

## Original Research Article

# Intravesical prostatic protrusion and prostate volume in patients with acute urine retention

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## ABSTRACT

**Background:** To study the prevalence of significant Intravesical Prostatic Protrusion (IPP) in patients presenting with acute urinary retention (AUR) due to Benign prostatic hyperplasia (BPH) and to study the correlation between intravesical prostatic protrusion and prostatic volume.

**Methods:** We assessed 68 men between the ages 45 to 85 who presented with acute urinary retention. Initial assessment included detailed clinical history, International Prostate Symptom Score (IPSS) and Quality of Life assessments and a transabdominal ultrasonogram to measure Prostate Volume (PV) and Intravesical Prostatic Protrusion (IPP). The degree of IPP was determined by the distance from the tip of the protrusion to the circumference of the bladder at the base of the prostate gland. Patients with IPP >10 mm were taken to have significant IPP and those ≤10 mm was taken to be insignificant. Statistical analysis included descriptive analysis and Pearson's correlation coefficient.

**Results:** Of the 68 patients in our study who presented with AUR, 29 patients (42.9%) had significant IPP. Mean IPP was 9.81mm with a standard deviation of 5.41 mm. All patients with significant IPP had a severe IPSS grade. IPP had a statistically significant correlation with prostatic volume.

**Conclusions:** The IPP as assessed by transabdominal ultrasound can be used to direct appropriate patients to more aggressive treatment strategies like surgery.

**Keywords:** Benign prostatic hyperplasia, Intravesical prostatic protrusion, Acute urinary retention

## INTRODUCTION

Benign prostatic hyperplasia (BPH) is one of the most common diseases in elderly men. The prevalence of histological BPH increases with age and appears in approximately 40% of men aged 50-60 years and in approximately 90% of men aged more than 80 years.<sup>1</sup> Acute urinary retention (AUR) represents one of the most significant and painful events in the natural history of BPH. Ten per cent of men in their seventies and 30% in their eighties will have AUR within the next five years. BPH is the cause for the AUR in at least 65% of men presenting with AUR. Men with AUR often have lower

urinary tract symptoms (LUTS) for an average of 32 months before the AUR.<sup>2</sup>

Up to a third of patients undergoing surgical treatment for BPH present with AUR.<sup>2</sup> Acute urinary retention is associated with significant anxiety, discomfort and patient inconvenience. But the symptoms and obstruction do not entirely depend on the prostate's size. In contrast, Intravesical Prostatic Protrusion (IPP) has been found to correlate with bladder outlet obstruction.<sup>1</sup> IPP is a morphological change due to overgrowth of prostatic median and lateral lobes into the bladder and may lead to dyskinetic movement of the bladder during voiding.

Several studies have previously demonstrated that the ultrasonographic measurement of IPP can detect Bladder Outlet Obstruction (BOO) in BPH patients quickly and noninvasively.<sup>1</sup> In patients with LUTS, detection of significant IPP can be an indication for early surgical intervention.

Hence in this study, we did a hospital-based study to find out the prevalence of Intravesical Prostatic Protrusion and the correlation between Intravesical Prostatic Protrusion and Prostate Volume in patients presenting with Acute Urinary Retention due to BPH.

### Objectives

To find out the prevalence of significant IPP in patients presenting with acute urinary retention due to benign prostatic hyperplasia. To study the correlation between intravesical prostatic protrusion and prostatic volume.

### METHODS

This was a descriptive study of 68 patients who reported with acute urinary retention to the department of urology at Narayana Medical College for two years, from April 2018 to March 2020. The study was initiated after obtaining ethical clearance from the institution ethical clearance committee. Inclusion criteria were all patients of BPH presenting with acute urinary retention, men of age group 45-85 years. Exclusion criteria were Patients with bladder calculus, neurological conditions (Parkinson's Disease or CVA which predispose the patient to the neurogenic bladder), documented malignancy. Informed consent was obtained from those patients presenting with acute urinary retention. Relevant

clinical data (demographic age, sex, place, occupation) including history was obtained from the patient. An International Prostate Symptom Score questionnaire is also provided and the severity of symptoms was graded.

Intravesical prostatic protrusion and prostatic volume were assessed by trans-abdominal ultrasonogram. IPP was measured the shortest distance connecting the protruded end of the prostate into the bladder base on the bladder neck in the sagittal plane, which reflects the maximal longitudinal length of the prostate as suggested by Nose et al.<sup>3</sup> IPP <10 mm was not considered significant. IPP >10 mm was considered significant. Normal prostate volume is 15-20 cc. Correlation of the IPP with the volume of the prostate and the prevalence of significant IPP in patients presenting with acute retention of Urine was calculated.

### Statistical analysis

Data collected were entered in microsoft excel 2010. Statistical analysis was done using Statistical package for social sciences (SPSS) trial version 20.0. Descriptive analysis of the data (mean and standard deviation) together with Pearson's correlation coefficients were used to assess the relationships between IPP, PV and IPSS.

### RESULTS

The distribution of age in the study population ranges from 45 to 85 years. The mean age of study participants was 65.94±8.271 years (Table 1).

**Table 1: Variables of study participants.**

	Minimum (n)	Maximum (n)	Mean (n)	Standard deviation
<b>Age of participants (years)</b>				
Value	45	85	65.94	8.271
<b>Prostate volume (mm<sup>3</sup>)</b>				
Value	23	105	64.10	23.255
<b>Distribution of IPP (mm)</b>				
Value	4	23	9.81	5.412
<b>Distribution of IPSS</b>				
Value	17	33	24.32	4.692

**Table 2: Age distribution and IPP in the study group.**

	40-49 years	50-59 years	60-69 years	70-79 years	80-89 years	Total (n)
<b>Age distribution (years)</b>						
Frequency (n)	1	10	34	17	6	68
Percent	1.5	14.7	50	25	8.8	100
<b>Distribution of IPP (mm)</b>						
>10 mm Frequency (n)	0	3	11	10	5	68
≤10 mm	1	7	23	7	1	

Half of the study participants were in the 60-69 years of age group (50%), followed by the 70-79 years of age group (25%) (Table 2).

The distribution of prostate volume in the study population ranged from 23 to 105 mm<sup>3</sup>. The mean prostate volume of study participants was 64.10±23.255 mm<sup>3</sup> (Table 1).

The distribution of intravesical prostatic protrusion (IPP) in the study population ranged from 4 to 23 mm. The mean IPP of study participants were 9.81±5.412 mm (Table 1).

In our study, significant intravesical prostatic protrusion was present in 42.6% of patients who presented with acute urinary retention (Table 5).

35.3% of the study participants had grade III prostatomegaly (60-90 gm) and 30.9% of the study participants had grade II prostatomegaly (40-60 gm) (Table 3).

In our study, 19% of the patients who presented with Acute Urinary retention were found to have only grade I prostate (<40 cc). 31% of the patients had grade II

prostate, 35% of the patient's grade III prostate and 14% patients grade IV prostate (Table 3).

All patients with grade IV prostate had significant IPP and significant IPP was most prevalent in patients of the oldest age group (80-89 years) (Table 2).

#### IPSS components

In our study, about 35.3% of the patient gave a history of incomplete micturition less than half the time, and 14% had the complaint almost always. About 44% of the patients had increased frequency of micturition more than half the time. About 41% of the patients had intermittency while voiding about half the time while 27% of the patient had the complaint more than half the time. About 32% of the patients complained of the weak urinary stream more than half the time and about 31% had the complaint about half the time. About 23% had a weak stream of urine almost always and the rest of the patients had the complaint at least half the time. About 36% of the patients in our study had to strain to void urine more than half the time and 47% had the complaint about half the time (Table 4). In our study, all our patients had to void more than 3 times a night. More than half of the study participants were unhappy regarding the quality of life.

**Table 3: Distribution of prostate grade in the study group.**

Prostate grade	I (20-40 gm)	II (40-60 gm)	III (60-90 gm)	IV (>90 gm)	Total
<b>Distribution of prostate grade</b>					
Frequency (n)	13	21	24	10	68
Percent	19.1	30.9	35.3	14.7	100
<b>Distribution of prostate grade among patients with significant IPP</b>					
>10 mm Frequency (n)	0	0	19	10	68
≤10 mm	13	21	5	0	

**Table 4: IPSS components in the study group.**

	<1 time	Less than half the time	About half the time	More than half the time	Almost always	Total
<b>Distribution of incomplete emptying</b>						
Frequency (n)	7	24	14	13	10	68
Percent	10.3	35.3	20.6	19.1	14.7	100
<b>Distribution of frequency</b>						
Frequency (n)	0	3	19	30	16	68
Percent	0	4.4	27.9	44.1	23.5	100
<b>Distribution of intermittency</b>						
Frequency (n)	0	20	28	18	2	68
Percent	0	29.4	41.2	26.5	2.9	100
<b>Distribution of weak stream</b>						
Frequency (n)	0	0	19	30	16	68
Percent	0	0	29.9	44.1	23.5	100
<b>Distribution of straining</b>						
Frequency (n)	0	0	32	25	11	68
Percent	0	0	47.1	36.8	16.2	100

**Table 5: Significant IPP, AUR, pus cells in urine examination, prostate tenderness in the study group.**

	Frequency (n)	Percent (%)
Yes	29	42.6
<b>Significant IPP (&gt;10mm)</b>		
No	39	57.4
Yes	16	23.5
<b>Previous AUR</b>		
No	53	76.5
Yes	35	51.5
<b>Pus cells in urine routine Examination</b>		
No	33	48.5
Yes	7	10.3
<b>Prostate Tenderness</b>		
No	61	89.7

**Table 6: Distribution of IPSS grade.**

IPSS grade	Frequency (n)	Percent
<b>Moderate</b>	13	19.1
<b>Severe</b>	55	80.9
<b>Total</b>	68	100

**Table 7: Correlation between intravesical prostatic protrusion and prostatic volume.**

		Prostatic volume	IPP
<b>Prostatic volume</b>	Pearson correlation	1	0.878**
	Sig. (2-tailed)		0.000
	N	68	68
<b>IPP</b>	Pearson correlation	0.878**	1
	Sig. (2-tailed)	0.000	
	N	68	68

\*\* Correlation is significant at the 0.01 level (2-tailed).

The distribution of IPSS in the study population ranged from 17 to 33. The mean IPSS of study participants were  $24.32 \pm 4.692$  (Table 1).

All patients who presented with acute urinary retention had at least a moderate grade of IPSS. 80.9% of the study population had severe IPSS grades (Table 6).

23.5% of the study population have had a previous AUR (Table 5).

Half of the study participants (51.5%) had pus cells in urine routine examination (Table 5).

Only 10.3% had prostate tenderness (Table 5).

There is a strong positive correlation (0.878) between the intravesical prostatic protrusion and prostatic volume (Table 7).

## DISCUSSION

Although benign prostatic hyperplasia is not a life-threatening disease it adversely affects the quality of life.

Most patients seek treatment to be relieved of bothersome symptoms.<sup>4</sup> Benign Prostatic Hyperplasia is a common cause of bladder outlet obstruction and later causes acute urinary retention as a long term consequence. The impact of acute urinary retention on patients health-related quality of life is comparable to an attack of renal colic.<sup>5</sup> Urodynamic studies are the gold standard in the diagnosis of bladder outlet obstruction. But since it is an invasive, time-consuming and expensive procedure its clinical applications have been limited. Several non-invasive indices have been tried to obtain similar information in an objective to direct more aggressive therapy to those patients who are most likely to benefit from such an approach.<sup>6</sup>

IPSS is a simple tool in the evaluation of BPH and worsening scores warrant intervention. But it has a poor correlation with BOO.<sup>6</sup> Since Nose et al described the clinical implications of IPP there have been many studies related to IPP.<sup>3</sup> Kim et al in 2010 concluded in their study that IPP grade was statistically significantly related to both overactive bladder and acute urinary retention.<sup>7</sup> Hossain et al in 2010 concluded that PV and IPP measured through transabdominal USG are non-invasive, an accessible method that significantly correlates with

BOO in patients with BPH and correlation of IPP is stronger than that of PV.<sup>1</sup>

Keqin et al in 2007 did a study on the clinical significance of IPP in patients with BPH and concluded that BOO and impaired detrusor function were more severe in patients with significant IPP.<sup>8</sup>

Lee et al in 2010, concluded that IPP is a quick non-invasive test to predict clinical progression in BPH and that higher grade IPP is associated with a higher risk of clinical progression of BPH.<sup>9</sup> Lim, et al. in 2006 while comparing IPP, PV and serum PSA in the evaluation of BOO, concluded that PSA, PV and PSA correlate well with one another but IPP predicts BOO better than PSA or PV.<sup>6</sup> Gyawali et al in 2008 while studying the relationship with IPP and PV, concluded that IPP assessed by trans abdominal USG is more accurate than PV in evaluating bothersome symptoms in men with BPH.<sup>10</sup> Chia et al in their study on the correlation of IPP with BOO, concluded that IPP assessed by transabdominal USG is a better and more reliable predictor of BOO than a pressure-flow study.<sup>11</sup> Cumpanas et al in 2011 concluded that men with IPP exceeding 10mm were more frequently poor responders to medical treatment with tamsulosin among patients with lower urinary tract symptoms due to BPH, PV <40 ml, PSA <1.5 ng/ml.<sup>12</sup> Mariappan et al in 2006, found out that among white men presenting with AUR, a trial without a catheter is more likely to fail in patients with intravesical prostatic protrusion larger than 10 mm.<sup>13</sup>

Franco et al in their study concluded that suprapubic USG of detrusor wall thickness and IPP is a simple, non-invasive accurate system to assess bladder prostatic obstruction in patients with LUTS due to BPH.<sup>14</sup> Lee et al in his study found that IPP showed a significant correlation with storage symptoms and could potentially be a useful marker for the assessment and management of LUTS.<sup>15</sup> Leonardo et al in their study on intravesical protrusion of the prostate as a predictive method of bladder outlet obstruction concluded that IPP and Prostate volume measured by transabdominal ultrasound is useful in the diagnosis of male urinary obstructive symptoms. 59.5% of the patients evaluated were found to have IPP >10 mm.<sup>16</sup> In our study 42% of men who presented with acute urinary retention had significant Intravesical prostatic protrusion (>10 mm).

In our study, we found that IPP and Prostate volume correlate well with one another. With higher prostate volume, it is also likely to have a higher grade IPP. Also, in our study, all patients with significant IPP had a severe IPSS grading. Although our study demonstrates a good correlation between prostate volume and intravesical prostatic protrusion, the importance of measuring IPP is most evident in small prostate glands with obstruction. These glands tend to have a significant IPP. The high IPP is due to a protruding median lobe creating a ball-valve effect while voiding. A strong bladder contraction force

could open a channel between the lobes but it aggravates the ball valve effect in IPP, increasing the urethral resistance.<sup>17</sup> In addition, the presence of median lobe enlargement causes dyskinetic movement during micturition.<sup>10,17</sup>

IPP measurement can easily be obtained from a trans-abdominal USG in an outpatient setting and is a non-invasive, reproducible and cost-effective procedure. All patients in our study with significant IPP had a severe IPSS grade. Previous studies (Cumpanas et al and Mariappan et al) have shown that trial voiding without a catheter is likely to fail in these patients. Hence greater emphasis is warranted in the evaluation of BPH during decision making in offering treatment options.

### **Limitations of our study**

The measurements made by bladder ultrasound scans might have been inconsistent among the radiologists, although we believe that the measurements were within acceptable error ranges. Our study included a small number of patients and showed a wide range of outcomes, which limited its immediate practical use.

### **CONCLUSION**

Our study concludes that intravesical prostatic protrusion and prostate volume correlates well with one another and that there is a high prevalence of significant IPP in patients eventually developing acute urinary retention. All patients in our study with significant IPP had a severe IPSS grade. IPP can be used to direct appropriate patients to more aggressive treatment strategies like surgery.

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