i.e. slow waves have low amplitudes. This also means that usually when a slow start of a detrusor contractions is observed, e.g. < 1cmH2O/s, it will not reach a high amplitude. In this male patient group, instability was found in 34% and rectal contractions in 18%. Relaxation of pelvic floor during voiding is quite common in males with 15%.

Conclusions: TSP is a powerful tool for the qualitative plausibility and quality control. Combined with typical value ranges TVRs, the TSPs allow definitive judgment of the quality of a urodynamic investigation, and the clear identification of artifacts. The definite identification of the described typical signal patterns is an indispensable pre-condition for good urodynamic practice. The suggested definitions and classification of TSPs is another relevant step towards a genuine computer expert system for clinical urodynamic practice, which can only work on basis of a functioning automated real-time quality control.

Ref: Drafts ICS Standard "Good Urodynamic Practice", Yokohama 1997 and Jerusalem 1998

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THE VOLUME DEPENDENCE OF MAXIMUM FLOW RATES REVISITED

Aims of study

In a population of patients or healthy volunteers, maximum flow rates increase with the voided volume. Mechanically, there are two possible explanations for this phenomenon. Firstly, larger volumes will generally be voided by people with a larger bladder, i.e. consisting of more smooth muscle cells. The contraction velocity of a shortening muscle depends linearly on the number of cells that are in series in the muscle. Secondly, the volume change of a contracting sphere depends on the product of the wall shortening velocity and the 2/3 power of the volume. When flow rates are measured repeatedly in the same individual the first mechanism does not apply. But the second does. As it is known that in urinary bladder smooth muscle the (maximum) shortening velocity is independent of the stretched muscle length [1] it may be expected that in an individual flow rates increase with the 2/3 power of the volume. This is not the case. As early as in 1979 [2] evidence has been provided that in a single person, above a certain minimum voided volume, flow rates are independent of the voided volume, or even slightly decrease with increasing voided volume. The subject of the present study is the hypothesis that this discrepancy results from mechanical interaction between the cells in the bladder wall, i.e. that the frequently used 2/3 power law is not valid for the urinary bladder geometry.

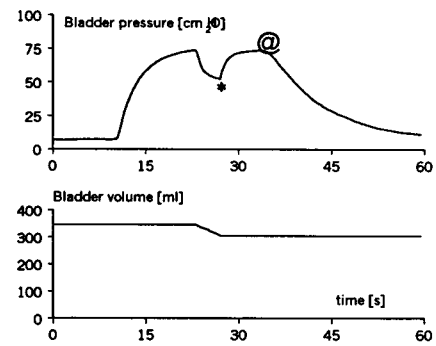

Fig.1. A stop test measurement in a pig urinary bladder in vitro.

Methods

Fresh, male pig bladders from the local slaughterhouse were suspended in a 2 liter organ bath containing Krebs solution. A double lumen catheter was inserted into the bladder via the prostatic urethra and connected to a pressure transducer and infusion pump. The bladder was stimulated to contract with 50 V pulses of alternating polarity with 5 ms duration at a repetition rate of 100 Hz. When maximum isometric pressure was developed the pump withdrew a small, preset volume of fluid from the bladder at a preset flow rate. The procedure was controlled by a PC, and is illustrated in Figure 1. The passive response to the flow rate enforced by the pump was also measured and used for

correction. The (corrected) pressure just before flow rate was stopped (*), was normalized by dividing by the maximum pressure achieved (at the same bladder volume) after the flow rate had been stopped (•). The quotient was called the relative pressure. It was measured at different bladder volumes.

Results

The measured relative pressure dependended linearly on the flow rate applied (This is the bladder output relation, or the total bladder equivalent of the (Hill) force-velocity relation). Therefore these pressures were linearly extrapolated to derive Q_0, which is the flow rate that would be achieved if the bladder outlet resistance were negligible. Figure 2 shows, preliminary, for four different sets of measurements in three bladders, this zero-resistance-flow- rate as a function of the bladder volume. The drawn line is a 2/3 power function of the bladder volume.

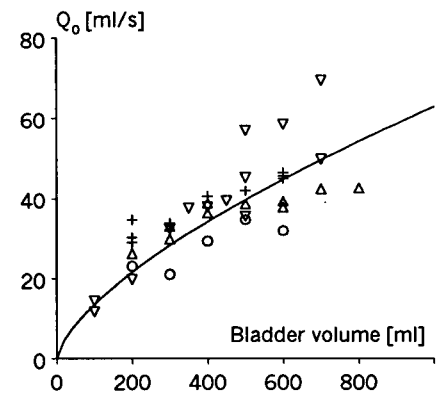

Fig.2. The flow rate that would be achieved if bladder outlet resistance were negligible, as a function of the bladder volume.

Conclusions

The hypothesis must be rejected. The data measured in complete pig urinary bladders in vitro is compatible with the frequently used theoretical model which predicts that in an individual flow rates increase with the 2/3 power of the bladder volume. Also the data confirms that in smooth muscle the maximum contraction velocity is independent of the muscle length. The results are thus in disagreement with repeated flow rate measurements in patients and volunteers that show constant or decreasing flow rates with increasing voided volumes. A new hypothesis to be tested is that this discrepancy must be ascribed to a difference in activation of the bladder muscle : in vitro activation is maximal, in vivo there is evidence that activation is submaximal during normal voiding [3].

[1] Length dependence of the contractility of smooth muscle fibres of the pig urinary bladder. In press.

[2] Med.Biol.Eng.Comput. 17 : 291-300 (1979). [3] Neurourol.Urodyn. 13 : 587-595 (1994).

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THE ROLE OF URODYNAMICS FOR MEN WITH PERSISTENTLY INADEQUATE UROFLOW VOLUMES

Aims of Study: Uroflowmetry is an important diagnostic test in men with lower urinary tract symptoms (LUTS). The clinical entities of LUTS include bladder outlet obstruction (BOO), detrusor instability (DI) and underactive detrusor. Because of the great intraindividual variability and the volume dependency of the maximum flow rate (Qmax), the 4th International Consultation on BPH recommends at least 2 flow rates of > 150 ml voided volume [1]. It is our policy to avoid making surgical management decisions based on such inadequate uroflow volumes (IUV). There have been papers proposing that such IUV can predict the presence of BOO [2], as well as how multiple serial uroflows reduce the IUV rate [3]. However, there remains a group of men who persistently give IUV and *no* studies have been done to address this issue as well as how urodynamics (UDS) can overcome the diagnostic dilemma in these patients.

Methods: This is a prospective consecutive series on male patients presenting to our urology outpatient clinic with LUTS. From January 1998 to January 1999, there were 17 men (aged 37 – 86 years, median 66 yrs) who satisfied the inclusion criteria of at least 2 inadequate voided volume (< 150 ml) on uroflow and who were willing to undergo UDS. UDS was performed at a medium fill rate using an 8F filling catheter and 5F catheter for intravesical pressure measurement. Prior to UDS, the attending urologist would make a provisional clinical diagnosis based on the history, physical examination, biochemical results, urinalysis and at least 2 uroflow studies. Post-void residual urine was also measured by means of an ultrasound scan. This diagnosis was then compared to the post-UDS diagnosis to assess the correlation. Confirmation of obstruction was based on the pressure-flow plot on the Abrams-Griffiths nomogram. Paired non-parametric analysis using the Wilcoxon-Signed-Rank test was used to derive statistical significance for Qmax and voided volume between uroflowmetry and UDS.