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.

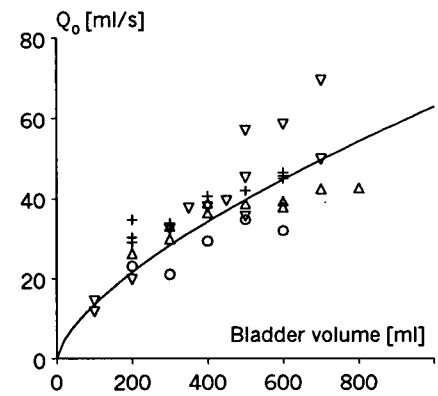

Fig.2. The flow rate that would be achieved if bladder outlet resistance were negligible, as a function of the bladder volume.

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.

Results: There were a total of 40 IUVs amongst the 17 men as 6 patients performed 3 uroflows before agreeing to UDS. The average volume voided on uroflow was 69.1 ± 26.7 ml (range 17 – 119 ml) while the mean Qmax was 6.1 ± 1.7 ml/s (range 3.5 – 9.3 ml/s). From UDS, the mean Qmax obtained was 6.8 ± 2.2 ml/s (range 3.8 – 10.5 ml/s) and this was statistically non-significant when compared to the Qmax produced at either the 1st or 2nd uroflow (p=0.492 & p=0.813 respectively). However, the mean voided volume at UDS was 221.8 ± 88.8 ml (range 68 – 442 ml) and this was statistically highly significant (p=0.0001). The mean residual urine volume was 51.8 ± 41.1 ml (range 0 – 126 ml). Seven men assessed as having *only* DI pre-UDS were found to also have BOO post-UDS while 8/10 men with the clinical diagnosis of BOO were confirmed to be so at UDS; the remaining 2 were found to actually have underactive detrusor. UDS showed that out of the 15 men who had BOO, 10 (67%) had *both* DI & BOO.

Conclusions: Low voided volume on uroflow is still a situational problem despite adequate instructions. Making clinical decisions based on such IUV is not advised, and at best, has a 72% likelihood of a patient having BOO [4]. The issue of men who *persistently* produce IUV remains to be addressed and this study attempts to show the usefulness of UDS in overcoming this problem. We suspect that co-existent detrusor instability is a plausible explanation as to why such men are unable to hold their bladders as this was found in 67% of those who had BOO.

Results

Nine women were found to be continent at both pad tests and were excluded from the study. Fifty-six women (Mean age = 57, 95%CI 47-63) were proven to be incontinent (Pad test loss ≥2g) on one of the pad tests.

Despite our best attempts to achieve identical bladder volumes on the two tests, there were 13 women (23%) who were **continent** on the first pad test but **incontinent** on the second test. The median value for the first pad test loss of 4g (IQR 0.5-15) was significantly lower than that of the second test, 16g (IQR 4-31.5), Wilcoxon's signed ranks test p=0.017. Despite repeated careful scanning during the second test however, the second pad test total bladder volumes (541mls, IQR 377-603), were considerably greater than the first test bladder volume (433, IQR 331-568), Wilcoxon's signed ranks test p >0.001.

In twenty-six women, the total total bladder volumes were actually within 15% of each other (median volume 475mls *vs* 473mls). In these women, the second pad test loss was still significantly higher than first pad test (14g *vs* 4g, Wilcoxon's signed ranks test p = 0.037). The test-retest repeatability of the pad test (with similar bladder volumes) was quite poor (mean 10g difference, limits of agreement +46g to -66g), and the test does not conform to the British Standards Institution definition of adequate repeatability.

Questionnaires about pad testing were returned by 77% of women. Of these, 33% admitted that they tried very hard not to leak during the first pad test, and 21% tried not to leak during the second pad test. 84% of the women said that they felt more comfortable about the test in general and were less frightened of leaking at the second visit.

Conclusions

The widely used one hour pad test has poor repeatability. The bladder volume at the time of the test is important and should be quoted in research papers. A third of the women in this study, despite a full explanation of what the test involved and why it was being performed, still tried very hard not to leak during the test. However on repeating the test, the women were more confident and more likely to leak. We also feel that larger bladder volume in the second test was probably due to increased diuresis, as the women arrived for the second test better hydrated. The test-retest repeatability of the pad test at similar bladder volumes was still quite poor (limits of agreement +46g to -66g).

We conclude that the test-retest reliability of the one-hour pad test, even when constant bladder volumes are obtained, is inadequate. Therefore, although this test is a useful objective measure for baseline severity of incontinence, it should not be relied upon as an accurate post-treatment outcome measure.

1. Statistical methods for assessing agreement between two methods of clinical measurement. *Lancet* 1986;1:307-310
2. Scand.J.Urol.Nephrol. 1984; 18: 293-298
3. Obstets Gynecol. 1987; 69: 39-42
4. Obstets Gynecol 1987; 70: 739-743
5. Outcome measures for women. Neurourol & Urodyn, 1998, 3: 255-262

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THE REPEATABILITY OF THE STANDARD ONE HOUR PAD TEST USING SIMILAR ' NATURAL FILL' BLADDER VOLUMES

Introduction

The one hour pad test is recommended by the Standardisation Subcommittee of the ICS as an objective measure of severity of urinary incontinence. In the present era of evidence-based medicine, however, we need a measure of leakage severity that has sufficient test-retest reliability to be employed as a robust outcome measure. That is, the difference between the first test (T1) and the second test (T2) should lie within 2 standard deviations of the total mean difference between T1 vs T2, in 95% of cases[1]. Previous authors have investigated the