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DETRUSOR FORCE IN WOMEN: EVALUATION FROM MATHEMATICAL MODELING OF PRESSURE-FLOW STUDIES AND ANALYSIS OF THE EFFECT OF AGEING ON THE DETRUSOR FORCE.

Hypothesis / aims of study

Evaluation of detrusor force in women is a difficult challenge. Our hypothesis was that female voidings were governed by similar parameters than male voidings: the detrusor force and a "urethral resistance".

Our objectives were, using the VBN mathematical model of micturition [1-2], first to analyze pressure-flow (P-F) data to evaluate the detrusor force (**k)** in women and to search for a correlation with a "urethral resistance" simulated by a compressive obstruction (**gamma**), and second, to search for an effect of ageing on these mechanical parameters.

Study design, materials and methods

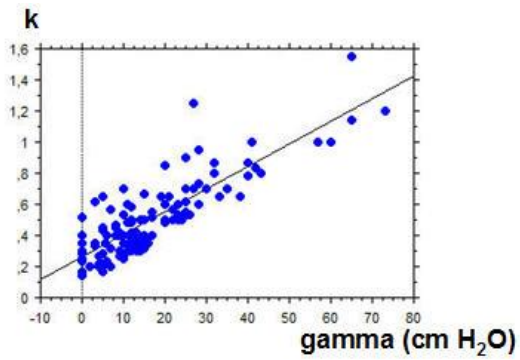
P-F studies of non-neurogenic women referred for evaluation of lower urinary tract dysfunction (LUTD) were retrospectively analyzed.

Criteria for inclusion were P-F tracings providing maximum flow rate Q_{max} and detrusor pressure at Q_{max} ($p_{det.Qmax}$) without significant contribution of abdominal pressure (<±3 cm H_2O between onset of flow and Q_{max}), an initial bladder volume (V_{ini})>100 mL, and a non-interrupted flow.

VBN computations needed to know V_{ini} and the urethral catheter diameter. Evaluated parameters were **k** (without unit) and **gamma** (unit cm H_2O). Standard values were **k** = 1.0 and **gamma** = 0.

Results

The population comprised of 125 women (mean age 58.8±17.0 y). The VBN parameter **k** and **gamma** were identified. **k** mean was .49±.25, range [0.14 - 1.55] and **gamma** mean .16.1±14.4 cm H_2O range [0.0 - 73.0 cm H_2O] with a significant correlation (p<.0001) between **k** and **gamma** (Fig 1): **k** = .259 + .015***gamma** (R^2 =.723).



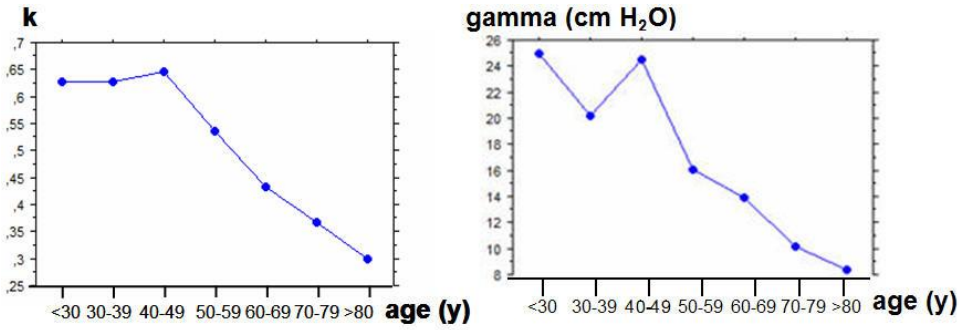
The value of **k** and of **gamma** was independent of the main complaint.

complaint	urge incontinence No = 37	mixed incontinence No = 32	stress urinary incontinence No = 12	frequency No = 15	other No = 29
k	0.55±0.28	0.44±0.21	0.47±0.24	0.49±0.19	0.49±0.28
gamma (cmH_2O)	19.5±16.1	12.0±12.5	14.6±16.4	15.1±11.8	17.1±14.7

Sub-groups were defined according with age:

	< 30 y No = 10	30-39 y No = 12	40-49 y No = 18	50-59 y No = 28	60-69 y No = 21	70-79 y No = 24	> 80 y No = 12
k	.63±.35	.63±.18	.65±.32	.54±.25	.43±.13	.37±.14	.30±.13
gamma (cmH_2O)	25.0±21.3	20.2±16.0	24.5±20.3	16.1±13.3	13.9±7.5	10.2±8.8	8.4±7.0

The values of **k** and **gamma** remained similar in sub-groups less than 50 y old (mean menopause age is 50.1 y in France) and decreased regularly with ageing (Fig 2). Evolution with ageing was significant: p < .0001 for **k** and p = .0030 for **gamma**.



Interpretation of results

Modelled analysis of pressure-flow studies allows to evaluate the detrusor force in women. A study limitation is that VBN analysis cannot be carried out in case low $p_{det.Qmax}$ associated with high Q_{max} (funnelling of both bladder neck and urethra?). Detrusor force is smaller than in men where the range is [.3 – 4.0] [1]. As in men the detrusor force is adjusted to the "urethral resistance" and this, whatever the complaint or the age.

If the detrusor force is not correlated with the main complaint, it is correlated with ageing. The detrusor force begins to decrease at menopause and deteriorate sharply with ageing.

Concluding message

The VBN analysis can evaluate the detrusor force in women who void without major straining efforts with a non-interrupted flow. The detrusor force is smaller than in men [1] and the range less spread out. As in men, there is an adjustment of the detrusor force to compensate a "urethral resistance". Further study will be devoted to analyse the mechanisms underlying the voidings at low pressure.

References

1. Valentini FA, Besson GR, Nelson PP, Zimmern PE. A mathematical micturition model to restore simple flow recordings in healthy and symptomatic individuals and enhance uroflow interpretation. NAU. 2000; 19(2) 153-176
2. Valentini FA, Besson GR, Nelson PP, Zimmern PE. Clinically relevant modelling of urodynamics function: The VBN model. NAU 2014; 33(3): 361-66. doi 10.1002/nau.22409

Disclosures

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