

## **Bladder Wall Thickness in men with lower urinary tract symptoms - Preliminary results**

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### **Abstract:**

**Aim:** To determine the relationship between bladder wall thickness (BWT) and lower urinary tract symptoms (LUTS).

**Material and Methods:** Male patients with LUTS completed the International Prostate Symptom Score (IPSS) sheet. Prostate size was measured using transrectal ultrasound. Urodynamic assessment was performed in all patients. Transabdominal ultrasound was used in measurement of BWT during filling cystometry at 250 ml using a 5 MHz abdominal transducer.

**Results:** A total of 72 patients were included in final analysis. A significant correlation was found between BWT and Age ( $r = 0.44$ ;  $p < 0.0001$ ), IPSS ( $r = 0.3$ ;  $p < 0.01$ ), and voided volumes ( $r = 0.45$ ;  $p < 0.0001$ ).

**Conclusions:** Increase in BWT can be related to development of LUTS in men with benign prostatic enlargement.

**Keywords:** Bladder wall thickness, Lower Urinary Tract Symptoms

### **1 Introduction:**

About 62% of men above age of 40 had at least one episode of lower urinary tract symptoms (LUTS) in their life [1] Urodynamics is an invasive diagnostic tool for used in men with LUTS. Elbadawi et al [2] found an increase in smooth muscles bulk in the bladder wall in men with LUTS due to bladder outlet obstruction (BOO) in men with benign prostatic enlargement (BPE). The ultrastructural changes in the extracellular matrix include increase in collagen type 3 to

collagen type 1 ratio with subsequent thickening of bladder wall components that ultimately affects bladder wall compliance [3,4]. Consequently, a number of researches have been conducted to measure the bladder wall thickness (BWT) and investigate its relation to LUTS/BOO. Olke et al found that men have higher detrusor wall thickness (DWT) than in women (1.4 mm vs. 1.2 mm,  $p < 0.001$ ). this could be explained by the higher outlet resistance in male urinary system.

In previous studies, BWT was found to be higher in men with LUTS than in healthy men (3.6 mm vs. 3.3 mm) [5], and was applied in screening for BOO in men with LUTS/BPE [6,7]

Karakose et al [8] found a significant decrease in BWT in patient with BOO after alpha blocker treatment ( $6.8 \pm 2$  mm vs.  $4.6 \pm 1$  mm,  $p = 0.02$ ).

## 2 Material and Methods:

A total of 98 men with LUTS from 3 centers were consecutively included in the study. All patients signed an informed written consent and completed the International Prostate Symptom Score (IPSS) sheet. Inclusion criteria were adult men with LUTS. Exclusion criteria were neurogenic bladder, previous prostatic surgery, or prostatic carcinoma.

Prostate size was measured using a transrectal ultrasound. Dipstick urine analysis was done to exclude UTI.

All patients underwent urodynamic assessment (Solar, MMS, Enschede, The Netherlands and Laborie Delphis KT, Toronto, Canada). A 6 Fr urethral catheter and a rectal catheter were used to monitor vesical pressure (Pves) and abdominal pressure (Pabd), respectively. The detrusor pressure (Pdet) was calculated as  $P_{det} = P_{ves} - P_{abd}$ . Filling cystometry was done at rate of 50 ml/min until the maximum cystometric capacity (MCC) was reached.

Oelke et al found that the Detrusor wall thickness (DWT) decreases with increase in bladder filling until the level of 250 ml is reached, then the decrease is not statistically significance [9]. Therefore, BWT was assessed at 250 ml of bladder volume in the current study. The radiological picture of bladder wall includes an outer bright layer of bladder adventitia, an intermediate dark layer of detrusor muscle, and innermost bright layer of bladder mucosa [10, 11]. An ultrasound

transducer with 5 MHz frequency was placed on the suprapubic area and the measurements were done at the sharpest image of the bladder wall.

JMP® 7.0.2 software (SAS Institute, Cary, NC) was used in analysis. Spearman correlation test was done to test the strength of correlation between study parameters.

## 3 Results:

A total of 98 men with LUTS were included in the study. Patients with less than 100 ml voided volumes were excluded from final analysis [12]. A total of 72 patients were included in the final analysis. Table 1 show the baseline characteristics of these 72 patients.

A significant correlation was found between BWT and Age ( $r = .44$ ;  $p < .0001$ ), IPSS ( $r = 0.3$ ;  $p < .01$ ), and voided volumes ( $r = 0.45$ ;  $p < .0001$ ). The median BWT was higher in patients without DO ( $n = 49$ ) than in those with DO ( $n = 23$ ) ( $4.1$  mm vs.  $3.4$  mm;  $p = 0.1$ ).

**Table 1- Baseline characteristics of study group.**

Parameter	Mean $\pm$ SD N = 72	95%CI
Age	$62.40 \pm 8.4$	60.4 - 64.5
IPSS	$20.4 \pm 5.4$	19.1 - 21.7
Prostate size	$62.0 \pm 37.2$	52.9 - 71.2
MCC	$352.0 \pm 83.4$	331.5 - 372.5
Voided volumes	$225.1 \pm 105.3$	199.2 - 251.0
Qmax	$7.23 \pm 2.9$	6.5 - 7.9
PVR	$136.1 \pm 104.0$	110.5 - 161.7
Pdet.Qmax	$81.0 \pm 29.70$	73.7 - 88.3
A/G number	$66.6 \pm 30.5$	59.1 - 74.1
BWT	$3.8 \pm 1.2$	3.5 - 4.1

IPSS = International Prostate Symptom Score, MCC = maximum cystometric capacity, Qmax= maximum urinary flow rate, PVR = postvoid residual urine, Pdet.Qmax = detrusor pressure at the maximum urinary flow rate, A/G = Abrams/Griffiths number, BWT = bladder wall thickness, CI = Confidence Interval.

#### 4 Discussion:

In the current study, a significant correlation was found between BWT and IPSS ( $r = 0.3$ ;  $p < 0.01$ ) which gives a clear indication that development of LUTS in men with benign prostatic enlargement (BPE) can be associated with concomitant increase in BWT. This is in keeping with previous studies that investigated the role of BWT in assessment of LUTS in men with BPE. Hakenberg et al found that a cut off BWT in men with LUTS was significantly higher than in healthy men (3.6 mm vs. 3.3 mm) [5]. BWT was able to distinguish patients with BOO [6, 7]. On the other hand, Blatt et al found no significant difference in BWT between patients with BOO, patients with DO, and patients with normal urodynamic parameters.

In the current study, BWT was measured at 250 ml bladder filling. Isikay et al [7] reported mean BWT of  $4.1 \pm 1$  measured in men with LUTS at 150-200 ml bladder filling. Manieri et al [6] reported a mean BWT of  $4.5 \pm 1.1$  mm measured at 150 ml bladder volume in 174 men with LUTS. The discrepancy in outcomes between these studies and the current study would be ascribed to using different transducers with different frequencies and doing the BWT at different bladder volumes.

In the current study, 23 patients with DO had a lower median BWT than in patients without DO (3.4 mm vs. 4.1 mm,  $p = 0.1$ ). This might indicate that DO does not significantly contribute to the increase in BWT in men with LUTS. This finding is in contrary to what had been reported by Nunzio et al [13], the authors found the BWT can be diagnostic for DO in men with LUTS. The authors suggested a BWT cut off of 3.8 mm as diagnostic for DO with 73% sensitivity and 59% specificity.

#### 5 Conclusions:

Increase in BWT can be related to development of LUTS in men with BPE.

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