381

Idzenga T[1], Pel J[1], van Mastrigt R[1]
1. Erasmus MC, Dept. Urology

LEAK POINT PRESSURE OR URETHRAL PRESSURE PROFILOMETRY? URODYNAMIC EVALUATION OF CONTINENCE TESTED IN A MODEL URETHRA.

Hypothesis / aims of study

The Urethral Pressure Profile (UPP) is a controversial diagnostic tool in urinary incontinence [1]. The Maximum Urethral Closure Pressure (MUCP), calculated from a UPP, is the parameter that ideally should represent the ability of the urethra to prevent leakage [2]. Another measure of the closure mechanism of the urethra is the Leak Point Pressure (LPP) [3]. The correlation of MUCP with the degree of (in)continence is meagre at best [1]. In a model of the urethra we studied the LPP and MUCP at different degrees of continence. We performed the UPP-measurement with a fluid-perfused catheter and used different withdrawal speeds and different perfusion rates.

Study design, materials and methods

We made a model of the urethra by freezing and thawing an aqueous solution of the polymer Polyvinyl Alcohol (PVA) in a mould. The model had an outer diameter of 16 mm, a Y-shaped channel and was freeze-thawed twice. It was placed in a self-made container filled with water. Around the model a 28 mm inflatable cuff (Tricomed, EME Ltd., Brighton, UK) was placed. This cuff was inflated to pressures from 70 to 160 cm H_2O in steps of 10 cm H_2O using a water column. We connected one side of the model to a second water column representing bladder pressure and measured at each cuff pressure LPP by decreasing the bladder pressure until the model urethra ceased to leak. At each cuff pressure we also performed a UPP (without connecting the water column to the model) by placing a 5 F fluid-perfused catheter with an end hole in the model. We varied the perfusion rate and the withdrawal speed of the catheter. First we kept the withdrawal speed of the catheter constant at 0.5 mm/s and varied the perfusion rate (0.5, 2 and 10 ml/min). Next we kept the perfusion rate constant at 2 ml/min and varied the withdrawal speed (0.5, 2 and 4 mm/s). From each UPP we calculated the MUCP as the maximum difference between the recorded urethral pressure and the pressure in the catheter exposed to atmospheric pressure at the level of the transducer.

Results

An example of two UPP measurements at a constant withdrawal speed with two perfusion rates is shown in Figure 1. All pressure values measured with a 10 ml/min perfusion rate were higher than those measured with a 0.5 ml/min perfusion rate. The pressures measured as LPP and MUCP at the different cuff pressures are presented in Figure 2. In the left panel the withdrawal speed was kept constant at 0.5 mm/s and the perfusion rate was varied, in the right panel the perfusion rate was kept constant at 2 ml/min and the withdrawal speed was varied. In general the measured MUCP did not equal the measured LPP, neither did both match the cuff pressure. At a constant withdrawal speed, an increase in perfusion rate increased the slope of the MUCP-curve. An increase in withdrawal speed decreased this slope.

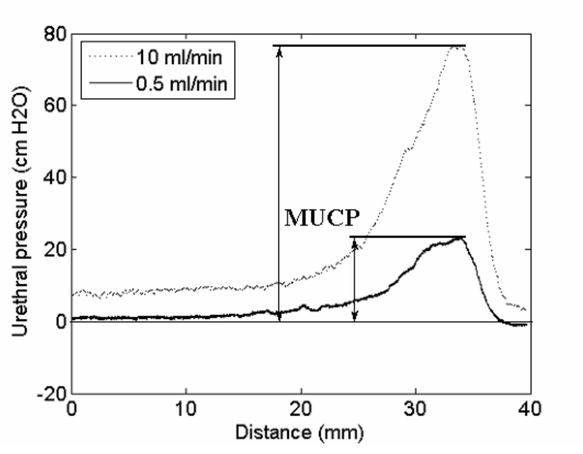

Figure 1: Urethral Pressure Profile measured at a cuff pressure of 150 cm H_2O with a withdrawal speed of 0.5 mm/s and two different perfusion rates.

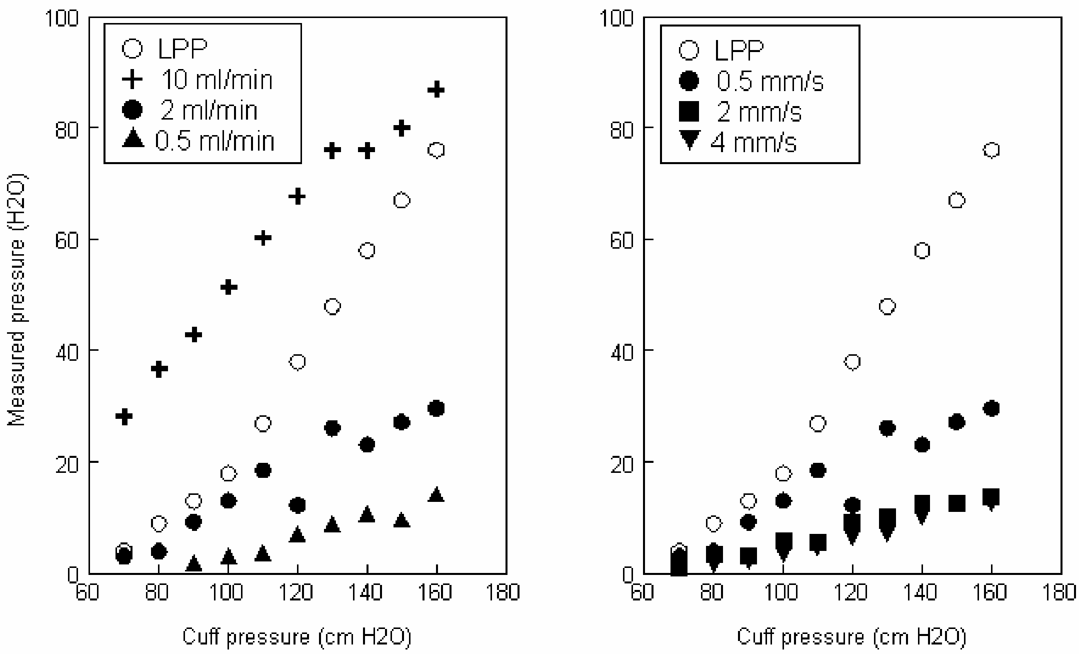

Figure 2: Measured pressures at different cuff pressures with a constant withdrawal speed of 0.5 mm/s (left) and with a constant perfusion rate of 2 ml/min (right).

Interpretation of results

An initial cuff-pressure of ~60 cm H_2O was required to contact the model urethra. Between 70 and 100 cm H_2O the cuff adapts to the model and at cuff pressures higher than 100 cm H_2O the LPP accurately reflected the cuff pressure (with an offset). If we accept that the LPP accurately reflected the degree of continence of the model at LPP-values > 20 cm H_2O, i.e. cuff pressures > 100 cm H_2O, it follows that the MUCP-values did not. However, in the range of cuff-pressures between 70 and 100 cm H_2O at a withdrawal speed of 0.5 mm/s and a perfusion rate of 2 ml/min MUCP-values show good agreement with the LPP-values, whereas between 140 and 160 cm H_2O a perfusion rate of 10 ml/min shows better agreement with the LPP-values. At cuff pressures between 100 and 140 cm H_2O a perfusion rate somewhere between 2 and 10 ml/min might produce MUCP-values that correlate pretty well with the LPP-values. Alternatively, a microtiptransducer could be used to measure MUCP. However, a microtiptransducer is orientation-sensitive and has worse within-patient reproducibility than a fluid-perfused catheter [1].

Concluding message

In our PVA model urethra the Maximum Urethral Closure Pressure calculated from Urethral Pressure Profilometry correlated badly with the measured Leak Point Pressure. A UPP measured with a fluid-perfused catheter depends on the perfusion rate and the withdrawal speed of the catheter. It appears that the optimum combination of perfusion rate and withdrawal speed to correctly measure a specific degree of continence depends on the degree of continence itself. When the results in this model study are extrapolated to the patient situation, the LPP seems a better technique than UPP for assessing the degree of continence.

References

[1] Is urethral pressure profilometry a useful diagnostic test for stress urinary incontinence?, Obstetr Gynecol Surv 56(11): p.720 – 735, 2001;

[2] The standardisation of terminology of lower urinary tract function, Scand J Urol Nephrol, Suppl 114: p. 5 – 19, 1988;

[3] Prognostic value of urodynamic testing in myelodysplastic patients, J Urol 126: p. 205 – 209, 1981.

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