

# Urodynamic Evaluation of Benign Prostatic Hyperplasia Patients with Urinary Retention and Small Prostate Volume

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**Abstract--***The relevance of prostate size in the pathophysiology of lower urinary tract symptom and urinary retention in BPH patients is still controversial. We evaluated the urodynamic findings in patients with Benign Prostate Hyperplasia (BPH) and urinary retention with small prostate volumes (20-40cc). The 96 patients aged older than 50 years and clinically diagnosed with BPH and urinary retention with prostate volume 20-40 cc were enrolled in this study. We compared all findings in urodynamic study, age and prostate volume according to the presence of Bladder outlet obstruction (BOO) or not. Mean prostate volume was  $31,12 \pm 4,7$  ml. BOO was the main finding, affecting 56 (58.3%) patients, followed by non-BOO 40 (41,7%) patients. The maximum cystometric-capacity (CCmax), compliance, maximum flow rate (Qmax) and residual urine was significantly higher in non-BOO compared to BOO patients ( $p < 0,000$ ,  $p < 0,023$ ,  $p < 0,009$  and  $p < 0,020$  respectively). The detrusor-pressure during CCmax (PdetCCmax) and during maximum urinary-flow (PdetQmax) were significantly higher in BOO compared to non BOO patients ( $p < 0,000$  and  $p < 0,000$  respectively). All (100%) non-BOO patients experienced detrusor underactivity (DU), meanwhile only 42% of BOO patients experienced detrusor underactivity (DU). Thirty-five percent of BOO patients had detrusor overactivity (DO). No significant differences in age and prostate volume, were observed between the two groups. Almost half of the patients with urinary retention and small prostates were not obstructed and all of them experienced either DO or DU as the basis of their voiding symptoms. Our results emphasize the value of urodynamic in this population, especially when invasive treatments are being considered.*

**Key words--***Benign Prostatic Hyperplasia (BPH), bladder outlet obstruction, small prostate volume, urodynamics.*

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## I. INTRODUCTION

Urinary retention is urology emergency condition which require rapid decompression of the bladder. It is characterized by pain in the lower abdominal, distension and inability to urinate. Prolonged urinary retention may develop into an infection, permanent bladder damage and even kidney failure. Because of the natural history of benign prostate hyperplasia (BPH) disease, the risk of urinary retention increases with age (10-30% with every 5-year age increase).

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There are three pathophysiology of urinary retention, bladder outlet obstruction, detrusor underactivity and neurogenic bladder, the first two mechanisms are that contribute to urinary retention in BPH patients. Urinary retention is one of the most significant complications and lowering the quality of life in BPH patients.

The correlation of prostate size in the pathophysiology of lower urinary tract symptoms (LUTS) and urinary retention in patients with BPH and its implication for treatment remain unclear although many studies try to correlate this. Likewise, many authors showed poor correlation between bladder outlet obstruction (BOO) and prostate volume. Importance prostate size as a prognostic factor in patients who undergo surgery for BPH also remain unclear, many author reporting unsuccessful clinical result after surgery in men with small prostate .

Urodynamic studies provide a major contribution to the pathophysiology of LUTS or urinary retention. But role of urodynamic as a the additional investigation in patients with LUTS due to BPH still controversial. Currently urodynamic not recommended as a routine examination in patients with BPH , except with special conditions. Knowing the causes of urinary retention in patients with BPH is very important to determine management strategies , especially when surgery is considered , because the good results obtained in those with clinically proven.

The present study analyzes the urodynamic findings in men with urinary retention and a prostate volume 20-40 cc. This issue may contribute for a better understanding of the complex relationship between prostate volume and voiding dysfunction.

## II. PATIENTS AND METHODS

From January 2010 to December 2015, the records of all men aged above 50 years old with urinary retention suggestive of BPH and a prostate volume 20-40 ml that were referred to our urodynamic center were reviewed.

Patients were referred for urodynamic evaluation by different urologists of our hospital, after an initial investigation that included a detailed clinical evaluation including a complete history and physical examination, urinalysis and measurement of the prostate volume with transrectal ultrasound. Patients with history of previous prostatic or pelvic surgery, prostate or bladder cancer, pelvic radiotherapy, neurological diseases, urethral stricture excluded from this study.

Urodynamics study examined to all patients using Medtronic Duet Urodynamic System © Urodynamic evaluation included filling phase (cystometry) and pressure-flow voiding phase. 6-Fr urodynamic catheters were inserted trans-urethrally. Sterile water (Aquadex Wida©) was inserted through the catheters at a rate of 30 ml/min. The other catheter is used to calculate intra-vesical pressure. Rectal balloon catheter is used to measure intra-abdominal pressure. Detrusor pressure was calculated electronically. All operational definitions based on standardized terminology of the International Continence Society.

The urodynamic parameters analyzed were: maximum cystometric capacity (CCmax ), detrusor pressure in the CCmax (Pdet ,CCmax), bladder compliance, detrusor activity, maximum flow rate during pressure-flow study (Qmax), detrusor pressure in the maximum flow rate (Pdet ,Qmax) and residual urine. Detrusor overactivity (DO) was defined as any involuntary detrusor contraction during the filling phase. The detrusor contractility was assessed with

the bladder contractility index (BCI) with the formula:  $BCI = (P_{det}, Q_{max}) + 5 (Q_{max})$ . The BCI was considered normal if  $>100$ . Detrusor underactivity (DU) was defined when BCI was  $<100$ . BOO was assessed with the BOO index (BOOI) with the following formula:  $BOOI = (P_{det}, Q_{max}) - 2 (Q_{max})$ . Patients were characterized as obstructed when  $BOOI >40$  and unobstructed when  $BOOI <20$ . Intermediary values were considered equivocal (15). For the present study, patients with equivocal obstruction were included in the unobstructed group.

Patients were divided into two groups based on the presence BOO, and compared all urodynamic parameters findings based on these two groups.

Numerical data were reported as mean  $\pm$  SD. Categorical variables were reported as number and percentages. Student's t test was used to compare numerical variables and the X2 test or the Fisher's exact test were used for categorical variables. Data were processed using SPSS 20.0 for Windows statistical software and  $p < 0.05$  considered significant.

### III. RESULTS

The average age of the patients was  $67 \pm 6,5$  years. The prostate volume of the 96 patients with a mean of  $31,12 \pm 4,7$  cc. The cystometric findings and the results of the pressure-flow studies are summarized in tables 1 and 2, respectively. Urodynamic abnormalities were found in 96 patients, with BOO as the main finding, affecting 56 (58,3%) patients. Other findings included DU in 64 (66%) and DO in 20 (20,8%) patients.

**Table 1.** Cystometric findings in 96 patients BPH with urinary retention and small prostate volume (20-40 cc)

No	Parameter	Mean $\pm$ SD
1	Age (Yrs)	67 $\pm$ 6,5
2	Prostate volume (cc)	31,12 $\pm$ 4,7
3	CC max (ml)	213,38 $\pm$ 115,9
4	PdetCCmax (cm H2O)	62,7 $\pm$ 30,5
5	Bladder compliance (ml/cmH2O)	41,62 $\pm$ 2,33
6	Detrusoroveractivity	20(20,8%)

**Table 2.** Pressure-flow studies in 96 patients with BPH with urinary retention and small prostate volume (20-40 cc)

No	Parameter	Mean $\pm$ SD
1	Qmax (ml/s)	5,6 $\pm$ 2,97
2	PdetQmax (cmH2O)	62 $\pm$ 28,39
3	BOOI	50,98 $\pm$ 28,19
4	BCI	88,79 $\pm$ 30,55
5	Detrusor underactivity	64(66%)
6	Residual urine(ml)	117,16 $\pm$ 74,44
7	BOO	56(58,3%)
8	Non BOO	40 (41,7%)

### Comparison of Patients with and without Bladder Outlet Obstruction

The mean age of patients with and without BOO was  $67\pm 6,7$  and  $67\pm 6,17$  respectively ( $p = 0.676$ ). No significant differences were found in terms of prostate volume between the two groups. Cystometric parameters demonstrated the maximum cystometric-capacity (CCmax), compliance, maximum flow rate (Qmax) and residual urine was significantly higher in non-BOO compared to BOO patients ( $p 0,000$ ,  $p 0,023$ ,  $p 0,009$  and  $p 0,020$  respectively). The detrusor-pressure during CCmax (PdetCCmax) and during maximum urinary-flow (PdetQmax) were significantly higher in BOO compared to non BOO patients ( $p 0,000$  and  $p0,000$  respectively). All (100%) non-BOO patients experienced detrusor underactivity (DU), meanwhile only 42% of BOO patients experienced detrusor underactivity (DU). Thirty-five percent of BOO patients had detrusor overactivity (DO). Table 3 shows the clinical and urodynamic parameters of the two groups

**Table 3.** Comparison between patients with and without BOO

No	Parameters	Patients without BOO (40 patients)	Patients with BOO (56 patients)	p
1	Age (Yrs)	$67\pm 6,17$	$67\pm 6,70$	0,676
2	Prostate volume (cc)	$31,8\pm 4,09$	$30,64\pm 5,01$	0,399
3	CCmax (ml)	$270,4\pm 102,83$	$172,64\pm 107,85$	0,000
4	PdetCCmax (cmH2O)	$35,1 \pm 15,37$	$82,42\pm 22,15$	0,000
5	Compliance (ml/cmH2O)	$40,9 \pm 2,19$	$42,14\pm 2,32$	0,023
6	Detrusoroveractivity	0(0%)	20(35%)	0,000
7	Detrusor underactivity	40(100%)	24(42%)	0,000
8	Qmax (ml/s)	$6,34\pm 3,05$	$5,08\pm 2,79$	0,009
9	PdetQmax (cmH2O)	$36,1\pm 8,44$	$80,64\pm 22,35$	0,000
10	BOOI	$23,68\pm 7,81$	$70,48\pm 20,01$	0,000
11	BCI	$67,1 \pm 21,24$	$104,28\pm 26,57$	0,000
12	Residual urine (ml)	$100,9\pm 88,57$	$128,78\pm 60,66$	0,020

## IV. DISCUSSION

Urinary retention is a condition that will reduce the patients quality of life. Although many condition can caused urinary retention (classified as bladder outlet obstruction, myogenic and neurogenic) , BPH is the most common cause . The exact mechanism is still debated <sup>16,17</sup>, but studies on population showed increased urinary retention in increasing age.

Risk factors of developing urinary retention in BPH can be divided into the basic factors and dynamic factors. Basic factors including age, degree of LUTS, low urine flow rate, an increase in the post void residual volume (PVR), prostate volume, and PSA. Dynamic factor where there is a worsening of IPSS > 4 points, bothersome score > 3 during

treatments, increasing PVR and no response with alpha blocker treatments. This dynamic factors can be actively monitored to predict the occurrence of urinary retention and assess the need for surgery.

Prostate volume increases with increasing of age. In the study of Roehrborn et al., prostate volume could be predictor for urinary retention in BPH but Kefi et al.<sup>20</sup> found that there was no correlation between urinary retention and prostate volume in BPH Patients. Bosch et al. found that prostate volume could not be a predictor for urinary retention in BPH.

In this study, we evaluated 96 patients with small prostate volumes (20-40cc) referred for urodynamic evaluation. All had urinary retention suggestive of BPH and we excluded those with potentially confounding conditions such as previous prostatic or pelvic surgery, prostate or bladder cancer, pelvic radiotherapy, neurological diseases, and urethral stricture.

In our study, urodynamic abnormalities were found in 96 patients (100%), with BOO as the main finding, affecting 56 (58,3%) patients. Other findings included DU in 64 (66%) and DO in 20 (20,8%) patients.

Several studies revealed that BOO is present in 50–80% of men with LUTS and BPH (12,13,22,23). The presence of BOO is regarded by many as an important factor for achieving good results after surgical treatment of BPH . In this study, BOO was present in 58,3% of the patients, which is similar to other reports that evaluated men with small prostate volume.

The comparison of the urodynamic parameters between men with and without BOO revealed no significant differences in the age and prostate volume between two groups. Cystometric parameters demonstrated the maximum cystometric-capacity (CCmax), compliance, maximum flow rate (Qmax) and residual urine was significantly higher in non-BOO compared to BOO patients. The detrusor-pressure during CCmax (PdetCCmax) and during maximum urinary-flow (PdetQmax) were significantly higher in BOO compared to non BOO patients. All non-BOO patients experienced detrusor underactivity (DU), meanwhile only 24 (42%) of BOO patients experienced detrusor underactivity (DU). Twenty patients (35%) of BOO patients had detrusor overactivity (DO)

Hirayama et al., evaluated 36 patients with a small prostate volume and LUTS. In their study, impaired contractility was observed in 23.8% of the men with BOO and in 79.6% of the without BOO. These findings indicate that when BOO is absent, impaired detrusor contractility especially DU is a highly prevalent diagnosis in men with urinary retention and a small prostate volume, same as our results in this study. This is a very important finding because patients with detrusor weakness usually fare worse after operation.

The increasing of age will also lead to changes in pathology and pathophysiology of the bladder, and could be worsening BPH symptoms. Some studies show changes in pathology and pathophysiology of bladder directly due to age. Increasing age could make the incidence of over active bladder will increase too. Some studies also indicate an increase in age would decrease bladder muscle tone. When associated with BPH, it could be worsening BPH symptom and make patients easily get urinary retention even in small volume of prostate.

Observations on the strength of muscle contractions, the bladder muscle pressure at a maximum rate of urine flow rate decreased with age shows that there are changes in the function of the bladder muscle. Another study showed

a decrease in bladder muscle pressure and decrease the flow rate of urine associated with age. There are changes in both histology and ultrastructure of the urinary bladder in elderly, and even the unobstruction, obtained imbalances functions of the bladder muscle. Furthermore, decrease of acetylcholine in the muscles in older age associated with change in contraction pattern. Decrease bladder muscle contractions may reflect age-related changes in myogenic, neurogenic or both.

In summary, our study showed a high prevalence of urodynamic abnormalities in patients with urinary retention suggestive of BPH and a prostate volume 20- 40 cc. BOO was a common finding, but was present in only half of the patients, which is inferior to the prevalence observed in most studies of BPH patients. This finding and the high prevalence of other abnormalities such as DO and, specially, IDC indicate that patients with small prostate volumes may be a subset of BPH patients that deserves special considerations and for whom urodynamics should be performed when invasive treatments are being considered

## V. CONCLUSION

Almost half of the patients with urinary retention and small prostates were not obstructed and all of them experienced either DO or DU as the basis of their voiding symptoms. Our results emphasize the value of urodynamic in this population, especially when invasive treatments are being considered.

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