

## EVALUATION OF DETRUSOR CONTRACTILITY AND URETHRAL OBSTRUCTION IN NON NEUROLOGICAL WOMEN.

### Hypothesis / aims of study

Voiding process is governed by detrusor contractility (**k**) and urethral obstruction (anatomical or urethral resistance) (**U**) parameters. Using a simple, handheld, Excel software, we recently developed nomograms [1] to evaluate **k** and **U** from a pressure flow study recording using three measurements: filling volume ( $V_{ini}$ ), maximum flow rate ( $Q_{max}$ ) and detrusor pressure at  $Q_{max}$  ( $p_{det, Q_{max}}$ ). The aims of this study were to evaluate these parameters from large cohorts of non-neurogenic women presenting with various clinical conditions and tested urodynamically.

### Study design, materials and methods

Urodynamic data was obtained from 2 large databases: 1) women without symptom suggestive of obstruction and referred for evaluation of lower urinary tract dysfunction. They were categorized as normal, phasic or terminal detrusor overactivity (DO), stress urinary incontinence (SUI), intrinsic sphincteric deficiency (ISD) or hypertonic urethra (urethral pressure at rest > (110 – age) + 20%) [2] 2) women with anatomically proven bladder outlet obstruction (BOO) (site of urethral obstruction confirmed on lateral view voiding cystourethrogram).

First, a correlation between **k** and **U** vs. age was searched in the non-obstructed group. Then correlation between **k** and **U** was investigated in sub-groups according to the main UDS diagnosis in both groups. At last, a correction for the effect of ageing (made possible after studying the correlation between **k** and **U**) was introduced in all sub-groups older than 50 years.

### Results

1- In the non-obstructed group (N=202), value of **k** and **U** remained constant until menopausal age, and then decreased regularly with advancing age (Table 1).

Table 1. Relationship between **k** and **U**, and increasing age categories.

Age (y)	< 30	30-39	40-49	50-59	60-69	70-79	> 80
Number	8	16	26	40	37	46	29
<b>k</b>	.65 ± .33	.67 ± .24	.63 ± .29	.52 ± .22	.43 ± .24	.38 ± .18	.35 ± .17
<b>U</b> (cm H <sub>2</sub> O)	25.9 ± 20.4	24.9 ± 18.3	23.3 ± 19.8	17.1 ± 13.8	16.0 ± 13.8	12.0 ± 12.5	11.5 ± 10.6

2- Table 2. Correlations between **k(U)** and mean value of **k** and **U**.

	Normal UDS	Phasic DO	Terminal DO	SUI	ISD	Hypertonic urethra	All non-obstructed	All BOO
Number	18	71	71	15	17	10	202	126
Age(y)	59 ± 16	53 ± 18	66 ± 13	59 ± 15	68 ± 15	45 ± 16	58 ± 17	57 ± 13
<b>k(U)</b> R <sup>2</sup>	.87	.70	.74	.39	.26	.84	.73	.84
< <b>k</b> >	.47 ± .24	.56 ± .30	.52 ± .30	.39 ± .14	.38 ± .14	.48 ± .20	.48 ± .20	.68 ± .40
< <b>U</b> >	17.3 ± 15.0	20.0 ± 16.0	21.0 ± 19.0	8.8 ± 7.7	8.5 ± 7.0	15.0 ± 13.0	15.6 ± 14.0	28.5 ± 22.0

Mean value of **k** and **U** was significantly higher in the obstructed group (N=126) (comparing non-obstructed vs. obstructed:  $p < .0001$  for each parameter)

Correlation between **k** and **U** showed a wide dispersion in SUI or ISD patients. Compared to phasic DO, **k** and **U** were significantly lower in women with SUI ( $p=.0183$  and  $p=.0090$ ) or ISD ( $p=.0060$  and  $p=.0048$ ). Compared to terminal DO, **U** was significantly lower in women with SUI ( $p=.0289$ ) or ISD ( $p=.0172$ ).

3- As the value of **k** and **U** decreased regularly with ageing after menopause, a correction of the effect of age was made using a corrective factor of 0.011/y for **k** and 0.84/y for **U**. Table 3 gives <**k**<sub>c</sub>> and <**U**<sub>c</sub>> value adjusted to this age.

Table 3. Age-adjusted values of **k** (**k**<sub>c</sub>) and **U** (**U**<sub>c</sub>)

	Normal UDS	Phasic DO	Terminal DO	SUI	ISD	Hypertonic urethra	All BOO
Age (y)	59 ± 16	53 ± 18	66 ± 13	59 ± 15	68 ± 15	45 ± 16	57 ± 13
< <b>k</b> >	.47 ± .24	.56 ± .30	.52 ± .30	.39 ± .14	.38 ± .14	.48 ± .20	.68 ± .40
< <b>k</b> <sub>c</sub> >	.57	.59	.70	.49	.58	.48	.76
< <b>U</b> >	17.3 ± 15.0	20.0 ± 16.0	21.0 ± 19.0	8.8 ± 7.7	8.5 ± 7.0	15.0 ± 13.0	28.5 ± 22.0
< <b>U</b> <sub>c</sub> >	24.9	22.5	34.4	16.4	23.6	15.0	34.4

With age adjustment to 50 y, values of **U** and **k** parameters for terminal DO appeared close to those of obstructed patients.

### Interpretation of results

- As previously described [3], detrusor contractility remains constant before menopause but with a lower value ( $k = .64$ ) than in age-comparable men ( $k = 1.0$ )
- The low values of  $k$  and  $U$  in non obstructed women with SUI or ISD seem to be mainly related to age.
- Terminal DO occurred with a higher prevalence in older women which may explain the low value of  $k$ . Adjusted to the reference age, an unexpected result was that  $k$  and  $U$  have value close to that of obstructed women whereas phasic DO is assumed to reinforce the sphincter (no leakage) and consequently the detrusor.
- The strong correlation between  $k$  and  $U$  points out to an adaptive process between detrusor contractility (detrusor force) and urethral resistance (obstruction). That phenomenon appears comparable to what has been reported in men with benign prostatic enlargement.

### Concluding message

Evaluation of detrusor contractility ( $k$ ) and urethral obstruction ( $U$ ) can be obtained from a pressure-flow study. These two parameters can be easily calculated from a simple software. A strong correlation was noted between detrusor contractility and urethral obstruction consistent with an adaptive process. After age adjustment, anatomical BOO and terminal DO appear to produce values of  $k$  and  $U$  in a similar range. Age above 50 years old affects measurements; thus a corrective factor needs to be applied to compare  $U$  and  $k$  data across various age ranges.

### References

1. Valentini FA, Nelson PP. Building a nomogram for evaluation of detrusor contractility in women. *Neurourol Urodyn* 2015; 34-S1-10
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3. Valentini FA, Nelson PP, Robain G, Zimmern PE. Effect of ageing on detrusor force in women. Evaluation from mathematical modeling of pressure-flow studies. *Neurourol Urodyn* 2015; 34-S1-28-29

### Disclosures

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