

## TO DESIGN A SIMPLE OFFICE-BASED METHOD TO INTERPRET FREE UROFLOWMETRIES (FF) IN THE FOLLOW-UP OF WOMEN AT RISK OF DEVELOPING OUTFLOW OBSTRUCTION OVER TIME AFTER SURGICAL INTERVENTIONS.

### Hypothesis / aims of study

This study has three related aims in women: 1. to obtain a reliable evaluation of urethral obstruction (**U**) and detrusor contractility (**k**) parameters from the maximum flow rate and detrusor pressure at maximum flow rate values extracted from pressure-flow studies (PFs). 2. to create nomograms for **k** and **U** based on theoretical computations using the VBN model [1] in order to simplify the calculation processes and offer a simple hand-held tool to the practitioner to rapidly perform these computations. And 3. to propose a protocol to interpret free-flows (FF) in the follow-up of women at risk of developing bladder outlet obstruction.

### Study design, materials and methods

The VBN mathematical model determines micturition parameters based on two patient dependent mechanical parameters (detrusor contractility and urethral obstruction), three time-dependent functions (nervous excitations of detrusor and sphincter, and a possible component of abdominal straining) and two circumstantial parameters (the filling (initial) bladder volume and the catheter size (for PFs)).

First, a hypothesis similar to what has been done in a prior work related to BOO in men was considered in order to compute **k** and **U** from the values of maximum flow rate ( $Q_{\max}$ ) and detrusor pressure at maximum flow rate ( $p_{\det.Q_{\max}}$ ) during PFs.

Next, nomograms were built from tables giving  $Q_{\max}$  and  $p_{\det.Q_{\max}}$  for various combinations of **k**, **U** and  $V_{\text{ini}}$  (initial volume equals bladder filling volume).

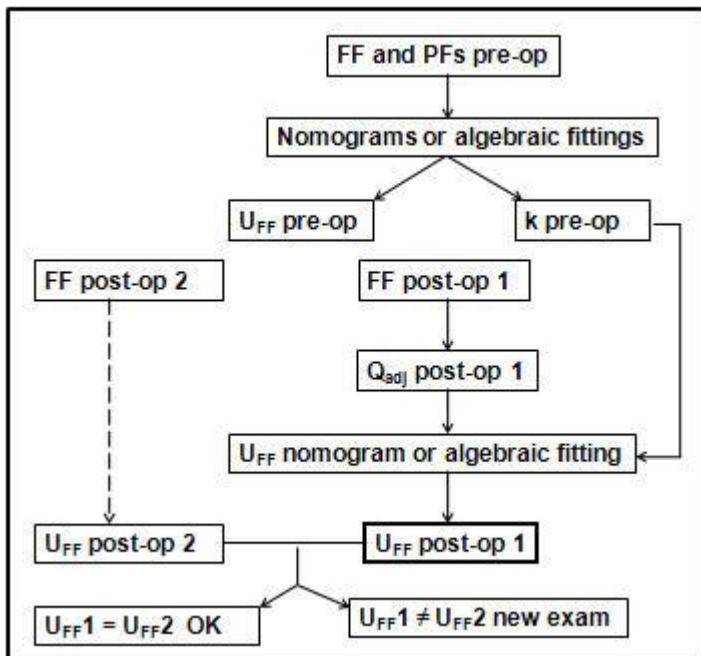
### Results

A- The first step was to create useful nomograms (aims 1 and 2):

1- A urethral obstruction nomogram implying linear relationships allowed to define a Woman Obstruction Index ( $WOI = p_{\det.Q_{\max}} - 0.5 \cdot Q_{\max}$ ) which has the same structure than the A-G number in men.

2- A detrusor contractility nomogram (not straight lines) was also created and was generalized to all initial bladder volumes. The curves were fitted by algebraic equations easily programmable on any handheld device (Excel file).

B- The next step (aim 3) was to describe a protocol to evaluate the possibility of urethral obstruction from a FF: **U<sub>FF</sub>** and using this information over time to track women at risk of urethral obstruction (Fig).



### Interpretation of results

Due to the lack of tools for assessment of both detrusor contractility and urethral obstruction in women and given the possibilities offered by modeling, our goal was to use the VBN mathematical model of micturition to build nomograms for these 2 critical parameters. A potentially clinically relevant aspect of such nomograms is the post-operative follow-up of women at risk for BOO based on serial FFs. A hidden assumption is that abdominal straining is negligible until the flow reaches  $Q_{\max}$  and that nervous excitations remain standard during this time interval. Additionally, we have assumed that the voiding pressure measured by PFS remains unchanged post-operatively as detrusor aging will happen only gradually over time but not in the short span of the post-

operative period. A limitation of the study results from the occasional occurrence of an intriguing voiding pattern in woman which combines low detrusor pressure and high maximum flow rate.

#### Concluding message

Use of the VBN mathematical model of micturition allows to construct 2 main nomograms to evaluate detrusor contractility (**k**) and urethral obstruction (**U**) in women from a pressure-flow study. Algebraic fitting of the curves was performed, which led to an economy of equipment and of time needed to calculate these 2 mechanical parameters. A simple office-based free flow can provide these 2 parameters (u and k) from any handheld device. Therefore, serial FFs over time should permit an easy follow-up of women at risk of progressing or recurring BOO after surgical interventions (i.e. recurrent stricture after urethral dilation, LUTS or suspected voiding dysfunction after sling...).

#### References

1. 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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