



# Serum prostate-specific antigen as a predictor of prostate volume in Sudanese patients with benign prostatic hyperplasia

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## Abstract

**Background:** Benign prostatic hyperplasia (BPH) is now recognized as one of the principal medical problems facing the male population in Sudan.

**Objective:** The aim of this study is to assess the ability of serum prostate-specific antigen (PSA) to predict prostate volume (PV) in patients with benign prostatic hyperplasia (BPH).

**Materials and Methods:** This is retrospective observational case-detection hospital based study. Eighty medical records of patients with an enlarged prostate attending the urology clinic at University Teaching Hospital were enrolled. This research was conducted in University Charity Teaching Hospital, Khartoum, Sudan.

**Results:** Enrolled patients had a median age of 63.5 years (51 to 94), a mean PSA of 2.94 ng/ mL and a mean PV of 46.96 mL, respectively. There is linear relationship between PSA levels and prostate size. Those with a prostate size of > 40 ml were found to be more likely to have high PSA mean level. PSA mean values were found to be associated with age (P <0.006).

**Conclusion:** Serum prostate specific antigen (PSA) is significantly correlated with prostate volume in Sudanese men. PSA may be a useful tool in making therapeutic decisions and follow-up management in BPH patients.

**Keywords:** Serum Prostate Specific Antigen; Prostate Volume; Benign Prostatic Hyperplasia.

## 1. Introduction

Benign prostatic hyperplasia (BPH), diagnosed by the presence of benign prostate enlargement and lower urinary tract symptoms (LUTS), has been considered to be a chronic and progressive disease. Because baseline prostate volume (PV) has been linked to the progression of BPH (e.g., acute urinary retention and surgery for BPH), PV has been included as a useful tool in treatment guidelines (Kwon et al. 2013). Therefore, it is clear that knowledge of individual PV would be beneficial for everyday management of patients presenting to physicians. This undertaking has some problems, most notably fact that digital rectal examination is relatively inaccurate in measuring the correct prostate size when measured by either transrectal ultrasound (TRUS) or other imaging modalities, such as computerized tomography or magnetic resonance imaging (Tubaro et al. 2003). Because imaging modalities accompany financial burden and limited reproducibility, it is reasonable to search for alternative parameters that could be used instead of PV.

Prostate-specific antigen (PSA) is a marker for prostate cancer and BPH. The relationship between PSA and PV has been examined frequently in men with BPH, in part to determine how PSA can be used to predict PV (Bohnen et al. 2007, Choi et al. 2013, Chung et al. 2006, Kalish et al. 1994, Mochtar et al. 2003, Roehrborn et al. 2000, Shim et al. 2007). These studies have consistently shown a positive correlation between PSA and PV. However, most studies of the relationship between PSA and prostate volume have originated from developed countries, and few studies have been conducted in Africa.

Thus, we performed a study to determine the predictive power of PSA for prostate volume in Sudanese patients with biopsy proven benign prostatic hyperplasia.

## 2. Materials and methods

This is retrospective observational case-detection hospital based study. Eighty medical records of patients with an enlarged prostate attending the urology clinic at University Teaching Hospital were enrolled. This research was conducted in University Charity Teaching Hospital, Khartoum, Sudan.

Demographic details, clinical presentation, Serum prostate-specific antigen (PSA) profiles and assessment of prostate volume (PV) of all patients were entered into our study proforma. For PSA testing, patients' serum was obtained before prostatic manipulations. PV was measured with transabdominal ultrasound and PV was defined by measuring the height (H), width (W), and length (L) of the prostate from two selected orthogonal views and calculating the volume (V) as that of the corresponding ellipsoid formula:  $V=0.52 \times W \times H \times L$  (Choi et al. 2013).

Exclusion criteria were patients with a history of receiving 5-alpha reductase inhibitor therapy and those with a history of invasive surgical treatment of benign prostatic hyperplasia (BPH), such as transurethral resection or laser prostatectomy. Patients with a history of acute prostatitis, with a history of urinary retention within the past month, or lacking data on any of the aforementioned parameters were excluded. Prostate cancer patients with results confirmed by subsequent TRUS-guided prostate biop-

sy were excluded. Only patients proven to have benign results by the prostate biopsy were included in this study. Patients with PSA above 20 ng/ mL were also omitted to decrease the possibility of occult prostate cancer. After all exclusions, 80 men were enrolled in this study.

All summary statistics are stated with 95% confidence limits. A method appropriate for small samples was applied to the percentages and odds ratios were derived using logistic regression methods (SPSS version 17). P-value of less than 0.05 was considered statistically significant.

### 3. Results

The mean age of patients was 63.5 years and the age ranged from 51 to 94 years. When the patients (n=80) were classified according to their age, it was noticed that 31 (38.8%) of them were found to have fallen within the age group of (51-61) years, Whereas 27 (33.8%) fell in the age group (62-72), with an average age of 65.93 years and a standard deviation, as a measure of dispersion (variability) of 8.7 years. Sixty three (78.7%) patients were married and 17 (21.2%) were unmarried. Geographically, 20 (25%) patients were from the rural area and 60 (75%) from urban area. General and demographic characteristics are shown in Table 1.

**Table 1:** General and Demographic Characteristics of the Patients (No=80)

Item	Patients No (%)
<b>Age (year)</b>	
51- 61	31 (38.8%)
62-72	27 (33.8%)
73-83	20 (25%)
84-94	2 (2.4%)
<b>Marital Status</b>	
Married	63 (78.8%)
Not married	17 (21.2%)
<b>Residence</b>	
Urban	60 (75%)
Rural	20 (25%)
<b>Prostate volume (ml)</b>	
20- 40	33 (41.2%)
41- 61	30 (37.5%)
62- 82	12 (15%)
83-103	5 (6.2%)

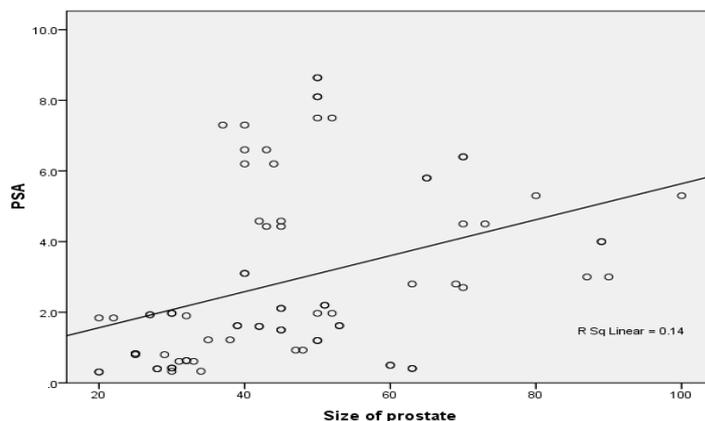
When the patients were classified according to the size of the prostate it was found that 33 (41.2%) of them were found to have a prostate size (20-40g). Whereas, 30 (37.5%) were found to have a prostate size of (41-61 g). Mean PSA value was of 2.94 ng/ mL and a mean PV of 46.96 mL. PSA value (mean value) as an independent variable was found to be associated with the prostate size (Tab. 2). Those with a prostate size of >40g were found to be more likely to have high PSA mean level (P < 0.009).

**Table 2:** Comparison of the PSA Means According To the Volume of Prostate (N=80)

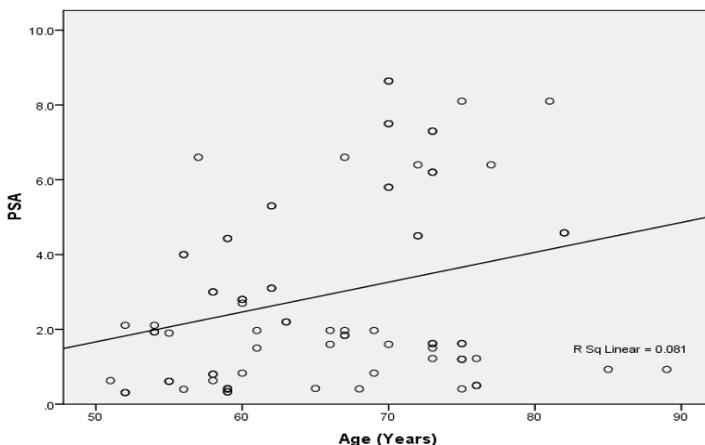
Volume of prostate (ml)	Prostate Specific Antigen			Std. Error
	N	Mean	Std. Deviation	
(20-40)	33	1.9	2	0.355
(41-61)	30	3.5	2.8	0.507
(62-82)	12	4	2.1	0.619
(83-103)	5	3.9	0.9	0.424
Total	80	2.9	2.5	0.275

One way ANOVA (p. value = 0.009)\*\*

Figure 1 represents, graphically, the relationship between PSA levels and prostate size. Looking into the chart one could notice there is linear relationship between the two variables (P =0.001). PSA mean values were found to be associated with age (P <0.006) (Fig 2). A positive weak correlation was also found between PSA mean levels and age of the patient.



**Fig. 1:** Relationship between PSA and Prostate Size (Correlation (R) =0.375)



**Fig. 2:** Relationship between PSA and Age (Correlation (R) =0.284)

## 4. Discussion

Prostate volume (PV) is perhaps the most extensively studied risk factor for BPH progression. Men with a PV of  $\geq 30$  mL are more likely to have moderate-to-severe symptoms (3.5-fold increase), decreased flow rates (2.5-fold increase), and urine retention (three- to four-fold increase) than are men with a PV < 30 mL (Park et al. 2013). So, PV information has become more and more important because the PV strongly predicts BPH-related morbidity such as acute urinary retention and the need for surgery.

Generally, the typical method of measuring PV is transrectal ultrasound (TRUS) (Stravodimos et al. 2009). But, TRUS is relatively painful. Moreover, TRUS is also not cost-effective and routine evaluation of patients with BPH. In our setting, TRUS is not available. Additionally, DRE is simple to perform and practical for estimating the PV, but it has been revealed that DRE underestimates the real prostate size.

Rosenberg first assessed the PSA threshold as a predictor of PV by characterizing the relationship between PV and serum PSA in men with symptomatic BPH in the Proscar Long-Term Efficacy and Safety study (Kravchick et al. 2007). Because PV is strongly related to serum PSA in men with no evidence of prostate cancer, they suggested that serum PSA can be used to estimate the degree of prostate enlargement accurately enough for it was a useful tool in therapeutic decision making. Previous studies have focused on the relationship between serum PSA and PV (Choi et al. 2013, Furuya et al. 2001, Jara Rascon et al. 2005, Kwon et al. 2013, Mochtar et al. 2003, Park et al. 2013, Roehrborn et al. 2000, Shim et al. 2007). According to these studies on serum PSA, there were strong relationship with PV, and they found that PSA would be able to predict the PV. Other studies on free PSA showed a log-linear relationship with PV and free PSA predicted PV more precisely than total PSA in BPH patients (Canto et al. 2004, Lazzeri et al. 2013). The ability of PSA to predict PV increased with prostate size. In our study total PSA mean values were found to be associated with the size of the prostate; the greater the size of the prostate, the higher the PSA value. PSA mean value were also found to be associated with age; the older the patient, the greater the PSA mean value. In our log-linear correlation analysis, the serum PSA cutoff value was 1.47 to detect a PV.30 ml and 2.8 to detect a PV.35 ml. However, its level of relationship and accuracy of predicting PV was relatively low when compared to previous studies in Western countries.

To the best of our knowledge, this study is the first to examine the relationship between PSA and PV in Sudanese men, and to show the efficacy of PSA at predicting more precise PV in Sudanese men. Because of the ability to obtain more accurate estimates of the PV without the help of more expensive, invasive diagnostic evaluations, PSA would introduce a more reasonable contribution in the proper management of patients with BPH.

## 5. Conclusion

Serum prostate specific antigen (PSA) is significantly correlated with prostate volume in Sudanese men. PSA may be a useful tool in making therapeutic decisions and follow-up management in BPH patients. Further studies are required to elucidate the exact interactions between PSA and PV in prospective controlled studies.

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