894
Nelson P[1], Valentini F[1], Zimmern P[2]
***1.** ER6/Université Pierre et Marie Curie - Paris 6, **2.** UTSouthwestern Medical Center Dallas TX*

IMPACT OF URETHRAL CATHETER SIZE DURING VOIDING IN MAN: OBSTRUCTIVE OR NOT? CONSEQUENCE ON EVALUATION OF BLADDER OUTLET OBSTRUCTION USING ABRAMS-GRIFFITHS NUMBER.

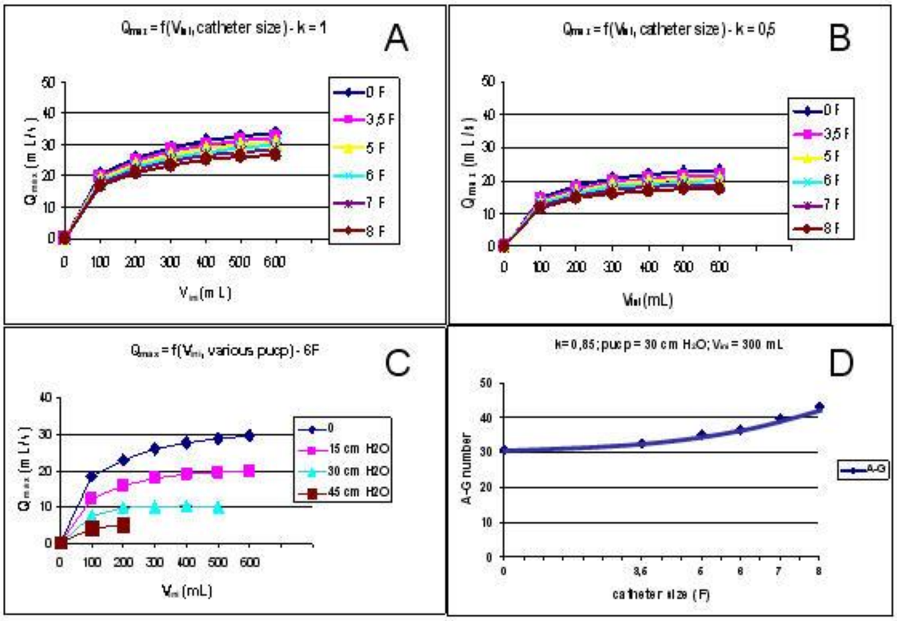
Hypothesis / aims of study
Pressure flow studies in men are the gold standard to investigate urethral obstruction (1). Is there an impact of the presence and size of the urethral catheter on maximum flow rate (Q_{max}) and consequently on detrusor pressure (p_{det})? If yes, what is the consequence on the evaluation of urethral obstruction using Abrams-Griffiths number (A-G)? We used the VBN mathematical micturition model (2) to analyze the parameters most likely to influence the voiding phase of a urodynamic study (UDS) in man.

Study design, materials and methods
The VBN model was used to investigate the effect of catheter size during voiding and to tease out its role against other influential parameters of voiding in men, such as volume voided and degree of detrusor contractility. Simulations of voidings were made for a range of catheter sizes frequently utilized during UDS: 3.5, 5, 6, 7 and 8F. Other studied parameters included bladder volumes (from 100 to 600 mL), detrusor contractility (k parameter), a compressive urethral obstruction (simulation of prostate enlargement: pucp=15, 30 and 45 cm H_2O). A-G was evaluated. Comparisons were made between the computed Q_{max} in these various conditions.

Results
The geometrical obstruction due to a catheter was almost negligible compared with the volume effect (Fig-A). The highest decrease in Q_{max} resulted from a decrease of detrusor contractility (Fig-B: k=.5) or to a urethral compression (Fig-C: k=1) with a high incidence of catheter size higher than 6F. Concomitant urethral compression and decrease of detrusor contractility increased the apparent obstructive effect and decreased the volume effect. In that last condition the apparent obstructive effect due to the catheter generated an increase of A-G of about□10 (Fig-D: k=.85, pucp=30 cmH_2O, V_{ini}=300mL) which introduced an uncertainty in the evaluation of BOO (ICS limits of A-G from 20 to 40).

Interpretation of results
Hydrodynamic equations giving the flow rate vs. time are coupled with the law of urethral elasticity: the cross-section of the urethra S(x), area of the fluid, is a function of the local hydrodynamic pressure p(x). A urethral catheter (cross-section s) in situ does not modify the elasticity law S(p), but the area of the fluid becomes (S-s). This mechanical effect is taken into account by the VBN model as a constrictive effect.
From computations it appears that the decrease of Q_{max} during IF is more dependent of the mechanical parameters of the lower urinary tract than on the geometric effect of the catheter (catheter size). A strongly decreased Q_{max} can be the consequence of decreased detrusor contractility or of urethral compression.
Thus, a remaining question is: how is it possible to distinguish between these two mechanical parameters? The answer could be given by the study of detrusor pressure at maximum flow rate ($p_{det.Qmax}$). Decreased detrusor contractility is associated with decreased $p_{det.Qmax}$ while urethral compression is associated with increased $p_{det.Qmax}$ (cf. Hill-Griffiths' law).
Another consequence is that, in men, the urethral catheter increases the effect (increased $p_{det.Qmax}$) of the urethral compression due to benign prostatic enlargement with consequence an overestimation of A-G number.

Concluding message
Based on the VBN model, the main reason for a decrease in Q_{max} during an intubated flow in man is related to a decrease in detrusor contractility or to a urethral compression. Only geometrical obstructive effect of the catheter is less contributive. For BOO man, A-G could be overestimated due to the catheter in situ.



References

1. 1- Griffiths D, Höfner K, van Mastrigt R, Rollema HJ, Spanberg A, Gleason D. Standardization of terminology of lower urinary tract function: Pressure-flow studies of voiding, urethral resistance, and urethral obstruction. NAU 1997; 6: 1-18.
2. 2- Valentini FA, Besson GR, Nelson PP, Zimmern PE. A Mathematical Micturition Model to Restore Simple Flow Recordings in Healthy and Symptomatic Individuals and Enhance Uroflow Interpretation. NAU 2000; 19:153-176

Disclosures

Funding: None **Clinical Trial:** No **Subjects:** HUMAN **Ethics not Req'd:** It is a theoretical analysis of the effects of a device. **Helsinki not Req'd:** It is a mathematical modeling of the effect of a device. **Informed Consent:** No