Correlation Between Prostate Volume And Prostate-Specific Antigen In Patients Diagnosed With Benign Prostatic Hyperplasia

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Abstract

Background: Prostate volume (PV) and serum prostate specific antigen (PSA) have been consistently linked to benign prostatic hyperplasia (BPH) disease progression especially when prostate volumes are >30mls and PSA>1.5ng/ml. PSA is produced by the ductal epithelial cells of the prostate. Understanding the natural history of prostate diseases requires knowledge of prostate volume and PSA.

Objective: We set out to determine the correlation between prostate volume and PSA in our cohorts of men diagnosed with BPH.

Methodology: Information from the case notes of 120 patients were retrieved including history, physical examination and result of relevant investigations. Data collated were analyzed using the statistical package for social sciences (SPSS) version 20.0 software.

Results: Mean age of the patients was 64.95±9.22 years while mean PV and PSA were respectively 70.20±52.01mls and 4.58±3.32ng/ml. Correlation between PV and PSA was statistically significant: r= .407, P value was set at <.05.

Conclusion: We concluded that PV and serum PSA levels have a direct relationship.

Keywords: Prostate Volume, Serum Prostate specific antigen, correlation, Benign prostatic hyperplasia.

Introduction

Prostate volume and serum PSA have been known to be critical factors in BPH progression and with greatest risk at volumes ≥30mls and PSA ≥1.5ng/ml.[1] Prostate volume aids in selecting medical therapy in conjunction with international prostate symptom score (IPPS) and found its usefulness in evaluating clinical response to medical treatments.[2] European association of urology guideline recommends that patients with moderate to severe lower urinary tract symptoms (LUTS) and a PV > 30ml is an indication for the use of 5α –reductase inhibitor.[3] De la Rosette JJ et al[4] reported increased risk of treatment failure when patients with PV > 40mls received only α-adrenergic blockers, whereas in another study, patients with smaller total PV (≤30mls) who received tamsulosin alone responded better on flow parameters.[5] Elevated PSA together with findings on digital rectal examination of the prostate will prompt prostate biopsy to rule out a diagnosis of prostate cancer.

PSA was identified and purified by Wang et al in 1979.[6] It is produced by the ductal epithelial cells of the prostate and known to be neither organ specific nor disease specific. However, its serum level is thought to depend on the volume of the prostate as well as the number of epithelial cells within it.[7] Other factors like inflammation and trauma to the prostate may also elevate its serum level. Hammerer PG et al,[8] reported that BPH may be associated with increases in serum PSA values. Another author,[9] demonstrated that BPH increases serum PSA levels due to increased PV in contradistinction to PSA

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increases in prostate cancer (Pca). In prostate cancer, a rise in peripheral blood level of PSA is said to occur when the prostate basement membrane barrier layers are damaged by the tumor. Several studies have demonstrated significant correlation between PV and serum PSA.[8,10-12] However, this finding has been found to be variable in different races, with the Japanese and Taiwanese men showing more PSA per unit prostate volume and so stronger relationships.[10,12-14] than the Asian and white American men. This study was meant to correlate prostate volume and serum PSA in our cohorts of men diagnosed with benign prostatic hyperplasia.

Patients and Methods:

This was a retrospective study of 120 patients who were diagnosed of BPH in our Urology Clinic between January 2014 to December 2016. Information from their case notes were retrieved including bio-data, relevant history, physical examination including a digital rectal examination (DRE) of the prostate, laboratory investigation results were renal function test, urine microscopy and culture, full blood count and serum PSA. Results of imaging modalities were also retrieved mainly abdominopelvic ultrasound scan, transrectal ultra-sound scan (TRUS) and TRUS-guided needle biopsy of the prostate. A standard procedure for prostate biopsy was followed for each patient. Prior to the procedure, bowel preparation was done with lukewarm saline enema a night before and morning of the procedure. Prophylactic antibiotic of intravenous ciprofloxacin 500mg stat was given and continued for five days post procedure with the oral form. In a left lateral position, about 10mls of 2% xylocaine gel was instilled into the rectum and after 5 to 7 minutes, an ultrasound probe was used to first scan the prostate and biopsy taken from suspicious areas with the aid of a size 18G biopsy needle mounted on an automated spring loaded biopty gun. Ten(10) to 12 cores of tissue were taken and sent to the laboratory in a formalin containing bottle. Inclusion criteria were patients with LUTS, enlarged prostates with normal findings on rectal examination and PSA <4ng/ml, suspicious areas on DRE of the prostate irrespective of PSA levels with a negative report of malignancy on prostate biopsy. Data collated were entered into SPSS software version 20.0 and analyzed. P-value was set at<.05 and Pearson correlation coefficient was used to find the relationship between PV and PSA.

Results

120 patients diagnosed with BPH who were between the ages of 44 and 90 years with a mean age of 64.95± 9.22 years were studied. Patients who presented in their 7th decade of life were 42.5%. Mean serum PSA was 4.58±3.32ng/ml while mean PV was 70.20±52.01mls (Table1). More patients (20%) had a PV between 40 and 49mls and PV > 100mls were also more in number (20%), although the range in the latter category may be beyond intervals of 10 (Table 2ii). Only one patient was evaluated in his 10th decade of life who also had a PV> 100mls (Tables 2,3). No patients in their 5th decade of life had a PV> 49mls and more patients in their 7th decade of life had prostate volumes in excess of 100mls (Table 3), 51.7% of patients had PSA< 4.0ng/ml, 39.2 % of them had PSA between 4 and 10ng/ml while 9.2% had PSA>10.0ng/ml (Table 4). Correlation between PV and serum PSA was positive and statistically significant: r= .407, P<.05 (Table 5).

Discussion:

BPH progression has been linked to the volume of the prostate and serum level of PSA.[1] Prostate volume in particular is useful in determining episodes of acute urinary retention (AUR) and also predicts the outcome and future need for BPH-related surgery[3] as well as in selecting regimen for medical treatment (α-adrenergic blockers, 5α-reductase inhibitors or a combination).[2] PSA is produced by the ductal epithelial cells of the prostate and known to be neither organ specific nor disease specific. Its serum level is thought to depend on the volume of the prostate and the number of prostatic ductal epithelial cells[7], aside from trauma and inflammation of the prostate. Both PV and serum PSA values can guide further assessment of the patients to rule out malignancy via prostate biopsy. Some authors have studied the relationship between PV and serum PSA and had found significant correlations.[8,10-12.]However, these studies had noted racial differences in correlating both variables. We set out to study the relationship between PV and PSA in our cohorts of patients diagnosed with BPH. The mean age of our patients was 64.95±9.22years,

Table 1: Descriptive Statistics for variables:

Variables	Mean	Standard Deviation
Age (years)	64.95	9.22
PSA (ng/ml)	4.58	3.32
Prostate volume (mls)	70.20	52.01

Table 2: Frequency Tables:

(i) Age (in Decades years)

	Frequency(n)	Percent(%)	Cumulative percent(%)
40-49	4	3.3	3.3
50-59	27	22.5	25.8
60-69	51	42.5	68.3
70-79	30	25.0	93.3
80-89	7	5.8	99.2
90-99	1	0.8	100.0
Total	120	100.0	

(ii) Prostate volume (in mls)

PV Categories	Frequency(n)	Percent(%)	Cumulative Percent(%)
<30	13	10.8	10.8
30-39	17	14.2	25.0
40-49	24	20.0	45.0
50-59	18	15.0	60.0
60-69	13	10.8	70.8
70-79	6	5.0	75.8
80-89	3	2.5	78.3
90-99	2	1.7	80.0
>100	24	20.0	100.0
Total	120	100.0	

Table 3: Cross Tabulation: Age/Prostate Volume
Age (in decades)/Prostate Volume(in mls)

30-39	40-49	50-59	60-69	70-79	80-89	90-99	≥100	Total
2(1.7%)	1(0.8%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	4(3.3%)
2(1.7%)	5(4.2%)	7(5.8%)	4(3.3%)	3(2.5%)	0(0.0%)	1(0.8%)	0(0.0%)	27(22.5%)
7(5.8%)	10(8.3%)	4(3.3%)	8(6.7%)	3(2.5%)	2(1.7%)	0(0.0%)	12(10.0%)	51(42.5%)
6(5.0%)	7(5.8%)	5(4.2%)	0(0.0%)	0(0.0%)	1(0.8%)	1(0.8%)	9(7.5%)	30(25.0%)
0(0.0%)	1(0.8%)	2(1.7%)	1(0.8%)	0(0.0%)	0(0.0%)	0(0.0%)	2(1.7%)	7(5.8%)
0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	1(0.8%)	1(0.8%)

Table : 4 Cross tabulation between PSA and PV

PSA(ng/ml)   **Prostate Volume Categories**

PSA(ng/ml)	<30	30-39	40-49	50-59	60-69	70-79	80-89	90-99	>100	Total
<4	12(10.0%)	10(8.3%	17(14.2%	11(9.2)	3(2.5%)	1(0.8%)	1(0.8)	1(0.8%)	6(5.0%)	62(51.7
4-10	1(0.8%)	7(5.8%)	7(5.8%)	6(5.0%)	8(6.7%)	4(3.3%)	2(1.7)	1(0.8%s)	11(9.2%)	47(39.2
>10	0(0.0%)	0(0.0%)	0(0.0%)	1(0.8%)	2(1.7%)	1(0.8%)	0(0.0	0(0.0%)	7(5.8%)	11(9.2

Table 5: Correlation between prostate volume and serum PSA

		Prostate Volume	PSA
Prostate Volume	Pearson Correlation	1	0.407
	sig. (2-tailed)		0.000*
	N	120	120
PSA	Pearson Correlation	0.407	1
	Sig. (2 -tailed)	0.000*	
	N	120	120

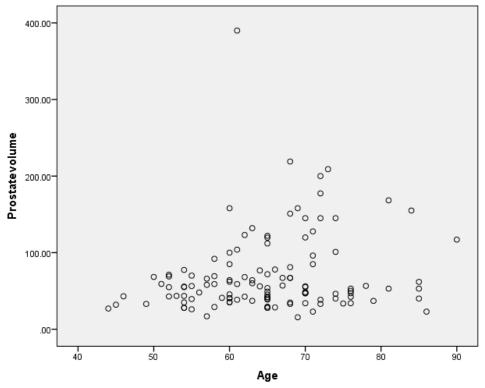***Correlation is significant at the .05 level (2-tailed)**

Fig. 1 Scatter plot between Prostate Volume and PSA

similar to a study of Indian men with BPH[10] and in Nigerian men with same condition.[15] In another study of Italian men,[17] the mean age was significantly higher (74.2±6.8 years). This was also a hospital-based study. The older group of patients here may likely be due to late presentation to hospital for care. Mean serum PSA was 4.58±3.32ng/ml (Table 1). This was quite lower than in another study[15] of Nigerian men whose PV was also higher (72.79±44.38 mls) than in our men even with same close mean age. Another author[10] who evaluated Indian men with BPH reported mean serum PSA of 2.3ng/ml with consequential lower PV of 43mls. In an Italian study[17] with mean PSA of 3.71 3±.07 ng/ml, the mean PV was also moderately lower (55.529±.9mls). This scenario seems to follow a particular pattern of elevated PSA in line with increased volume of the prostate, racial differences not- withstanding.

Most of our patients (42.5%) were in their 7th decade of life (Table 2i). Same report was also documented by Sarkar B et al [16] and Deori R et al.[10] Does this age decade corresponds to the height of BPH symptomatology? Is another area of interest for further research. Few patients, presented in their 5th decade of life. This may depict disease rarity in this age group and only one patient was seen in the 10th decade of life, suggesting a lower population of men in that age group probably due to age-related morbidities and mortality who may likely succumb to complications of other illnesses.

Most men had a PV range of 40-49mls and also PV> 100mls, the latter group may be attributed to the fact that the range of values here may exceed an interval of 10. In another study[10] most men had a PV of ≥50mls. Our report shows that most patients can still benefit from minimal access surgery of the prostate while a significant number also will benefit from open prostatectomy where indicated by reason of prostate size. As a follow up to this, some authors have advised transurethral resection of the prostate (TURP) with prostate volumes less than 75mls to reduce the resection time and avoid complications like TURP syndrome and excessive bleeding, then open surgeries for prostate volumes >75mls[17]. Again, those that will be treated medically, are likely to receive a combination therapy with α-adrenergic blockers and 5α–reductase inhibitor

according to AUA practice guidelines committee.[2] Most patients had serum PSA of <4ng/ml, followed by those between 4-10ng/ml and small group of subjects with PSA>10ng/ml (Table 3). This same trend was seen in 2 other studies.[10,11.] Our study also support other works done on this topic and shows that slight to moderate increases in serum PSA values are possible without evidence of cancer mainly accounted for increases in prostate volume. However, those with PSA>10ng/ml, malignancy could not be completely ruled out since the specimens were collected via trucut biopsy needle and not prostatectomy specimen. In this study, most of the patients that had PSA > 10ng/ml were also found to have PV in excess of 50mls. Carvalhal GF et al[9] noted that BPH increases PSA mainly through increased PV while Pca elevates PSA independent of PV rather by a damage to the basement membrane barrier layers of the prostate by the tumor releasing PSA from the cells into the lymphatics and ultimately into the peripheral blood. Correlation between PV and PSA was positive and statistically significant (r=.407, P-value<.05) supporting direct increases in PSA with PV. Similar reports had been documented.[10,11,18,19] Udeh E et al,[15] who also studied Nigerian men with same diagnosis noted same direct relationship between PV and PSA although with a relatively weaker association (r=.3365, P-value <.05). This could be attributable to different population of patients studied.

Limitation of this study is that of its retrospective nature, it was a hospital-based allowing for evaluation of men with moderate to severe diseases. However, this cannot invalidate the usefulness of this report because this is the ideal population to formulate hypothesis regarding parameters of an enlarged prostate and propose modalities of management of such patients. Also, the retrospective nature of the study did not allow for verification of true absence of malignancy. Again, specimens for histopathological studies were taken with trucut biopsy needle which could have missed sites of malignancy.

On the whole, this study carries the information already documented, now proven to also apply to men in our locality.

Conclusion:

Prostate volume together with prostate-specific antigen are critical variables in the management of BPH and prostate cancer patients alike. Prostate volume effectively correlates with PSA in BPH patients in several well designed studies including the present study. The degree of correlation may vary depending on the population studied with diverse genetic and racial factors modulating it. Measurements of prostate volume alone therefore can provide an idea as to the patient's serum PSA and insights into disease (BPH) progression and need for appropriate therapy.

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