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Original Article

Relationship of age, prostate-specific antigen, and prostate volume in Indonesian men with benign prostatic hyperplasia

Ida Bagus O.W. Putra, Agus R.A.H. Hamid, Chaidir A. Mochtar, Rainy Umbas*

Department of Urology, Faculty of Medicine University of Indonesia, Cipto Mangunkusumo Hospital, Jakarta, Indonesia

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ABSTRACT

Background: To investigate the relationship between age, prostate specific antigen (PSA), and prostate volume (PV) in Indonesian men with histologically proven benign prostatic hyperplasia.
Methods: Data were generated from our BPH database from June 1994 until December 2013. Subjects were men with a minimum age of 40 years with chief complaint of LUTS or urinary retention, diagnosed with BPH. All patients underwent TRUS-guided prostate biopsy. Patients with PSA level >10 ng/mL were excluded from the study to exclude the possibility of occult prostate cancer. PV was measured with TRUS. Appropriate statistical tests were employed for data analysis.
Results: In all, 1638 patients were enrolled in our study. There was a statistically significant difference in PSA ($P = 0.03$) and PV ($P < 0.0001$) between age groups. Overall correlation between age, PSA, and PV were: i). Age and PV ($r = 0.12$, $P < 0.0001$); ii). Age and PSA ($r = 0.07$, $P = 0.008$); iii). PSA and PV ($r = 0.26$, $P < 0.0001$). Subgroup analysis in terms of indwelling catheter use versus without: i). Age 66.09 ± 8 years versus 65.38 ± 7.66 years ($P = 0.158$); ii). PSA 4.93 ± 2.62 ng/mL versus 4.68 ± 2.82 ng/mL ($P = 0.038$); iii). PV 47.58 ± 21.33 mL versus 41.43 ± 20.55 mL ($P < 0.0001$). Correlation between age, PSA, and PV in patients were similar in patients with and without indwelling catheter.
Conclusion: In Indonesian men with biopsy-proven BPH, both PV and PSA increased with ageing. Prostate volume was significantly correlated with PSA. Even though the results were weaker, these results are consistent with results in other sets of population. The results vary between different countries and thus, ethnicities. Indonesia is a populous a sociocultural and ethnically diverse country. Therefore, aside from PSA, age, and PV, when investigating men with BPH, ethnicity may also need to be taken into account.

1. Introduction

Benign prostatic hyperplasia (BPH) is a common progressive disease in the male aging population.[1] Although aging and androgens are established risk factors, the cause of BPH remains uncertain.[2,3] Several mechanisms were hypothesized to be involved in the progression of BPH including hormonal or vascular alterations, inflammation, epithelial/stromal interactions, and luminal/epithelial cell interactions.[2,3]

In the aging male, there is significant tissue remodeling taking place within the prostate. It was postulated that prostate growth is the result of a disturbed balance between apoptotic and proliferative activities with a net reduction in apoptotic activity. Histologic analysis showed a decreased apoptotic activity in glandular and basal epithelial cells of the prostate.[2–4] Thus, with increasing age there is a tendency of increasing prostate volume (PV).

Prostate-specific antigen (PSA) is a widely used tumor marker for prostate cancer.[5,6] Although it is well known that PSA is prostate specific, it is not a disease-specific biomarker. Several studies have examined the relationship between PSA and PV.[5,7–9] These studies consistently showed a positive correlation between PSA level and PV. However, these results were derived from Western and East Asian populations, and thus may not accurately reflect the conditions in an Indonesian population. Differences in ethnicity and geographical factors may exert differences in BPH characteristics in men.[10,11] The exact relationship between age, serum PSA, and PV in Indonesian men with histologically proven BPH has yet to be established. Thus, the aim of this study was to investigate the

* Corresponding author. Department of Urology, Faculty of Medicine University of Indonesia, Cipto Mangunkusumo Hospital, Number 71 Jalan Diponegoro, Jakarta 10430, Indonesia.
E-mail address: rainy.umbas@gmail.com (R. Umbas).

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Table 1 Characteristics of 1,638 patients with histologically proven BPH.

Age (y)	65.67 ± 7.81
Age group (y)	
≤ 60	448 (27.4)
61–69	664 (40.5)
≥ 70	526 (32.1)
PSA (ng/mL)	4.78 ± 2.74
	0.02–10
PV (mL)	43.93 ± 21.08
	3–174
Indwelling catheter	
Yes	666 (40.7)
No	972 (59.3)

Data are presented as *n* (%) or mean ± SD.
PSA, prostate-specific antigen; PV, prostate volume.

relationship between age, PSA level, and PV in Indonesian men with histologically proven BPH.

2. Materials and methods

Data were generated from our BPH database from June 1994 until December 2013. These involved patients whose chief complaint was lower urinary tract symptoms or urinary retention who visited the Department of Urology of the "Cipto-Mangunkusumo" Hospital. The inclusion criteria were a minimum age of 40 years and a diagnosis of BPH (histopathologically proven). Patients with indwelling catheter were those with a history of urinary retention who failed trial without catheter with α blocker. All patients underwent standard clinical evaluation and PSA testing. Indication for prostate biopsy in our department was a PSA value of greater than or equal to 4 ng/mL or abnormal findings in digital rectal examination. Core biopsy was done with an 18-gauge needle, TRUS guided, using a spring-loaded biopsy gun (Bard Magnum). Our patients underwent a 6- to 12-core biopsy. Those patients with biopsy results of prostate cancer, atypical acinus, atypical small acinar proliferation, atypical adenomatous hyperplasia, and prostatic intraepithelial neoplasia were excluded from the study. Those who consumed 5α-reductase inhibitors and those with a PSA level of greater than 10 ng/mL (in order to avoid the possibility of occult prostate cancer) were also excluded from the study.

Patients were divided into three age groups: 60 years of age or younger, between 61 and 69 years of age, and 70 years of age and older. Based on the measurements obtained using TRUS, PV was calculated using the following formula: PV = height × width × length × 0.52. PV was categorized into Less than 30 mL, 31–40 mL, 41–50 mL, 51–100 mL, and greater than 100 mL.[12]

Descriptive statistics were used to characterize all variables. Prior to statistical analysis, numerical data were log-transformed for normalization. One-way analysis of variance (ANOVA) test and independent *t* test were used to analyze the differences in numerical data (age, PV, and PSA) among the different age groups and catheter use groups. Pearson's test for correlation was used to analyze the linear correlation between age, PSA, and PV. A *P* value of less than 0.05 was considered statistically significant. Statistical analysis was performed using IBM SPSS Statistics (IBM Corp., New York, United States; www.ibm.com/SPSS_Statistics) version 20.

3. Results

A total of 1,638 patients were included in our study. The characteristics of these patients are presented in Table 1. The median (range) PSA and PV in age groups ≤ 60 years, 61–69 years, and ≥ 70 years were 4.29 (0.1–9.93) ng/mL and 30.68 (3–141.29) mL, 4.61 (0.07–10) ng/mL and 38.92 (11.4–149) mL, and 4.8 (0.02–10) ng/mL and 40.48 (3–174) mL, respectively. There was a statistically significant difference in PSA ($P = 0.03$, one-way ANOVA test) and PV ($P < 0.001$, one-way ANOVA test) between age groups. These results are illustrated in Figs. 1A and 1B.

PSA was < 4 ng/mL in 715 (43.65%) patients. PV was ≤ 30 mL in 436 (26.6%) patients, 31–40 mL in 442 (27%), 41–50 mL in 296 (18.1%), 51–100 mL in 430 (26.3%), and > 100 mL in 34 (2.1%).

The correlation between age, PSA, and PV are illustrated in Fig. 2. The results of the subgroup analysis based on indwelling catheter use are presented in Table 2. The correlation between age, PSA, and PV in patients with and without indwelling catheter is illustrated in Fig. 3.

4. Discussion

BPH is age-related, and the prevalence increases with increasing age.[13,14] Among many factors that contribute to prostate

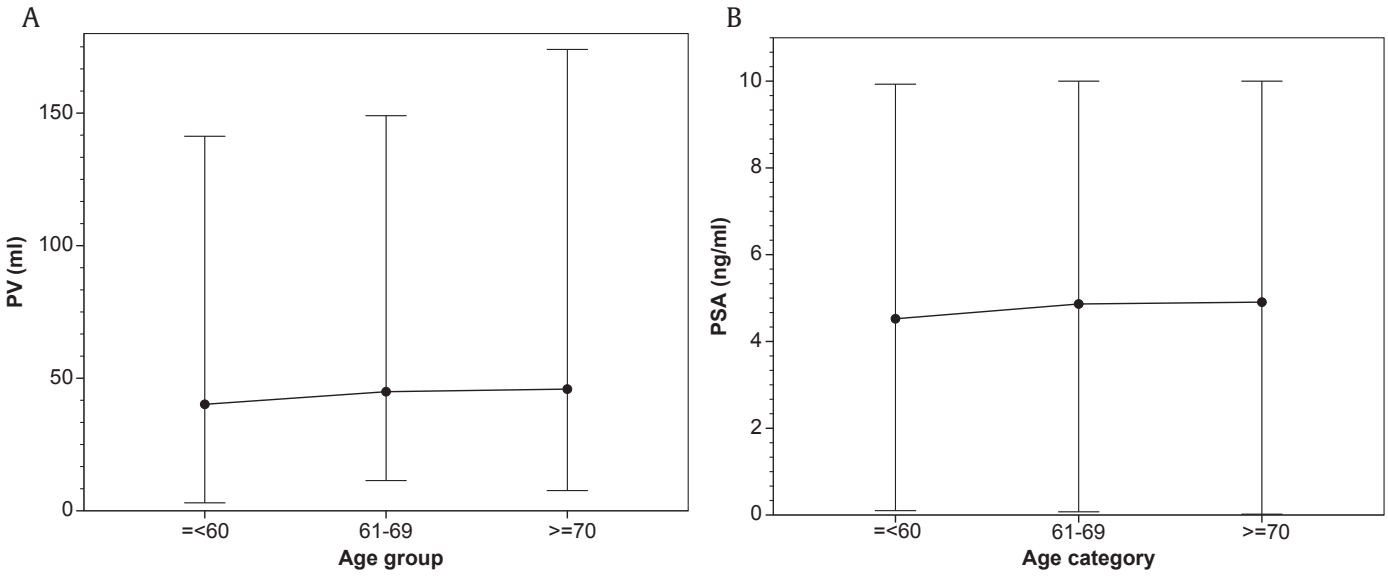

Fig. 1. Median and range values, by age group. (A) Prostate volume (PV). (B) Prostate-specific antigen (PSA).