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Research Article

Is there any Relation between Serum PSA and Urine Flow and Post-Voiding Residual Urine in Benign Prostatic Hyperplasia Patients?

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Abstract

Objective: To examine BPH patients for the relationships between serum PSA and Qmax of uroflowmetry, and between serum PSA and post voiding residual urine.

Patients and Methods: One hundred Egyptian BPH patients were enrolled in our prospective study. Evaluation included full medical history, thorough clinical examination, laboratory investigation (urine analysis, kidney function tests, serum PSA level), pelvi-abdominal ultrasound with estimation of post voiding residual urine, prostate size and Transrectal Ultrasound (TRUS) for prostate size and adenoma size. Then patients' uroflowmetry. Patient data was analyzed statistically using SPSS statistical package version 13.

Results: Our data results revealed that the correlation between serum PSA level and maximum flow rate of uroflowmetry was of no statistical significance (r= -0.100, p= 0.320). On the other hand, there was significant correlation between the volume of residual urine and serum PSA value (r= 0.254, p= 0.014).

Also our results revealed that there was significant correlation between the age of the 100 patients and their serum PSA level (r= 0.310, p= 0.002). Also our study showed that there was significant correlation between PSA and prostate volume (r= 0.320, p= 0.001).

Conclusion: In BPH patients with lower urinary tract symptoms, there was a significant relation between the serum PSA level and volume of post voiding residual urine, while there was no significant relation between the serum PSA level and Qmax of uroflowmetry. Further studies may be needed to confirm these results.

Keywords: PSA; Residual urine; Prostate; BPH; Uroflowmetry; Prostate size

Abbreviations

Benign Prostatic Hyperplasia (BPH); Prostate Specific Antigen (PSA); Lower Urinary Tract Symptoms (LUTS); Digital Rectal Examination (DRE); International Prostate Symptom Score (IPSS)

Introduction

Benign Prostatic Hyperplasia (BPH) is a common progressive disease in the male aging population [1]. Although aging and androgens are established risk factors, the cause of BPH remains uncertain [2,3]. It may be clinically manifested by storage and voiding Lower Urinary Tract Symptoms (LUTS).

Prostate-Specific Antigen (PSA) is a serologic biomarker often used in screening for prostate cancer, and there are substantial variations in recommended guidelines for its value in determining potential risk [4]. The PSA level at the time of diagnosis is prognostic for outcome [5], and since 2010 the PSA level and Gleason score have been incorporated into the seventh edition of the American Joint Committee on Cancer (AJCC) Tumor-Lymph Node- Metastasis (TNM) staging system for prostate cancer.

Although it is well known that PSA is prostate specific, it is not a disease-specific biomarker. In BPH patients, relationship between PSA to Age, Prostate size is documented through several studies that showed a positive correlation [6-9].

On the other hand, the relationship between serums PSA to other variables in BPH disease is not well investigated. Other variables in BPH disease as Post voiding residual urine and urine flow may have a positive correlation to the serum PSA level. So we decided to investigate these potential correlations in our study.

The aim of our study was to examine BPH patients for the relationships between serum PSA and Qmax of uroflowmetry, and between serum PSA and Post voiding residual urine.

Patients and Methods

Our prospective study was conducted upon one hundred BPH patients attended in our outpatient clinics, complaining of lower urinary tract symptoms.

Inclusion Criteria was: Male Patients, above fifty years old

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complaining of lower urinary tract symptoms. While exclusion Criteria was: Urinary Tract Infection (UTI) and Prostatitis (acute or chronic), Prostate cancer (by DRE or markedly elevated PSA and proven by biopsies), Patients with bladder calculi and recent urological intervention (such as: Urethral catheterization, Cystoscopy, TURP, TRUS-guided Biopsy).

Evaluation of the patients started with a full comprehensive medical history was taken from each patient with special reference to: Personal history to exclude patients below the age of 50 years, Complaint of lower urinary tract symptoms either voiding symptoms or storage symptoms or both of them with IPSS recording, Sexual history to exclude patients with recent sexual acts as ejaculation which may alter our results, Medical history to give an idea about any drugs the patient take that may alter our results (example: finasteride) and to exclude patients with recent urinary tract infections that may alter our results (eg. prostatitis), and finally Operative history to exclude patients having operations done recently that may alter our results (eg. TURP).

Patient evaluation continued with a thorough Clinical Examination which included: Abdominal examination to detect presence of residual urine and to exclude presence of abdominal swelling, DRE: to exclude patients with hard nodules or asymmetry in the prostate gland.

Then patients are well investigated by: Laboratory investigation (Urine analysis, Kidney function tests, Serum PSA level using quantitative measurement of PSA by PSA ELISA kit) and imaging through pelvi-abdominal ultrasound with estimation of residual urine, size of prostate and search for exclusion criteria such as bladder stones. Transrectal Ultrasound (TRUS) for measurement of the prostate size and adenoma size. TRUS guided biopsies were done only for patients with total PSA more than 4 to exclude prostate cancer. And at last patients were asked to micturate in the uroflowmetry.

Patient data was collected, revised, verified then analyzed statistically using SPSS statistical package version 13. The following tests were done: Mean (x), Standard Deviation (SD), Person correlation coefficient (r).

Results

Our hundred patients were above age of fifty years with minimum age was 50 years and maximum age was 77 years with mean 63.6 +/- 5.7 (SD). They complained of either irritative urinary symptoms in the form of frequency, nocturia and urgency OR obstructive urinary symptoms in the form of weak stream, hesitancy and interrupted stream.

The size of the prostate of the 100 patients was calculated during pelvic ultrasonography and varied from 15g to 180g with mean size 46.4 +/- 28.66 (SD). The size of the adenoma of the prostate was calculated in 69 patients by Transrectal Ultrasound (TRUS) and varied from 5g to 130g with mean size 30.5 +/- 21.2 (SD).Blood sample was collected from the 100 patients to calculate serum level of PSA. The value of PSA varied from 0.14 ng/ml to 29 ng/ml with mean value of 3.2 +/- 3.5 (SD). Post voiding residual urine was detected in 92 patients by pelvic ultrasonography and the value of residual urine varied from 0cc (no RU) to 800cc with the mean value of 60.8 +/- 112 (SD). Uroflowmetry was done for the 100 patients and the value of Qmax varied from 4 ml/sec to 38 ml/sec with mean value of 12.8 +/- 5.9 (SD). The volume of urine voided was calculated for the 98 patients and its value varied from 110 ml to 537 ml with mean value of 237.3 +/- 82.9 (SD). (The volume of urine voided in 2 patients was 980 and 750 ml and they were excluded from our statistics as they were considered outliers). All the patients with PSA more than 4 ng/ml were subjected to TRUS and biopsy to exclude prostate cancer. Statistics was done to correlate between serum PSA value of our 100 patients and their volume of residual urine and the Qmax of uroflowmetry. Also correlations with the age and size of prostate are done.

Table 1: Correlation between the serum PSA level and volume of residual urine.

Pearson correlation coefficient	0.254
P-value	0.014
number	100

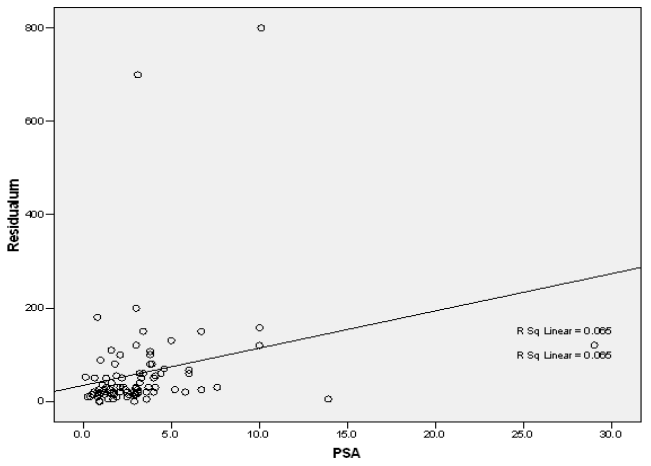

Figure 1: The Correlation between PSA and the residual urine.

Table 2: Correlation between the serum PSA level and Qmax of the uroflowmetry.

Pearson correlation coefficient	0.254
P-value	0.014
number	100

Statistical analysis showed that there was significant correlation between Post voiding Residual Urine with PSA level in serum, as shown in (Table 1 and Figure 1), where P value was 0.014. On the other hand there was a non-significant correlation between the PSA level in serum and the Qmax of uroflowmetry, as shown in (Table 2).

Other statistical correlations were done between PSA level and other variables as age of patients and the prostate size. It showed that there is significant correlation between the age of patients and the serum PSA level and again a significant correlation between PSA and prostate size. Summary of all the correlations between Serum PSA level and the four variables investigated in our study is shown in (Table 3).

Discussion

PSA is an important tumor marker and absolute values greater

Table 3: The correlation between the prostate size, the volume of residual urine, and the age of the patients, Qmax of uroflowmetry and the PSA level in serum together.

Serum PSA with	Prostate size	Residual urine	Age of patients	Qmax of uroflowmetry
Pearson correlation coefficient	0.320	0.254	0.310	-0.100
P-value	0.001	0.014	0.002	0.320
number	100	100	100	100

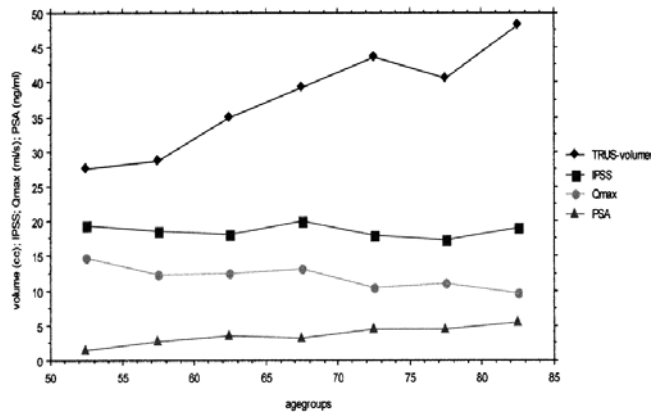

Figure 2: The mean prostate volumes, IPSS, peak flow rates (Qmax) and PSA concentrations of 354 men with LUTS by age group.

than 10 ng/ml have over than 60 percent predictive risk for prostate cancer. Still PSA is not a cancer specific serum marker, and various physiologic and benign pathologic processes have effect on the serum PSA concentration [10].

Many studies were done to detect causes of elevation of PSA level in serum. It occurs due to disruption of prostatic architecture. It increases mainly in adenocarcinoma of the prostate and benign prostatic hyperplasia [11]. Other than prostate cancer and BPH, studies were done to detect other causes for the rise of serum PSA level, either due to causes related to the prostate (eg. Prostatitis, Ejaculation, urine retention) or related to the investigations or manipulations done to the patients that may alter the level of PSA in these patients. (e.g. cysytoscopy, uretheral catheterization, Transurethral resection of the prostate (TURP), DRE & TRUS). In our study, we excluded patients with any cause of rise of PSA level mentioned before that may affect our study.

In BPH patients, relationship between PSA to age, prostate size is documented through several studies [6-9]. These studies consistently showed a positive correlation between PSA level and prostate size. Our results revealed also that there was significant correlation between the age of the 100 patients and their serum PSA level (r= 0.310, p= 0.002). The serum level of PSA increases with the patients' age. This significant correlation between the age of the patients and their serum PSA level was proved before by many studies. Also our study showed that there was significant correlation between PSA and prostate volume (r= 0.320, p= 0.001). The level of serum PSA increased with the increase in prostate volume. Many studies showed significant correlation between PSA and prostate volume. S. Vesely et al. (2003) also studied 354 men with LUTS due to BPH. Prostate volume correlated positively with serum PSA (r=0.54, p<0.0001) [12]. Yet, in our study, we were not mainly concerned about PSA relationships to Age and Prostate size, but we were concerned about the relationship between serum PSA level and Qmax of uroflowmetry, volume of residual urine.

As for the correlation between serum PSA and Qmax of uroflowmetry, we wondered that obstruction of urine flow lead to straining; this can be detected by performing uroflowmetry and be seen in the Qmax and pattern of flow. This straining may increase pressure in prostatic uretheral due to resistance which can cause compression on the prostatic gland and acini leading to disruption of cells or just more release of PSA to the blood stream leading to increase in serum level of PSA. So we were concerned to proof or disproof that rises of PSA may also be due to obstructed flow of urine.

Our data results revealed that the correlation between serum PSA level and maximum flow rate of uroflowmetry was of no statistical significance (r= -0.100, p= 0.320). Compared to other studies, the relationship between serum PSA level and uroflowmetry was studied by S. Vesely et al. in 2003 who found significant correlation between PSA level and uroflowmetry ($r = -0.29$, $p < 0.0001$) as shown in (Figure 2) [12]. However further studies are needed to confirm any relationship between serum PSA level and uroflowmetry parameters.

On the other hand, our study showed that there was significant correlation between the volume of residual urine and serum PSA value (r= 0.254, p= 0.014). Up to our knowledge the correlation between residual urine and PSA is not well investigated in literature. In our study this positive correlation may be explained by the high incidence of large residual urine with increase of prostate volume (r= 0.494, p= 0.000).

Conclusion

To sum up, In BPH patients with lower urinary tract symptoms, there was a significant relation between the serum PSA level and volume of post voiding residual urine, while there was no significant relation between the serum PSA level and Qmax of uroflowmetry. Further studies may be needed to confirm these results.

Other documented positive relationships between serum PSA and both age of patients and prostate size, were confirmed in our study.

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