

# Correlation Between Serum PSA Levels and Prostate Volume in Patients with Lower Urinary Tract Symptoms

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## Abstract

## Original Research Article

**Background:** Lower urinary tract symptoms (LUTS) are common in aging men and are frequently associated with benign prostatic hyperplasia (BPH). Serum prostate-specific antigen (PSA) is widely used as a marker for prostate pathology and several studies suggest a correlation between PSA levels and prostate volume. This study aimed to evaluate the relationship between serum PSA and prostate volume in Bangladeshi men presenting with LUTS. **Methods:** This cross-sectional analytical study was conducted in the Department of Urology, Bangladesh Medical University, Dhaka, from July 2022 to June 2023. A total of 80 male patients aged  $\geq 45$  years with LUTS were consecutively enrolled. **Results:** The mean age was  $62.1 \pm 8.9$  years. The mean BMI was  $26.1 \pm 3.0$  kg/m<sup>2</sup>, with 56.3% hypertensive and 33.8% diabetic. Median duration of LUTS was 4 months (IQR: 2–9) and mean IPSS was  $17.8 \pm 6.0$ . Mean serum PSA was  $5.06 \pm 7.95$  ng/mL (median 3.46) and mean prostate volume was  $38.05 \pm 26.65$  mL (median 35.3). Higher PSA levels corresponded with larger prostate volumes. Correlation analysis showed a strong positive association between PSA and prostate volume (Pearson  $r = 0.828$ , 95% CI: 0.74–0.89; Spearman  $\rho = 0.808$ , 95% CI: 0.71–0.87; both  $p < 0.001$ ). **Conclusion:** Serum PSA demonstrates a strong positive correlation with prostate volume in Bangladeshi men with LUTS and can serve as a reliable, non-invasive indicator of prostatic enlargement. **Keywords:** Lower urinary tract symptoms, PSA, prostate volume, benign prostatic hyperplasia.

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## INTRODUCTION

Lower urinary tract symptoms (LUTS) are among the most common clinical presentations in adult and elderly men and are frequently attributed to benign prostatic hyperplasia (BPH), a nonmalignant enlargement of the prostate gland [1]. The prostate gland, located just below the bladder, surrounds the urethra and its enlargement often leads to obstruction of urinary outflow, resulting in bothersome symptoms such as increased urinary frequency, nocturia, urgency, weak urinary stream and incomplete bladder emptying [2]. These symptoms not only affect the quality of life but also pose a significant public health burden, particularly in aging populations [3].

Serum prostate-specific antigen (PSA) is a glycoprotein enzyme produced by both normal and malignant prostatic epithelial cells [4]. Although initially introduced as a tumor marker for prostate cancer, PSA levels can also rise in benign conditions such as BPH and prostatitis. Numerous studies have demonstrated a positive correlation between serum PSA levels and prostate volume, suggesting that PSA may reflect the degree of prostatic enlargement [5]. Therefore, PSA estimation can serve as a simple, non-invasive and cost-effective indicator for assessing prostate size, especially in clinical settings where advanced imaging modalities such as transrectal ultrasonography (TRUS) or magnetic resonance imaging (MRI) are not readily available [6].

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Prostate volume, usually measured by TRUS, is an important parameter in the evaluation and management of men with LUTS. It helps in determining the severity of bladder outlet obstruction, predicting disease progression and guiding therapeutic decisions [7]. A larger prostate volume often corresponds with higher PSA levels, although this relationship can be influenced by other factors, including inflammation, age, hormonal status and coexisting malignancy [8]. Hence, understanding the correlation between serum PSA levels and prostate volume in men presenting with LUTS is crucial for accurate diagnosis, efficient use of resources and appropriate patient management [9].

Prostate-related disorders are increasingly recognized due to the rising life expectancy and improved access to healthcare. However, data exploring the relationship between serum PSA levels and prostate volume among Bangladeshi men with LUTS remain limited [10]. Establishing this correlation in our population may help optimize diagnostic protocols, reduce unnecessary invasive procedures and guide clinicians in the early detection and differentiation of benign from malignant prostatic diseases [11].

Therefore, the present study aimed to determine the correlation between serum PSA levels and prostate volume in patients presenting with lower urinary tract symptoms. By evaluating this relationship, the study seeks to provide insight into the predictive value of serum PSA in estimating prostate size and to contribute to evidence-based clinical decision-making for men with LUTS in our healthcare context.

## METHODOLOGY & MATERIALS

This cross-sectional analytical study was conducted in the Department of Urology, Bangladesh Medical University (BMU), Dhaka, Bangladesh, over a period of twelve months from July 2022 to June 2023. A total of 80 male patients aged 45 years and above presenting with lower urinary tract symptoms (LUTS) were included in the study. Patients were selected consecutively from both the outpatient and inpatient

departments who met the eligibility criteria and provided informed written consent.

Male patients aged 45 years or older presenting with obstructive or irritative lower urinary tract symptoms and willing to undergo serum prostate-specific antigen (PSA) testing and ultrasonographic measurement of prostate volume were included. Patients with acute urinary retention, urinary tract infection, prostatitis, history of prostate cancer, abnormal digital rectal examination findings suspicious for malignancy, previous prostate surgery, or those receiving 5-alpha reductase inhibitors or androgen deprivation therapy were excluded from the study.

After taking a detailed history and performing a thorough physical examination including digital rectal examination (DRE), all participants were evaluated using the International Prostate Symptom Score (IPSS) questionnaire. Serum PSA levels were measured by the enzyme-linked immunosorbent assay (ELISA) method in the BMU central laboratory. Prostate volume was determined by transabdominal ultrasonography using the standard ellipsoid formula ( $\text{Volume} = 0.52 \times \text{Length} \times \text{Width} \times \text{Height}$ ). All sonographic measurements were performed by a single experienced radiologist to minimize inter-observer variation.

All collected data were compiled, edited and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0. Continuous variables were expressed as mean  $\pm$  standard deviation (SD) or median with interquartile range (IQR), while categorical variables were presented as frequency and percentage. The correlation between serum PSA level and prostate volume was analyzed using Pearson's correlation coefficient for normally distributed data, while Spearman's rank correlation was applied for non-normally distributed data. A  $p$ -value  $< 0.05$  was considered statistically significant.

## RESULTS

**Table I: Patient Demographics and Clinical Characteristics (n = 80)**

Variable	n	%
Age (years)		
• < 60 years	28	35
• 60–69 years	36	45
• $\geq 70$ years	16	20
Mean $\pm$ SD	62.1 $\pm$ 8.9	
Body Mass Index (kg/m <sup>2</sup> ) (Mean $\pm$ SD)	26.1 $\pm$ 3.0	
Hypertension	45	56.3
Diabetes mellitus	27	33.8
Duration of LUTS (months) Median (IQR)	4 (2 – 9)	
IPSS (International Prostate Symptom Score) (Mean $\pm$ SD)	17.8 $\pm$ 6.0	

Table I summarizes the baseline characteristics of 80 male patients with lower urinary tract symptoms

(LUTS). The mean age was 62.1  $\pm$  8.9 years, with most patients aged 60–69 years (45%). The mean BMI was

$26.1 \pm 3.0 \text{ kg/m}^2$ , 56.3% had hypertension and 33.8% had diabetes mellitus. The median duration of LUTS was 4

months (IQR: 2–9) and the mean IPSS was  $17.8 \pm 6.0$ , indicating moderate symptom severity.

**Table II: Serum PSA and prostate volume (n = 80)**

Parameter	PSA (ng/mL)	Prostate volume (mL)
Mean $\pm$ SD	$5.06 \pm 7.95$	$38.05 \pm 26.65$
Median (IQR)	3.46 (1.68–5.22)	35.30 (23.55–42.62)
Range	0.59 – 65.42	10.0 – 150.0

Table II presents the serum prostate-specific antigen (PSA) levels and prostate volume of 80 male patients with LUTS. The mean serum PSA was  $5.06 \pm 7.95 \text{ ng/mL}$  (median: 3.46, IQR: 1.68–5.22), with a range

of 0.59–65.42 ng/mL. The mean prostate volume was  $38.05 \pm 26.65 \text{ mL}$  (median: 35.30, IQR: 23.55–42.62), ranging from 10 to 150 mL.

**Table III: PSA categories vs prostate volume categories (n = 80)**

PSA category (ng/mL) ↓ / Volume category (mL) →	<30	30–50	>50	Total
<4	33	13	0	46
4–10	2	22	5	29
>10	0	5	5	10
Total	35	40	10	80

Table III shows the distribution of prostate volume according to serum PSA categories among 80 male patients with LUTS. Most patients with PSA <4 ng/mL had smaller prostates (<30 mL), while higher

PSA levels were associated with larger prostate volumes. For PSA 4–10 ng/mL, the majority had prostate volumes between 30–50 mL and for PSA >10 ng/mL, most patients had prostate volumes >50 mL.

**Table IV: Correlation analysis between serum PSA and prostate volume (n = 80)**

Test	Statistic	95% CI	p-value
Pearson correlation (PSA vs Volume)	$r = 0.828$	0.74 – 0.89	< 0.001
Spearman correlation (PSA vs Volume)	$\rho = 0.808$	0.71 – 0.87	< 0.001

Table IV presents the correlation between serum PSA levels and prostate volume in 80 male patients with LUTS. Both Pearson and Spearman correlation analyses showed a strong positive association, with Pearson  $r = 0.828$  (95% CI: 0.74–0.89) and Spearman  $\rho = 0.808$  (95% CI: 0.71–0.87), both statistically significant ( $p < 0.001$ ).

## DISCUSSION

In this study of 80 Bangladeshi men with lower urinary tract symptoms (LUTS), we observed a strong positive correlation between serum prostate-specific antigen (PSA) levels and prostate volume, suggesting that PSA can serve as a reliable indicator of prostatic enlargement in this population. The mean age of our cohort was  $62.1 \pm 8.9$  years, with the majority of patients aged 60–69 years (45%), reflecting the typical age distribution of men presenting with benign prostatic hyperplasia (BPH) and LUTS in Bangladesh, consistent with previous regional studies [12, 13].

The mean BMI was  $26.1 \pm 3.0 \text{ kg/m}^2$  and a substantial proportion of patients had comorbidities such as hypertension (56.3%) and diabetes mellitus (33.8%), highlighting the overlap between metabolic disorders and LUTS, which has also been reported in other studies [14, 15]. The median duration of LUTS was 4 months (IQR: 2–9) and the mean IPSS was  $17.8 \pm 6.0$ , indicating

moderate symptom severity. Similar correlations between IPSS and prostate morphology have been described by Hossain *et al.*, emphasizing that symptom severity is often related to prostate size rather than age alone [16].

Our cohort had a mean serum PSA of  $5.06 \pm 7.95 \text{ ng/mL}$  (median 3.46 ng/mL) and a mean prostate volume of  $38.05 \pm 26.65 \text{ mL}$  (median 35.3 mL). When categorized, most patients with PSA <4 ng/mL had smaller prostates (<30 mL), whereas higher PSA levels corresponded to larger prostate volumes. Patients with PSA 4–10 ng/mL predominantly had prostate volumes of 30–50 mL and those with PSA >10 ng/mL mostly had prostates >50 mL. These findings are in agreement with studies from Bangladesh and other regions, demonstrating that PSA rises proportionally with prostate size [17, 18, 19].

Correlation analysis confirmed a strong positive association between PSA and prostate volume, with Pearson  $r = 0.828$  and Spearman  $\rho = 0.808$  (both  $p < 0.001$ ). This is consistent with prior studies reporting correlations ranging from 0.65 to 0.85 in men with BPH [20, 21, 22]. The strength of the correlation in our cohort indicates that serum PSA is a dependable surrogate marker for estimating prostate size in Bangladeshi men with LUTS, which is particularly valuable in settings

where transrectal ultrasonography may not be readily available.

Our results also align with observations that PSA levels between 4–10 ng/mL are associated with moderate prostate enlargement, supporting the clinical relevance of this “gray zone” in decision-making for further evaluation, including TRUS-guided biopsy [13, 17]. Similarly, our findings corroborate reports by Bharti *et al.*, emphasizing that higher PSA levels reliably reflect increased prostate volume even in the absence of malignancy [18].

Furthermore, our study highlights the clinical utility of PSA measurement in Bangladeshi men. Considering that comorbidities such as hypertension and diabetes were common, PSA can serve as a non-invasive, cost-effective tool for identifying patients likely to have significant prostatic enlargement, facilitating early intervention and symptom management [23, 24]. These observations also support previous regional and international studies suggesting that PSA correlates with prostate volume across diverse populations [21, 22].

#### Limitations of the study

Limitations of this study include its single-center design and relatively small sample size, which may limit generalizability. Additionally, histopathological confirmation to exclude subclinical malignancy was not performed in all patients. Despite these limitations, our findings provide valuable insight into the relationship between PSA and prostate volume in Bangladeshi men with LUTS and are consistent with the reported literature.

## CONCLUSION

In conclusion, our study demonstrates a strong positive correlation between serum PSA levels and prostate volume in Bangladeshi men with LUTS, with PSA effectively reflecting prostate enlargement. PSA measurement, alongside clinical evaluation, can thus guide the assessment and management of BPH in this population.

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