

PHASIC DETRUSOR OVERACTIVITY: ARE THERE DIFFERENCES BETWEEN MALE AND FEMALE? CONTRIBUTION OF THE ANALYSIS OF THE COUPLING BETWEEN EFFERENT NERVOUS EXCITATION OF DETRUSOR AND SPHINCTER.

Hypothesis / aims of study

Detrusor overactivity (DO) is a frequent urodynamic diagnosis in patients with urge syndrome. DO is characterized by non inhibited detrusor contractions (NIDC). It is usual to distinguish phasic (P) (wave(s) with or without leakage) from terminal (T) DO. In the VBN model [1], the detrusor contraction depends on the excitation of the efferent motoneurons which is quantified by their firing rate F or the ratio F/F_{\max} . Without DO, $F/F_{\max} = 0$ during continence and 1 during voiding [2]. It has been shown that the calcium concentration in the muscular cell is a delayed function of the firing rate; the time constant is $T_{\det}=6s$ for the detrusor and $T_{sph}=3s$ for the sphincter [2]. The muscular force is almost proportional to the calcium concentration.

In a previous study on PDO in women it has been concluded that an afferent signal triggers a normal voiding which components are separately and quickly inhibited.

Our objective was to apply the model in order to search for differences of the efferent nervous excitation between male and female.

Study design, materials and methods

Cystometries (filling rate 50 mL/min, triple lumen urethral catheter 7F) of 15 women (incontinence or frequency) and 15 men (frequency) were analyzed. All patients had urodynamically proven PDO.

Urethral sensor was located at the site of maximum urethral closure pressure.

First, urodynamics characteristics of NIDC were analyzed: number, duration and amplitude.

Second, the VBN model [1] was applied to the recordings to deduce F/F_{\max} from the recorded pressures [2]. Exclusion criterion for VBN analysis was polyphasic waves of detrusor pressure. Each NIDC was analyzed independently.

Results

Mean age was 69 ± 7 y in men and 49 ± 21 in women. An history of neurological disease was found in 5 men (2 incomplete spinal cord injury, 3 Parkinson disease) and 3 women (multiple sclerosis).

Urodynamics:

The mean number of NIDC was significantly different between the 2 groups (Table: $p=.0024$).

All patients except 7 (5 men, 2 women) had an additional NIDC at functional bladder capacity.

	No NIDC	duration of p_{\det} increase (s)	duration of p_{\det} decrease (s)	Amplitude of the first NIDC (cm H ₂ O)	Mean amplitude of all NIDCs (cm H ₂ O)	F/F_{\max}
Men (No=15)	2.1 ± 1.0	8.3 ± 2.1	10.9 ± 2.4	15.1 ± 11.2	15.3 ± 9.9	0.68 ± 0.38
Women (No= 15)	3.7 ± 1.0	7.4 ± 2.6	11.9 ± 3.9	8.8 ± 4.1	16.1 ± 10.9	0.48 ± 0.28
p	.0024	n.s.	n.s.	n.s.	n.s.	n.s.

There was no significant difference in both the duration in increase and decrease of the NIDC whatever the gender.

In case of several NIDC, the amplitude increased from the first to the last one in women while that phenomenon was absent or not significant in men.

During each NIDC the sphincter behavior was relaxed in 13 female files and 1 male file, steady in 1 female file and 14 male files, reinforced in 1 female file.

VBN analysis:

In men and women, each NIDC resulted from an all or none variation of the detrusor excitation of constant amplitude $(F/F_{\max})_{\det}$. Duration was 5-12s in both men and in women. Then $(F/F_{\max})_{\det}$ returned to 0.

In case of successive NIDC, the amplitude was constant or increasing with bladder filling.

$(F/F_{\max})_{\det}$ was ≈ 1 during all NIDC and voiding for 2 men (without neurological disease) and in the range 0.1-1.0 for the other.

$(F/F_{\max})_{\det}$ was in the range 0.12-1.0 for women.

During NIDC the sphincter behavior relaxation resulted from all or none variation of $(F/F_{\max})_{sph}$ which amplitude varied from a high value to a low value. The duration of spikes was wider for the sphincter.

Interpretation of results

Several authors ascribe DO to abnormal afferent signalling due to abnormal intrinsic bladder reflexes. No animal model is able to reproduce all the phenomena which generate DO.

A merit of mathematical modelling is to allow analysis of urodynamic recordings from individuals. From our analysis, the detrusor excitation appears as the leading phenomenon. The duration of the detrusor excitation, greater than T_{\det} is consistent with an inhibitory feedback. Characteristics of NIDC do not differ with the gender. The only significant difference between men and women is the number of NIDC.

The sphincter relaxation occurring after the onset of the detrusor excitation could be analogous to the voiding reflex. The inhibitory feedback which stops the detrusor excitation allows the sphincter excitation to regain a value compatible with continence.

Explanation of sphincter behaviour (mainly steady in men) needs a larger population.

Limitations of this study are 1) the small number of patients, particularly with an history of neurological disease (in non discussed files of patients with an history of neurological disease, unexpected results have been found) and 2) mainly in men, co-contractions of perinea and bladder.

Concluding message

That study of the efferent signal suggests that the afferent signal would trigger a normal contraction of the detrusor in phasic DO whatever the gender. An inhibitory reflex stops the contraction after a 5s. The only difference between men and women is the number of NIDC during bladder filling.

References

1. 1- NAU 2000; 19:153-176
2. 2- Uro Today Int J 2010; vol 3(4)

Disclosures

Funding: None **Clinical Trial:** No **Subjects:** HUMAN **Ethics not Req'd:** It involves retrospective analysis of urodynamic studies from a database **Helsinki:** Yes **Informed Consent:** No