

Short and Long Term Reproducibility of Urethral Closure Pressure Profile Parameters

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Summary. In ten incontinent female patients the reproducibility of urethral closure pressure profile parameters obtained with the Brown and Wickham technique in two consecutive measurements and in measurements after a one month interval was assessed. Variances after one month were statistically significantly larger than the variances between consecutive measurements. The mean values obtained with one month interval did not differ significantly.

Key words: Urethral closure pressure profile, Reproducibility, Variance.

Pressure measurement within the resting urethra with a fluid perfused catheter was introduced by Brown and Wickham in 1969 (5). Other techniques for urethral closure pressure profile (UCPP) measurements are available (2, 3), but the Brown and Wickham method is most widely used today. UCPP measurement is commonly performed in patients with incontinence, infravesical obstruction or in the evaluation of the pharmacological effect of drugs on urethral function.

Several reports concerning the interpretation and sources of error in this measurement have been published (1, 3, 4, 6, 7, 8, 9), but little attention has been paid to the reproducibility of the results (1, 6, 7). The aim of the present study was to evaluate the reproducibility of the UCPP in consecutive and repeated measurements within one month using the Brown and Wickham technique.

MATERIAL AND METHOD

A total of 10 female patients suffering from urinary incontinence entered the study.

In all patients UCPP-measurement was undertaken as the first investigation in a urodynamic evaluation. Patients were examined in the supine position. 100 ml 38°C saline was instilled into the empty bladder through a single lumen polyethylene profile catheter, Charriere 8, closed in the end and with two opposite sideholes 5 cm from the tip. The catheter was constantly perfused from a mechanical pump with saline at 2 ml per min., and further connected to a pressure transducer placed at the level of the symphysis pubis. The UCPP catheter was firmly fixed to a mechanical retractor allowing no axial rotation and pulled with a speed of 0.33 cm/sec. Results were recorded on a hot wire recorder, paperspeed 5 mm/sec. and calibration 20 cm H₂O/cm. Manometer lines were 1.5 m with an inner diameter of 1.2 mm. All connections were secured and airbubbles carefully removed from the measuring system before every investigation.

Patients were instructed to avoid abdominal straining and squeezing of the external urethral sphincter during the examination.

In all patients two consecutive UCPP measurements without obvious artefacts were secured, and the investigation was repeated exactly the same way after one month to exclude as far as possible changes due to different serum oestrogen levels (10).

No medication was started or altered during this month, and no operation was undertaken in any patient.

All pressures (intravesical pressure (Pves), maximum urethral closure pressure (MUCP) and maximum urethral pressure (MUP) were measured to the nearest cm H₂O, and functional profile length and the distance from bladder neck to MUCP was recorded to the nearest mm.

Methods definitions and units conform to the standards proposed by the International Continence Society except where specifically noted.

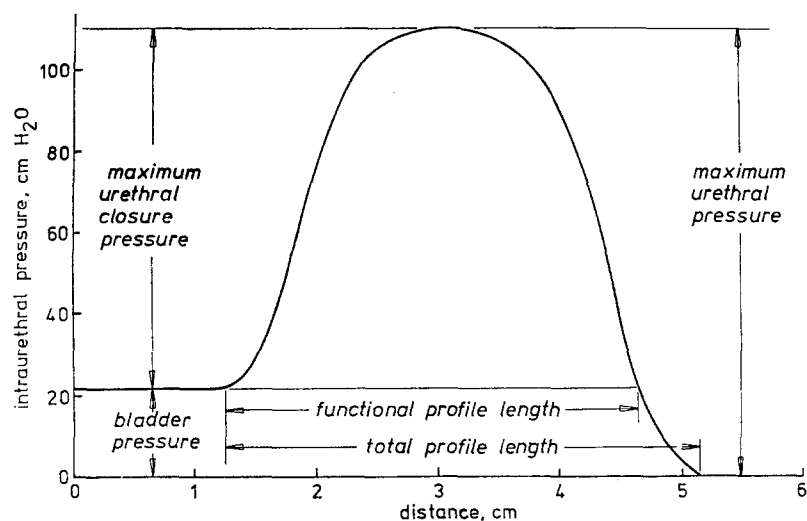


Fig. 1. A schematic representation of the urethral closure pressure profile

Table 1. Differences in two consecutive UCPP measurements

	P ves cm H ₂ O	MUCP cm H ₂ O	MUP cm H ₂ O	Functional profile length mm	Distance from bladder neck to MUCP, mm
Mean	+0.3	-0.1	-0.9	-0.9	-0.4
SD	1.0	5.0	4.6	1.7	2.0
Variance	1.0	25.2	21.4	3.0	4.0
Range	-1 to +3	-9 to +10	-9 to +7	-3 to +2	-6 to +3

Table 2. Differences in UCPP measurements repeated within one month

	P ves cm H ₂ O	MUCP cm H ₂ O	MUP cm H ₂ O	Functional profile length mm	Distance from bladder neck to MUCP, mm
Mean	-0.5	+1.4	+0.8	-0.9	+0.1
SD	3.8	8.1	9.2	2.7	3.1
Variance	14.1	65.9	85.2	7.5	9.6
Range	-6.5 to +5.5	-10.0 to +19.5	-14.5 to +17.5	-4.5 to +6.0	-5.0 to +5.0
F test	P < 0.01	< 0.05	< 0.01	< 0.05	ns

RESULTS

In order to establish the reproducibility in consecutive measurements we calculated the differences between the first and the second measurement of the different parameters in each patient. Mean, standard deviation, range and variance of the differences are given in Table 1.

The reproducibility within one month was evaluated from differences between mean values of consecutive measurements obtained with one month interval - Table 2.

An F-test for the proportion of variances within consecutive and repeated measurements was performed. A statistically significant larger

variance was found within measurements with one month interval compared to consecutive measurements, except for distance from bladder neck to MUCP - Table 2.

For each UCPP parameter, mean values obtained with one month interval did not differ statistically - Wilcoxon Matched - Pairs Signed Rank test, $P > 0.05$.

DISCUSSION

Variation in results from UCPP measurements may be due to physiological and instrumental factors.

The latter has been discussed by Harrison (8), Asmussen (3), Brown and Malcolm (4) and recently Abrams et al. (1). Important factors among others seem to be delay in response time, damping due to airbubbles and leak of fluid in connections, variation in flow rate and catheter withdrawal rate, variation in bladder volume and of course inaccuracy in transducer position and calibration.

Axial rotation of the catheter during withdrawal seems unimportant (1).

Physiological factors might be involuntary and voluntary activity of smooth and striated urethral muscles and transmitted abdominal pressure alterations (9), influences from respiration (7), hormones e.g. oestrogen, drugs and pulsation.

The pure instrumental contribution to the total variability was estimated for consecutive measurements by Abrams et al. (1) to be ± 4 cm H₂O for MUP, and they calculated a standard deviation of 7 cm H₂O - slightly above the standard deviation for that value in this series.

In a previous study in this laboratory nine postmenopausal women in a controlled clinical trial had UCPP measurement with four months interval before and after placebo-treatment. UCPP was measured with a method similar to the present one, except a manual catheter extraction, guided by metronome was undertaken (11). Standard deviations of differences in consecutive measurements were of the same order as in this paper, and the variations were statistically significantly larger in measurements with four months interval compared to consecutive measurements except for MUP and functional profile length. Ghoneim (7) mentions reproducibility in anaesthetised dogs within four hours in the range of $\pm 5\%$. From results in this paper it is evident that variation between measurements with a one month interval is statistically significantly larger than variation in consecutive measurements.

Previous studies by Edwards (6) showed no statistically significant differences in measurements repeated up to 6 months - but no documentation is present in the paper.

At the repeated measurements after one month in this series patients were familiar with the test-situation and one might suppose some parameters - e.g. MUCP - generally to be altered in one direction - most likely decreased - compared to results from first measurements. But no statistically significant alteration was found.

CONCLUSION

It is important to know the reproducibility of results from a method of investigation in order to assess if changes in results are due to treatment or to the unavoidable experimental variation.

If control MUCP measurements obtained with the described method after one month of treatment in a single patient e.g. show an alteration less than $\pm 2 \times \text{SD}$ (± 16 cm H₂O), the alteration

cannot for certain be regarded as due to treatment. For consecutive measurements of MUCP - e.g. before and after injection of Regitin® - a decrease of less than 10 cm H₂O might as well be due to the experimental variation.

Otherwise for a group of patients a significant change of mean MUCP after one month treatment is most likely to be due to treatment, since mean values did not change statistically significant in this study.

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