

CORRELATION BETWEEN PROSTATIC URETHRAL ANGLE WITH CLINICAL PARAMETERS AND BOO

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ABSTRACT

Objective: We investigated the correlation of the PUA on clinical parameters and bladder outlet obstruction (BOO) in men with lower urinary tract symptoms (LUTS) suggestive of benign prostatic hyperplasia (BPH). **Material & Method:** This study was performed between January to April 2011. A cross sectional analysis of 24 men with LUTS associated BPH aged > 50 years was performed. Patients underwent evaluation including International Prostatic Symptom Score (IPSS), transrectal ultrasonography, uroflowmetry, and pressure-flow study. Statistical analysis was performed to evaluate correlation of the PUA on clinical parameters and bladder outlet obstruction (BOO). **Results:** A total of 24 patients, aged 51 to 78 years were enrolled in this study. The mean value of total IPSS, prostate volume, PUA, and Qmax was 22 (range 7-35), 34,4 cm³ (range 21-70 cm³), 37,3° (range 25°-55°), and 10,5 mL/s (range 4,2-17,9 mL/s), respectively. Pearson's correlation analysis showed that PUA was not significantly correlated with IPSS ($p = 0,117$), Qmax ($p = 0,434$), total prostate volume ($p = 0,213$). Patients with increased PUA ($PUA > 35^\circ$) had higher incidence and degree of BOO ($p < 0,05$). **Conclusion:** PUA may be one method to assess the presence of BOO in men with LUTS associated BPH. Our investigation suggest that PUA may help in the treatment of individuals by better predicting their likely classification from a pressure-flow study.

Keywords: Prostatic urethral angle, benign prostatic hyperplasia, lower urinary tract symptoms, bladder outlet obstruction.

ABSTRAK

Tujuan Penelitian: Kami meneliti korelasi sudut uretra prostatika dengan parameter klinis dan Bladder Outlet Obstruction (BOO) pada pria dengan benign prostatic hyperplasia - lower urinary tract symptoms (BPH - LUTS). **Bahan & Cara:** Penelitian ini dilakukan antara bulan Januari sampai April 2011. Analisis cross sectional dari 24 pria dengan LUTS yang terkait dengan BPH dan berusia > 50 tahun. Pasien menjalani evaluasi termasuk International Prostatic Symptom Score (IPSS), transrectal ultrasonography, uroflowmetri, dan studi urodinamik dengan pressure-flow study. Analisis statistik dilakukan untuk mengevaluasi korelasi sudut uretra prostatika dengan parameter klinis dan BOO. **Hasil Penelitian:** Sebanyak 24 pasien, berusia antara 51-78 tahun yang tercatat dalam penelitian ini. Nilai rerata dari IPSS total, volume prostat, sudut uretra prostatika, dan Qmax adalah 22 (7-35), 34,4 cm³ (21-70 cm³), 37,3° (25°-55°), dan 10,5 mL/s (4,2-17,9 mL/s). Analisis uji korelasi Pearson menunjukkan bahwa PUA tidak signifikan berkorelasi dengan IPSS ($p = 0,117$), Qmax ($p = 0,434$), total volume prostat ($p = 0,213$) ($p > 0,05$). Pasien dengan sudut uretra prostatika meningkat (sudut > 35°) menurut analisis dari uji korelasi Spearman memiliki kejadian dan derajat BOO yang lebih tinggi ($p = 0,000$) ($p < 0,05$). **Simpulan:** Sudut uretra prostatika merupakan salah satu metode untuk menilai adanya BOO pada pria dengan LUTS terkait BPH. Penelitian kami menunjukkan bahwa sudut uretra prostatika dapat membantu dalam menentukan terapi.

Kata Kunci: Sudut uretra prostatika, benign prostatic hyperplasia, lower urinary tract symptoms, bladder outlet obstruction.

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INTRODUCTION

Benign prostatic hyperplasia (BPH) is actually a histopathologic term referring to the increasing number of stromal cells and epithelial cells of the prostate gland. Changes in prostate structure in BPH include changes in volume and histology. Prostate volume changes occur vary at each age.¹ BPH patients complain of annoyance and disruption in activities of daily living. Complaints in patients with BPH present as Lower Urinary Tract Symptoms (LUTS), which consists of symptoms of obstruction and irritation symptoms. This situation is a result of an enlarged prostate gland or benign prostate enlargement (BPE) that causes obstruction of the bladder neck and urethra or known as bladder outlet obstruction (BOO). Specific obstruction caused by enlarged prostate gland known as benign prostate obstruction (BPO). BPE, LUTS, and BOO are the basis for the clinical diagnosis of BPH, but the three do not always occur together. There was no clear correlation between LUTS, BPE, and BOO.²

Bladder outlet obstruction (BOO) is a term used to describe infravesical obstruction. BOO could be due to other causes such as BPH or urethral stricture, urethral stones or inflammation. Urodynamics (pressure-flow study) is the gold standard examination that compares the detrusor pressure with urinary stream during the bladder emptying phase, while the obstruction degree can be assessed by using a plot or a nomogram.² Studies with urodynamic examination found that 30-40% of patients with symptoms of urgency, frequency and weak urinary stream did not have BOO, therefore prostate resection may not be beneficial.^{3,4} One problem that still unanswered until today is the dearth of information on the correlation between the proportion of prostate examination with BOO degree⁴ and urodynamics examination is still relatively invasive, expensive, and time consuming.⁵

The prostatic urethra runs through the prostate from base to apex. The urethral course creates an anterior angle of 35° at proximal verumontanum. The angle divides prostatic urethra into proximal segment (pre prostatic) and distal segment (prostatic), which both have anatomical and functional differences.^{6,7} With the enlargement of the medial lobe, prostatic urethral angle tends to increase or more than 35°. It causes loss of energy and increased blockage on the corner of the prostatic urethra during micturition process so that it causes

bladder outlet obstruction (BOO). In urethro-cystoscopy examination the increased angle of the prostatic urethra is indicated by the presence of high bladder neck, although without an accompanying increase in prostatic volume. This may explain the presence of micturition symptoms and decreased urine stream without any enlargement of the prostate.⁸

OBJECTIVE

We investigated the correlation between prostatic urethra angle with clinical parameters and bladder outlet obstruction (BOO) in patients with benign prostatic hyperplasia (BPH) with lower urinary tract symptoms (LUTS).

MATERIAL& METHOD

This study was carried out using cross-sectional analytic observational design between January to April 2011. The study population was LUTS patients due to BPH who came to the Urology Outpatient Clinic, Dr Soetomo Hospital, Surabaya. All patients were asked about medical history and IPSS assessment. IPSS total score of question number 2, 4, and 7 was the manifestation of bladder filling phase component (irritative complaints), while total score of the numbers 1,3,5,6 were manifestations of bladder emptying phase component (obstructive complaints). Qmax was measured with uroflowmetry with minimum voided volume of 150 ml, whereas prostate volume was measured with TRUS with probe 7 MHz. Prostatic urethral angle was measured in the mid-sagittal plane, between the proximal segment (preprostatic) and distal segment (prostatic), the mid-sagittal was performed using transrectal ultrasonography (TRUS). Subsequently, all patients were examined for urodynamics (cystometry and pressure-flow study) with Medtronic DUET according to ICS standards. Inclusion criteria were men with LUTS due to BPH with age above 50 years, while the exclusion criteria, among others, LUTS due to other than BPH, history of previous surgery, urinary retention, bladder or prostate malignancy, and previous medical treatment.

Data were analyzed descriptively and analytically. Prior to hypothesis testing, Kolmogorov-Smirnov was done for normality of data distribution. Correlation between prostatic urethral angle with the IPSS, uroflowmetry, prostate volume

and the incidence of bladder outlet obstruction (BOO) was tested using correlation test.

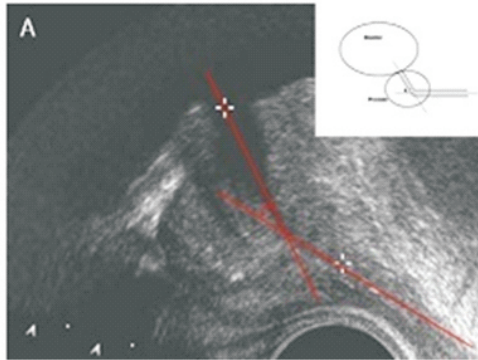


Figure 1. Prostatic urethral angle: angle measured between the proximal segment (preprostatic) and distal segment (prostatic), the mid-sagittal cut using transrectal ultrasonography (TRUS).

RESULTS

Data showed that the youngest patient aged 51 years and the oldest 78 years. Overall mean age of patients was $64,4 \pm 6,8$ years. Data from the literature showed from the autopsy that the prevalence of BPH in men aged 41-50 years was 20%, aged 51-60 years 50% and above 80 years of age by 90%.9 Most of the patients in our study, as many as 62,5% or 15 patients, presented with severe degrees IPSS score and 33,3% or 8 patients with moderate IPSS score. Only 4,2% or 1 patient who came with minor complaints.

Data on the patients' urine stream showed in Qmax category of < 10 ml/sec, the largest percentage (37,5%) occurred in patients with prostatic urethral angle of > 35°. In Qmax category of 10-15 ml/sec, the percentage of patients with prostatic urethral angle of > 35° was 16,7%. In Qmax category of > 15,

Table 1. Descriptive data.

Variable	N	Mean	SD	Min	Max
Age	24	64,4	6,8	51	78
IPSS (obstructive)	24	12,1	5,1	2	20
IPSS (irritative)	24	9,9	3,7	2	15
Total IPSS	24	22,0	7,5	7	35
Qmax	24	10,5	3,2	4,2	17,9
Prostate Volume	24	34,4	4,4	21,0	70,0
PUA	24	37,3	12,5	25	55

the percentage in patients with prostatic urethral angle > 35° was 8,3%.

This study shows there were 70,8% of respondents who had prostate volume of 21-40 ml. Smallest prostate volume was 21 ml and the largest prostate volume was 70 ml, and the mean prostate volume was $34,36 \pm 12,46$ ml. In prostate volume category of 20-40 g, the percentage of patients with prostatic urethral angle > 35° was 37,5% and prostatic urethral angle 35° was 33,3%. In prostate volume > 40 g, the largest percentage occurred in patients with prostatic urethral angle > 35°, which was 25%.

The results of statistical analysis showed that there was no significant correlation between prostatic urethral angle with the total IPSS, obstructive IPSS, and irritative IPSS.

Table 2. Correlation test between IPSS and prostatic urethral angle.

Correlation between prostatic urethral angle & variables	Pearson's Correlation Value	Sig.
IPSS O	0,328	0,117
IPSS I	0,217	0,308
IPSS total	0,328	0,117

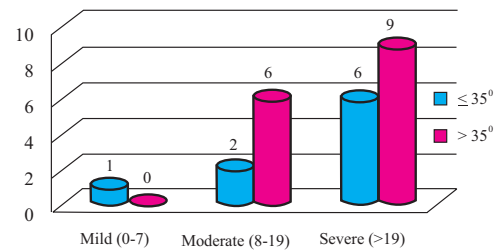


Figure 2. Correlation between IPSS and prostatic urethral angle

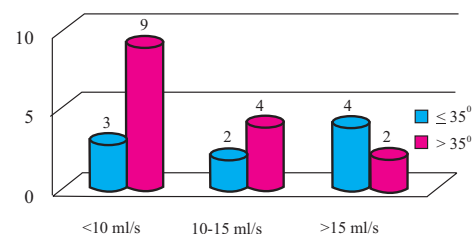


Figure 3. Maximum urinary stream diagram.

Table 3. Correlation test between prostate volume and prostatic urethral angle.

Prostate volume categories	Prostatic urethral angle		Total	Pearson's Correlation Test
	$\leq 35^\circ$	$> 35^\circ$		
20 - 40 g	8 33,3%	9 37,5%	17 70,8%	r = 0,264 p = 0,213
> 40 g	1 4,2%	6 25%	7 29,2%	
Total	9 37,5%	15 62,5%	24 100,0%	

Table 4. Correlation test between prostatic urethral angle and Abrams-Griffiths nomogram.

Prostatic urethral angle categories	Abrams-Griffith			Total	Spearman's Correlation Test
	Non-obstructed	Equivocal	Obstructed		
$\leq 35^\circ$	2 8,3%	5 20,8%	2 8,3%	9 37,5%	r = 0,745 p = 0,000
$> 35^\circ$	0 0%	1 4,2%	14 58,3%	15 62,5%	
Total	2 8,3%	6 25%	16 66,7%	24 100,0%	

Table 5. Cross-tabulation and correlation test between prostatic urethral angle and Schafer nomogram.

Prostatic Urethral Angle Categories	Schafer's Categories							Total	Spearman's Correlation Test
	Not obstructed		Mild-Moderate Obstruction			Severe Obstruction			
	O	I	II	III	IV	V	VI		
$\leq 35^\circ$	0 0%	5 20,8%	3 12,5%	0 0%	1 4,2%	0 20,0%	0 ,0%	9 37,5%	r = 0,886 p = 0,000
$> 35^\circ$	0 0%	0 0%	2 8,3%	5 20,8%	5 20,8%	3 12,5%	0 0%	15 62,5%	
Total	0 0%	5 20,8%	5 20,8%	5 20,8%	6 25%	3 12,5%	0 0%	24 100,0%	

The results of correlation test indicated no significant correlation between prostatic urethral angle with prostate volume. The results found 2 patients (8,3%) with Qmax 15 ml/sec who had prostatic urethral angle $> 35^\circ$. The results of correlation test indicated no significant correlation between prostatic urethral angle with prostate volume.

Prostatic urethral angle of $> 35^\circ$ occurs more frequently in Schafer categories III and IV and no Schafer categories of O or I in urethral angle $> 35^\circ$. Our results found a statistically significant correlation with the category of very strong correlation between prostatic urethral angle with the

degree of obstruction as assessed by Schafer nomogram.

DISCUSSION

Bladder outlet obstruction (BOO) is a term used to describe infravesical obstruction. BOO could be due to BPH or other causes such as urethral stricture, urethral stones or inflammation. Urodynamics (pressure-flow study) is the gold standard examination, which compared detrusor pressure with urine stream during bladder emptying phase, while its obstruction degree is assessed using a plot or a nomogram.² Based on Abrams-Griffiths nomogram,

the incidence of obstruction has obtained the highest frequency of 16 patients (66,7%), 6 patients (25%) with equivocal figure and 2 patients (8,3%) did not show any obstruction.¹⁰ The degree of obstruction based on Schafer nomogram showed most (79,1%) or 19 of the patients were found to have obstruction (Schafer II-VI), 66,7% or 16 patients included in the category of mild to moderate obstruction (Schafer II-IV), 12,5% or 3 patients included in the category of severe obstruction (Schafer IV-VI) and 20,8% or 5 patients had no obstruction (Schafer 0-I).¹¹

The results of statistical analysis showed that there was no significant correlation between prostatic urethral angle with the total IPSS, obstructive IPSS and irritative IPSS. This indicates the same results with the results of previous studies stating that the prostatic urethral angle has no significant correlation with the total IPSS score.¹²

According to EAU guidelines in 2010, medical therapy and invasive procedure is a therapeutic option in BPH patients with moderate and severe LUTS. Outcomes would be better if the patient previously was shown to have obstruction.¹ Unfortunately, IPSS ability to predict the presence or absence of obstruction in BPH patients is still questionable. One possible reason is that the IPSS is subjective and depends on the individual's perception of micturition dysfunction experienced.¹³

The results also found 2 patients (8,3%) with $Q_{max} > 15$ ml/sec who had prostatic urethral angle $> 35^\circ$. In another study, it was found that a normal urinary stream or higher than normal ($Q_{max} > 15$ ml/sec) was 7% proved to be obstructed.¹² This is called high flow obstruction, in which causes high detrusor contraction retains urinary stream remain high despite the obstruction. Therefore, uroflowmetry only describes the end result of the coordination of detrusor contractility and bladder outlet conditions. It should be underlined that this examination alone cannot determine accurately the presence or absence of obstruction.¹⁴ In general, it can be concluded that the uroflowmetry examination itself is insufficient in the diagnosis of BOO since this examination cannot distinguish true obstruction with low detrusor contractility.¹⁵

The results of correlation test indicated no significant correlation between prostatic urethral angle with prostate volume. So that from these results it can be inferred that an increase in prostate volume will not necessarily lead to an increase in prostatic urethral angle. One thing that still cannot be answered until today is the dearth of information on

the correlation between the proportion of the prostate with the degree of BOO.⁴

There are several possible explanations, 1) Obstruction of the bladder neck can occur without prostate enlargement, 2) BPH is an enlargement process that is not symmetrical and the enlargement of specific lobe. With the enlargement of medial lobes, the angle of prostatic urethra tends to increase or more than 35° , causing loss of energy and the increasing constraints on prostatic urethral angle during micturition process leads to bladder outlet obstruction (BOO).^{8,16} This may explain the presence of symptoms and complaints of micturition and any decline the urine stream without total volume of prostate enlargement.^{8,16}

Results of pressure flow study (PFS) of patients showed 58,3% of all patients who had prostatic urethral angle $> 35^\circ$ had obstruction based on Abrams-Griffith nomogram. Correlation test revealed significant correlation with the category showing a strong correlation between prostatic urethral angle with BOO events. Another previous study shown an association between prostatic urethral angle with BOO index.¹²

The degree of BOO in this study was assessed using 6 degrees based on Schafer nomogram. Prostatic urethral angle of $> 35^\circ$ occurs more frequently in Schafer categories III and IV and no Schafer categories of O or I in urethral angle $> 35^\circ$. Our results found a statistically significant correlation with the category of very strong correlation between prostatic urethral angle with the degree of obstruction as assessed by Schafer nomogram. This is in accordance with the results of studies where there were no patients found to have prostatic urethral angle $> 35^\circ$ not obstructed (Schafer 0-I). As hypothesized above, the more increased the angle of prostatic urethra, the less the energy and the more the constraints at the angle of the prostatic urethra during the process of micturition, thus contributing to the impairment of BOO.^{8,16}

CONCLUSION

PUA may be one method to assess the presence of BOO in men with LUTS associated BPH. Our investigation suggest that PUA may help in the treatment of individuals by better predicting their likely classification from a pressure-flow study.

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