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ORIGINAL ARTICLE

Usefulness of an algebraic fitting of nomograms allowing evaluation detrusor contractility in women

Intérêt du lissage algébrique des nomogammes permettant l'évaluation de la contractilité du detrusor de la femme

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Detrusor contractility;
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Summary
Aims. — Nomograms based on Valentini-Besson-Nelson (VBN) model implying only 3 measurements (filling bladder volume, maximum flow-rate [Q_{max}] and detrusor pressure at Q_{max}) were recently developed to evaluate detrusor contractility (**k**) and urethral obstruction (**U**) in women. As their algebraic fitting leads to fast evaluations (Excel® software), our aims were applications to populations of non-neurologic women without and with bladder outlet obstruction (BOO).
Methods. — The software was applied to measurements obtained during pressure flow studies. Hidden hypothesis of nomograms were no significant contribution of abdominal pressure between onset of flow and Q_{max} and standard nervous excitations until Q_{max}. Studied populations were 202 women without symptom suggestive of obstruction and 125 women with proven anatomical urethral obstruction who underwent urodynamic study.
Results. — For non-obstructed women, a good agreement was found between the values of **k** and **U** obtained using nomograms or a complete VBN analysis of the recorded curves. Whatever the obstructive status, there was a good correlation between the value of **k** and **U**. Evolution with ageing was similar with higher values of **k** and **U** in the BOO group. Curves **k**(age) and **U**(age) gave coefficients allowing an age adjustment. The high **k** value in the detrusor overactive (DO) group was consistent with a similar effect to that of BOO on the detrusor.

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Conclusion. — Evaluation of detrusor contractility (**k**) and urethral obstruction (**U**) can be obtained from the point of Q_{max} during pressure-flow study. Evolution with ageing is similar with (higher values) or without BOO. DO also induces an increased detrusor contractility.
Level of evidence. — 4.

MOTS CLÉS
Contractilité du detrusor ;
Nomogrammes ;
Obstruction sous-vésicale ;
Femme

Résumé
Introduction. — Des nomogrammes déduits du modèle Valentini-Besson-Nelson (VBN) permettent d'évaluer la contractilité du detrusor (**k**) et l'obstruction urétrale (**U**) chez la femme. Leur lissage algébrique permet une évaluation très rapide (sous Excel®) à partir des données d'un instantané mictionnel à l'instant du débit maximum (Q_{max}). Notre but était l'application de cette méthode à des femmes non-neurologiques.
Méthodes. — Deux populations ont été étudiées : 202 patientes sans symptôme obstructif et 125 patientes ayant une obstruction urétrale anatomique documentée. Les conditions requises étaient l'absence de pression abdominale significative et des excitations nerveuses standards entre le début du débit et l'atteinte du Q_{max}.
Résultats. — Chez les patientes non-obstruées, on retrouvait une bonne correspondance entre les valeurs de **k** et **U** obtenues par utilisation des nomogrammes et celles obtenues par analyse VBN de l'ensemble des courbes. Quel que soit le statut obstructif, on trouvait une bonne corrélation entre les valeurs de **k** et **U**. L'effet du vieillissement était semblable dans les 2 groupes avec des valeurs significativement plus élevées de **k** et **U** dans le groupe obstrué. Les courbes **k**(âge) et **U**(âge) donnent des coefficients permettant une correction d'âge. Hyperactivité du detrusor et obstruction urétrale conduisent à des valeurs élevées de **k**.
Conclusion. — Contractilité du detrusor (**k**) et obstruction urétrale (**U**) peuvent être évaluées à partir du point de Q_{max} pendant un IM. L'obstruction anatomique conduit à des valeurs plus élevées mais l'évolution avec le vieillissement est comparable. L'hyperactivité du detrusor entraîne elle aussi une augmentation de la contractilité du detrusor.
Niveau de preuve.— 4.

Introduction

Detrusor contractility and urethral obstruction (anatomical or ''urethral resistance'') are the driving factors of the voiding process. These mechanical parameters are respectively named **k** and **U** in the VBN mathematical model of micturition [1,2].

In a previous study, **k** and **U** have been evaluated in a population of non-neurologic, non-obstructed women from the VBN analysis of the whole set of urodynamic tracings recorded during a pressure-flow study (PFs) [3]. In women, unlike in men, the impact of bladder outlet obstruction (BOO) on bladder contractility has been little discussed.

Recently, VBN-based nomograms have been developed [4] to follow women at risk of obstruction over time. They allow evaluating **k** and **U** from a PFs recording using only three measurements: filling volume (V_{ini}), maximum flow rate (Q_{max}) and detrusor pressure at Q_{max} ($p_{det.Qmax}$). More algebraic fitting of these nomograms have allowed to carry out a usable software in Excel® or in any simple handheld. Thus, it is no longer necessary to extrapolate between the reference curves of nomograms to obtain the values of **k** and **U**. Using the Excel® software, values are obtained instantaneously from the three measurements listed above.

Our aims were:

- to compare the values of **k** and **U** obtained from nomograms and complete VBN analysis;
- to apply the nomograms to data of large cohorts of non-neurogenic women tested urodynamically in order to analyze the effect of anatomical urethral obstruction on detrusor contractility;
- to propose a correction of the effect of ageing in order to separate the effect of ageing from a specific effect of a lower urinary tract dysfunction (LUTD) on the mechanical parameters.

Materials and methods

This study was conducted in accordance with the Declaration of Helsinki. Urodynamic data were obtained from 2 large databases from 2 institutions.

Non-obstructed group

The first sample (non-obstructed group) comprised women without symptom suggestive of obstruction (i.e. no

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