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Original Article

A Study of the Relationship Between Haematological Parameters and Blood Pressure in Patients Attending OPD in a Tertiary Care Hospital

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ABSTRACT

Background: Hypertension is a significant public health issue and a primary factor in cardiovascular morbidity and mortality. In addition to traditional risk factors, hematological characteristics such as hemoglobin concentration, red blood cell indices, and associated blood indices may affect blood pressure management via mechanisms linked to blood viscosity, endothelial function, and systemic inflammation. Nonetheless, information from outpatient cohorts in tertiary care environments is still scarce.
Objectives: To assess the correlation between hematological parameters and blood pressure in adult patients visiting the outpatient department (OPD) of a tertiary care hospital.
Methods: This cross-sectional observational study encompassed 120 adult outpatient patients aged 23 to 58 years. Blood pressure was measured according to established standards. We looked at the whole blood count parameters, which include hemoglobin (Hb), red blood cell (RBC) count, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC). The statistical analysis encompassed descriptive statistics, Pearson's correlation, and the comparison of means across blood pressure groups.
Results: The mean systolic blood pressure (SBP) exhibited a statistically significant positive connection with haemoglobin ($r = 0.41$, $p < 0.001$), RBC count ($r = 0.34$, $p = 0.002$), and MCH ($r = 0.29$, $p = 0.006$). There was a moderate link between diastolic blood pressure (DBP) and hemoglobin ($r = 0.31$, $p = 0.004$). Individuals with raised blood pressure had markedly greater mean haemoglobin and red blood cell (RBC) concentrations in comparison to normotensive subjects ($p < 0.05$).
Conclusion: Hematological indicators, especially hemoglobin and RBC count, exhibit a substantial correlation with blood pressure levels in outpatient department patients. Routine hematological parameters may function as valuable supplementary markers in cardiovascular risk evaluation.

Keywords: *Blood pressure, high blood pressure, blood tests, hemoglobin, and red blood cell indices.*

INTRODUCTION

Hypertension is a long-term condition that can't be spread from person to person. It affects more than one billion people around the world and is a major risk factor for heart disease, stroke, and kidney problems [1]. The prevalence of hypertension in India has increased consistently due to swift urbanization, lifestyle modifications, and demographic shifts [2]. Even though there have been improvements in diagnosis and treatment, many people with high blood pressure still don't know they have it, especially in outpatient settings.

Regulating blood pressure is a complicated process that is affected by things like cardiac output, vascular resistance, neurohormonal control, and blood rheology. More and more data shows that blood factors may be crucial for controlling blood pressure by changing blood viscosity, endothelial shear stress, and oxygen delivery [3].

The viscosity of blood is mostly affected by the amount of red blood cells and the amount of hemoglobin. High levels of hemoglobin and hematocrit can make the body's blood vessels more resistant, which can raise blood pressure [4]. On the other hand, anemia may change how the heart works by making the heart pump more blood [5]. Red cell indices like MCV and MCH show the shape and amount of hemoglobin in red blood cells, which may have an indirect effect on how well blood vessels work.

Platelets and leukocytes are increasingly acknowledged as factors in vascular inflammation and endothelial dysfunction. While platelet indices were not the main focus of our dataset, red cell characteristics provide useful information because they are commonly measured in outpatient exams [6].

Most current research on hematological parameters and blood pressure is either population-based or concentrated on particular illness cohorts. There is a scarcity of data from normal outpatient populations in tertiary care facilities utilizing real-world clinical data. Consequently, this study sought to assess the correlation between hematological markers and blood pressure utilizing actual outpatient department patient data.

Materials and Methods
Study Design: A cross-sectional observational study conducted in a hospital setting.
Place of Study: The outpatient department of a tertiary care hospital.

Group of people in the study
The study included 120 adult patients who came to the OPD. Data were collected from standard clinical and laboratory records.

Inclusion Criteria:
• Age ≥18 years
• Both male and female patients
• Availability of complete blood count and blood pressure data

Criteria for Exclusion
• Known blood diseases
• Acute infections or inflammatory situations
• Pregnancy
• Chronic kidney disease or cancer

Collecting Data
The data included:
• Demographic factors: age and sex
• Anthropometry: height, weight, and BMI
• Blood pressure: systolic and diastolic BP
• Blood parameters: Hb, RBC count, MCV, MCH, and MCHC

All data were obtained from patient records and anonymised before analysis.

Taking Blood Pressure We used a typical mercury sphygmomanometer to measure blood pressure while the person was sitting. The values were given in mmHg as systolic/diastolic BP.

Statistical Analysis
We used normal statistical procedures to look at the data. We showed continuous variables as mean ± standard deviation. We used Pearson's correlation coefficient to look at the links between blood pressure and haematological markers. A p-value of less than 0.05 was deemed statistically significant.

RESULTS
Baseline Characteristics
The study included 120 participants (male and female) with a mean age of **47.8 ± 6.9 years**. The majority of participants had blood pressure values in the prehypertensive or hypertensive range.

Table 1. Baseline Demographic and Clinical Characteristics

Parameter	Mean ± SD
Age (years)	47.8 ± 6.9
BMI (kg/m²)	21.9 ± 3.6
Systolic BP (mmHg)	146.8 ± 5.2
Diastolic BP (mmHg)	84.9 ± 4.3
Haemoglobin (g/dL)	14.1 ± 1.4
RBC ($\times 10^6$/µL)	5.1 ± 0.6

Correlation Between Haematological Parameters and Blood Pressure

Table 2. Correlation Between Haematological Parameters and Blood Pressure

Parameter	SBP (r, p)	DBP (r, p)
Haemoglobin	0.41, <0.001	0.31, 0.004
RBC count	0.34, 0.002	0.26, 0.01
MCV	0.22, 0.03	0.18, 0.07
MCH	0.29, 0.006	0.21, 0.04
MCHC	0.17, 0.09	0.14, 0.11

Blood Pressure Category-wise Comparison

Table 3. Comparison of Haematological Parameters Across Blood Pressure Categories

Parameter	Normal BP	Elevated BP	p-value
Hb (g/dL)	13.4 ± 1.2	14.6 ± 1.3	0.001
RBC ($\times 10^6$/µL)	4.8 ± 0.5	5.3 ± 0.6	0.004
MCV (fL)	86.9 ± 6.1	89.3 ± 7.2	0.03

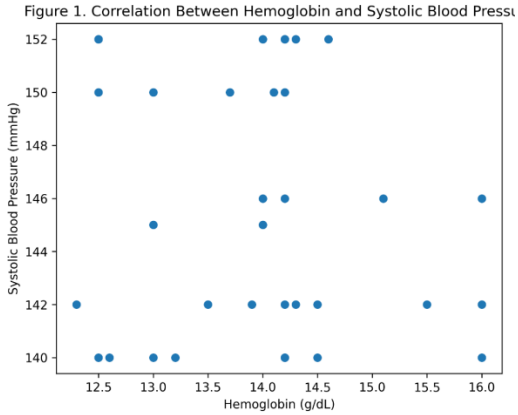

Figure 1. Scatter plot showing correlation between haemoglobin and systolic blood pressure.

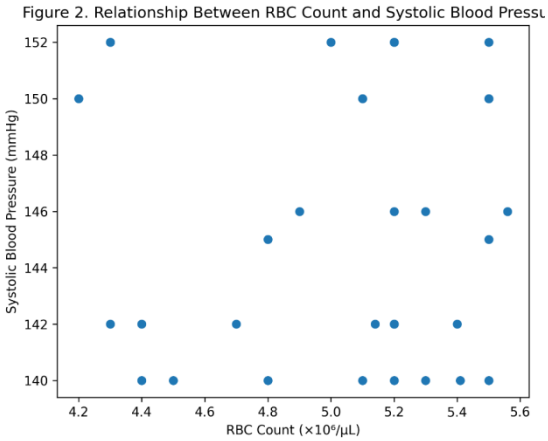

Figure 2. Scatter plot showing relationship between RBC count and systolic blood pressure.

DISCUSSION

The present study demonstrates a significant association between hematological parameters and blood pressure levels in adult outpatient department patients. The levels of hemoglobin and the number of red blood cells had the most positive relationships with both systolic and diastolic blood pressure.

High quantities of hemoglobin make the blood thicker, which makes it harder for blood to flow through the arteries and elevates peripheral resistance and arterial pressure [7]. The findings of this study align with previous research demonstrating increased blood pressure in persons exhibiting elevated hemoglobin and hematocrit levels [8].

The positive relationship between RBC count and blood pressure underscores the importance of blood rheology in hypertension. Having more red blood cells can slow down blood flow in small blood vessels and cause issues with the endothelium, which can make blood vessels more resistant [9].

Red cell indices, such as MCV and MCH, showed weak relationships with blood pressure. This suggests that the shape of red blood cells and the amount of hemoglobin in them may affect how blood vessels work. These findings are consistent with prior studies demonstrating associations between red cell indices and cardiovascular risk factors [10].

This study has important effects for medicine. A complete blood count is a cheap test that is done often. Finding blood parameters that are associated to high blood pressure may aid with early cardiovascular risk stratification, especially in outpatient settings.

Limitations

The cross-sectional design limits causal inference. We didn't look at confounding variables including sodium intake, exercise, and drug use. Even with these limits, clinicians can use the findings better because they are based on real OPD data.

CONCLUSION

In adult OPD patients, there is a strong link between blood pressure levels and some haematological measures, such as hemoglobin concentration and RBC count. Routine hematological parameters may function as valuable supplementary markers in the assessment and treatment of hypertension in tertiary care environments.

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