



Original Article

Can sonographic prostate volume predicts prostate specific antigen(PSA)levels in blood among non prostatic carcinoma patients ?

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ABSTRACT

Prostatic diseases are common among aging men causing significant morbidity. Benign Prostatic Hyperplasia begins before 30 years and approximately 8% of men have histological evidence of benign prostatic hyperplasia by 40 years, 50% by 60 years and 90% by 90 years of age. Prostate enlargement can cause "lower urinary tract symptoms", which tend to interfere with quality of life. This study was to correlate and establish relation among sonologically measured prostate Volume and Prostate Specific Antigen (PSA) levels in blood. Total of 115 individuals in the age group of 43- 87 years (mean age of 65.71 years) with lower urinary tract symptoms underwent transabdominal sonography for the estimation of prostate volume and prostate specific antigen levels in blood. Among 115 individuals, 35 patients (30.4%) had prostate volume 20 – 30 cc, followed by 24 patients (20.9 %) had the volume more than 50 cc. The PSA mean value was 2.2 + 1.89 ng/ml. There was significant correlation of prostate volume with Blood PSA ($r = 0.415$, 'P' < 0.0001). but there was no correlation of age with prostate volume ($r = 0.145$, 'P' > 0.05). To conclude there was moderate but statistically significant correlation of prostate volume with blood PSA in non-prostatic carcinoma patients. Blood PSA can be fairly predicted by assessing the prostate volume among non prostatic carcinoma patients.

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1. Introduction

Prostatic diseases are common among aging men causing significant morbidity. Benign Prostatic Hyperplasia begins before 30 years and approximately 8% of men have histological evidence of benign prostatic hyperplasia by 40 years, 50% by 60 years and 90% by 90 years of age [1] prostate enlargement can cause "lower urinary tract symptoms", which tend to interfere with quality of life [2].

The prostate volume estimation by ultrasonography is simple and basic investigation to be performed before any clinical decision is taken in the management of the prostatic pathologies. The transabdominal sonography is noninvasive; it requires no preparation except natural bladder filling, provides accurate estimation of prostate size, gives additional information that is intravesical growth of the prostate, amount of post void residue and presence of bladder abnormalities such as diverticula, status of

the kidneys and upper urinary tract. Transabdominal sonography is quick, cost effective and also allow clear separation of patients who require an open operation for relief of bladder neck obstruction [3].

The clinical application of Sonological measurement of the prostatic volume and postvoid residual urine volume is in the evaluation of patients with lower urinary tract symptoms including bladder outlet obstruction, acute urinary retention, obstructive uropathy and its complications.

This study is to correlate and establish relation among sonologically measured prostate Volume and Prostate Specific Antigen (PSA) levels in blood.

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2. Methods & Materials

Sample Size -115 clinically symptomatic patients.

2.1. Prostate Specific Antigen Levels In Blood

The quantitative measurement of prostate specific antigen levels in serum is done by Solid phase chemiluminescent immunometric assay using IMMULITE 1000 PSA KIT. The samples of blood were obtained before the patient undergoes digital rectal examination, urinary catheterization, biopsy, prostatectomy or prostatic massage, since manipulation of the prostate gland may lead to elevated PSA levels which may persist for up to 3 weeks[4].

2.2. Ultrasonography

The equipment used for the study are Wipro GE-logiq 500 pro -curvilinear probe 3.5- 5 MHz and Siemens Sonoline G 50 USA Inc- curvilinear probe 3.5- 5 MHz.

The prostate gland was evaluated transabdominally after adequate bladder distension. The prostate gland assessed for volume, echotexture, morphology, focal lesions and median lobe. The prostate volume was calculated by using Prolate ellipsoid formula Anteroposterior Transverse x Cranio-caudal x 0.52. Transabdominal ultrasound (TAUS) preferred over transrectal ultrasound (TRUS) examination since Transrectal ultrasonography is invasive compared to TAUS and some patients reject repeated administration of TRUS. In addition TRUS is sometimes difficult to perform without anesthesia particularly in patients who have a very narrow anal ring[5]. The grading of the prostate gland enlargement was done as follows[6] Grade - I 21 - 30 cc. Grade - II - 31 - 50 cc Grade - III - 51 - 80 cc and Grade - IV - 80 and above. The median lobe enlargement was measured separately by obtaining both in longitudinal and transverse planes. The median lobe volume was added to the total prostatic gland volume. The urinary bladder was scanned for assessment of prevoid urine volume, wall thickness, mucosal regularity, calculi, diverticuli and post void assessment for the residual urine. The kidneys and ureters were also scanned for the pathology.

2.3. Study Design

This study was prospective collection of data and analyses involving 115 individuals come to the hospital with lower urinary tract symptoms. The study carried out over the duration of 20 months from October 2007 to May 2009. The study was approved by Institute Ethical Committee and procedures followed in this study are in accordance with the ethical standard laid down by ICMR's ethical guidelines for biomedical research on human subjects (2006). A written informed consent was obtained from all the patients who participated in the study after explaining the patient's diagnosis, the nature and purpose of the study.

2.4. Collection of data:

A total of 115 individuals in the age group of 43-87 years (mean age of 65.71 years) with lower urinary tract symptoms underwent Transabdominal sonography for the estimation of prostate volume and laboratory investigation for prostate specific antigen levels in blood apart from other routine blood and urine investigations. The patients with prostatic carcinoma, serum Prostate Specific Antigen levels above 10 ng / ml and who have undergone previous prostatic surgery were excluded from the study.

2.5. Statistical Analysis

The statistical calculation performed using the Student's t-test and Pearson's correlation coefficient with statistical software statistical package of social sciences (SPSS, V 10.5) package. The 'P' value less than 0.05 was considered statistically significant. One way analyses of variance were used to test the difference between groups. Analysis of variance is a technique by which the total variance is split into two parts one between groups and the other within the groups. If 'F' value is significant there is a significant difference between group means. The formula used as follows. Comparison of two variance S_a^2 and S_b^2 , estimated for two group N_a and N_b subjects respectively. Uses F test $F = S_a^2 / S_b^2$ with $N_a - 1$ and $N_b - 1$ degree of freedom.

3. Results

The patients in this study were in the age group ranging from 43 to 87 years with the mean age of 65.71 years. The maximum number of patients were in the seventh decade constituting 34.8 % followed by 33.0 % of patients in eighth decade. The maximum number of patients had the prostate volume measuring 20 - 30 cc (30.4% of patients). followed by 20.9 % of patients had the volume measuring more than 50 cc. The lowest prostate volume was 10 cc and the largest prostate was 130 cc, mean being 37.04 cc +18.81. [TABLE-1] There was significant correlation of prostate volume with Blood PSA ($r = 0.415$) 'p' value of <0.0001 [TABLE-2]. There was no correlation of prostate volume with age ($r = 0.145$) 'p' value of >0.05 . There was weak correlation between age and PSA ($r = 0.189$) 'p' value of <0.05 . The PSA values were ranging from 0.04 to 9.5 ng /ml. with a mean value of $2.2 + 1.89$ ng / ml. 98 Patients (85.2%) had the PSA volume less than 4 ng/ml. where as only 17 patients were had PSA more than 4 ng / ml. There was weak but statistically significant correlation between age and PSA ($r = 0.189$) 'p' value of <0.05 [TABLE-3]. We can predict age adjusted blood PSA level depending on the transabdominal ultrasound estimated prostate volume.

Table : 1. Distribution of prostate volume and psa according to age(n=115)

	Age	N	Mean	Std. Deviation	Min	Max	'F' Value	'P' aValue
Prostate Volume in cc	40-49 yrs	04	26.50	09.11	15	36	1.339	0.260
	50-59 yrs	28	33.36	16.86	10	81		
	60-69 yrs	40	39.17	19.31	16	130		
	70-79 yrs	38	36.89	17.94	10	83		
	80-89 yrs	05	50.20	32.03	12	91		
PSA levels in blood in ng/ml	40-49 yrs	04	2.9150	4.4258	0.20	9.50	1.896	0.116
	50-59 yrs	28	1.6024	1.2868	0.04	4.91		
	60-69 yrs	40	2.0153	1.7426	0.15	7.00		
	70-79 yrs	38	2.7542	1.9955	0.12	7.80		
	80-89 yrs	05	2.7320	1.8939	0.72	5.24		

PSA: prostate-specific antigen, a: $p < 0.05$, cc: cubic centimeter, ng /ml- nanogram/milli liter.

Table : 2. Increasing Prostate Volume As The Psa Increases(n=115)

PSA level	N	Mean Prostate Volume in cc	Std. Deviation	Min	Max	'F' Value	'P' Value
<25th Percentile	28	27.89	12.49	10	65	14.218	.000
25th to 75th Percentile	59	34.73	15.39	10	81		
>75th Percentile	28	51.07	22.96	22	130		

PSA: prostate-specific antigen, a: $p < 0.05$, cc: cubic centimeter

Table : 3. Correlation of prostatic volume with prostate specific antigen(n=115):

	Prostate Volume in CC	PSA levels in blood
Age	Pearson Correlation	.145
	'p' value	.189
	N	115
Prostate Volume in CC	Pearson Correlation	.145
	'p' value	.189
	N	115

PSA: prostate-specific antigen, a: $p < 0.05$, cc: cubic centimeter

4. Discussion

In our study among 115 patients, maximum number of patients had the prostate volume measuring 20 –30 cc, observed in 35 patients (30.4%). followed by 24 patients (20.9 %) who had the prostate volume of more than 50 cc. The lowest prostate volume was 10 cc and the maximum prostate volume was 130 cc, mean being 37.04 cc +18.81. A study by Collins et. al.[7] of 1627 patients on pattern of prostate enlargement in benign prostatic hyperplasia also showed the maximum number of patients having the prostate volume ranging between 20 to 30 cc. A study by Babaian et. al [8] showed 65.6% of the patients had the prostate volume between 25 to 50 cc and 35.5% of the patients had prostate

volume more than 50 cc. Our study is comparable to both of the above studies but in our study patients with 20 to 50 cc prostate volume constituted 79.1% which is higher than the Babaian et al. study. The size of the prostate is important because the Scandinavian Reduction of the Prostate Study (SCARP), the Proscar Safety Plus Efficacy Canadian Trial (PROSPECT), and the Proscar Worldwide Efficacy and Safety Study (PROWESS)—showed that men with larger prostate glands have an increased risk of developing AUR[9,10]. The grading of prostatomegaly varies widely among various studies. The size of the prostate is very important because it helps in the decision making. Depending on the baseline size of the prostate the urologist will decide where the patient require transurethral or open prostatectomy in asymptomatic patients. More than 70 –80 cc size of the prostate the supra pubic prostatectomy is easy to perform without much complications. In our study PSA values ranged from 0.04 to 9.5 ng /ml. with a mean value of 2.2 + 1.89 ng / ml. 98 Patients (85.2%) had the PSA volume less than 4 ng/ml. where as only 17 patients had PSA more than 4 ng / ml. The exact cutoff value for an abnormal PS A remains controversial. Generally a serum value of less than 4.0 ng / ml is accepted as normal. Between 4 to 10 ng / ml PSA value can be due to Benign prostatic hyperplasia. In our study when the patients PSA value more than 4 ng/ml and abnormal digital rectal examination in the form of firm consistency of the prostate, they underwent prostatic biopsy to rule out malignancy.

Roehrborn and colleagues analyzed placebo-controlled multicenter trials of patients with BPH and a safety study in normal young men to determine the relationship between

baseline measurements of serum PSA and prostate volume determined that serum PSA and prostate volume have an age-dependent log-linear relationship [11]. The investigators determined that PSA had a good predictive value for assessing prostate volume and were able to develop a prostate volume prediction model given a patient's serum PSA level and age [12]. Our study also agrees with Roehrborn et al and Matthew B Gretzer et al.

Clinical trial data further confirm the utility of PSA level in determining risk of BPH progression. Strong evidence exists showing that baseline serum PSA level, like baseline prostate volume, predicts future prostate growth[13,14].The results of the current study agree with all previous studies.

Roehrborn and colleagues analyzed prostate volume changes over time in the placebo group of this large long-term study and determined that both baseline prostate volume and PSA level were excellent predictors of future prostate growth. This prediction of prostate growth suggests that baseline prostate volume and PSA level may also have utility in predicting clinical parameters of progression[15].

5. Conclusion

There is moderate but statistically significant correlation of prostate volume with blood Prostate Specific Antigen in non prostatic carcinoma patients. There is weak but statistically significant correlation between age and PSA. There is no correlation of prostate volume with age. Increase in the blood PSA value can be predicted by transabdominal ultrasound prostate volume in Non-prostatic carcinoma patients. Prostate volume may be used as a surrogate for PSA levels in blood.

6. Acknowledgement

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7. References

- [1] Gary D. Fergus V. Benign Prostatic Hyperplasia: Clinical Overview and value of Diagnostic Imaging. The Radiological clinics of North America, Prostate gland, 2000; 38(1):31-47
- [2] Haltbakk J, Hanestad B. R, Hunskaar S, How Important are Mens Lower Urinary Tract Symptoms (LUTS) And Their Impact On The Quality Of Life (QOL)? Quality of life research 2005; 14(7), 1733-1741
- [3] Garcia Navas R, Sanz Mayayo E, Arias Funez F. Diagnosis and follow-up of benign prostatic hyperplasia by ultrasound. Arch Esp Urol. 2006; 59:353-60
- [4] Robert L. Vessella, Paul H. Lange, Issues in the assessment of PSA Immunoassays. The Urologic Clinics of North America: 1993; 20:04 607-619.
- [5] Kobayashi T, Kawahara T, Nishizawa K, Ogura K, Mitsumori K, Ide Y. Value of prostate volume measurement using transabdominal ultrasonography for the improvement of prostate-specific antigen-based cancer detection Int J Urol. 2005; 12(10):881-5.
- [6] Aguirre et al. Evaluation and comparison of prostate volume with open prostatectomy surgical specimen. J. Urol. 1980; 86:675-79
- [7] Collins GN, Lee RJ, McKelvie GB, Rogers AC, Hehir M., Relationship between Prostate specific antigen, prostate volume and age in Benign Prostatic Hyperplasia. BJU Int. 1993; 71:445-454.
- [8] Babaian RJ, Fritsche HA, Evans RB. Prostate-specific antigen and prostate gland volume: Correlation and clinical application. Journal of Clinical Laboratory Analysis; 1990; 4(2):135-137.
- [9] J. Curtis Nicke. Benign Prostatic Hyperplasia: Does Prostate Size Matter? Rev Urol. 2003; 5(4):S12-S17.
- [10] Matthew B Gretzer, Alan W Partin. PSA Levels and the Probability of Prostate Cancer on Biopsy. European urology. 2002; 1(6):21-27
- [11] Roehrborn CG, Boyle P, Gould AL, et al. Serum prostate-specific antigen as a predictor of prostate volume in men with benign prostatic hyperplasia. Urology. 1999; 53:581-589
- [12] Bob Djavan. Treatment of Symptomatic Benign Prostatic Hyperplasia: Current and Future Clinical Practice in Europe - What is Really Happening? European urology. 2007; 6(6):446-453.
- [13] Roehrborn CG, McConnell J, Bonilla J, et al. Serum prostate-specific antigen is a strong predictor of future prostate growth in men with benign prostatic hyperplasia: Proscar Long-Term Efficacy and Safety Study. J Urol. 2000; 163:13-20
- [14] Marberger MJ, Andersen JT, Nickel JC, et al. Prostate volume and serum prostate-specific antigen as predictors of acute urinary retention: combined experience from three large multinational placebo-controlled trials. Eur Urol. 2000; 38:563-568
- [15] Roehrborn CG, McConnell J, Jacobs S, et al. Baseline prostate volume and serum PSA Predictors of prostate growth: analysis of the MTOPS data. J Urol. 2003; 4:364.