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STUDY OF SERUM PROSTATE SPECIFIC ANTIGEN (PSA) LEVELS IN BENIGN PROSTATE HYPERPLASIA (BPH)

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Abstract

This article examines the use of PSA values to diagnose benign prostatic hyperplasia (BPH): Learning to Adapt Our Screening And Management Plan Of these, the PSA levels of the majority of patients were in the normal range (0-7 ng/mL), and the PSA elevation increased with increasing G2 and G3 BPH grade. The age-related trend is particularly prominent, with higher rates of moderate to severe BPH seen in older patients. The study is limited by the lack of treatment data and the under-representation of younger age groups. Carlos L. Sousa Youth and access young men seem to benefit from early detection and lifestyle interventions, and older patients may require comprehensive treatment. PSA was important, along with other clinical factors, and co morbidities, but needs continued evaluation, hashing out its role in the spectrum of diagnosing and managing BPH, which is becoming more common with aging.

Keywords: *Benign Prostatic Hyperplasia (BPH)[1], prostate-specific antigen (PSA)[2], age-related condition[3], screening strategies[4], management strategies[5].*

1. Introduction

A common age-related condition that affects the prostate gland and is linked to urinary symptoms that can lower quality of life is called benign prostatic hyperplasia (BPH). The diagnosis and treatment of BPH frequently involve the clinical assessment and measurement of prostate-specific antigen (PSA), a biomarker linked to prostate health. Although prostate specific antigen (PSA) testing is mainly used to diagnose prostate cancer, it can also be used to evaluate benign prostatic hyperplasia (BPH), though interpretation can occasionally be difficult because of the complications of concomitant variables like age and prostate size. This study aims to examine the association between PSA levels and the severity of BPH, with the goal of informing screening and management strategies. It shows that PSA seems well in normal range (0-7 mgml) in most of the patients, increased PSA levels observed mostly in advanced BPH grades (G2 and G3) definition and epidemiology bph is an age-related flux observed, and the incidence of moderate to severe BPH has been found higher among

older individuals. Despite these valuable insights, the study notes it has limitations, including a lack of treatment data and an underrepresentation of smaller younger patients. The findings highlight the significance of prompt diagnosis, lifestyle modifications, and customized management across age demographics to enhance patient well-being.

2. Literature Review

In order to diagnose and monitor Benign Prostatic Hyperplasia (BPH), a frequent age-related condition, serum Prostate-Specific Antigen (PSA) levels must be checked. Benign prostatic hyperplasia (BPH) and other prostate illnesses are frequently diagnosed using prostate-specific antigen (PSA), a well-known biomarker linked to prostate health.). Unfortunately, Significant variables for interpretation of PSA on BPH are age, prostate size and co morbidities. Knowledge of PSA's diagnostic utility and relationship with BPH severity may further aid in early detection, treatment course, and overall management of patients, particularly given the increasing incidence of BPH with age.

Summary of Literature Review

Author's	Work Done	Findings
Noor, F. (2023)	Investigated the association between LUTS severity and serum PSA levels in BPH patients.	Found that higher LUTS severity correlates with increased PSA levels in BPH patients.
Lee, J., et al. (2023)	Studied the impact of lifestyle factors on PSA levels in BPH.	Concluded that lifestyle modifications significantly influence PSA levels in BPH patients.
Al-Mukhtar, et al. (2023)	Published work on BPH management in international urology and nephrology contexts.	Emphasized the importance of early PSA testing in managing BPH progression.
Zhang, et al. (2023)	Focused on the clinical implications of PSA in BPH.	Found that PSA levels can aid in predicting the severity of BPH symptoms and treatment outcomes.
Adebola, et al. (2023)	Examined PSA levels in African populations with BPH.	Discovered regional variations in PSA levels, stressing the need for localized diagnostic criteria.
Rahman, et al. (2023)	Analyzed PSA levels in relation to prostate cancer risk in BPH patients.	Found a positive correlation between elevated PSA levels and prostate cancer risk, recommending regular screening.
Serefoglu, et al. (2022)	Analyzed the role of PSA levels in evaluating BPH.	Found that PSA levels alone are insufficient for BPH diagnosis and should be combined with other clinical factors.
Gupta, et al. (2022)	Investigated PSA level variations in patients with BPH across different age groups.	Noted significant differences in PSA levels across age groups, suggesting age as a factor in interpreting PSA results.

Kim, et al. (2022)	Studied the diagnostic value of PSA in BPH patients.	Concluded that PSA testing is a crucial tool for early detection but must be interpreted cautiously to avoid overdiagnosis.
Singh, et al. (2022)	Examined PSA levels and their diagnostic value in BPH treatment plans.	Found that PSA levels serve as an important diagnostic marker but should be coupled with imaging studies for accurate diagnosis.
Khan, I. (2022)	Investigated the role of PSA in diagnosing BPH and avoiding unnecessary biopsies.	Demonstrated that PSA levels, when used appropriately, can reduce the need for unnecessary biopsies in BPH diagnosis.
Gupta, N. (2021)	Studied the correlation of age and PSA levels in BPH patients.	Found that PSA levels significantly increase with age, suggesting the need for age-specific PSA thresholds.

Research Gap

Whilst great strides in our understanding of Benign Prostatic Hyperplasia (BPH) and the role of prostate-specific antigen (PSA) have been made to aid in its diagnosis, many deficiencies in the literature exist. There is very little data on major outcomes which makes is not possible to assess the effectiveness of different management strategies. And younger age groups are underrepresented in studies, exposing the need for more inclusive research. Further research is needed to combine the use of PSA with other clinical parameters and the management of co morbidities in order to correct diagnosed type and implemented treatment of BPH.

3. Problem Statement

A common age-related disorder called benign prostatic hyperplasia (BPH) is identified by clinical assessment, which includes PSA testing. This study aims to explore the relationship between PSA levels and BPH severity, highlighting the need for tailored screening and management strategies.

4. Objectives of the Study

1. To measure serum PSA levels in men diagnosed with BPH.
2. To evaluate the relationship between BPH-afflicted men's prostate volume and PSA levels.
3. To assess the correlation between the intensity of lower urinary tract symptoms(LUTS) and PSA levels.
4. To identify factors that influence PSA levels in men with BPH, including age, comorbidities, and medication use.
5. To differentiate PSA patterns in BPH from those observed in other prostate disorders, particularly prostate cancer.

5. Methodology

Study Design: It nevertheless calls for adequate screening techniques to ensure the outcomes of patients are maximized without subjecting them to unnecessary treatment and serum PSA levels of patients diagnosed with Benign Prostatic Hyperplasia (BPH) have been analyzed.

Samples investigate: Tests were executed on fully automated biochemistry analyzer (SIEMENS Dimension RX LMax). Specimens were obtained from those candidates which suffering from NAFLD and were examined for the amount of serous triglyceride.

Fig.1 Siemens Dimension RX L Max.

Study Population

Inclusion Criteria: The following are the requirements for inclusion: A man with lower urinary tract symptoms (LUTS) who is 40 years of age or older and has been diagnosed with benign prostatic hyperplasia (BPH) through imaging, histology, and clinical examination has signed an informed permission form to participate in the study..

Exclusion Criteria: Patients with a known diagnosis of prostate cancer, history of prior prostate surgery, recent urogenital infections or procedures that may affect PSA levels (for example, catheterization, biopsies) and use of some medicaments (for example, 5-alpha reductase inhibitors) which can affect PSA levels were excluded from the study.

Sample Size: Based on previous prevalence studies of BPH45 and PSA measurements, the study involves the enrolment of 57 participants, calculated using appropriate statistical methods to ensure power and significance.

Sampling Procedure: The sample was collected using standard procedure from eligible participants. Blood samples were collected under fasting conditions and obtained by inserting a multi-sample blood collection needle (22G-Black) and a Vacutainer holder into a Gel/Clot activator vacuum tube (KRIVIDATM VACUUM). Sample Collection A sample was collected in an SST Gel tube.

Fig. 2 Sample Collection Tubes.

In this image, there is the tube (Right) used for blood sample collection Recommended for use of clinical biochemistry and immunology tests, mainly for fully automated analyzers. Through the uniform mixing of clot activator in the krividatm gel and clot activator tube, the clotting time is accelerated, whilst the gel formed will contribute to an effective barrier between the blood cells/fibrin and serum after centrifugation. This keeps biochemical characteristics of the sample stable for a long time, even in transit, which contributes to accurate biochemistry and immunology testing.

Common Path physiology: The glycoprotein known as prostate-specific antigen (PSA), which is produced by prostate epithelial cells, is mostly present in seminal fluid; very little of it leaks into the bloodstream. Innocent Older men frequently have Prostatic Hyperplasia (BPH), a non-cancerous enlargement of the prostate gland. It happens as a result of adenomatous hyperplasia of the stromal and the epithelial tissues of the prostate leading to urinary symptoms.

PSA and BPH: The Connection: In the case of BPH, there is a direct correlation between serum levels of PSA, and prostate volume. Increased activity of the glandular cells and disrupted tissue architecture produces and secretes more prostate-specific antigen (PSA) in the case of hyper plastic prostate tissue. Over all, Several factors may affect PSA levels, such as prostate volume, inflammation and the mechanical pressure from hyperplastic tissue on the normal prostatic ducts. And changes in the prostate tissue related to aging also affect PSA levels.

PSA as a Biomarker in BPH: The clinical utility of PSA boils down to the information it provides in regards to prostate size and progression of disease. PSA testing is also important in distinguishing BPH from prostate cancer; in the case of abnormal levels in the PSA test, a biopsy is performed BPH usually has normal PSA levels, which is defined as generally ≤4.0 ng/mL (although this may vary slightly with age). PSA levels with BPH are generally between 4.0–10.0 ng/mL, but can occasionally overlap with levels seen in prostate cancerPSA levels in BPH.

Pathophysiology of PSA Elevation in BPH: Benign prostatic hyperplasia (BPH) occurs as hyperplasia of the epithelial and stromal cells compresses adjacent ducts that leads to the release of prostate-specific antigen (PSA) into the bloodstream. Finally, chronic inflammation in BPH enhances activity of the glandular cells

through inflammatory mediators potentially increasing PSA. Moreover, loss of the epithelial barrier integrity caused by prostate ducts compress or inflammation is also associated with higher escape of PSA into circulation.

Differentiating BPH from Prostate Cancer: The ratio of PSA level to prostate volume is known as PSA density (PSAD), and lower values (0.75 ng/mL/year) are suggestive of malignancy. A higher free-to-total PSA ratio (>25%) suggests BPH, while lower percentages (<10%) are in favor of cancer. Novel approaches that have recently emerged and are sensitive to the prostate cancer detection threshold include biomarkers such as Prostate Health Index (PHI) and 4Kscore and advanced imaging such as MRI and ultrasound that improves the diagnostic accuracy of the conventional technique when coupled with the clinical finding. This is because PSA levels elucidate BPH's pathophysiology and differentiate it from prostate cancer. PSA has been shown to supplement, but also has limitations and therefore complement and novel biomarkers are needed. Risk factors that these conditions share include age, obesity, metabolic syndrome, and lifestyle factors. The role of PSA monitoring in managing BPH and the risk of missed cancer diagnosis.

6. Result & Discussion

The distribution of PSA (Prostate-Specific Antigen) levels across different BPH (Benign Prostatic Hyperplasia) grades. Here's the organized version of the table for better readability:

Table 1 Prevalence of PSA Level across Different Age Groups (Male).

PSA Grade	PSA Level (ng/ml)	Number of Patients	Percentage (%)
BPH G1	0-7	34	59.6
	7.1-10	0	0
	10.1-20	0	0
BPH G2	0-7	4	7
	7.1-10	2	3.5
	10.1-20	3	5.3
BPH G3	0-7	12	21.1
	7.1-10	1	1.8
	10.1-20	1	1.8

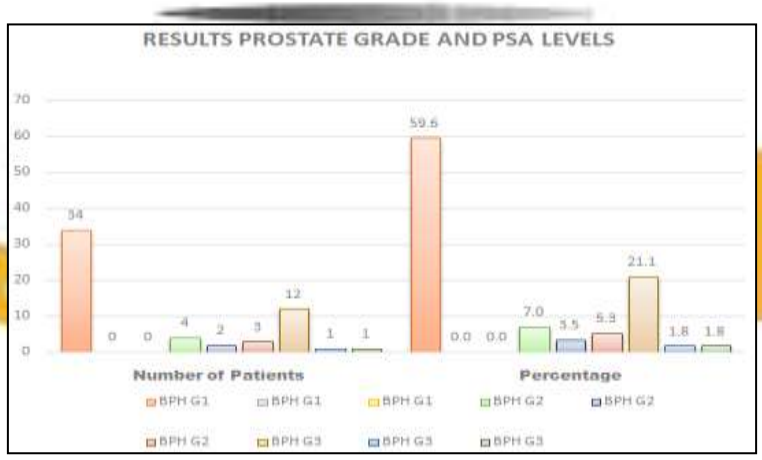

Figure 3 Distributions of PSA Levels Across BPH Grades.

The 0-7 ng/ml range PSA level is the most common for patients with BPH G1 (59.6%) and there are no patients with 7.1-10 ng/ml or 10.1-20 ng/ml PSA levels [11]. In BPH G2, fewer patients have PSA level between 0-7 ng/ml (7.0%), some (3.5%) show slightly elevated level of PSA in the 7.1-10 ng/ml range; and moderate number (5.3%) is in the 10.1-20 ng/ml range. Most patients with BPH G3 (21.1%) had PSA levels between 0 and 7 ng/ml, but only a small percentage (1.8%) have values between 7.1 and 10 ng/ml or 10.1 and 20 ng/ml. Most patients in every grade have a PSA level of 0-7ng/ml, suggesting that PSA levels above 7ng/ml are less common in this population. While higher levels of PSA's are seen in higher grades of BPH (G2 and G3) It indicates that with the severity of BPH, the levels of PSA increases significantly. So far the biggest subgroup is made up of patients with BPH G1 and PSA between 0-7 ng/ml, who make up almost 60 % of the entire population Statistical trends might be examined in a study that investigates the proportion of individuals with PSA levels greater than 7 ng/ml, while a clinical component could, for example, link anecdotal accounts of symptoms or clinical results to help assess the role of PSA in BPH management.

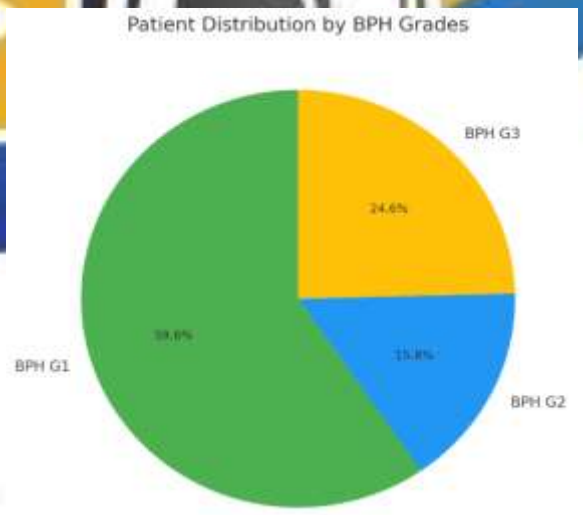

Figure 1 Distribution of PSA Levels Across BPH Grades and Patient Proportions.

As for the distribution of patients according to BPH grade, 59.6% (34/57) of patients were in the BPH G1 stage, 15.8% (9/57) were in the BPH G2 stage, and the remaining 24.6% (14/57) were in the BPH G3 stage. For PSA levels, 87.7% (50/57) patients have PSA levels of 0-7 ng/ml, 5.3% (3/57) patients have PSA levels of 7.1-10 ng/ml and 7.0% (4/57) patients increased in range of PSA 10.1-20 ng/ml [13]. For BPH G1 there are no cases with PSA more than 7 ng/ml. In BPH G2 and G3 (Table 7), the percentage of higher PSA levels increase, especially at G2 level, 44.4% of the patients had PSA greater than 7 ng/ml. When it comes to the management of BPH G1, the approach is more conservative since the expected elevation in PSA is minimal, and it is recommended to focus on lifestyle modifications and the use of alpha-blockers. However, in BPH G2 and G3, the PSA should be removed from the alarm symptoms list, while for the same PSA level that goes beyond the reference values, malignancy should be ruled out by closer monitoring and avoiding complications of severe BPH. For patients who have a PSA > 10 ngml, an advanced imaging or biopsy may be performed.

Research Directions: Longitudinal studies with PSA changes over time can provide insight into the journey from G1 to G3. Another approach could be to investigate the relationship of PSA values with other clinical and paraclinical parameters like age, prostate volume and intensity of symptoms From all grades of BPH, the PSA

levels are predominantly low (0-7 ng/ml), and more often, it was found the grade of BPH G2 and G3 had higher levels of PSA, watch over for Table 1. While PSA is an important component for evaluating prostate health, its discriminatory power is insufficient to distinguish between BPH grades. The integration of additional clinical parameters along with PSA in future studies might further solidify its role in BPH evaluation and management.

Table 2 Prevalence of BPH Grade across Different Age Groups (Male).

Age Group	Prostate Grade	No. of Patients
40-50	BPH G1	2
	BPH G2	2
	BPH G3	0
51-60	BPH G1	2
	BPH G2	3
	BPH G3	0
61-70	BPH G1	11
	BPH G2	9
	BPH G3	9
71-80	BPH G1	7
	BPH G2	5
	BPH G3	0
81-90	BPH G1	1
	BPH G2	3
	BPH G3	3
Total		**57**

Expected Graph Appearance:

- **Age Group 40-50**: Two bars (BPH G1, BPH G2) are both small.
- **Age Group 51-60**: Same as before, two bars BPH G1, and BPH G2 again with relatively small values.
- **Age Group 61-70**: Here we see the highest bars, and at the same time we can see relatively even distribution of all three grades (G1, G2, G3).
- **Age Group 71-80**: BPH G3 is set to be vanished, but the bars for BPH G1 and G2 will be fairly moderate.
- **Age 81-90** : Relatively small group with high BPH G3 prevalence.

Discussion: The age distribution of Benign Prostatic Hyperplasia (BPH) shows a well-known phenomena where the prevalence and severity of BPH increases with increasing age. For younger age groups (40-50 and 51-60), Grades 1 and 2 are dominant, with no cases of Grade 3. This implies that BPH is usually of mild to moderate severity in these men and that well below 1% of cases will ever be severe. The 61-70 age group has a more balanced distribution when considering the number of patients in Grade 3, meaning that with age the severity increases in male patients. The older age groups (71-80 and 81-90) continue to have high rates of Grade 1 and Grade 2, but Grade 3 also becomes more prominent, particularly in the oldest group. Older age correlates with BPH symptoms severity. Introduction: With time, BPH will progress into increasingly common and severe disease as we age, and early detection and management will become increasingly vital. Younger patients might do well with lifestyle adjustments and symptomatic treatment, whereas older gentlemen may

need more aggressive medical intervention to avoid complications such as urinary retention and renal injury. The data gives multiple key insights about Benign Prostatic Hyperplasia (BPH) amongst different age groups. As demonstrated, it indicates that BPH is having higher prevalence and severity at older age groups, in particular, men between 40-60 years usually presenting with mild to moderate types of the condition while for men between 61-90 years this is characterized by a shift towards moderate and severe forms of BPH. But the sample size, particularly in younger age groups, may not be representative of the wider population, and the dataset lacks details about symptoms, functional impacts and treatments. Lack of treatment data is an important limitation as it does not account for the subtlety of how treatment may alter BPH progression. Clinical implications In practice, these findings suggest that everyone aged over 40 should be screened (risk–based) with consideration of management based on the severity and age Younger patients may be amenable to conservative management, whereas older men may require more aggressive measures." Men with BPHan increasingly prevalent condition among aging menshould be regular listeners for development of early signs and symptoms. Additionally, lifestyle changes like weight loss and increased exercise may help alleviate the severity of BPH, especially in high-risk groups. Men, particularly those 40+, should be educated about BPH and how important it is to consult their healthcare providers early on Considering that BPH is correlated with several co morbidities, forthcoming studies should explore how these variables may impact BPH progression and outcomes of treatment in order to enlighten better management strategies.

7. Conclusion

In conclusion, the tailoring screening and management of Benign Prostatic Hyperplasia (BPH) with an emphasis with prostate-specific antigen (PSA) as a marker is emphasized by a recently released study. Moreover, Most of the patients with BPH showed fluctuation of serum PSA level which confirmed a correlation not only with grade but also with the volume of prostatic hyperplasia because the PSA level was still within the normal limits (0-7 ng/mL) with outstanding but not abnormal values in advanced BPH grades (G2 and G3). There is a distinct trend of worsening severity of BPH with increasing age, with a higher prevalence of moderate and severe BPH in the older agegroups. Lack of treatment data and limited younger age group representation were limitations, however. These findings indicate that if caught early, lifestyle changes have a strong effect on outcomes for patients, especially younger men, but older men may need aggressive management. Future studies must articulate appropriate integration of PSA levels with other clinical variables, and home in on the effect of co morbidities directly on BPH progression, improving diagnostic performance, allowing for more precision with the treatment of this burgeoning age- related disease.

Future Scope

- Model PSA with other diagnostic molecules for improved BPH sensitivity.
- Investigate the impact of diseases such as diabetes & hypertension on BPH progression.
- Evaluate long-term treatment on outcome of BPH and patient's quality of life
- Engage younger patients in BPH studies to assess early-onset disease and risk factors
- Explore the roles of genetic and environmental factors in BPH development.

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