Relationship of Age, Prostate Specific Antigen, Prostate Volume and Lower Urinary Tract Symptoms in Patients with Benign Prostatic Hyperplasia

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Abstract

Background: Benign prostatic hyperplasia is a common disease among aging men. Although not all men with prostate enlargement develop symptoms of the disease, symptomatic patients often present with lower urinary tract symptoms and a poor quality of life. The important clinical parameters of benign prostatic hyperplasia significant for the diagnosis and management of the disease include international prostate symptom scores (IPSS), digital rectal examination findings (DRE), peak flow rate, post-void residual volume, and bladder wall thickness, among others.

Objective: To investigate the relationship between age, prostate-specific antigen, prostate volume, and lower urinary tract symptoms in patients with benign prostatic hyperplasia.

Method: Patients with clinical, sonographic, and laboratory features of benign prostatic hyperplasia were recruited into the study following informed consent. The patients underwent routine clinical evaluation, including demographic data collection, assessment of the international prostate symptom score (IPSS), serum prostate-specific antigen (PSA) assay, and transrectal prostate scan to determine age, IPSS, PSA, and prostate volume, respectively. The relationship between these parameters was subsequently determined. Data obtained were analyzed with SPSS version 23. Analysis was

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performed using Pearson's correlation coefficient for continuous variables and Spearman's rank correlation coefficient for categorical variables. A p-value of < 0.05 was considered statistically significant.

Result: A total of 109 patients completed the study. The age distribution among the participants ranged from 42 to 81 years, with a mean of 66 ± 8.12 SD. The majority fell within the age group of 66-69. The prostate volume of the study group ranged between 22 and 367 mL, with a mean prostatic volume of 106.9 ± 57.19 SD. Serum prostate-specific antigen (PSA) showed a range of 0.28-111 ng/mL, with a mean of 10.33 ± 17.01 SD. Serum PSA was further grouped into three categories: 0-4, 5-10, and >10. The serum PSA of the majority of the patients was within the range of 0-4 (48.7%, 53 patients). The remaining patients fell into the ranges of 5-10 (24.7%, 27 patients) and >10 (26.6%, 29 patients). Concerning lower urinary tract symptoms, the majority of the study group reported severe IPSS (75.2%, 82 patients). There was a significant correlation between serum PSA and IPSS ($p < 0.05$).

Conclusion: There was a significant correlation between serum PSA and IPSS (International Prostate Symptom Score), but no significant correlation was observed among other measures of BPH investigated in this study.

Keywords: benign prostatic hyperplasia, prostate specific antigen, prostate volume

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INTRODUCTION

Benign prostatic hyperplasia is a common disease among aging men (1). Although not all men with prostate enlargement develop symptoms, symptomatic patients often present with lower urinary tract symptoms (LUTS), which can significantly impair their quality of life (2, 3). These symptoms include voiding, storage, and post-micturition symptoms (4).

The important clinical parameters of benign prostatic hyperplasia, significant for its diagnosis and management include international prostate symptom scores (IPSS), digital rectal examination findings (DRE), peak flow rate, post-void residual volume, and bladder wall thickness, among others (5). These parameters measure the severity of benign prostatic hyperplasia (BPH) and form the basis for therapeutic intervention (6). Although IPSS is a subjective measure, it assesses the severity of LUTS, while bladder wall thickness (BWT), peak flow rate, and post-void residual volume are more objective measures of the disease's severity.

Efforts have focused on understanding the importance of age, prostate-specific antigen (PSA), and prostate volume in the pathology, diagnosis, and management of BPH (7). Increasing age has consistently been linked to the development of BPH and is regarded as one of its strongest risk factors (8). Studies have shown a positive correlation between increasing age and prostate volume, and prostate volume has been reported to correlate with prostate-specific antigen (PSA) (9, 10). However, it has been established that prostate volume does not correlate with lower urinary tract symptoms (11, 12).

The direction and extent of the relationship between age, PSA, prostate volume, and LUTS are key to understanding the natural history of the disease. The majority of studies exploring this relationship have been conducted among white populations and often focus on two or three clinical parameters. It is known that these clinical parameters exhibit racial variation (13). For example, higher PSA values have been observed in African populations, with or without the presence of prostatic disease (14, 15). Additionally, the average prostate volume in African populations is higher than in Western populations (16).

Conducting this study in a Nigerian population is valuable for updating existing PSA cut-off interpretations, determining average PSA levels in patients with BPH, and identifying the cut-off levels at which prostate cancer can be excluded. Furthermore, these findings may guide therapeutic decision-making.

METHODS

Study design

This was a prospective, hospital-based observational study conducted in the Urology Division of Ladoke Akintola University of Technology Teaching Hospital (LTH), Ogbomoso, Nigeria. This center is located in Ogbomoso, the second-largest town in Oyo State. It serves not only the people of Ogbomoso but

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also receives referrals from neighboring states such as Osun and Kwara. The hospital, established by the government of Oyo State in 2011, has approximately 200 inpatient beds.

Ethical approval was obtained from the Ethics and Research Committee of LTH, Ogbomoso, with approval number LTH/OGB/EC/2023/298. Consenting patients presenting with a clinical suspicion of prostatic disease were adequately evaluated. A thorough history and focused general examination, including digital rectal examination (DRE), were performed.

Patients with clinical, radiological, and laboratory features suggestive of benign prostatic hyperplasia (BPH) were recruited for the study. Patients with elevated prostate-specific antigen (PSA) levels (>10 ng/ml) or suspicious findings on DRE underwent prostatic needle biopsy to exclude prostate cancer.

Inclusion and Exclusion Criteria

The inclusion criteria comprised all patients diagnosed with BPH.

The exclusion criteria included:

- Patients with prostate cancer.
- Patients with bladder cancer.
- Patients on medical therapy for BPH.
- Patients with urinary tract infections.

Data Collection

Patients were asked to complete the International Prostate Symptom Score (IPSS) questionnaire to assess the severity of lower urinary tract symptoms (LUTS). Blood samples were collected to measure PSA levels, and prostate size was determined using transrectal ultrasound (TRUS). Additional routine investigations for patients with BPH were performed.

The data obtained from these evaluations were recorded on a structured proforma. Data entry was performed using SPSS version 23. Statistical analysis was conducted using Pearson's correlation coefficient for continuous variables and Spearman's rank correlation coefficient for categorical variables. A p-value < 0.05 was considered statistically significant.

RESULTS

A total of 109 patients completed the study. The age distribution of the participants ranged from 42 to 81 years, with a mean age of 66 ± 8.12 SD. The majority of the participants (47.7%, 52 patients) fell within the age group of 60–69 years (Table 1). The prostate volume among the study group ranged from 22 to 367 mL, with a mean prostate volume of 106.9 ± 57.19 SD. Serum prostate-specific antigen (PSA) levels ranged from 0.28 to 111 ng/mL, with a mean of 10.33 ± 17.01 SD.

The distribution of serum PSA levels was as follows:

- 0–4 ng/mL: 48.6% (53 patients)
- 5–10 ng/mL: 24.8% (27 patients)
- 10 ng/mL: 26.7% (29 patients)

Regarding lower urinary tract symptoms (LUTS), as assessed by the International Prostate

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Symptom Score (IPSS) (table 1):

- 0–7 (mild symptoms): 0.9% (1 patient)
- 8–19 (moderate symptoms): 23.9% (26 patients)
- 20–35 (severe symptoms): 75.2% (82 patients)

The study revealed a significant correlation (Spearman) between serum PSA levels and IPSS ($p < 0.05$). However, no significant correlations were found between the following variables:

- Age and prostate volume ($p = 0.476$)
- Age and PSA ($p = 0.611$)
- PSA and prostate volume ($p = 0.236$)
- Age and IPSS ($p = 0.934$)
- Prostate volume and IPSS ($p = 0.695$)

Table 1. The age distribution, PSA and IPSS of the study group

s/n	age	Frequency n=109	Percentage %
1	40-49	3	2.7
2	50-59	19	17.3
3	60-69	52	47.7
4	70-79	29	26.6
5	80-89	6	5.5
		66+/8.12SD	
	IPSS	**Frequency n=109**	**percentage**
1	0-7	1	0.9
2	8-19	26	23.85
3	20-35	82	75.23
	PSA	**Frequency n=109**	**percentage**
1	0-4	53	48.6
2	5-10	27	24.77
3	11-15	29	26.66

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DISCUSSION

Benign prostatic hyperplasia (BPH) is one of the most common clinical conditions observed in men (17). Age, prostate volume, prostate-specific antigen (PSA), and lower urinary tract symptoms (LUTS) are some of the parameters used to measure BPH. The outcomes of studies that sought to determine the relationships between these parameters remain controversial (18).

It was observed that the majority of the subjects studied were elderly, between the ages of 60–69 years. This reaffirms that BPH is more commonly seen in the elderly, as reported in the medical literature. Increasing age is one of the risk factors for the development of BPH (19). This finding further establishes age as a consistent risk factor for BPH.

The lowest prostate volume of 22 g and the highest of 367 g, with a mean prostatic volume of 106 g, as seen in this study, is consistent with the history of symptomatic BPH. Various prostate sizes have been reported in patients with symptomatic BPH. Some similar studies have reported a mean prostatic volume of more or less than 100 g (20). This has not, in any way, significantly correlated with the severity of symptoms.

It was noted in this study that the PSA levels among the study group ranged between 0.2–111 ng/mL, with a mean of 10.33 ng/mL. A PSA value of >10 ng/mL is an indication for the exclusion of prostate cancer, and a PSA value of more than 100 ng/mL may be synonymous with prostate cancer. However, none of the patients investigated were confirmed to have prostate cancer, considering the range of PSA levels noted in them. This further supports the fact that PSA is not consistent with any specific prostatic disease. A mean PSA value of 10 ng/mL has also been reported in similar studies.

We discovered that the majority of the investigated subjects reported severe lower urinary tract symptoms. This was in tandem with the outcome of a similar study, where it was reported that patients with symptomatic BPH had moderate to severe lower urinary tract symptoms (21). These symptoms comprise both voiding and storage symptoms. The development of these symptoms may be a result of either static or dynamic benign prostatic obstruction.

The correlations among measures of BPH, such as age, prostate volume, PSA, and IPSS, in patients with BPH have been inconsistent. Some studies have expressly reported significant correlations, while others have reported otherwise (22). The findings from this study have also added to the debate. We noted that there was a significant correlation only between PSA and IPSS. Every other correlation was not significant. Although this study did not set out to investigate the reasons for the variance in the outcomes of several similar studies, this dissimilarity may not be unconnected with ethnic and racial differences.

CONCLUSION

There was a significant correlation between serum PSA and IPSS, but no significant

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correlation was observed among other measures of BPH investigated in this study.

Acknowledgements: None declared.

Conflict of Interest Statement: The author declares that have no conflict of interest.

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