

EVALUATION OF DETRUSOR FORCE IN WOMEN FROM PRESSURE-FLOW STUDIES WITH THE VBN® METHOD.

Hypothesis / aims of study

Evaluation of lower urinary tract symptoms relies on urodynamic investigation. In males, pressure-flow studies (PFs) allows the assessment of urethral and detrusor function during the voiding phase; in this population PFs appear as the gold standard. In females, few studies have been conducted, excepted in bladder outlet obstruction [1]. Our purpose was to describe a method allowing the evaluation of the detrusor force in women with urinary incontinence.

Study design, materials and methods

Three hundred and sixty nine women without neurological disease, diabetes mellitus or pelvic prolapse of grade > II were investigated for stress or mixed urinary incontinence between January 2002 and December 2004. The mean age was 54.5 years (range 26-86). All women underwent physical examination and one urodynamic session (Bonito unit from Laborie). The last included: a free uroflow FF (in private), a profilometry in supine position (emptied bladder), a cystometry and PFs in sitting position, a profilometry in sitting position (filled bladder) and a FF (in private). The urethral catheter was 10 F and allowed to record the urethral pressure at the site of maximum urethral closure pressure and the bladder pressure. Then, the tracing vs time of the maximum pressure exerted by the striated sphincter was deduced from the recordings of both urethral and rectal pressure ($p_{sph}(t) = p_{ura}(t) - p_{rec}(t)$).

The VBN® method [2] was used to evaluate the urethral status (normal, compressive or constrictive obstruction, gaping) and the detrusor force. The last was characterized by the detrusor force coefficient k (normal k = 1, hypocontractile detrusor k < 1 and hypertrophied effective detrusor k > 1).

Criteria to perform a VBN® modelled analysis were 1) to have one PFs and one FF, 2) voided volumes > 100 mL, 3) flow curves without interruption. The analysis of each test was achieved when recorded and computed curves superimposed with a quadratic error < 2%. Values of the mechanical parameters (effective urethra cross section area and detrusor force) had to be compatible (relative error < 5%) for the whole set of tests performed by a given patient.

Results

Only 129 files (35%) fulfilled the required criteria for a modelled analysis. Between them, only 100 files (77.5%) had recorded urethral traces of good quality.

An unexpected finding was a sphincter overactivity (incomplete sphincter relaxation) during the voiding phase, despite a concurrent detrusor contraction; this phenomenon, characterized from the urethral voiding pressure recording, was observed in 52/100 files (52.0%).

Comparison of usual pressure flow parameters (maximum flow rate Q_{max} , detrusor pressure at maximum flow rate $p_{det.Qmax}$) pointed out a significant difference in $p_{det.Qmax}$: 28.5 ± 9.0 cm H₂O in the group with relaxed sphincter vs 37.7 ± 15.0 cm H₂O in the other group.

No file was associated with k > 1, a normal detrusor force was found in 47 files (47.0%) and a reduced detrusor force (k < 1) in the remaining 53 files (53.0%). Between the last, the mean value was k = 0.60 ± 0.16 (range [0.4 – 0.86]).

Hypocontractile detrusor was more frequent in the group with relaxed sphincter: 83.3% vs 27.3%.

Analysis of FF was consistent with a relaxed sphincter for 85.7% of the files. Q_{max} was significantly higher than during PFs whatever the sphincter status during voiding.

Interpretation of results

Our analysis requires good quality of urodynamic traces, specially pressure recordings and at least one FF to evaluate accurately the mechanical parameters; that constraint could explain the high percentage of rejected files compared with the unfortunately few data of the literature (15% [3]).

Analysis of the urethral voiding pressure allows to point out a high percentage of patients whom sphincter is not completely relaxed during PFs; consequently, $p_{\text{det}Q_{\text{max}}}$ is significantly increased despite the absence of urethral obstruction. As the voiding pressure are significantly lower in females than in males, the impact of this phenomenon, assumed variable under testing circumstances, could alter the use of nomograms.

In this female population, evaluation of the detrusor force identifies normal or hypocontractile detrusor; absence of effective hypertrophied detrusor is consistent with the absence of bladder outlet obstruction in the studied population.

Concluding message

Detailed analysis of pressure flow studies in women with urinary incontinence allows to evaluate the detrusor force and points out that recording of the urethral voiding pressure has significant importance. The impact on urodynamic diagnosis and the nature of incomplete sphincter relaxation during voiding appear as an exciting field of research. This preliminary study has to be extended in order to search for a correlation between the detrusor force and different female urodynamic diagnoses.

[1] Neurourol Urodyn 19: 553-564 (2000)

[2] Neurourol Urodyn 19: 153-176 (2000)

[3] Neurourol Urodyn 23: 104-108 (2004)