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ARE NOMOGRAMS BASED ON FREE UROFLOWS HELPFUL TO EVALUATE URETHRAL OBSTRUCTION IN MEN?

Hypothesis / aims of study

Comparison between free uroflow (FF) and intubated flow (IF) in women has demonstrated that, when a large decrease of maximum flow rate (Q_{max}) during IF is observed, a urethral reflex could occur, due to foreign material in the urethra [1]. The consequence is an overestimation of the obstruction. Our hypothesis was that a similar phenomenon could occur in men. So, our purpose was to search for a method using the results of a FF preceding an IF to eventually correct the BOOI (AG number) estimation.

Study design, materials and methods

A- Retrospectively, a database comprising 441 urodynamic studies of men suspected of bladder outlet obstruction (BOO) were analyzed. Each file included a FF (voided volume (VV), post void residual (PVR), Q_{max}, followed by an IF (urethral catheter 8F) providing initial bladder volume (V_{ini}), VV, PVR, Q_{max}, detrusor pressure at Q_{max} ($p_{det.Qmax}$) and evaluation of BOO according to AG number ($p_{det.Qmax}$-2*Q_{max}). Classification was non-obstructed (NO) if AG < 20, equivocal (E) if 20<AG<40 and obstructed (O) if AG>40.

B- Methods

1- A powerful software (the VBN model of micturition) takes into account all the well known elementary phenomena occurring during micturition and link the urethral obstruction and the detrusor contractility to the values of Q_{max} and $p_{det.Qmax}$. In men, urethral obstruction is mainly the counter pressure exerted by the prostate on the urethra (VBN parameter pucp). It is constant during voiding and for successive voidings. Obstruction due to the urethral catheter (8F) is taken into account by the model. The gold standard for BOO evaluation is AG number. AG and pucp are strongly correlated [2].

Detrusor contractility is the maximum force F_{max} in the force-length-contraction velocity relationship in muscles (Hill's law transposed into spherical geometry). In VBN, to avoid strange units, the maximum force is reported to the maximum force of a healthy young male volunteer chosen as a reference: $k = (F_{max}/F_{max.ref})$; then, k= 1 for this volunteer. The BCI ($p_{det.Qmax}$+5*Q_{max}) has been proposed as a simple approximate evaluation. The modified mBCI = ($p_{det.Qmax}$+1.5*Q_{max}) seemed often more reliable [2]. In fact, k cannot be approximated by such simple formula.

Looking only at the time of Q_{max}, VBN was used to draw nomograms; the curves were fitted by algebraic equations easily programmed in Excel.

2- AG and BCI are sufficient for a rough evaluation of urethral obstruction and detrusor contractility. But nomograms are necessary to compare FF and IF.

a- The effect of a urethral reflex is to increase the obstruction and so to strongly decrease Q_{max} during IF. As for women [1], $Q_{max.FF} > 1.5*Q_{max.IF}$ was chosen as cut off value for the hypothesis of urethral reflex.

b- If such a reflex occurs, FF is governed by k and pucp, IF by the same k but an increased obstruction (pucp+□p). This remark was used to compute the (no recorded) pressure during FF (without reflex) and so to obtain a corrected value of AG (cor-AG).

c- The D index [3] characterizes the compatibility between the urethra and the detrusor. Thus, high D values can be related either to high urethral obstruction (cut off values are NO <18.5 and O >32.5 cm H_2O) or a low detrusor contractility (k<1.0).

3- For each of the 441 files, looking first at the IF, $V_{ini.IF}$, $Q_{max.IF}$ and $p_{det.Qmax}$ were used to compute k, (pucp + □p), AG, BOOI and the Watt's factor. Looking then at the FF, $V_{ini.FF}$, $Q_{max.FF}$ and the now known k were used to compute pucp and cor-AG. $V_{ini.FF}$ and $Q_{max.FF}$ allowed to compute D.

Results

Among the 441 files, 79 had a $V_{ini.FF}$< 90 mL. These files were not considered for analysis.

For the 362 others, changes in BOO classes were analyzed applying the nomograms: for example (O for AG becoming E or NO for cor-AG) or (O for AG becoming D < 32.5).

→ 114 files had $Q_{max.FF} > 1.5* Q_{max.IF}$. There was no significant difference in V_{ini} (375±245 mL for FF vs. 410±139 mL for IF; n.s.).

N=114	less obstructed	unchanged	more obstructed
Cor_AG vs. AG	61 (53.5%)	53 (46.5%)	0
D vs. AG	51 (44.7%)	39 (34.2%)	14 (12.3%)

→ 248 files had $Q_{max.FF} < 1.5* Q_{max.IF}$. Vini was significantly different (313±195 mL for FF vs. 431±154 mL for IF; p <.0001)

N=248	less obstructed	unchanged	more obstructed
Cor_AG vs. AG	39 (15.7%)	181 (72.9%)	28 (11.3%)
D vs. AG	30 (12.1%)	117 (47.2%)	101 (40.7%)

Looking at the mean detrusor contractility of the 362 files it was found that for the files unchanged or classified less obstructed according with D (N= 237): k = 1.15 ± 0.56, and for the files classified more obstructed according with D (N= 115): k = 0.60 ± 0.39.

The difference in k value was significant (p < .0001).

Interpretation of results

1- V_{ini} is not significantly different between IF and FF sub-population where $Q_{max.FF} > 1.5* Q_{max.IF.}$ That result implies an increased obstruction during IF which cannot be explained otherwise than by the occurrence of a urethral reflex consequence of a foreign material in the urethra (probably without clinical significance and perhaps irreproducible). That reflex induces an overestimation of BOO using BOOI.

2- An emended AG (cor_AG) can be obtained using some nomograms (fitted by algebraic equations and easily programmed in Excel). Computing cor-AG is an easy way to correct the evaluation of BOO from IF. A great ratio of files are founded less obstructed with the use of nomograms in the sub-population where $Q_{max.FF} > 1.5* Q_{max.IF}$.

3- A great number of files appears more obstructed after evaluation with D (115/362 = 31.8%, mainly if $Q_{max.FF} < 1.5* Q_{max.IF}$).That result points out a sub-population with a low value of the parameter k which is characteristic of a decreased detrusor contractility (impaired detrusor).

Concluding message

These results suggest that to obtain reliable evaluation of BOO in men, it is suitable to perform a FF before the IF. An easily usable Excel tool allows computing from basic urodynamic parameters a corrected AG (cor_AG) which value, if lower than AG, indicates the occurrence of a urethral reflex during IF. An unexpected result is that the increased evaluation of BOO using D index is related to a detrusor underactivity. From that retrospective study, it is suggested that the proposed nomograms could be a help for evaluation of BOO in men.

References

1. Valentini FA, Robain G, Hennebelle DS, NELSON PP. Decreased maximum flow rate during intubated flow is not only due to the urethral catheter in situ. Int Urogynecol J 2013; 24: 461-7. doi 10.1007/s00192-012-1856-2.
2. Valentini FA, Griffiths DJ, Zimmern PE, Besson GR, Nelson PP. Quantification de l'obstruction chez l'homme: comparaison des méthodes usuelles avec la méthode VBN®. Ann. Réadap. Méd. Phys. 2005 ; 48 :11-19.
3. Valentini FA, Nelson PP, Besson GR, ZImmern PE. Challenging the maximum flow rate: a new index of voiding dysfunction in men with benign prostatic enlargement. BJUInt 2008; 101: 995-999.

Disclosures

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