

ORIGINAL ARTICLE

The Study of Prostate-specific Antigen and Prostate Volume in Benign Prostatic Hyperplasia

A. G. Das¹, P. G. Chougule²

ABSTRACT

Introduction: Benign prostatic hyperplasia (BPH) is the most common benign tumor in men over 50 years of age and can have a significant impact on the quality of life of BPH patients. In this study, we focused on the utility of prostate-specific antigen (PSA) in the management of lower urinary tract symptoms (LUTSs) secondary to BPH and studied the relationship between prostate size or volume and PSA and their importance in predicting the natural history of the condition.

Aims and Objectives:

The aims and objectives are as follows:

- To study PSA concentration and PV.
- To evaluate the correlation between serum PSA and PV.
- To study the association of acute urinary retention (AUR) with PSA levels in BPH.

Materials and Methods: In our study, 200 cases with LUTS coming to Krishna Hospital outpatient department were studied between July 2015 and July 2017 from detailed history taking, grading of patients on the basis of signs and symptoms to grading of enlarged prostate by doing direct rectal examination for all the patients. Biochemical estimation of SPSA, blood urea and creatinine with abdominal, and transrectal usage was also done.

Results: There was a significant positive correlation between PSA and prostate volume. There was a significant positive correlation between age and prostate volume. There was a significant positive correlation between age and PSA levels. There was a significant positive correlation between PSA and prostate volume. There was significant association found between increase in PSA levels and AUR.

Conclusion: From the study, PV can be predicted from PSA, and PSA can also estimate "prostate enlargement" sufficiently accurately to be useful for the management of BPH.

Keywords: Antigen, Benign prostatic hyperplasia, Prostrate, Prostate-specific antigen, Urinary retention.

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INTRODUCTION

The term "prostate" which means "stand before" is apt since it stands at the exit of the bladder. The prostate gland in the normal adult male is a relatively small organ measuring approximately 4 cm in maximum dimension and weighing about 20 g. It is clear that benign hyperplasia is an aging process. During the process of senility, the tissues atrophy elsewhere in the body, but the prostate hypertrophies, 70% of the men beyond the age of 70 years have prostate that is hyperplastic and 30–40% of them present with symptoms of prostatism. The exact etiology of hyperplasia is not understood. The challenge, it has thrown to surgical practice, is multifaceted and formidable. A close cooperation between the surgeon, physician, biochemist, radiologist, and anesthetist is necessary in the management of prostatic patient. It is not the hypertrophied prostate *per se* that causes all the problems. However, its vital position anatomically, the gland causes obstruction to free flow of urine. The gradual obstruction over a period of several years leads to back pressure effects on the urinary system. This, associated with other diseases that are frequent at that age such as hypertension, diabetes mellitus, atherosclerosis, and chronic bronchitis, is the cause for the distress, morbidity, and mortality. Benign prostatic hyperplasia (BPH) is the most common benign tumor in men with prevalence estimates ranging from 50% for men in their 50s to 90% for men in their 90s.^[1] Although not all men suffer from this condition, approximately 50% of those developing histological hyperplasia eventually will develop moderate-to-severe and bothersome, storage and voiding symptoms collectively called the LUTSs. Due to its extraordinarily high prevalence of this, in general, non-lethal disease as well as in the aging of the population, health care providers in primary care and in urology will see themselves confronted with an ever-enlarging number of men seeking consultation, advice, and treatment for LUTSs often associated with BPH. Although BPH is not a life-threatening condition, the impact of BPH on quality of life can be significant and should not be underestimated.^[2,3] In this study, we focused on the utility of serum prostate-specific antigen (PSA) in the management of men with LUTSs secondary to BPH. We had studied the relationship between prostate size or volume and serum PSA, and subsequently, the importance of prostate

volume and serum PSA in predicting the natural history of the condition. Historically, treatment for BPH through either medical or surgical intervention has focused on symptom relief.^[1,4] However, recent additional alternatives in drug treatment and increased understanding of the natural history of the disease give the choice of a more proactive approach to managing BPH in which the patient can be offered treatment to alter disease progression in addition to providing symptom relief.^[4-7] To optimize the therapy, it is therefore important for clinicians to determine which patients are at high risk of disease progression.^[8-10] Hence, this study has been carried out to do the same.

Aims and Objectives

Aims

This study aims to study the serum PSA concentration and prostate volume in cases of LUTSs secondary to BPH.

Objectives

The objectives of this study were as follows:

- To evaluate the correlation between serum PSA and prostate volume and their importance in predicting the progression and management of BPH.
- To study the association of acute urinary retention (AUR) with PSA levels in BPH.

METHODOLOGY

In this clinical study of benign enlargement of prostate, 200 cases with LUTSs coming to Krishna Hospital outpatient department, Karad, between November 2015 and December 2017, were studied as per the pro forma enclosed. The study was divided into three groups:

1. Clinical study.
2. Biochemical study.
3. Sonological study.

Clinical Study

This study was conducted under the following headings:

- a. Detailed history taking.
- b. Clinical examination included detailed general survey, associated diseases, and systemic and genitourinary system.
- c. Depending on the symptoms and signs, the patients were categorized as mild, moderate, and severe as per the International Prostate Symptom score (IPS score) and based on the IPS score, the modality of treatment (medical with alpha-blockers and/or 5 alpha-reductase inhibitors or surgical - transurethral resection of the prostate) was decided.

- d. Digital rectal examination was done in all cases to know the grades of enlarged prostate and the lobes involved on the following basis.

Grade I: The prostate is just palpable and upper limit is easily reached.

Grade II: The prostate is well palpable and the upper limit is reached with difficulty.

Grade III: The upper limit of the prostate cannot be reached.

Biochemical Study

Biochemical estimations such as blood urea, serum creatinine, and PSA were done in the biochemistry laboratory of Krishna Hospital including all routine blood investigations.

Sonological Study

Abdominal and transrectal ultrasonography were done in the Sonology Department of KIMS, Karad. The size of prostate the lobes involved, and residual urine volume was assessed sonologically.

Inclusion Criteria

All newly diagnosed BPH patients with LUTS. LUTS include as follows:

| Voiding symptoms | Storage symptoms |
|-----------------------|-------------------|
| Hesitancy | Increased |
| Poor flow | Frequency |
| Intermittent stream | Nocturia |
| Dribbling | Urgency |
| Poor bladder emptying | Urge incontinence |
| Retention of urine | |

Exclusion Criteria

The following criteria are excluded from the study:

1. Patients with PSA level of > 10.0 ng/ml are excluded from the study, to reduce the likelihood of occult prostate cancer.
2. Patients diagnosed to have carcinoma prostate during workup or incidentally diagnosed to have carcinoma prostate by histopathology postoperatively.
3. Patients with acute prostatitis.
4. BPH patients requiring additional procedures for associated clinical entities such as vesical calculus, bladder diverticula, renal failure, and recurrent UTI.
5. Patients who are already on treatment with alpha-blocker and/or 5 alpha-reductase inhibitors.
6. Previous history of prostate surgery.

Statistical Methods

Convenience method of sampling was used; sample size of 200 was selected for this study. Data were

entered into Microsoft Excel data sheet and were analyzed using SPSS 22 version software. Categorical data were represented in the form of frequencies and proportions. Continuous data were represented as mean and standard deviation. Correlation was done to find the relationship between two quantitative variables. Linear regression was calculated between PSA and prostate volume. Scatter plots were plotted to show correlation between two quantitative variables. Comparisons were done by applying Student's unpaired *t*-test and *p* value < 0.05 was considered as statistically significant.

RESULTS

Majority of subjects (42%) in the study were in the age group of 70–79 years and 31% were in 60–69 years. Least number of subjects were in the age group of >80 years. The youngest was 45 years old and the oldest one was 89 years old. In our study, 72 of all the 200 patients had acute retention of urine. Majority of the patients (66%) had IPSS scores in the range of 20–35. Prostate volume of 108 of 200 patients was in the range of 51–80 cc. Majority (58%) of the patients had PSA levels in the range of 4.01–10 ng/ml [Table 1]. In the study, it was observed that there was a significant positive correlation between age and prostate volume, i.e. with increase in age, there was increase in prostate volume and vice versa. In the study, it was observed that there was a significant positive correlation between age and PSA levels, i.e., with increase in age, there was increase in PSA levels and vice versa with $P < 0.0001$, hence, showing significant positive correlation [Graph 1]. In the study, there was no any significant association found between increase in prostate volume and AUR ($P = 0.845$) [Table 2] with $P < 0.0001$, hence, significant positive correlation [Graph 2]. In our study, it was observed that there was a significant positive correlation between PSA and prostate volume, i.e. with increase in PSA, there was increase in prostate volume and vice versa with $P < 0.0001$, hence, showing significant positive correlation between the both [Graph 3].

DISCUSSION

Symptomatic BPH does not progress in all patients; therefore, progression modifying intervention is not always warranted. To tailor therapeutic and/or preventive approaches appropriately, it is valuable to differentiate patients at high risk of progression from those at low risk of progression. Serum PSA, a commonly used screening test for prostate cancer, can also be useful in predicting disease progression in BPH when considered in conjunction with other clinical indicators. Specifically, patients with elevated PSA in the presence

Table 1: Distribution of subjects according to IPSS score, prostate volume, and PSA levels

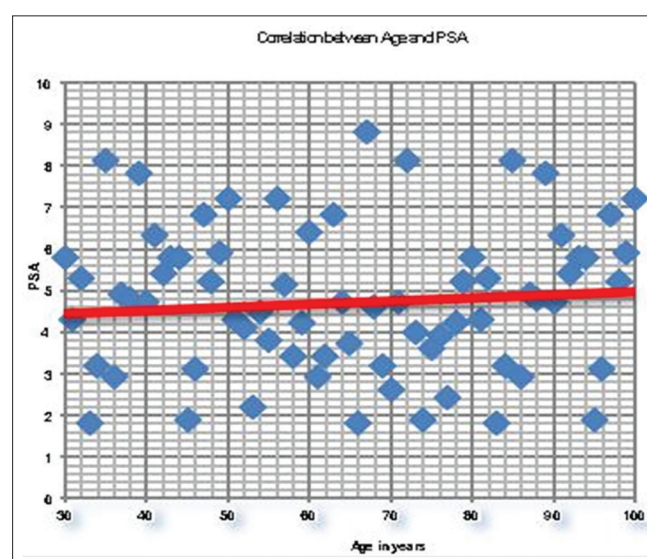
| | Number of cases (%) |
|-----------------|---------------------|
| IPSS score | |
| 0–7 Mild | 0 (0) |
| 8–19 Moderate | 68 (34) |
| 20–35 Severe | 132 (66) |
| Prostate volume | |
| 21–30 cc | 18 (9) |
| 31–50 cc | 56 (28) |
| 51–80 cc | 108 (54) |
| >80 cc | 18 (9) |
| PSA (ng/ml) | |
| 0–2 | 18 (9) |
| 2.01–4 | 64 (32) |
| 4.01–10 | 116 (58) |
| 10.01–20 | 2 (1) |
| >20 | 0 (0) |

PSA: Prostate-specific antigen

Table 2: Association between AUR and prostate volume

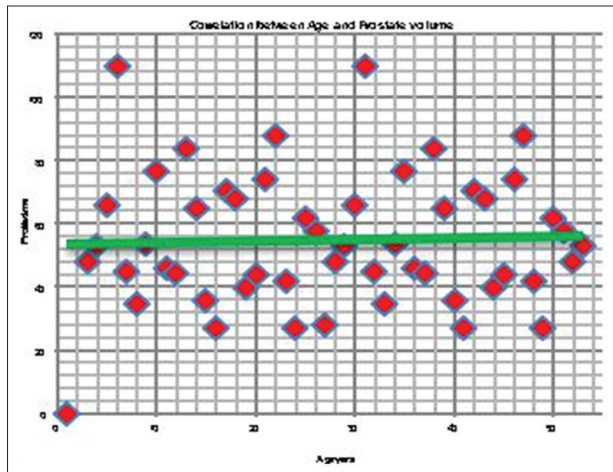
| Volume of Prostate | AUR present | No AUR | Total |
|--------------------|-------------|--------|-------|
| <50 cc | 26 | 48 | 74 |
| >50 cc | 46 | 80 | 126 |
| Total | 72 | 128 | 200 |

Chi-square: 0.038, $P = 0.845$. AUR: Acute urinary retention

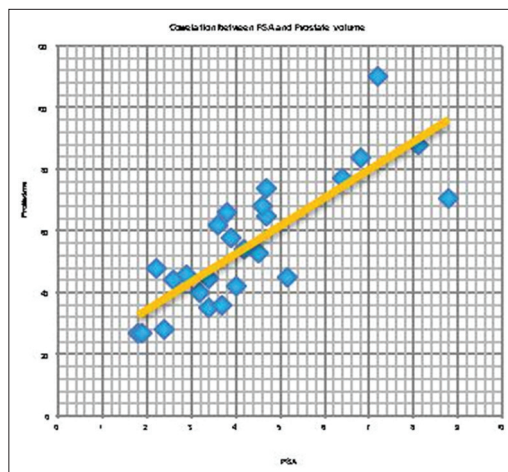


Graph 1: Correlation between age and prostate-specific antigen ($r = 0.01577$)

of an enlarged prostate and LUTSs are at increased risk of disease progression. These patients may benefit from close monitoring and may be good candidates for pharmacotherapy to arrest the disease process. On the other hand, patients with a small prostate gland, low serum PSA, and bothersome LUTSs may benefit most from symptomatic treatment but should be periodically monitored to assess changes in clinical status. The strong



Graph 2: Correlation between age and prostate volume ($r = 0.7622$)



Graph 3: Correlation between prostate-specific antigen and prostate volume ($r = 0.8154$)

predictive utility of PSA combined with the fact that it, unlike other clinical markers of BPH status, can be accurately and easily measured renders it as an important tool for the clinician seeking to optimize outcomes for patients with BPH. In our study, we found that SPSA levels >4.79 ng/ml, prostate volume >59.87 cc, age >68 , and severe IPSS grading together are strongly associated with the risk of progression of LUTSs and acute retention of urine. Chen *et al.*^[11] studied that patients having acute retention of urine to evaluate the effect of TURP with needle biopsy against TURP alone in patients aged more than 70 years. The group had higher mean age and IPSS and lower mean serum PSA levels and mean prostate volume. Mohamed *et al.*^[12] conducted a study to find out the risk factors for acute retention of urine and reported the findings similar to our study. The study population with acute retention of urine had higher mean age, serum PSA, and IPSS but lower mean prostate volume. Milonas *et al.*^[13] studied patients with benign prostatic hyperplasia with LUTSs and predictors of progression of the disease with the same

parameters comparing with patients with acute retention of urine with the patients without acute retention of urine. The author reported the similar findings. The mean prostate volume was less, but serum PSA levels, IPSS, and age were slightly higher as compared to our study. After comparing our study with the above-discussed studies, serum PSA levels can be used as a predictor of progression of LUTSs in a patient with bladder outlet obstruction secondary to enlarged prostate. The study conducted by Lakhey *et al.*^[14] for correlation of serum PSA levels with histological findings found that most of the patients with BPH had serum PSA levels <2 ng/ml, and BPH with inflammation had serum PSA levels >5 ng/ml, which are similar to the findings in our study. Thus, combination of SPSA levels >4.79 ng/ml, prostate volume >59.87 cc, and age >68 years can be predictors of progress of BPH and LUTSs and acute retention of urine.

CONCLUSION

Serum prostatic-specific antigen, widely used for screening, early detection, and follow up of carcinoma prostate, can also be used as a predictor of progress of benign prostatic hyperplasia in terms of progressive LUTSs and acute retention of urine. From the study, prostate volume can be predicted from PSA levels, as well as serum PSA can also estimate "prostate enlargement" sufficiently accurately to be useful for therapeutic, especially medical management in Indian men. From the study, patients with serum PSA levels >4 ng/dl are at high risk of developing acute retention of urine. Hence, pharmacotherapy should be initiated in such patients.

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