

Hematological Parameters and C-Reactive Protein in Patients with Benign Prostatic Hyperplasia

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Abstract

Background: Benign prostatic hyperplasia (BPH) is a prevalent condition in aging men and has been associated with chronic inflammation and systemic effects. However, evidence on its relationship with hematological parameters and inflammatory markers such as C-reactive protein (CRP), particularly in Nigerian populations, remains limited. Aim: This study evaluated selected hematological parameters and CRP levels in patients with BPH.

Methods: A case-control study was conducted among 60 male participants (30 BPH patients and 30 age-matched controls). Venous blood samples (5 mL) were collected and analyzed for hemoglobin concentration and red cell indices using an automated hematology analyzer, while CRP levels were measured using standard immunoassay methods. Data were expressed as mean $\pm$ standard deviation and analyzed using independent t-tests and Pearson's correlation. Statistical significance was set at $p < 0.05$.

Results: BPH patients showed significantly lower hemoglobin (11.77 ± 0.49 g/dL vs 14.03 ± 1.23 g/dL), MCV (83.63 ± 1.10 fL vs 89.70 ± 1.53 fL), MCH (27.18 ± 1.36 pg vs 29.69 ± 0.48 pg), and MCHC (31.84 ± 0.20 g/dL vs 33.79 ± 0.53 g/dL) compared to controls ($p < 0.0001$). CRP levels were significantly higher in BPH patients (10.10 ± 0.64 mg/L vs 2.14 ± 0.23 mg/L; $p < 0.0001$). A strong negative correlation was observed between CRP and MCV ($r = -0.725$, $p < 0.0001$).

Conclusion: The findings suggest an association between BPH, elevated CRP levels, and reduced red cell indices. However, given the small sample size and cross-sectional design, these results should be interpreted with caution. Further studies incorporating larger sample sizes and multivariable analyses are needed to clarify these relationships.

Key Words: benign prostatic hyperplasia; hemoglobin; red cell indices; c-reactive protein; inflammation

Introduction

Benign prostatic hyperplasia (BPH) is one of the most prevalent urological conditions affecting aging men worldwide [1]. It is characterized by non-malignant enlargement of the prostate gland, leading to lower urinary tract symptoms such as frequency, urgency, and nocturia [2].

Recent evidence suggests that BPH is not merely a proliferative disorder but also involves chronic inflammation [3]. Inflammatory processes contribute to prostatic enlargement and disease progression through cytokine-mediated pathways and immune cell infiltration [4].

C-reactive protein (CRP) is an acute-phase protein synthesized by the liver in response to inflammation and has been widely used as a marker of systemic inflammatory response [5]. Elevated CRP levels have been associated with several chronic diseases, including cardiovascular disease and urological conditions such as BPH [6].

Chronic inflammation may also affect hematopoiesis, leading to alterations in hematological parameters such as hemoglobin and red cell indices, often resulting in anemia of chronic disease [7].

Despite increasing recognition of inflammation in BPH, there is limited data in Nigeria examining the relationship between CRP and hematological parameters in BPH patients. This study therefore aims to bridge this gap.

2.0 Materials and Methods

2.1 Study Design and Area

This was a case-control study conducted at Federal Teaching Hospital Owerri, Imo State, Nigeria.

2.2 Study Population

A total of 60 male participants were recruited, comprising:

- 30 patients with clinically diagnosed BPH
- 30 apparently healthy age-matched controls

2.3 Inclusion Criteria

Confirmed diagnosis of BPH

Age $\geq$ 50 years

3.0 Results

2.4 Exclusion Criteria

- Patients with malignancy
- Chronic inflammatory diseases
- Recent infections

2.5 Sample Collection

Five milliliters (5 mL) of venous blood were collected aseptically.

2.6 Laboratory Analysis

Hemoglobin and red cell indices (MCV, MCH, MCHC) were analyzed using an automated hematology analyzer

CRP levels were determined using standard immunoassay techniques

2.7 Statistical Analysis

Data were expressed as mean $\pm$ standard deviation. Independent t-test and Pearson correlation were used. Statistical significance was set at $p < 0.05$.

Parameters	Test (N=30)	Control (N=30)	t-value	p-value
Hb (g/dl)	11.77 $\pm$ 0.49	14.03 $\pm$ 1.23	-9.330	<0.0001*
MCV (fl)	83.63 $\pm$ 1.10	89.70 $\pm$ 1.53	-17.609	<0.0001*
MCH (pg)	27.18 $\pm$ 1.36	29.69 $\pm$ 0.48	-9.562	<0.0001*
MCHC (g/dl)	31.84 $\pm$ 0.20	33.79 $\pm$ 0.53	-18.808	<0.0001*
CRP (mg/L)	10.10 $\pm$ 0.64	2.14 $\pm$ 0.23	64.098	<0.0001*

Table 3.1: Mean Values of Hb, MCV, MCH, MCHC, and CRP in Patients Diagnosed with Benign Prostate Hyperplasia and Healthy Controls (Mean $\pm$ S.D).

KEY:

S.D – Standard Deviation

Hb – Hemoglobin

MCV – Mean Corpuscular Volume

MCH – Mean Corpuscular Hemoglobin

MCHC – Mean Corpuscular Hemoglobin Concentration

CRP – C-Reactive Protein

* – Significant p-value

Hb significantly lower in BPH patients

MCV, MCH, MCHC also reduced

CRP significantly elevated

Parameters	N	R	p-value
Age	30	-0.022	0.906
Hb	30	-0.012	0.951
MCV	30	-0.725	<0.0001*
MCH	30	-0.325	0.080
MCHC	30	-0.078	0.684

Table 3.2: Correlation of C-Reactive Protein (CRP) with Hematological Parameters in Patients Diagnosed with Benign Prostate Hyperplasia.

CRP had negative correlation with haematological parameters.

The mean hemoglobin concentration in male diabetic patients (11.28 $\pm$ 1.75) g/dL was higher than that of female diabetics (10.04 $\pm$ 1.37) g/dL, although this difference did not reach statistical significance ($t = 1.76$, $p = 0.096$). Similarly, the mean red blood cell count was slightly higher in males (4.11 $\pm$ 0.73) $\times 10^{12}/L$ compared with females (3.73 $\pm$ 0.65) $\times 10^{12}/L$, but the difference was not statistically significant ($t = 1.24$, $p = 0.230$).

The total white blood cell count was higher among female diabetic patients (9.42 $\pm$ 4.84) $\times 10^9/L$ compared with males (7.39 $\pm$ 4.18) $\times 10^9/L$, although the difference was not statistically significant ($t = -1.00$, $p = 0.329$). A similar pattern was observed for neutrophils, where females (4.47 $\pm$ 2.62) $\times 10^9/L$ had slightly higher values than males (4.11 $\pm$ 3.56) $\times 10^9/L$, but again without statistical significance ($t = -0.26$, $p = 0.799$).

Lymphocyte counts were higher in female diabetic patients $(4.06 \pm 2.51) \times 10^9/L$ compared with males $(2.73 \pm 0.95) \times 10^9/L$, showing a noticeable difference and however, this did not reach statistical significance ($t = -1.53$, $p = 0.145$). Monocyte values followed the same trend, with females $(0.56 \pm 0.36) \times 10^9/L$ recording slightly higher levels than males $(0.45 \pm 0.37) \times 10^9/L$, but the difference was not statistically significant ($t = -0.71$, $p = 0.488$).

Eosinophil and basophil counts showed minimal variation between both sexes, with eosinophils $(0.12 \pm 0.07) \times 10^9/L$ in males versus $(0.13 \pm 0.11) \times 10^9/L$ in females ($t = -0.21$, $p = 0.837$), and basophils $(0.02 \pm 0.01) \times 10^9/L$ in males versus $(0.03 \pm 0.02) \times 10^9/L$ in females ($t = -1.33$, $p = 0.198$). Neither parameter demonstrated statistical significance.

4.0 Discussion

This study demonstrated that BPH patients have significantly altered hematological parameters and elevated CRP levels, supporting the role of inflammation in BPH pathophysiology.

The reduced hemoglobin and red cell indices observed may be attributed to anemia of chronic disease, which is commonly associated with inflammatory conditions⁷. Chronic inflammation interferes with iron metabolism and erythropoiesis, leading to reduced red cell production [8].

Elevated CRP levels in BPH patients further confirm the presence of systemic inflammation. CRP may contribute to disease progression through activation of inflammatory pathways and immune responses [9].

The observed negative correlation between CRP and hematological parameters suggests that inflammation plays a critical role in hematological alterations seen in BPH patients.

These findings are consistent with previous studies that reported elevated inflammatory markers in BPH and their association with disease severity [10].

5.0 Conclusion

This study demonstrates that BPH is associated with:

- Elevated CRP levels
- Altered hematological parameters
- Evidence of chronic inflammation
- CRP may serve as a valuable biomarker in the clinical assessment and management of BPH patients.

6.0 Acknowledgements

- Routine evaluation of CRP in BPH patients should be considered.
- Anti-inflammatory strategies may be beneficial in BPH management.
- Further large-scale studies are recommended.

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