

VIDEOURODYNAMIC STUDY OF DYSFUNCTIONAL VOIDING IN FEMALE VOIDING DYSFUNCTION – THE ROLE OF URETHRAL SPHINCTER AND PELVIC FLOOR MUSCLES

Hypothesis / aims of study

Dysfunctional voiding (DV) is one of the most common non-neurogenic, nonstructural cause leading to female BOO. Poor relaxation of urethral sphincter (PRES) is a common finding in adult women with lower urinary tract symptoms (LUTS) investigated with videourodynamic (VUD) study. The aim of this study is to analyze the VUD characteristics of DV and PRES in female voiding dysfunction.

Study design, materials and methods

A total of 1914 neurologically normal women aged > 18 years with LUTS received VUD studies from 1997 to 2015 were reviewed. Patients were diagnosed to have DV when high voiding detrusor pressure (Pdet), intermittent flow, if increased sphincter electromyography (EMG) activity, and dilation of proximal urethra combined with a “spinning top” appearance at middle urethra during voiding phase on cine-fluoroscopy. PRES was considered if there was no concomitant relaxation of EMG activity during voiding with the same radiologic manifestation of lower urinary tract. The VUD characteristics of DV and PRES were compared with a group of urodynamically normal controls.

Results

There were 325 (17.0 %) women diagnosed as DV and 336 (17.6 %) to have PRES. Fifty six urodynamically normal women were served as controls. The mean age was 61.1 ± 16.5 years in the DV group, 56.5 ± 15.9 years in the PRES group, and 54.0 ± 14.3 years in the control group. Detrusor overactivity (DO) occurred in 60% of women with DV, and in 5.7% of PRES ($p < 0.05$). Patients with DV had significantly increased bladder sensation, lower cystometric bladder capacity (CBC), lower bladder compliance, higher Pdet, lower Qmax, smaller voided volume (VV), larger post-void residual volume (PVR), lower voiding efficiency (VE), and higher bladder outlet obstruction index (BOOI) than PRES and the controls. Patients with PRES had significantly increased bladder sensation, lower CBC, lower Qmax, smaller VV, larger PVR, lower VE, and lower bladder contractility index (BCI) than the controls. There was no obvious difference noted when stratified analysis in patient of age ≤ 55, age > 55.

Interpretation of results

Patients with DV have typical urodynamic characteristics of BOO (high Pdet in combination with low Qmax) and high rate of DO. Hyperactivity of urethral sphincter and poor relaxation of pelvic floor muscles have been considered as causes of female DV. Functional obstruction of urethral sphincter and pelvic floor muscles contributed to female BOO, and urethral sphincter obstruction tended to be more severe than pelvic floor muscle obstruction. PRES patients had low Qmax and large PVR, but low Pdet with low BOOI. They also had a small rate of DO then the DV group, and a lowest BCI among the 3 groups. A EMG pattern of urethral guarding similar to DV may result from abdominal straining to compensate for impaired detrusor contractility, which can be a cause of PRES.

Concluding message

VUD study features of BOO and urodynamic DO were present in women with DV. PRES shared the similar VUD characteristics of pelvic floor muscle obstruction, and could be considered as a milder form of DV. PRES might be also resulted from abdominal straining in patients with detrusor underactivity.

Table 1. Urodynamic parameters of all study participants

Patients	DV (N=325)	PRES(N=336)	Normal (N=56)	p value
DO/yes	195 (60.0 %)	19 (5.7%)	0 (0%)	<0.01
FSF (mL)	129.7 ± 69.1	153.5 ± 64.0	166.8 ± 71.6	<0.01
FS (mL)	196.7 ± 95.1	253.5 ± 89.8	290.3 ± 103.0	<0.01
CBC (mL)	300.5 ± 144.9	351.9 ± 142.9	508.1 ± 119.9	<0.01
Compliance (mL/cmH ₂ O)	63.4 ± 77.4	85.0 ± 95.2	84.8 ± 72.1	<0.01
Pdet (cmH ₂ O)	45.7 ± 18.3	17.3 ± 11.7	17.3 ± 8.2	<0.01
Qmax (mL/s)	9.35 ± 6.12	9.55 ± 6.21	24.14 ± 7.82	<0.01
VV (mL)	179.4 ± 125.3	247.8 ± 143.4	488.6 ± 114.3	<0.01
PVR (mL)	121.1 ± 123.3	104.1 ± 126.5	19.5 ± 28.8	<0.01
VE (%)	62.3 ± 30.6	71.0 ± 29.6	96.4 ± 4.9	<0.01
BCI	92.4 ± 34.6	65.1 ± 35.9	138.0 ± 40.1	<0.01
BOOI	26.97 ± 22.6	-1.78 ± 14.7	-30.97 ± 17.5	<0.01

The values were shown as Mean ± SD or N (%), p values were calculated based on AVOVA test, DV: dysfunctional voiding, PRES: poor relaxation of external sphincter, Normal: normal control, DO: detrusor overactivity, FSF: first sensation of bladder filling, FS: first desire to void, CBC: cystometric capacity, Pdet: detrusor pressure at maximum flow rate, Qmax: maximum flow rate, VV: voided volume, PVR: post-void residual, VE: voiding efficiency = (VV/CBC)*100, BCI: bladder contractility index = Pdet + 5Qmax, BOOI: BOO index = Pdet–2Qmax.

Table 2. Urodynamic parameters of participants aged \leq 55 years

Patients	DV (N=120)	PRES(N=145)	Normal (N=30)	p value
DO/yes	65 (54.2 %)	6 (4.1%)	0 (0%)	<0.01
FSF (mL)	127.8 \pm 65.9	142.8 \pm 58.5	143.3 \pm 53.6	<0.01
FS (mL)	205.5 \pm 93.8	239.8 \pm 88.9	272.8 \pm 92.0	<0.01
CBC (mL)	309.1 \pm 140	325.0 \pm 133.0	500.3 \pm 106.5	<0.01
Compliance (mL/cmH ₂ O)	62.2 \pm 71.1	70.7 \pm 79.9	92.7 \pm 82.9	<0.01
Pdet (cmH ₂ O)	49.6 \pm 15.7	18.7 \pm 12.1	19.1 \pm 8.1	<0.01
Qmax (mL/s)	11.66 \pm 6.93	9.40 \pm 6.35	22.63 \pm 5.8	<0.01
VV (mL)	226.4 \pm 133.1	256.8 \pm 137.5	483.4 \pm 97.3	<0.01
PVR (mL)	82.7 \pm 109.6	68.2 \pm 99.1	16.9 \pm 27.0	<0.01
VE (%)	75.2 \pm 27.7	78.7 \pm 26.9	96.9 \pm 4.6	<0.01
BCI	107.9 \pm 37.1	65.7 \pm 37.4	132.3 \pm 29.9	<0.01
BOOI	26.3 \pm 21.6	-0.11 \pm 14.6	-26.1 \pm 14.3	<0.01

Table 3. Urodynamic parameters of participants aged > 55 years

Patients	DV (N=205)	PRES(N=191)	Normal (N=26)	p value
DO/yes	130 (64.3%)	13 (6.8 %)	0 (0%)	<0.01
FSF (mL)	130.7 \pm 71.1	161.6 \pm 66.9	193.9 \pm 80.8	<0.01
FS (mL)	191.5 \pm 95.7	263.8 \pm 89.3	310.5 \pm 112.9	<0.01
CBC (mL)	295.5 \pm 147.8	372.4 \pm 147	517.1 \pm 135.3	<0.01
Compliance (mL/cmH ₂ O)	64.1 \pm 81.0	95.8 \pm 104.3	75.7 \pm 57.3	<0.01
Pdet (cmH ₂ O)	43.36 \pm 19.25	16.29 \pm 11.36	15.23 \pm 8.05	<0.01
Qmax (mL/s)	8.00 \pm 5.14	9.67 \pm 6.11	25.89 \pm 9.46	<0.01
VV (mL)	151.9 \pm 111.9	241.0 \pm 147.7	494.7 \pm 133.0	<0.01
PVR (mL)	143.6 \pm 125.6	131.4 \pm 137.9	22.4 \pm 30.9	<0.01
VE (%)	54.8 \pm 29.7	65.0 \pm 30.3	95.8 \pm 5.4	<0.01
BCI	83.4 \pm 29.6	64.6 \pm 34.9	144.7 \pm 49.2	<0.01
BOOI	27.4 \pm 23.2	-3.05 \pm 14.7	-36.6 \pm 19.4	<0.01

Table 4. Bladder capacity and postvoid residual urine of participants

Patients	DV (N=325)	PRES (N=336)	Normal (N=56)	p value
CBC < 350 mL	215 (66.2%)	167 (49.7%)	2 (3.6%)	<0.01
PVR > 1/3 CBC	164 (50.2%)	127 (37.8%)	0 (0%)	<0.01

DV: dysfunctional voiding, PRES: poor relaxation of external sphincter, Normal: normal control, CBC: cystometric capacity, PVR: post-void residual.

Disclosures

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