CORRELATION BETWEEN PCAR WITH IPSS SCORE, QMAX, AND POST VOIDING RESIDUAL URINE AND ITS CUT-OFF VALUE IN DETERMINING BOO IN PATIENTS WITH BPH LUTS

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ABSTRACT

Objective: This study was conducted to determine the correlation between Presume Circle Area Ratio (PCAR) and IPSS score, Qmax, and post voiding residual urine (PVR) and to find PCAR cut-off value in determining the presence Bladder Outlet Obstruction (BOO) in Benign prostatic hyperplasia (BPH) Lower Urinary Tract Symptoms (LUTS). **Materials & Methods:** *This study was observational analytic study with 30 BPH LUTS patients as subjects during the period September 2015 to January 2016. The determined variables were PCAR, IPSS score, Qmax, post voiding residual urine (PVR) and analyzed using the SPSS program v21.* **Results:** *There were 30 patients who met the inclusion and exclusion criteria with the mean age of 67.47 years. In the correlation test, there was insignificant correlation between PCAR with IPSS (r=0.138, p=0.467), a significant correlation between PCAR with Qmax (r=0.468, p=0.009), PCAR with PVR (r=0.399, p=0.029), PCAR with BOO (r=0.491, p=0.006) PCAR cutoff value is 0.65 with sensitivity of 69% and specificity of 71%.* **Conclusion:** *PCAR has a significant correlation with PVR, Qmax and BOO but no significant with IPSS score. PCAR value >0.65 indicating BOO in BPH LUTS. PCAR can be used as an alternative non-invasive examination in determining the existence of BOO.*

Keywords: Lower urinary tract symptoms, presume circle area ratio, bladder outlet obstruction, post voiding residual urine.

ABSTRAK

Tujuan: Penelitian ini dilakukan untuk mengetahui hubungan presume circle area ratio (PCAR) terhadap skor IPSS, Qmax, dan post voiding residual urin serta mencari nilai cut-off PCAR dalam menentukan adanya Bladder Outlet Obstruction (BOO) pada Benign prostatic hyperplasia (BPH) Lower Urinary Tract Symptoms (LUTS). **Bahan & cara:** *Penelitian ini adalah studi analitik observasional dengan 30 subyek penderita BPH LUTS selama periode September 2015 sampai dengan Januari 2016. Variabel yang dicatat adalah PCAR, Skor IPSS, Qmax, post voiding residual urin dan dianalisa menggunakan program SPSS v21.* **Hasil:** *Didapatkan 30 pasien yang memenuhi kriteria inklusi dan eksklusi dengan rerata usia 67.47 tahun. Pada uji hubungan yang dilakukan didapatkan adanya hubungan yang tidak signifikan antara PCAR dengan IPSS (r=0.138, p=0.467), hubungan yang signifikan antara PCAR dengan Qmax (r=0.468, p=0.009), PCAR dengan PVR (r=0.399, p=0.029), PCAR dengan BOO (r=0.491, p=0.006) serta nilai cut-off PCAR 0.65 dengan sensitivitas 69% dan spesifitas 71%.* **Simpulan:** *PCAR memiliki hubungan yang signifikan dengan PVR, Qmax dan BOO namun tidak signifikan dengan skor IPSS. Nilai PCAR >0.65 menunjukkan adanya BOO pada BPH LUTS. PCAR dapat digunakan sebagai alternatif pemeriksaan non invasif dalam menentukan adanya BOO.*

Kata kunci: Lower urinary tract symptoms, presume circle area ratio, bladder outlet obstruction, post voiding residual urine.

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INTRODUCTION

Benign prostatic hyperplasia (BPH) is a benign enlargement of the prostate gland that its incident related to age and significantly can cause interference with micturition which can reduce the quality of life of the patients. Autopsy study found that the prevalence of BPH in men aged 41-50 years

by 20%, ages 51-60 years by 50% and an increase in age over 80 years by 90%.[1] Based on the results of a community-based study in Korea found that incidence of BPH with LUTS as much as 17.7% at the age of 50-59 years, 23.2% at the age of 60-69 years, and 35.3% in those aged >70 years old.[2] The correlation between BPH with LUTS are very complex, which was not all BPH patients complain of micturition disorders, and not all of the micturition complaints caused by BPH.[3,4] IPSS score as the sole means have proven to provide accurate information on the occurrence of BOO, so the IPSS score cannot be diagnosed BOO.[4] Uroflowmetry is the simplest technique of urodynamic techniques in measuring urinary steam because it is noninvasive, simple and cheap. Uroflowmetry examination can assess the maximum flow rate (Qmax), voided volume (VV), flow time, average flow rate (Qave), and a maximum of micturition. Based on Qmax it can be understood the probability of BOO. When Qmax <10 ml/sec the probability of BOO is 90%. When Qmax is between 10-14 ml/sec the possibility of BOO is 67%, whereas when Qmax >15 ml/sec the probability of BOO is 30%.[4] Post voiding residual urine (PVR) volume is the amount of fluid remaining in the bladder immediately after voiding is completed. PVR in large quantities can describe obstruction due to the BOO, or due to neurogenic bladder.[4] Various methods were used in the looking for a correlation with the occurrence of the prostate volume of BOO, either by measurement of total prostate volume, the transitional zone index and with presumed circle area ratio (PCAR). Watanabe et al revealed that PCAR has a strong correlation to the occurrence of BOO compared with the transitional zone volume.[5]

OBJECTIVE

This study was conducted to find the correlation Presumed circle area ratio (PCAR) against IPSS score, Qmax, and post voiding residual urine and to find out PCAR cut-off value in determining the presence of BOO in patients with BPH-LUTS in Soetomo Hospital Surabaya.

MATERIAL & METHOD

This study used analytic observational study design in all patients with BPH-LUTS in Soetomo Hospital Surabaya. The study population was patients diagnosed with Benign Prostate Hyperplasia (BPH) with LUTS who come to the urology

clinic of Soetomo Hospital Surabaya. The population was male patients with BPH-LUTS, age above 50 years, willing to follow and signed a research agreement. The population with the following criteria were not included in the study if BPH patients with a tendency lead to malignancy of the prostate (PSA >4 ng/dl), BPH patients who received therapy α-blockers or 5α reductase inhibitor prior to the study, had undergone prostate surgery before either endoscopic or open, BPH accompanied by abnormalities such as bladder tumors, bladder stones, urethral stones, diabetes mellitus, and urethral strictures. The population excluded from the study if the patient did not perform a complete examination during the study, did not cooperate in the implementation of TRUS or urodynamic. Data will be analyzed by descriptive and analytic. The Kolmogorov-Smirnov test for normality of data distribution was performed before hypothesis test. The correlation between PCAR with a score of IPSS, Qmax, and PVR were tested using Pearson/Spearman correlation test, and using diagnostic test to look for the PCAR cut off value. It can be said significant statistically if $p < 0.05$.

RESULTS

In this study, 30 patients with BPH-LUTS who meet the inclusion and exclusion criteria. General data of patients included in this study can be seen in the table.

Table 1. General data research sample.

	Minimal	Maximal	Mean	SD
Age	61	77	67.47	3.946
IPSS	6	24	15.27	19.34
Qmax	4.2	113	14.20	19.34
PVR	6.23	78.3	41.53	17.98
PCAR	0.48	0.82	0.63	0.09

n = 30

Table 2. Age distribution research sample.

Age	n	%
50-59	0	0
60-69	21	70
>70	9	30
Total	30	100

In this study, we obtained 61 years old as the youngest patients and the oldest was 77 years old. From the table 2, it can be viewed no patient (0%)

were aged 50-59 years, 21 patients (70%) were aged 60-69 years, and 9 (30%) were aged >70 years. The overall mean age of the sample was 67.47 years.

Table 3 shows that in the patients studied by 2 patients (6%) came with a mild degree of IPSS, 19 patients (64%) with moderate IPSS, and 9 (30%) present with the severe complaint.

Table 3. Distribution of IPSS sample.

Total IPSS	n	%
0 - 7	2	6
8 - 19	19	64
20 - 35	9	30
Total	30	100

Table.4 shows that 16 patients (53%) had maximum urinary stream <10 ml/sec, 11 patients (37%) with maximum urinary stream 10-15 ml/sec, while 3 patients (10%) comes with maximum urinary stream >15 ml/sec. Mean of maximal urinary stream in this study was 14.2.

Table 4. Distribution of maximum urinary stream (Qmax).

Qmax	n	%
< 10 ml/sec	16	53
10 - 15 ml/sec	11	37
> 15 ml/sec	3	10
Total	30	100

Obstruction assessed on the nomogram Abrams-Griffith diagram, which was obtained 14 patients (46%) came with LUTS without evidence of BOO, whereas 16 patients (54%) obtained with BOO.

Table 5. Distribution of BOO.

Scahffer category	n	%
Unobstructed	14	46
Obstructed	16	54
Total	30	100

PCAR measurement was obtained by measuring the surface area compared to the presumed circle area value of prostate thus divided into two groups which were <0.5 and >0.5. In the Table 6 it can be seen that 2 patients with PCAR value of <0.5 (6%) and 28 patients > 0.5 (94%), with the lowest value was 0.48 and the highest value was 0.82 and with a mean of PCAR was 0.63.

Table 6. Distribution of PCAR.

PCAR	n	%
< 0.5	2	6
> 0.5	28	94
Total	30	100

It this study found the minimal value of PVR 6.23 cc and maximum value 78.3 cc, with a mean 41.5 cc. In table 7, it can be obtained 21 patients (70%) with value of PVR <50 cc and as much as 9 patients with PVR >50 cc (30%).

Table 7. Distribution of PVR.

PVR	n	%
< 50	21	70
> 50	9	30
Total	30	100

The correlation test between IPSS total score and PCAR did by Pearson correlation test, and there was no significant association between IPSS with the PCAR (r=0.138, p=0.467).

Table 8. Correlation between PCAR with total IPSS.

	Total IPSS
PCAR	
• Pearson correlation	0.138
• Sig (2 tailed)	0.467

The correlation test was used in this study between PCAR and Qmax with Spearman correlation analysis and there was a significant association between PCAR with Qmax (r=0.468, p=0.009).

Table 9. Correlation between PCAR with Qmax.

	Qmax
PCAR	
• Pearson correlation	0.468
• Sig (2 tailed)	0.009

The correlation test was used in this study between PCAR and PVR with Pearson correlation analysis. There was a significant correlation between PCAR with PVR (r=0.399, p=0.029).

Table 10. Correlation between PCAR with PVR

	PVR
PCAR	
• Pearson correlation	0.399
• Sig (2 tailed)	0.029

In this study, the correlation test was used to the presence or absence of BOO PCAR based on urodynamic results. Using Pearson correlation analysis, there was a significant correlation between PCAR with BOO (r=0.491, p=0.006).

Table 11. Correlation between PCAR with BOO

	BOO (+/-)
PCAR	
• Pearson correlation	0.491
• Sig (2 tailed)	0.006

Based on the obtained grades of ROC area under the curve of 0.65 indicating that PCAR cut-off value in determining the existence of BOO was 0.65 with a sensitivity of 69% and a specificity of 71%.

DISCUSSION

The data shows the youngest patients was 61 years old and the oldest was 77 years old. Overall the average age of patients 67.47 (± 3946). Literature data indicated that the autopsy study found the prevalence of BPH in men aged 41-50 years by 20%, ages 51-60 years by 50% and increase in age over 80 years by 90%.[1] In this study, 2 patients (6%) came with IPSS mild degree, 19 patients (64%) with IPSS moderate, and 9 (30%) came with a severe complaint. Mean IPSS total in this study was 15:27. In a study involving 204 men with an average age of 67 years, made predictions of the BOO using a combination of the American Urology Association (AUA) symptom index, Qmax, and prostate volume, there were only 26% or 39 patients with predictable of BOO. In another study mentioned that AUA scores index calculation separately (filling and voiding) has no clinical meaning.[6] Urinary stream data of the patients gave results 16 patients (53%) with maximum urinary stream <10 ml/sec, 11 patients (37%) with maximum urinary stream 10-15 ml/sec, while 3 patients (10%) comes with maximum urinary stream >15 ml/sec. Uroflowmetry examination to assess Qmax was considered as a single examination which can determine the presence of BOO, but the interpretation of the results is difficult, especially in cases of BPH with detrusor overactivity.[7] Besides, a weak urine stream is not necessarily a diagnostic sign of BOO, because 25-30% of these patients caused by hypocontractility detrusor. In another study, it was found that the urine stream was normal or higher than normal (Qmax ≥15 ml/sec) turned out that 7% proved as obstruction and maximum rate of the urinary stream had a level of sensitivity and specificity were not high. A study conducted by the International Continent Society on BPH in 1998 found that Qmax has a sensitivity of 70% and a specificity of 47% in determining the occurrence of BOO.[8] Study variable of the PVR value was the 6.23cc minimum value of PVR and a maximum value of PVR 78.3cc with 41.5cc mean value. A total of 21 patients (70%) had a value of PVR <50 cc and as much as 9 patients with PVR >50cc (30%). Based on the study, Hinman and Cox 1967, PVR urine normal value ranges from 0.09 until 2.24 ml with the average value of 0.53 ML.9 A total of 78% in normal men aged 50-65 years had PVR value below 5 ml and 100% had PVR value less than 12 ml.[10] Other variables were noted in this study was the existence of BOO where 14 patients (46%) came with LUTS without evidence of BOO, whereas 16 patients (54%) with BOO. From other literature, using the urodynamic Pressure Flow Study (PFS) in evaluating men with LUTS, obtained the data that more than a third of older men with LUTS do not indicate the presence of an obstruction so that the obstruction caused by BPH should not be the only cause of LUTS complaint. Besides, a weak urine stream is not a diagnostic sign of BOO, because 25-30% of these patients caused by hypercontractility detrusor.[8]

This study looked at the correlation between PCAR with IPSS. From the statistical test, there was no significant correlation between the IPSS with the PCAR (r=0.138, p=0.467). The results obtained in this study was similar to previous research conducted by Desai where PCAR have a weak correlation with IPSS.[11] This is not surprising because IPSS has no correlation with BOO and in assessing clinical complaints of BPH with LUTS used IPSS instruments, where the scores obtained from the assessment of IPSS sometimes do not show the actual condition (subjectively).[12] In addition to assessing the correlation with the IPSS, the statistical tests performed to find the correlation between urinary stream rate and post voiding residual urine

with PCAR. In this study, 50% of the study sample had a maximum urinary stream <10 ml/sec. In correlation test performed using Spearman correlation test found a significant correlation between PCAR with Qmax (r=0.468, p=0.009), whereas the correlation between PCAR with PVR also found a significant correlation with the value of r=0.399, p=0.029. These results were similar to studies conducted by Kojima which was obtained the correlation between PCAR with maximum urinary stream and residual urin.[13] The degree of pressure on the urethra caused by an enlarged prostate is highly dependent on the prostate capsule. Elastic capsule made by the pressure on the urethra will be smaller than the prostate capsule which has less elastic. The emphasis on the urethra that causes urinary stream disturbance.[14]

In this study, the correlation tests between PCAR and the presence or absence of BOO based on urodynamic results. From the correlation test found a significant strong correlation between PCAR with BOO (r=0.491, p=0.006). The value of PCAR approaching 1 means a strong correlation with the incidence of BOO. This is consistent with the statement by Kojima where the greater the surface area of the prostate, the ratio of surface area to the area of prostate surface presumed to be close to the value of 1. The value of PCAR approaching a value of 1 may indicate obstruction.[13] Based on the value of ROC, obtained an area under the curve of 0.65 indicating that PCAR cut-off value in determining the existence of BOO is 0.65 with a sensitivity of 69% and a specificity of 71%. Desai also had demonstrated its value of PCAR 0.78 which was a good predictor in determining the presence of an obstruction with a sensitivity of 75% and specificity of 92%.[11]

CONCLUSION

PCAR has a significant correlation with PVR, Qmax and BOO but no significant with IPSS score. PCAR value >0.65 indicating BOO in BPH LUTS. PCAR can be used as an alternative non-invasive examination in determining the existence of BOO.

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