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THE USE OF A MODELIZED ANALYSIS OF FREE UROFLOWS (FF) TO IMPROVE WATCHFUL WAITING OF PATIENTS WITH BENIGN PROSTATIC ENLARGEMENT (BPE).

Hypothesis / aims of study

The obstructive status of a BPE patient is characterized by the urethral obstruction and by the contractile behavior of the detrusor. One cannot obtain quantitative evaluation of these two parameters from only FF. The aims of this study are 1) to define a parameter which can be evaluated from only FF and would be able to estimate the risk of retention for BPE patients, 2) to show how a modelized analysis of FF allows to obtain the value of this parameter, 3) to discuss its physiological meaning.

Study design, materials and methods

The population was composed 137 BPE patients. One hundred thirteen patients were included in a pharmacological study and performed only FF; 24 patients underwent urodynamics before TURP. A total of 306 free uroflows FF and 112 pressure-flow studies (P-Fs) were usable. Seventy nine files provided special interest as they contained several urodynamic tests (10 FF and 4 P-Fs for 9 files, 5 FF for 70 files).
Theoretical developments used the VBN modeling of micturition for a male patient [1]. Urethral obstruction and detrusor force were characterized respectively by two parameters: **pucp** is the prostatic urethra counter-pressure and **k** the detrusor force coefficient. From any couple of parameters (**pucp**, **k**), and for any initial bladder volume, the model allowed to compute theoretical flow rate and detrusor pressure curves. An automated version of the VBN method without manual intervention except to click on a switch "do calculation" was used to find the best fitting (quadratic error < 2%) between computed and recorded flow curves.

Results

Any free flow curve could be attributed to a family of "homologous voidings". It meant that for a given flow curve, a set of detrusor pressure curves could be associated, each with a different couple (**pucp**, **k**). All the couples (**pucp**, **k**) of a given family were on a curve in the **pucp**, **k** plane. This curve was referenced by a critical point **RRp** (Retention Risk parameter, this name will be justified in "interpretation of results") which was the value of **pucp** for **k** = 1 (normal detrusor). All the homologous voidings had the same residual volume (and the same maximum flow rate Q_{max}). **RRp** did not depend on the value of the initial bladder volume neither on the nervous control but (on the opposite of the maximum flow rate Q_{max}) only on the obstructive status of the patient. It was an estimation of the balancing of the urethral obstruction by the detrusor. From any flow recording, the automated VBN software gave in few milliseconds the value of **RRp**.
Comparison of the results from files including several recordings found an accuracy of +/- 3 cm H_2O for the **RRp** value.
On the figure, the left part shows how to determine the value of **RRp**. The right part represents the residual volume Vr versus the initial bladder volume Vi for different values of **RRp**; it shows how retention will occur for great values of **RRp**.

Interpretation of results

From theoretical computations, the figure above shows that **RRp** = 30 cm H_2O implies large residual volume, **RRp** between 30 and 40 cm H_2O retention for large initial bladder volume and **RRp** > 40 cm H_2O retention whatever the initial volume. Looking at the studied population we saw that the patients included in the pharmacological study had a value of **RRp** in the range [16-31 cm H_2O] mean **RRp** = 24 cm H_2O when the pre-TURP patients had a significantly higher value of **RRp**: range [27-36 cm H_2O], mean **RRp** = 32 cm H_2O. Thus we saw that the value of **RRp** was linked to a retention risk.
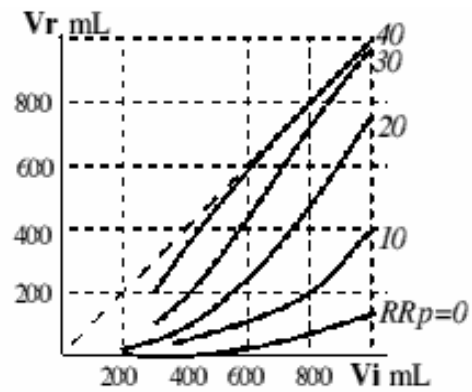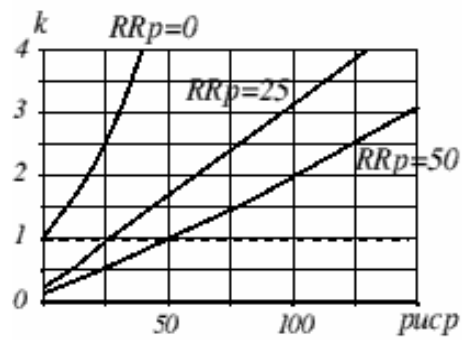
Concluding message

A clearly defined parameter **RRp** which only depends on the obstructive status of a BPE patient can be deduced from a free uroflow recording; it is more accurate than the Q_{max} as it does not depend on the testing circumstances. This parameter is easy to evaluate and can be related to a risk to develop retention; it can help the clinician when watchful waiting is proposed to a BPE patient.

References

[1] Modelized analysis of pressure-flow studies of patients with lower urinary tract symptoms due to benign prostatic enlargement. Neurourol Urodyn 2003. 22: 45-53.