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A COMPARISON OF MICROTIP AND FIBEROPTIC TRANSDUCERS FOR URETHRAL PRESSURE PROFILOMETRY AND LEAK POINT PRESSURE ASSESMENT

Specific Aims

The aim of this study was to establish the reliability and reproducibility of a fiberoptic transducer catheter (Lumax MedAmicus Inc., Minneapolis, MN) for urethral pressure profilometry (UPP) and leak point pressure (LPP) determination using a microtip transducer catheter (Mikro-tip Millar Instruments Inc., Houston, TX) as the gold-standard. Both microtip and fiberoptic transducer systems are widely used for urodynamic evaluation. The microtip transducer converts mechanical pressure into an electrical signal, which is then transmitted to a recording device. Fiberoptic transducers use light amplitude modulation to produce a similar electrical signal. This light amplitude modulation technology has been proven comparable to microtip transducer technology when used for urethrocystometry but not UPP or LPP determination.[1] Elser et al have shown that another fiberoptic catheter (FST 200 System Bard corp, Covington, GA) records significantly lower UPP values than the microtip catheter.[2] This Bard product differs from the MedAmicus product with respect to the site of the fiberoptic transducer on the catheter, which could affect pressure values. Furthermore, Elser et al were not able to determine whether the pressure values recorded by the fiberoptic catheter differed in a predictable way from the microtip catheter values. Our study sought to answer this question for the Lumax fiberoptic catheter.

Methods

Sixty women who were scheduled for urodynamic evaluation and who did not have significant pelvic organ prolapse were recruited. Institutional review board approval was given and informed consent was obtained from all participants. Each patient underwent a standardized comprehensive urodynamic evaluation including urethrocystometry, pressure voiding studies, static and dynamic UPP's, and LPP determination using the microtip transducer. Resting UPP's were also performed on all subjects using the fiberoptic catheter. With the patients in the upright sitting position, four resting UPP studies were performed at maximum cystometric capacity with each catheter. The order of catheter use was randomized for each patient. In order to evaluate the efficacy of LPP measurement with the Lumax catheter, the patients also performed four Valsalva maneuvers while both the Millar and Lumax catheters were simultaneously inside of their bladders. In order to determine the reproducibility of pressure readings, the Pearson correlation coefficients for both the Lumax and Millar catheters were determined. Mean functional urethral length (FUL), maximum urethral closure pressure (MUCP) and LPP values were compared using the paired t-test. In order to determine whether the MUCP values differed in a predictable way, a computer generated linear regression model was used to obtain a prediction equation.

Results

The Pearson correlation coefficients for the Lumax and Millar catheters were 0.96 and 0.94 respectively, indicating excellent reproducibility for each. The average FUL for the Lumax and Millar catheters were 27.47 mm (SD=1.54) and 26.97 mm (SD=1.19) respectively ($p=0.706$). The average pressures recorded during the LPP simulation with both catheters in place were 69.09 cmH20 (SD=3.55) for the Lumax catheter and 69.67 cmH20 (SD=3.76) for the Millar catheter ($p=0.706$). The average MUCP values for the Lumax and Millar catheters were 30.71 cmH20 (SD=17.3) and 45.11 (SD=24.9) respectively ($p=0.0001$). Using the linear regression equation: [(Millar MUCP) = 8.723 + 1.185(Lumax MUCP)], 68% of the variation of MUCP values between the two catheters could be explained. Using this equation to predict the Millar value for MUCP from the Lumax value, one patient would have been misclassified as having a "low pressure urethra" (using ≤20cmH20 as the cut off). However, four patients would have been classified as "normal" that were in the "low pressure" Millar group. The order of catheter use had no effect on the MUCP values.

Conclusions

Both the fiberoptic and microtip catheters provided reproducible FUL, LPP and MUCP results for a given patient. There was no significant difference between the FUL and LPP values recorded by the different catheters. However, the MUCP values recorded by the fiberoptic catheter were significantly lower than the microtip values for MUCP. The difference in the MUCP values for the two catheters did not occur in a predictable fashion. The excellent reproducibility of the fiberoptic catheter suggests that a useful table of normative values could be obtained for this system with further study.

This study was sponsored by MedAmicus Inc., Minneapolis, MN.

[1] Urodynamic Use of Fiberoptic Microtipped Catheter. J Urol 1986;137:936-938
[2] A Comparison of Urethral Profilometry Using Microtip and Fiberoptic Catheters. (accepted for publication: Int Urogyn J)

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THE EFFECT OF VOLUNTARY PELVIC FLOOR CONTRACTION AND RELAXATION ON THE URETHRAL CLOSURE PRESSURE

Aims of study

The maximum urethral closure pressure at rest (MUCP) is defined by the ICS as the maximum difference between intravesical and intraurethral pressure. In clinical practice the MUCP at rest is used to characterize the intrinsic pressure of the urethra. It has gained wide acceptance to define a low pressure urethra (MUCP ≤20 cmH_2O), which is indicative of intrinsic sphincter deficiency (1). It is also used to assess urethral pressure changes as a treatment effect of bladder neck surgery for stress incontinence (2).
Hypothetically, the urethral pressure profile (UPP) at rest is independent of striated pelvic floor muscle (PFM) activity. This study has been designed to assess the effect of voluntary PFM-contraction and voluntary PFM-relaxation on the MUCP.

Patients and methods

In 103 consecutive patients attending our urodynamic unit the UPP at rest was performed as a part of our standard urodynamics according to the recommendations of the ICS. A Gaeltec microtip dual pressure transducer was used and withdrawn at a rate of 1mm/s. Women were then instructed to perform a maximum PFM-contraction and maximum PFM-relaxation. Instruction consisted of verbal explanation followed by biofeedback using perineal ultrasound. After these instructions two further UPP's were carried out: one at maximum voluntary PFM-contraction and one at maximum voluntary PFM-relaxation.

Results

MUCP	Mean (±SD, cmH_2O)
at rest	50.6 ± 23.4 (range 16–126)
during maximum pelvic floor contraction	68.3 ± 29.6 (range 17–151) *
during maximum pelvic floor relaxation	43.1 ± 23.2 (range 10–117) *

- significantly different to MUCP at rest (paired t-test , $p < 0.001$)

Compared with the mean MUCP at rest, there was a significantly higher MUCP at maximum voluntary PFM-contraction ($p<0.001$; mean difference 18 cmH_2O, range –21 to 98 cmH_2O) and a significantly lower MUCP at maximum voluntary PFM-relaxation ($p<0.001$; mean difference 7.5 cmH_20, range –14 to 38 cmH_2O). In only eight women the MUCP during PFM-relaxation remained unchanged compared with the resting MUCP. In seven women the MUCP did not increase with voluntary PFM-contraction.

In five women the resting MUCP was ≤20 cmH_2O. At maximum voluntary PFM-contraction only one woman had an MUCP ≤20 cmH_2O, which is a significant decrease ($p=0.046$, Wilcoxon test). At maximum PFM-relaxation 16 women had an MUCP ≤20 cmH_2O, which is a significant increase compared with the number (=5) during the resting UPP ($p=0.002$, Wilcoxon test).

Conclusions

The results show that the resting MUCP measurements are influenced by pelvic floor muscle activity. The MUCP values relate to both pelvic floor contraction, and clinically more important, to pelvic floor relaxation; which has been neglected so