536

Valentini F[1], Marti B[1], Robain G[1], Nelson P[1]
1. UMRS 731 INSERM/Université Pierre et Marie Curie - paris 6

CONTRIBUTION OF MODELLING TO THE ANALYSIS OF THE DIFFERENCES BETWEEN THE DATA OF FREE FLOW AND INTUBATED FLOW IN WOMEN WITH URINARY INCONTINENCE.

Hypothesis / aims of study

There have been only few studies about the differences between urodynamic data extracted from a free flow (FF) and an intubated flow (IF) in women [1-2]. It is probable that the urethral catheter might produce some effects on the physiology of voiding. Our objectives were: 1) to compare urodynamic data from FF and IF in women with urinary incontinence and 2) to interpret the differences using a mathematical model of micturition [3].

Study design, materials and methods

Two hundred and seventeen women with urinary incontinence were evaluated between July 2002 and December 2004. Exclusion criteria were neurological diseases, diabetes mellitus and grade 2 or more pelvic organ prolapse. Included files consisted of one FF and one IF (10F triple-lumen urethral catheter, voiding at maximum cystometric capacity) with voided volume > 100 mL and continuous flow. FF was performed before catheterization. All voiding studies were conducted in the seated position, in privacy. Urodynamics was performed with the Bonito® unit from Laborie. Analyzed parameters were volumes (initial (V_{ini}), voided (V_u) and residual (V_r)), flow rate: maximum Q_{max} and average Q_{ave}, flow time t_{mic} and detrusor pressure (at opening, $p_{det.open}$ and Q_{max}, $p_{det.Qmax}$). From these parameters some ratios were defined: $rV_r = V_r/V_{ini}$, $rQ_{max} = Q_{max.IF}/ Q_{max.FF}$ and Q_{max}/Q_{ave}. Voidings with $rV_r \geq 20\%$ were named **V+,** those with $V_r < 20\%$ **V-**.

Mathematical modelling of recorded flow and pressure curves was performed using the VBN® model [2] allowing to evaluate the set of VBN parameters (detrusor force and urethral parameter) related to each patient. Then, to investigate and identify the causes of the observed differences between FF and IF, the model was used to make simulation of pathophysiological hypothesis.

Results

Only 102/217 (47.0%) women, mean age 54.3 years [24-86], succeeded in FF and IF according to the required criteria (voided volume and flow). For these 102 women, the values of the voiding parameters are shown in the table.

	V_{ini}	V_u	rV_r	Q_{max}	Q_{max}/Q_{ave}	t_{mic}
FF	286±58 mL	277±61 mL	7.1±14.0%	27±13mL/s	1.54±.18	19±10 s
IF	391±149mL	347±144mL	12.6±20.1%	15±8 mL/s	1.47±.22	49±23 s
p	<.0001	<.0001	=.016	<.0001	n.s.	<.0001

Sixty four women (62.7%) had **V-** in both FF and IF, 9 in only IF; 4 had **V+** in both FF and IF and 25 in only IF.

In the group with FF(**V-**) and IF(**V+**) rQ_{max} was .45±.27 while it was .71±.49 for **V-** in both FF and IF.

No significant difference was found in $p_{det.open}$ (20.3±16.5 vs 20.0±13.7 cmH_2O) and $p_{det.Qmax}$ (24.2±13.1 vs 27.2±16.7 cmH_2O) between the IF(**V-**) and the IF(**V+**) groups.

Each of the 102 files (one FF and one IF) was defined by a unique value of each VBN parameter (detrusor force and urethral parameter). Then, theoretical computations were made to simulate the decrease of Q_{max} and the increase of t_{mic}: the decrease of the effective cross-section of the urethra due to the catheter is $rQ_{max} = .75$ excepted in case of a strong urethral constriction.

Interpretation of results

1) The decrease of Q_{max} characterizes an obstructive effect of the catheter. The computed geometrical effect of the catheter is weak, nearly equal to the measured value in the IF(**V-**) group. But in 14/25 of the women with FF(**V-**) and IF(**V+**) the low value of rQ_{max} cannot be explained only by this geometrical effect; so, we have to assume a perturbation of the nervous control, incomplete sphincter relaxation (compressive obstruction) or/and fading of detrusor excitation.

2) The recorded increase of detrusor pressure during the voiding phase in the IF(**V+**) group would be sufficient to obtain complete bladder emptying (as in the IF(**V-**) group). The time needed for bladder emptying would be $t_{mic.nee} = V_{ini}/Q_{ave} \cong (1.51*V_{ini})/Q_{max}$. In the IF(**V+**) group, the recorded t_{mic} was found inferior to $t_{mic.nee}$: $t_{mic} / t_{mic.nee} = .71 \pm .22$ (vs 1.07 ±.26 in the IF(**V-**) group).Thus, modelling shows that high residual volume in the IF(**V+**) group is due to an additional fading of detrusor excitation.

Concluding message

Significant differences between free and intubated flow are found between free and intubated flow in woman with urinary incontinence. Modelling shows that the geometrical obstruction due to the urethral catheter is not sufficient to explain these differences. A compression-like effect possibly due to a urethral reflex seems to be induced by the catheter in situ; an additional fading of detrusor excitation leads to high residual volume. These findings underline the necessity to obtain at least one FF with one IF during a urodynamic session in order to improve the reliability of the conclusions of urodynamic investigation.

.

References

1- Urology, 2003, 62: 905-8.
2- Neurourol. Urodyn.
3- Neurourol. Urodyn. 2000, 19(2): 153-176.

FUNDING: No

HUMAN SUBJECTS: **This study did not need ethical approval because It is a retrospective study but followed the Declaration of Helsinki Informed consent was obtained from the patients.**