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DOES URETHRAL MOBILITY CONFOUND THE RELATIONSHIP BETWEEN PRETHRAL CLOSURE PRESSURE AND STRESS CONTINENCE?

Hypothesis / aims of study

Maximum urethral closure pressure (MUCP) and abdominal leak point pressure (ALPP) are thought to be a measure of intrinsic urethral function and predictors of stress urinary incontinence (SUI) and urodynamic stress incontinence (USI). We have recently been able to show that midurethral (more so than bladder neck) mobility also is a predictor of SUI and USI (1). In this study we set out to to determine whether urethral mobility confounds the relationship between MUCP and continence. The hypothesis was: “Midurethral mobility acts as an effect modifier in the relationship between MUCP and stress urinary continence”.

Study design, materials and methods

Between January and November 2009, a total of 261 women attended a tertiary referral service for multichannel urodynamic testing (Neomedix Acquidata) and 4D pelvic floor ultrasound imaging (GE Kretz Voluson 730 expert). Maximum urethral closure pressure was obtained with a perfused fluid- filled catheter with a freehand pull- through technique. Abdominal leak point pressure was obtained in the standing position on Valsalva maneuver. We retrospectively analysed their urodynamic and ultrasound datasets. One ultrasound volume dataset was irretrievable due to clerical error. Three other patients did not have MUCP or ALPP performed due to technical problems, leaving 257 for analysis.

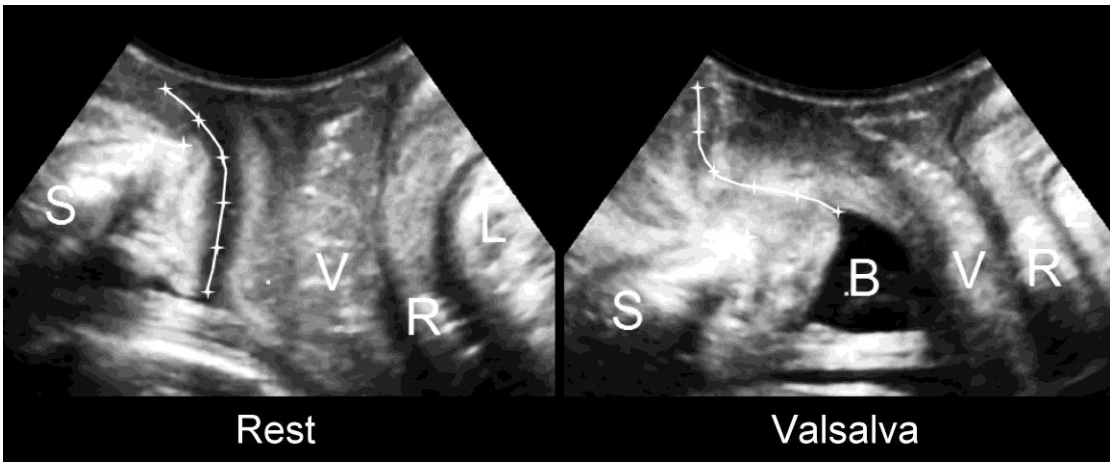

Figure 1: Determination of the Urethral Motion Profile in the midsagittal plane (left, at rest; right, on Valsalva).The curved lines indicate the course of the urethra from bladder neck to external meatus, at rest (left) and on Valsalva (right). S= symphysis, V= vagina, R= rectal ampulla, L= levator ani, B= bladder.

UMP analysis (see Figure 1) was carried out by the first author, using the software 4D View (v 5 and 7) on a desktop PC. The urethral length was traced and divided into 5 segments by defining 6 equidistant points along its length, with Point 1 at the internal urethral meatus, and Point 6 at the external meatus (2). As the manual determination of UMP coordinates is very time-consuming, we developed a semiautomatic method utilizing an Excel macro, allowing automatic determination of x and y coordinates on a bitmap imported from 4D View. Univariate analysis was performed to test the relationship between both MUCP and segmental urethral mobility and USI. In a multivariable binary logistic regression we tested the relationship between USI and urethral mobility and MUCP, controlling for a range of potential confounders. HREC approval had been obtained for retrospective data analysis.

Results

A test-retest series of 42 datasets (252 mobility vectors) performed by the first and second authors showed excellent repeatability, with an Intraclass correlation of 0.885 (CI 0.840- 0.913) for segmental urethral mobility. The mean age of 261 patients was 57 (range, 21-90). They presented with stress incontinence (n=194, 74%), urge incontinence (n=181, 69%), Frequency (n= 69, 26%), Nocturia (n=115, 44%), symptoms of voiding dysfunction such as hesitancy, poor stream, stop- start voiding (n=74, 28%) and symptoms of prolapse (vaginal lump or dragging sensation (n= 127, 49%). 238 had delivered vaginally (91%), 35% (n=90) had previously undergone a hysterectomy, and 24% had had an anti- incontinence or prolapse procedure (n=62). The mean bladder neck descent was 28 mm. On clinical assessment, 63% (n=164) had a significant (ICS POP-Q Grade 2 or higher) prolapse. This was a cystocele in 38% (n= 100), a uterine prolapse in 10% (n=17), an enterocele in 3% (n=8) and a rectocele in 44% (n=114). Levator avulsion was diagnosed in 23% (n= 61). On multichannel urodynamics, 174 (67%) were diagnosed with urodynamic stress incontinence, 74 (28%) with detrusor overactivity, and 91 (35%) with voiding dysfunction. The MUCP was measured at a mean of 36 cm H2O (range, 2- 111). Augmented MUCP was 40 cm H2O on average (4-124). Of those 142 women who were able to augment their MUCP, mean augmentation was 12 cm H2O (range, 1-80). Abdominal leak point pressures were obtained in 134 women, at a mean of 63 (range, 6- 182). The maximum Valsalva pressure obtained in those that did not leak was 98 on average. on average (range, 53- 182), with only 32 women below 100 cm H2O.

On univariate analysis both MUCP and urethral mobility vectors proved to be significant predictors of USI, but this applied only to mid-urethral mobility, not bladder neck mobility. On testing the two most significant predictors, MUCP and the mobility of Point 4, in a binary logistic regression (n= 257), taking into account any interdependence between the two variables, we obtained confirmation of the independent predictive value of MUCP (OR 0.97 per cm H2O,(CI 0.96- 0.99), P= 0.001) and mobility of the mid-urethra (OR 1.80 per cm of mobility, (CI 1.19- 2.74), P= 0.006). There is a confounding effect of MUCP on the relationship between mobility and USI in that accounting for MUCP increases the odds ratio of mobility vs USI from 1.61 (CI 1.09-2.38) to 1.80 per cm of mobility, (CI 1.19- 2.74). Previous anti- incontinence surgery or prolapse (stage 2+) are

	USI (n=172)	no USI (n= 86)	P=
MUCP	33.3 (18.6)	41.1 (18)	0.001
Urethral mobility	USI (n=174)	No USI (n= 86)	
Point 1	2.71 (1.09)	2.75 (1.25)	ns
Point 2	2.40 (0.89)	2.28 (0.95)	ns
Point 3	2.10 (0.74)	1.88 (0.71)	0.026
Point 4	1.89 (0.69)	1.68 (0.63)	0.013
Point 5	1.83 (0.76)	1.68 (0.69)	ns
Point 6	1.81 (0.92)	1.75 (0.84)	ns

Table 1: Association between MUCP/ segmental urethral mobility and USI.

Interpretation of results

We have recently shown that mid-urethral mobility is associated with stress incontinence and urodynamic stress incontinence, more so than bladder neck mobility (1). The results presented here confirm this data and demonstrate that both midurethral mobility and MUCP are independent predictors of USI, of approximately equal weight. Our hypothesis was found to be true: mid-urethral mobility acts as an effect modifier in the relationship between MUCP and USI.

Concluding message

Mid- urethral mobility and MUCP are independent predictors of USI.

References

1. Neurourol Urodyn 2009; 28 (S1): 851-852
2. Aust NZ J Obstet Gynaecol. 2008;48:337-42

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What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**Yes**
Specify Name of Ethics Committee	**SWAHS HREC**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**No**