

Authors: R. Tunn, K. Goldammer, D. Beyersdorff*, M. Rieprich, B. Hamm*, W. Lichtenegger
Institution: Dept. of Obstet. & Gynecol. and *Dept. of Radiology, Charité Medical School
Title: PATHOGENESIS OF URETHRAL FUNNELING IN WOMEN WITH STRESS URINARY INCONTINENCE - MR IMAGING PATHOMORPHOLOGY OF THE STRESS CONTINENCE CONTROL SYSTEM

Aims of Study:

Funneling of the proximal urethra is a typical ultrasound finding in stress urinary incontinence but no definitive proof. Clinically, the condition is referred to as bladder neck insufficiency but this leaves open the question whether the morphologic correlate is an insufficiency of the urethra, the levator ani muscle, or the endopelvic fascia. The study presented here was performed to determine whether women with funneling of the urethra show specific pathomorphologic changes of the continence control system at magnetic resonance (MR) imaging and whether the demonstration of urethral funneling has any diagnostic relevance.

Methods:

Fifty-four women (mean age 52 ± 11 years) with clinically (pad test) and urodynamically proven urinary incontinence without prolapse and without prior gynecologic surgery underwent standardized MR imaging: proton-density-weighted sequence (TR/TE 2200/15 msec), field of view 200 x 200 mm, transverse section orientation at the levels of the middle and proximal urethra, bladder neck, and bladder floor, 4-mm slice thickness, 0.8-mm gap. The following pathomorphologic changes of the stress urinary continence control system were distinguished: urethral defects (increased signal intensity of the urethral sphincter muscle, dorsally reduced muscle layer, lateral gapping of dorsal muscle layer (omega shape), defects of levator ani muscle (failure to demonstrate origin at the inner surface of the pubic bone, unilateral muscle loss, increased signal intensity compared to internal oburator muscle), and defects of endopelvic fascia (central, lateral fascial defects, loss of concave configuration towards the symphysis of the anterior vaginal wall). Funneling of the urethra was confirmed by introital ultrasound during pressing (vaginal sector scanner, 5 MHz, sagittal plane). Statistical analysis was performed using SPSS 9.0 for Windows.

Results:

The mean age of women without funneling ($n = 22$; 41 %) was 51 ± 12 years, that of those with funneling ($n = 32$; 59 %) 53 ± 10 years ($p < 0.208$). The majority of women without funneling were primiparas (55 %), those with funneling secundiparas (56 %, $p < 0.013$). The ultrasound, urodynamic, and MR findings are presented in the table.

| | Funneling of the urethra | | |
|----------------------------|--------------------------|-----------|-------------|
| | no (No.) | yes (No.) | |
| Ultrasound findings | | | |
| Vertical prolapse | 6 | 17 | $p < 0.017$ |
| Rotational prolapse | 9 | 3 | $p < 0.017$ |
| Mixed prolapse | 7 | 12 | $p < 0.017$ |
| Urodynamic data | | | |

| | | | |
|---|---|----|---------|
| Normal urethral closure pressure (>100 – age cm H ₂ O) | 7 | 6 | p<0.507 |
| Reduced urethral closure pressure (< 100 – age cm H ₂ O) | 9 | 17 | p<0.507 |
| Hypotonic urethra (< 20 cm H ₂ O) | 5 | 8 | p<0.507 |

MR imaging pathomorphology

Urethra

| | | | |
|---|----|----|---------|
| Increased signal intensity of urethral sphincter muscle | 10 | 17 | p<0.580 |
| Dorsally reduced urethral sphincter muscle | 7 | 13 | p<0.580 |
| Gapping of urethral sphincter muscle | 5 | 2 | p<0.580 |

Levator ani muscle

| | | | |
|--|---|----|---------|
| Increased signal intensity of levator ani muscle | 3 | 12 | p<0.054 |
| No origin of muscle at inner surface of pubic bone | 4 | 6 | p<0.476 |
| Unilateral loss of muscle substance | 7 | 9 | p<0.770 |

Endopelvic fascia

| | | | |
|---|----|----|---------|
| Central fascial defect | 10 | 11 | p<0.560 |
| Lateral fascial defect | 10 | 15 | p<0.893 |
| Loss of concave configuration towards symphysis | 9 | 12 | p<0.476 |

Conclusions:

Stress urinary incontinence in combination with funneling of the urethra was found to be associated with a significant increase in structural changes of the levator muscle at MR imaging (increased signal intensity) and vertical prolapse at ultrasound. Expected defects of urethral muscles were not found to be increased. Funneling of the urethra reflects a functional condition of the urethra caused by multifactorial pathomorphologic changes of the stress continence control system.

Comment: Our findings together with the results of an ultrasound study (1) which demonstrated funneling of the urethra in 90 % of women with stress urinary incontinence examined by contrast-enhanced ultrasound in the upright position suggest that the demonstration of funneling depends on the examination conditions rather than the severity or pathogenesis of stress urinary incontinence.

1. Urology 1996;47(3):452-3