

Correlation Between Serum Prostatic Specific Antigen and Prostatic Volume in Prostatic Hyperplasia

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ABSTRACT

Background

Prostate specific antigen (PSA) is a serine protease produced by the prostate epithelium and per urethral glands in male. Serum PSA elevation occurs as a result of disruption of normal prostatic architecture that allows PSA to diffuse into prostatic tissue and gain access to the circulation. Prostatic hyperplasia is a progressive condition characterized by prostate enlargement accompanied by lower urinary tract symptoms (LUTS).

Methods

The objective is to investigate the correlation between serum PSA levels and trans abdominal USG prostate volume in clinically diagnosed cases with prostatic hyperplasia. This is a hospital based study conducted in the Department of Radiology and Medicine at Bharatpur Hospital. All cases diagnosed clinically underwent USG by radiologist and serum PSA estimation was done in the lab by Elisa method. 150 cases were studied.

Results

Age of 51-60 years with a percentage of 29.30%, consisted of 67 patients with a volume of 20.00-39.99 cc (44.7%), 87 patients with PSA levels of <2.6 ng/mL (58.0%), prostate volume is 20.00-> 80 cc at the age of 51-60 years, PSA levels <2.6->20 ng / mL at the age of 51-60 years and value of $p = 0,000$ ($p < 0.05$) and the value of $r = 107.57$, implying that prostate volume and PSA levels has a significant and strong correlation.

Conclusions

There is a significant association between prostate volume and PSA levels in BPH patients in our study, with $p = 0,000$ and $r = 107.59$ showing a strong positive correlation.

Keywords: BPH; prostate specific antigen; prostate volume.

INTRODUCTION

Prostate specific antigen (PSA) is a serine protease produced by the prostate epithelium and per urethral glands in male. Serum PSA elevation occurs as a result of disruption of normal prostatic architecture that allows PSA to diffuse into prostatic tissue and gain access to the circulation. Prostatic hyperplasia is a progressive condition characterized by prostate enlargement accompanied by lower urinary tract

symptoms (LUTS).¹ Benign prostatic hyperplasia is characterized by prostate enlargement with lower urinary tract symptoms. An estimated 75% of men >50 years of age have symptoms arising from BPH, 20–30% reaching 80 years of age require surgical management¹. Benign prostatic hyperplasia, prostatic carcinoma and prostatitis are common diseases with increased PSA.² Normally serum PSA are proportional to the volume of prostatic epithelium, but the release

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of PSA from BPH is 3-4 fold that of normal prostate while in carcinoma of prostate it is thirty fold. PSA is elevated approximately 0.12ng/ml/g of BPH tissue.³⁻⁴ The ratio of PSA to gland volume is termed as PSA density⁵. PSA levels associated with a small prostate may have prostate cancer while the same value of PSA in a man with a large prostate may indicate BPH. PSAD greater than 0.15 is associated with 25% incidence of cancer.⁵ Transabdominal ultrasound for prostatic protrusion should be carried out at bladder volumes below 200 ml.⁶

METHODS

A hospital based cross sectional study was conducted in the Department of Medicine and Radiology at Bharatpur Hospital, Bharatpur from September to November 2023 with ethical approval (079/80-002). Patients were chosen for the study on the basis of clinical history and LUT. Patient with LUTS symptoms were further subjected to PSA screening and Transabdominal ultrasound for measuring prostatic volume. Patients were explained about procedure and following consent. Inclusion criteria for the sample are the medical record data of patients who have been diagnosed BPH clinically by a urology specialist, the medical record data of BPH patients who have performed a supporting ultrasound examination, and PSA laboratory tests through blood serum. Exclusion criteria of the study were medical records of BPH patients with other urinary tract diseases, medical records of BPH patients with prostatitis, medical records of BPH patients with trauma, medical records of patients with clinical, laboratory, and sonographic data likely to lead to prostate cancer and medical records of BPH patients who have undergone prior BPH surgery. Blood sample was drawn before prostatic manipulation, waited at least for 24 hrs. 5 ml of venous blood was collected in blood collecting tube. Standing at room temperature, centrifuging, separating serum a part. PSA was estimated by chemi luminescence immunosorbent assay (CLIA), a solid phase two-site immunoassay. Transabdominal ultrasound was used to measure prostatic volume at Radiology Department. Patients with minimal

bladder volume of 100 to 200 ml were subjected to USG for near correct estimation of prostate volume by USG.⁸ Prostatic volume was measured using ellipsoid formula. Ellipsoid formula (V) = length x height x width x 0.52. (V = volume of prostate). PSAD was then calculated by PSA (ng/ml) divided by prostatic volume (ml).⁷

RESULTS

The mean age of BPH patients is 64.27 with a standard deviation of 13.89, the age of prostate enlargement is mainly at the age of 51-60 years with a percentage of 29.30%, followed by the age of 71- 80 years with a percentage of 24.0%, (Figure 1).

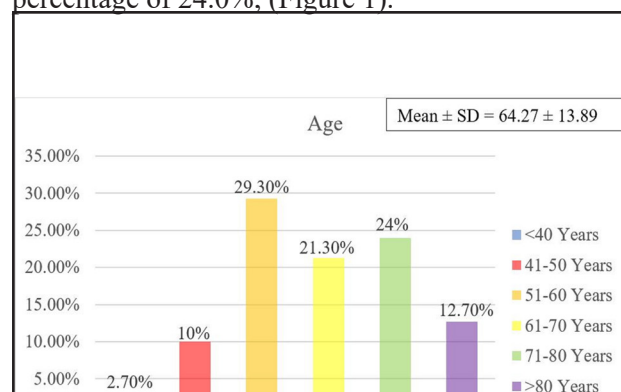


Figure 1. Distribution of BPH Patient based Age Group.

The mean (SD) of prostate volume in BPH patients was 39.07 cc (19.94). The distribution of prostate volume data of 150 patients, consisted of 67 patients with a volume of 20.00-39.99 cc (44.7%), 38 patients with a volume of 40.00-59.99 cc (25.3%) (Figure 2).

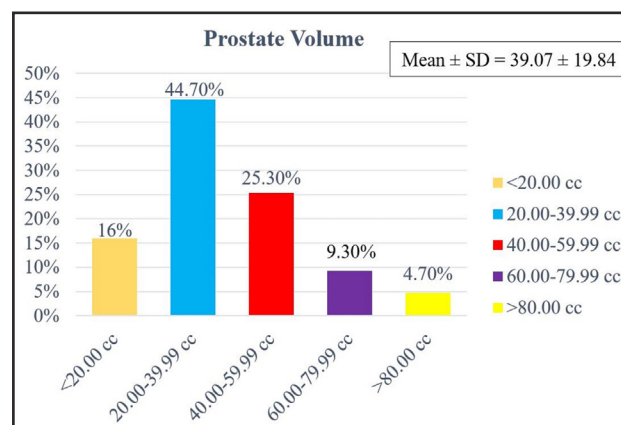


Figure 2. Distribution of BPH patient based on Prostate Volume.

PSA levels results of BPH patients showing an average level of 7.67 ng/mL and a standard deviation of 19.78 with a total of 150 subjects. The distribution of PSA levels of BPH patients based on presented 87 patients with PSA levels of <2.6 ng/mL (58.0%), followed by PSA levels of 2.6-9.9 ng/mL, 20.0 ng/mL of 45 Patient (30.0%), 13 patients with PSA level of >20 ng/mL (8.70%) and 5 patients with PSA level of 10-19.9 ng/mL (3.30%) (Figure 3).

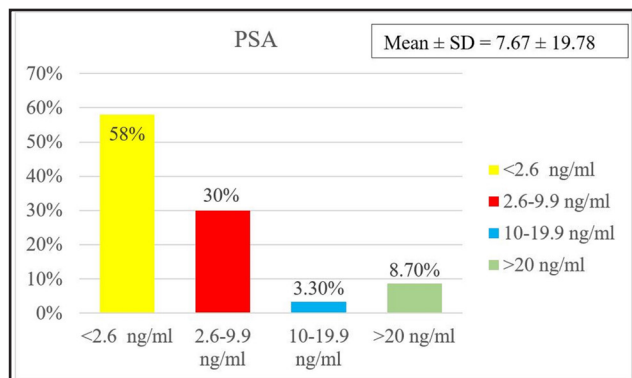


Figure 3. Distribution of BPH Patients based on PSA Level.

Proportion of prostate volume distribution by age shows that the most age obtained in prostate volume is 20.00-> 80 cc at the age of 51-60 years. This study shows the value of $p = 0,001$ ($p<0.05$) and the chi-square value of $r = 46.248$, implying that prostate volume and age has a significant and strong correlation (Figure 4).

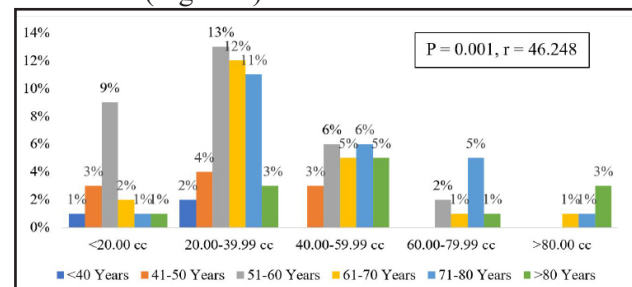


Figure 4. Distribution of Prostate Volume Based on Age.

Proportion of distribution of PSA levels by age (Figure 5) shows that the most age obtained at PSA levels <2.6->20 ng / mL is at the age of 51-60 years. This study shows the value of $p = 0,001$ ($p<0.05$) and the chi-square value of $r = 36.736$, implying that t prostate volume and age has a significant and strong correlation.

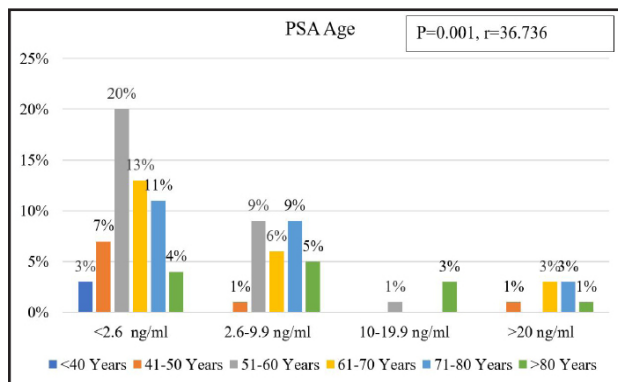


Figure 5. Distribution of PSA Levels Based on Age.

This study shows the value of $p = 0,000$ ($p<0.05$) and the value of $r = 107.57$, implying that t prostate volume and PSA levels has a significant and strong correlation (Figure 6).

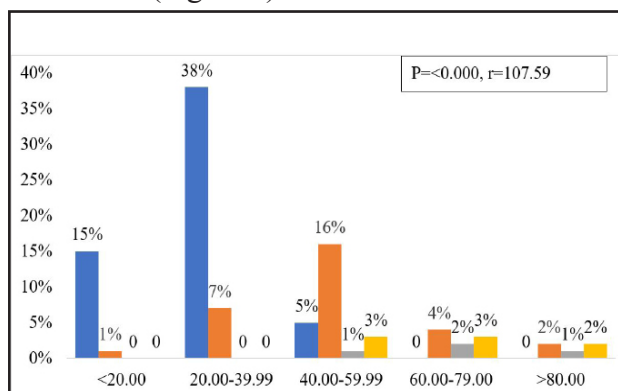


Figure 6. Correlations of Prostate Volume with PSA Levels

DISCUSSION

This study shows that, the age of prostate enlargement is mainly at the age of 51-60 years with a percentage of 29.30%, followed by the age of 71- 80 years with a percentage of 24.0%, aged 61- 70 years with a percentage of 21.30%, aged >80 years with a percentage of 12.70%, aged 41-50 years with a percentage of 10.0% and at the age of <40 years with a percentage of 2.70%. This is comparable to the research by Adelia et al. (2014-2017) at RSUP Prof. Dr. R. D. Kandou Manado with the most BPH patients at the age of 61-70 years with the percentage of 46.15% and the smallest percentage is the age of 41- 50 years with a percentage of 5.13%.⁷ This result is also similar to the research by Kresnoadi E, et al. (2017) at RS Bhayangkara Mataram that the highest BPH incidence rate was at 64 years old.⁸ Prostate

enlargement generally occurs due to hyperplasia. Microscopic pathological hyperplasia occurs at the age of 30-40 years, followed by macroscopic pathological hyperplasia at the age of 40-50 years, and hyperplasia with clinical symptoms at the age after 50 years.⁹ This study shows that, the distribution of prostate volume data of 150 patients, consisted of 67 patients with a volume of 20.00-39.99 cc (44.7%), 38 patients with a volume of 40.00-59.99 cc (25.3%), 24 patients with a volume of <20.00 cc (16.0%), 14 patients with a volume of 60.00-79.00 cc (9.3%) and 7 patients with a volume of >80.00 cc (4.7%). This is comparable to the research by Kresnodi E, et al. (2017) showing the distribution of prostate volume data of 52 patients, consisted of 16 patients with a volume of 20.00-39.99 cc (30.7%), 14 patients with a volume of 40.00-59.99 (26.9%), 12 patients with a volume of >80.00 cc (23.2%), and 10 patients with a volume of 60.00-79.99 cc (19.2%).⁷ This results also are similar to the studies conducted by Udeh EI, et al. (2015) where there is a correlation between prostate volume and PSA levels. Measurement of prostate volume is determined by conducting transabdominal and transrectal ultrasound as a diagnosis for BPH.¹⁰ This study shows that distribution of PSA levels of BPH patients based on presented 87 patients with PSA levels of <2.6 ng/mL (58.0%), followed by PSA levels of 2.6-9.9 ng/mL 20.0 ng/mL of 45 Patient (30.0%), 13 patients with PSA level of >20 ng/mL (8.70%) and 5 patients with PSA level of 10-19.9 ng/mL (3.30%). This is comparable to the research by Levisia, NRC. et al. (2021) The distribution of PSA levels of BPH patients at Ulin General Hospital Banjarmasin based on presented 24 patients with PSA levels of 2.6-9.9 ng/mL (46.2%), followed by PSA levels <2.6 ng/nL of 21 patients (40.4%), 4 patients with PSA

levels of 10-19.9 ng/mL (7.6%), and 3 patients with PSA level of >20.0 ng/mL (5.8%).¹¹ This result is comparable to research by Ventura M, et al. (2003) at the Education Hospital in Turin University which stated that out of 569 BPH patients, 179 patients (31.6%) had a PSA levels of >4 ng/mL, while there were 390 patients (68,4%) with a PSA levels of <4 ng/mL.¹² This is comparable to the study by Byung et al. (2006) in patients from 11 medical centers who first visited hospitals accompanied by LUTS complaints that PSA levels and age showed large variations among individuals and the study of Lee et al. (2007) in Korean men who showed an increase in PSA per increase in prostate volume decreased in the elderly group.^{13,14} PSA has a normal value of ≤ 4 ng/mL. PSA levels in seminal plasma are around 0.2–5 ng/mL. Normal blood serum levels are 0.2–4 ng/mL.¹⁵ This study shows that, Proportion of prostate volume distribution by age shows that the most age obtained in prostate volume is 20.00-> 80 cc at the age of 51-60 years. As well as the distribution of PSA levels by age shows that the most age obtained at PSA levels <2.6->20 ng / mL is at the age of 51-60 years. This study shows the value of $p = 0,001$ ($p < 0.05$) and the chi-square value of $r = 107.79$, implying that t prostate volume and PSA levels has a significant and strong correlation. This is comparable to the study by Levisia, NRC. et al. (2021) in This study shows the value of $p = 0,000$ ($p < 0.05$) and the value of $r = 0.616$, implying that t prostate volume and PSA levels has a significant and strong correlation.¹¹

CONCLUSIONS

There is a significant association between prostate volume and PSA levels in BPH patients.

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