

Evaluation of the relationship between prostate volume and prostate specific antigen in patients diagnosed with benign prostatic hyperplasia

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ABSTRACT

Aims: The aim of this study was to investigate the relationship between prostate volume and prostate specific antigen (PSA) levels in patients diagnosed with benign prostatic hyperplasia (BPH). In addition, it is aimed to show that BPH may be one of the causes of PSA elevation in patients without prostate cancer.

Methods: Prostate volume was calculated in 60 BPH patients who underwent prostate magnetic resonance imaging (MRI) imaging in radiology department between December 1, 2023 and March 1, 2024 due to elevated PSA. The relationship between prostate volume and the total prostate specific antigen and FPSA values of the patients in the last month was evaluated.

Results: There was a positive correlation between age and TPSA and in patients with benign prostatic hyperplasia. However, the correlation between age and FPSA was stronger. Similarly, a positive correlation was found between prostate volume and TPSA and FPSA. The correlation between increased prostate volume and increased FPSA was also stronger.

Conclusion: In our study, a positive correlation was found between prostate volume and TPSA and FPSA in patients diagnosed with BPH. It was determined that one of the reasons for the increase in PSA values may be the increase in prostate volume.

Keywords: Benign prostatic hyperplasia, prostate specific antigen, prostate volume, magnetic resonance

INTRODUCTION

Benign prostatic hyperplasia (BPH) is a regional nodular growth affecting the transitional zone of the prostate gland. It is a common benign neoplastic condition affecting men. BPH accounts for 83% of prostate neoplasia cases. Several studies have reported that BPH is the most common prostate lesion, accounting for 63% to 83% of prostate diseases.¹⁻³ Studies have found evidence of prostatic hyperplasia in more than 80% of autopsies performed in men over 70 years of age. However, symptoms compatible with the disease were observed in 40% of men aged 50-64 years.⁴

Affected men and these symptoms are referred to as lower urinary tract symptoms (LUTS). BPH clinically results in LUTS and the cumulative risk for developing acute urinary retention increases with age.⁵ Not all men with enlarged prostate have these symptoms. Only one in every ten men over 50 years of age has LUTS due to BPH.⁶

Prostate magnetic resonance imaging (MRI) and prostate specific antigen (PSA) measurement are widely used as screening tools to rule out prostate adenocarcinoma.⁶

PSA is a serine protease produced almost exclusively by epithelial cells of the prostate gland, and the normal total PSA (TPSA) level in cases of BPH is between 0 and 4 ng/ml.⁷

Serum PSA is thought to correlate well with prostate volume and it has also been suggested that high PSA levels predict BPH progression. It has been suggested that prostate volume is an important determinant of BPH progression and response to pharmacotherapy, which has become the mainstay of first-line treatment. A correlation has been found between TPSA level and prostate volume in men with histologically proven BPH, but the correlation between free PSA and prostate volume is stronger.⁸ In a study conducted in Saudi Arabia in



men with a mean age of 64.2 years, prostate volume of 35.2 ml and TPSA of 2.2 ng/ml, a significant correlation was found between prostate volume and PSA.⁹ In Jos, Nigeria, Udeh and colleagues studied 120 men with histologically proven BPH. In patients with a mean age of 65 years, prostate volume of 72.79 ml and TPSA of 12.44 ng/ml, a correlation was found between prostate volume and TPSA.¹⁰

The aim of this study was to investigate the relationship between prostate volume and PSA levels in patients diagnosed with BPH. In addition, it is aimed to show that BPH may be one of the causes of PSA elevation in patients without prostate cancer.

METHODS

This study was planned as a retrospective observational study in 60 patients with BPH who underwent prostate MR imaging due to elevated PSA in the radiology department between December 1, 2023 and March 1, 2024. This study was approved (Date: 26.03.2024, Decision No: 2024/191) by the local ethics committee of Selçuk University Faculty of Medicine. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

The patients included in the study were imaged with an MR device with a magnetic power of 1.5 T in the radiology department of our hospital. In T2A images obtained in axial and coronal planes, a slice thickness of 3 mm was obtained without slice skipping and TE: 100 ms, TR: 6000 ms; voxel size: 3.0x3.0x3.0 mm; matrix 256x224; flip angle: variable; FOV: 200 mm. Isotropic images with high resolution were reconstructed in multiple plans and evaluated. Prostate volume was calculated from the prostate MR images of the patients by first determining the prostate borders and then using the volume calculation software (Figure).

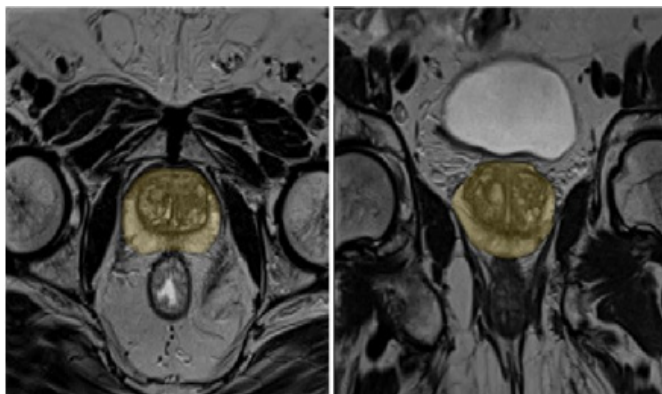


Figure: Prostate volume was calculate from axial and coronal MR images

At the same time, free prostate specific antigen(FPSA) and(TPSA) values of the patients in the last month were collected using the hospital database. Patients receiving prostate volume reduction therapy (5 alpha reductase inhibitors), patients with acute prostatitis and patients with histologically diagnosed prostate cancer were excluded from this study.

Pearson correlation test was used to analyze whether there was any correlation between prostate volume, patient age, FPSA and TPSA. Analyses were conducted using the

Statistical Package for Social Sciences (SPSS) v.26.0 program. The results were evaluated at 95% confidence interval and significance was evaluated at $p < 0.05$ level.

RESULTS

The prostates of a total of 60 BPH patients who underwent prostate MR imaging were evaluated. The mean age was 63.2 years and mean prostate volume was 70.7 ml (Table 1).

Table 1. Demographics of the patients.

	Mean	Std. Deviation	N
Prostate volume (mL)	70.7	30.4	60
Age	63.2	7.8	60
TPSA (ng/ml)	6.6	2.2	60
FPSA (ng/ml)	1.6	0.9	60

There was a positive correlation between age and TPSA and FPSA in patients with benign prostatic hyperplasia. However, the correlation between age and FPSA was stronger. Similarly, a positive correlation was found between prostate volume and TPSA and FPSA. The correlation between increased prostate volume and increased FPSA was also stronger (Table 2).

Table 2. Correlation between proostate volume and PSA values

	Prostate Volume	TPSA	FPSA	Age
Prostate Volume	1	.302**	.388**	0.204
		0,01	0,001	0,059
TPSA	.302**	1	.622**	.223*
	0,01		0	0.044
FPSA	.388**	.622**	1	.368**
	0.001	0		0.002
Age	0.204	.223*	.368**	1
	0.059	0.044	0.002	

** Correlation is significant at the 0.01 level (1-tailed).
* Correlation is significant at the 0.05 level (1-tailed).
PSA: Prostat specific antigen
TPSA: Total prostate specific antigen
FPSA: Free prostate specific antigen

DISCUSSION

This study investigated the relationship between prostate volume and TPSA and FPSA in patients with BPH. A positive correlation was found between the increase in prostate volume and the increase in TPSA and FPSA. In addition, a positive correlation was also found between age and TPSA and FPSA. Both age and prostate volume correlated more strongly with FPSA than TPSA.

Mao Q. et al.⁸ investigated the relationship between prostate volume and TPSA and FPSA in 268 patients. They found no significant relationship between age and TPSA and FPSA in patients with a mean age of 67 years and a mean prostate volume of 42 ml. However, they found a significant relationship between prostate volume and FPSA and TPSA. They also found that the relationship between prostate volume and FPSA was stronger. The relationship between prostate volume and FPSA was also investigated by dividing the patients into 4 groups according to their ages: <60, 60-69, 70-79 and >80. In patients <60 years of age, the correlation between prostate volume and FPSA was found to be stronger. Similarly,

a significant correlation was found between prostate volume and TPSA and FPSA in our study.

Contrary to Mao Q. et al.⁸ also found a positive correlation between age and TPSA and FPSA in our study. This result was thought to be due to the difference between the age and prostate volume of the patients in the two studies.

Mosli H. et al.⁹ investigated the relationship between prostate volume and TPSA in 447 BPH patients with a mean age of 67.2 years and a mean prostate volume of 35.2 ml. The mean TPSA value was 2.2 ng/ml and a positive correlation was found with prostate volume.

However, no significant correlation was found between age and PSA values. In our study, a positive correlation was found between prostate volume and PSA values similar to Mosli H. et al.⁹ However, in contrast to this study, a positive correlation was also found between age and PSA values in our study. Since our study included patients who underwent prostate MRI due to elevated PSA, the mean TPSA values were found to be different in the two studies.

Aigbe E. et al.¹¹ investigated the relationship between prostate volume and TPSA and FPSA in 80 patients with BPH. The mean age of the patients was 68 years, mean prostate volume was 88 ml, mean TPSA was 5.5 ng/ml and mean FPSA was 2.1 ng/ml. They also found a moderate positive correlation between prostate volume and TPSA and FPSA. In our study, a positive correlation was found between prostate volume and PSA values similar to Aigbe E. et al.¹¹ The difference in mean prostate volume was thought to be due to the difference in the measurement method and the population in which the study was conducted.

Limitations

The first limitation of our study is the small number of patients. The second limitation is that the patient group was selected from patients presenting with elevated PSA and therefore patients with BPH with normal PSA values were not evaluated.

CONCLUSION

In our study, a positive correlation was found between prostate volume and TPSA and FPSA in patients diagnosed with BPH. It was determined that one of the reasons for the increase in PSA values may be the increase in prostate volume. It is thought that BPH should be kept in mind in the differential diagnosis along with malignancy in patients presenting with elevated PSA.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of Ethics Committee of Selçuk University Faculty of Medicine (Date: 26.03.2024, Decision No: 2024/191).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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