

**EVALUATION OF FEMALE URETHRA AND SUPPORTING LIGAMENTS WITH MR IMAGING.**Hypothesis / aims of study

Two leading hypotheses for female stress urinary incontinence are a) intrinsic sphincter deficiency results from decreased muscle volume and b) urethral hypermobility results from defects in the supporting ligaments. Endocavitary MRI techniques provide high-resolution imaging of the urethral sphincter and supporting fascia. Our purpose was to evaluate the urethral sphincter in women with urinary incontinence and age-matched continent volunteers, and assess visualization of three urethral ligaments (periurethral, paraurethral, and pubourethral) with MRI.

Study design, materials and methods

We evaluated urethral sphincter with intraurethral MRI in 10 incontinent women (mean age 59.7) and two groups of continent volunteers: 8 volunteers age-matched to the incontinent group (mean age 51.7), and 6 volunteers not age-matched, mean age 43.8. We measured urethral sphincter muscle length and thickness and compared sphincters between incontinent patients and two groups of volunteers. We analyzed urethral support ligaments in 49 continent women. Twenty-patients (mean age 38.2) were imaged using 14 F endourethral MR coil, 29 women (mean age 40.1) were imaged using pelvic phased array coil. The visibility and symmetry of three ligaments were assessed. Subsequently, we compared the status of periurethral ligament in 20 continent women and 12 incontinent patients.

Results

Mid anterior striated muscle measured  $1.9 \pm 0.4$  mm in incontinent patients,  $2.1 \pm 0.3$  mm in age-matched continent volunteers, and  $2.5 \pm 0.6$  mm in continent volunteers non-age matched. There was no significant difference in the urethral sphincter size when incontinent patients were compared to age-matched volunteers. With intraurethral MRI performed in 20 volunteers, periurethral ligament was visible in 20 (100%), and symmetric in 19 (95%), paraurethral ligament visible in 12 (60%) and symmetric in 11 (92%), pubourethral ligament in 17 (85%) and symmetric in 16 (94%) (Table 1.).

**Table 1. Urethral ligaments in continent women.**

	14F coil n=20 (age $38.2 \pm 12$ )		Pelvic coil n=29 (age $40.1 \pm 12$ )	
	Visible	Symmetric	Visible	Symmetric
Periurethral lig.	20 / 100%	19 / 95%	27 / 93%	17 / 63 %
Paraurethral lig.	12 / 60%	11 / 92%	17 / 59 %	13 / 76%
Pubourethral lig.	17 / 85%	16 / 94%	15 / 52 %	13 / 87%

With standard pelvic MRI performed in 29 continent women, periurethral ligament was visible in 27 (93%), and symmetric in 17 (63%), paraurethral ligament visible in 17 (59%), symmetric in 13 (76%), pubourethral ligament visible in 15 (52%) and symmetric in 13 (87%) women. The intact periurethral ligament was the most consistently visualized urethral support structure in continent population. Only one of 20 continent women had asymmetric fluttering of periurethral ligament. In incontinent population, periurethral ligament was visualized in 12 patients (100%); it was completely disrupted in 6 (50%) and incompletely disrupted in 6 patients (50%).

**Figure 1.** Axial MR image of normal female urethra obtained with intraurethral MRI (T2-weighted TR/TE 6000/60, intensity corrected image). Urethra has “target-like” appearance, with outer dark striated urethral sphincter, inner hyperintense smooth muscle. Endourethral 14F coil (black) in the urethral lumen.



**Figure 2.** 14F endourethral coil (right). For comparison, standard urethral catheter (left). T2-weighted imaging technique: TR/TE 6000/60 ms, slice/space 2.5/1.0 mm, FOV 5 cm, 8 NEX, 256x256.



**Figure 3.** Intact periurethral ligament (arrow).



**Figure 4.** Disrupted periurethral ligament (arrow).



#### Interpretation of results

With advancing age, there is decrease in urethral sphincter muscle size and thinning of urethral ligaments. Incontinent patients with urethral hypermobility are more likely to have defects in periurethral ligaments.

#### Concluding message

Since decrease in urethral sphincter size is associated with normal aging, studies comparing sphincters in continent and incontinent women must incorporate age-matched populations. Defects in periurethral ligaments that may contribute to urethral hypermobility can be well assessed with MRI.

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