23.9	0.001 (-0.0003, 0.002)	0.12	0.002 (0.0001, 0.003)	0.04
MUCP (cmH2O)	68.0±34.5	-0.0002 (-0.001, 0.0007)	0.72	-	-
FPL (cm)	2.9±1.3	0.003 (-0.02, 0.03)	0.83	-	-
PTR (%)	93.5±45.7	0.002 (-0.0005, 0.0009)	0.64	-	-
Pad test (g)	28.5±51.7	0.0001 (-0.0005, 0.0007)	0.83	-	-

R2 = 0.08. † Abbreviations as Table 1.

References

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