

TOWARDS A NEW NOMOGRAM AND AN INDEX FOR FEMALE BLADDER OUTLET OBSTRUCTION

Hypothesis / aims of study

Evaluation of bladder outlet obstruction in women remains controversial. Some cutoff values [1] and nomogram [2] have been proposed but without consensus as evaluation of detrusor pressure in difficult.

The VBN mathematical micturition model [3] allows evaluating both detrusor contractility (**k**) and urethral obstruction (**gamma**) from UDS recordings.

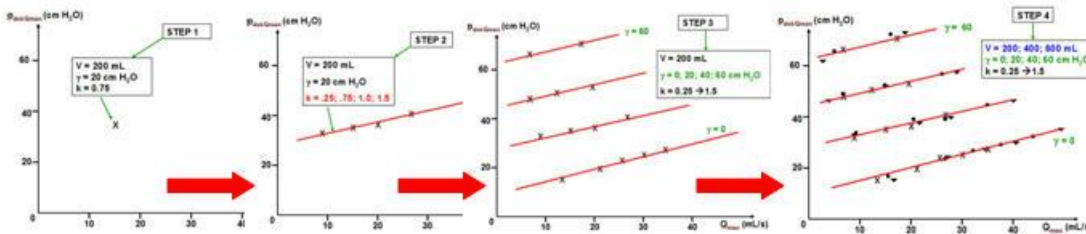
Our purpose was to build a nomogram in the plane [$p_{det.Qmax}$ - Q_{max}] allowing an evaluation of the urethral obstruction without any computation.

Study design, materials and methods

Using the VBN model (3), theoretical computations of intubated flow (catheter 7F) were performed for various values of initial bladder volume (V_{ini}) [200-600mL], **k** [0.25-1.5] and **gamma** [0-60 cmH₂O]. So, for computation with n values of each parameter (n=10), n³ computations (10³=1000) were necessary. Then the curves $p_{det.Qmax}(Q_{max})$ were plotted for various values of **gamma**. In addition, a retrospective application of **gamma** measurement was tested in 125 non-neurogenic women without grade >2 prolapse who underwent UDS for various lower urinary tract symptoms (LUTS).

Results

1- Building of nomogram and definition of an index



1a- The curves $p_{det.Qmax}(Q_{max})$ were found linear of equation $p_{det.Qmax} = A+B*Q_{max}$.

1b- For the different V_{ini} , it was observed that A and B did not depend of V_{ini} .

1c- The straight lines were close to parallel lines with B=0.5.

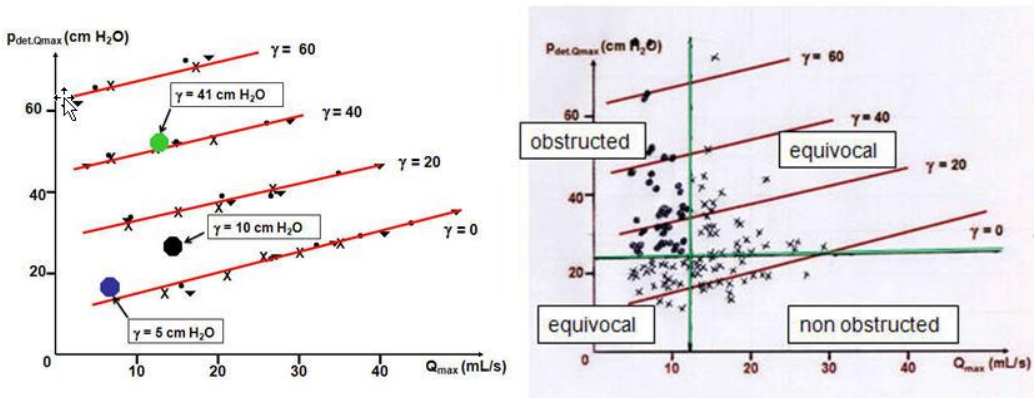
1d- The straight lines were regularly spaced out (A was a linear function of **gamma**).

So, a new index was defined: $A = (p_{det.Qmax} - 0.5*Q_{max})$, called WOI (Woman Obstruction Index) with **gamma** = $(1.16*A - 11.13)$.

2- Application of the nomogram

From comparisons a posteriori between \square obtained from VBN analysis (UDS recordings) and from nomogram ($p_{det.Qmax}$ and Q_{max}) error was <5%. Three tracing examples are displayed on Fig (left): green= detrusor overactivity (DO), black= intrinsic sphincter deficiency (ISD), and blue= normal UDS.

On Fig (right) are displayed data from 125 women showing classification using cutoff values from [1]. Circles represent obstructed; crosses represent non-obstructed. According to the values of $p_{det.Qmax}$ and Q_{max} , 2 equivocal zones (high $p_{det.Qmax}$ -high Q_{max} and low $p_{det.Qmax}$ -low Q_{max}) and a non obstructed zone (low $p_{det.Qmax}$ -high Q_{max}) were defined.



Interpretation of results

Use of a mathematical model of micturition allows carrying out a nomogram which to evaluate urethral obstruction in women from a pressure-flow study. Building of the nomogram reveals a simple relation between $p_{det.Qmax}$ and Q_{max} which shows a similarity of bladder function in women and men. Based on this theoretical study, analysis of data of women who underwent urodynamic

testing for various LUTS allows, using the cutoff values defined in [1], to propose a cutting of the non-obstructed zone in equivocal and non-obstructed.

Concluding message

Mathematical modeling can produce a nomogram for evaluation of urethral obstruction in woman. In addition, an obstruction index for woman (WOI), similar to BOOI in man, can be defined.

Future studies will investigate its relevance in large populations of women with anatomic bladder outlet obstruction.