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DOES EXIST A CORRELATION BETWEEN URETHRAL MEASUREMENTS OBTAINED WITH 3-D HIGH-FREQUENCY ENDOVAGINAL ULTRASOUND AND URODYNAMIC MEASURES OF URETHRAL FUNCTION IN WOMEN WITH URINARY INCONTINENCE?

Hypothesis / aims of study

Female urethra is associated with several structures that are relevant for the urinary continence and for understanding lower urinary tract dysfunction. In women with stress urinary incontinence (SUI), there is a spectrum of urethral characteristics, ranging from a highly mobile urethra with good intrinsic function to an immobile urethra with poor intrinsic function. When a parameter that measures urethral function, like maximum urethral closure (MUCP), was compared between patients with SUI and asymptomatic women, MUCP was significantly lower in those with SUI (1). The correlations between functional parameters (urodynamic) and morphological parameters measured by magnetic resonance have been investigated and were weak (2). Recent advances in high frequency endovaginal ultrasound (EVUS) enable differentiation and measurement of various anatomic parts of the urethra (3).

The aim of the study was to investigate the correlation between functional and morphological urethral parameters, measured by urodynamic and by 3D-EVUS, in women with stress incontinence urinary incontinence.

Study design, materials and methods

A cross-sectional study in women with symptoms of urinary incontinence (UI)was designed to evaluate female urethral morphology by EVUS. A convenient sample of 36 women between 30 and 80 years old, participating in ongoing cohort study considering changes after SUI surgery, were included. Inclusion criteria were to have at least one vaginal delivery and an urodynamic SUI. Study was conducted in an Urogynecology Unit of a teaching hospital, during 2011. All women with symptoms of UI underwent standardized urodynamic evaluation, including uroflow, cystometrogram and static urethral pressure profilometry. Urethral profilometry included MUCP and functional urethral length (FUL). Pelvic examination was performed in supine position after emptying their bladder and the Pelvic Organ Prolapse Quantification System (POP-Q) was used to measure the stage of pelvic organ prolapse. Patients with POP-Q>1 were excluded of this study. In addition, all patients underwent endovaginal ultrasound (EVUS) with biplanar and rotational 360º transducers (type 8848 and 2052 respectively, B-K Medical, Herlev, Denmark), using a standardized ultrasound protocol (high frequency 12MHz, 3D endovaginal scanning) taking care not to distort the urethra with the probe during scanning. The following measurements were performed (Figure. 1):

(a) In the midsagittal plane:

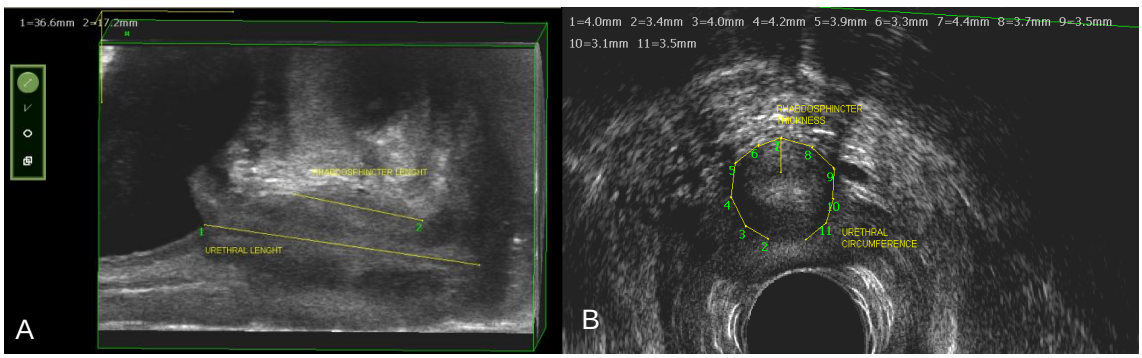
1. Urethral length (UL) was measured from the bladder neck to the external meatus along the urethral longitudinal axis.
2. Rhabdosphincter length (RSL) measured in anterior part of the urethra.

(b) In the axial plane of the mid-urethra:

3. Urethral circumference (UC)
4. Rhabdosphincter thickness (RST)
5. Urethral volumes were calculated with the mathematic formula: UV = (UW/2)×(UT/2)×UL×π (UW: urethral width, UT: urethral thickness).

Sperman's rho tests were carried out to assess the possible correlations between measurements of urethral structures and both MUCP and FUL.

Fig.1 High frequency 3D-EVUS. Measurements taken in (A) midsagittal plane with biplanar transducer and (B) axial plane with rotational 360º transducer.



Results

Among the 36 women included, the mean (SD) age was 53.2 (11.6) years and ranged from 36 to 80. Body mass index (BMI) ranged from 18.3 Kg/m^2 to 33.8 Kg/m^2, with a mean of 26.4 (4.3) Kg/m^2. The mean number of vaginal deliveries was 2.0 (1.3). All women had an urodynamic stress urinary incontinence (pure SUI in 13 patients and mixed urodynamic UI in 23 women).

Positive significant correlation was also observed between MUCP and urethral length measured by ultrasound (p=0.03); in addition, a positive significant correlations were found between FUL and with rhabdosphincter length (p=0.002) and with urethral volume (p=0.037) (Table 1).

Table 1. Spearman's rho correlation coefficients found between functional and morphological (3D-EVUS) measures

	Functional urethral lenght	**MUCP**
Urethral length	-0.55	0.363*
Rhabdosphincter length	0.503**	0.132
Rhabdosphincter thickness	0.089	0.075
Rhabdosphincter circumference	0.216	0.251
Urethral width	0.478**	0.160

*p<0.05
**p<0.01

Interpretation of results

Positive correlations were observed between some functional and morphological urethral parameters. This preliminary study allows us to consider 3D high frequency endovaginal ultrasound as a new tool for the evaluation of urethral morphology in patients with SUI.

Concluding message

High frequency endovaginal ultrasound allows to measure of different parts of the female urethra, which have correlations with accepted functional parameters.

More research is needed in order to define the exact role of morphological urethral parameters, measured by 3D-EVUS, in women with lower urinary tract dysfunction. The combination of functional parameters (urodynamic) and morphological parameters has also a further interest for research.

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