Original Article

Blood Cell Parameters Among Stable Ambulatory Hypertensive Patients and Non-Hypertensive Population - a cross sectional study

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Abstract

Background: Hypertension is a prevalent condition associated with increased cardiovascular risk. Altered blood cell parameters have been implicated in the pathophysiology of hypertension, but their specific role remains unclear.

Objective: This study aimed to compare blood cell parameters among stable ambulatory hypertensive patients and a non-hypertensive population.

Methods: A cross-sectional study was conducted, recruiting 500 participants (250 hypertensive and 250 non-hypertensive individuals) from Shahid Gangalal National Heart Centre Janakpur. Demographic information, medical history, and blood pressure measurements were collected. Venous blood samples were analyzed for red blood cell (RBC) count, white blood cell (WBC) count, platelet count, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC).

Results: Hypertensive patients exhibited a higher platelet count (298.2 ± 45.6 × 10^9/L) compared to the non-hypertensive group (271.4 ± 39.2 × 10^9/L) ($p < 0.05$). No significant differences were observed in RBC count, WBC count, MCV, MCH, or MCHC between the two groups ($p > 0.05$).

Conclusion: This study provides insights into the differences in blood cell parameters between stable ambulatory hypertensive patients and non-hypertensive individuals. The findings suggest a potential role of platelets in hypertension, warranting further investigation.

Introduction

Hypertension, a chronic condition characterized by elevated blood pressure levels, is a major risk factor for cardiovascular diseases, including stroke and myocardial infarction[1]. While its pathophysiology is complex, alterations in blood cell parameters may contribute to its development and progression[2,3].

Red blood cells (RBCs), white blood cells (WBCs), and platelets play essential roles in maintaining homeostasis. Previous studies have reported potential associations between hypertension and increased platelet activity, leading to vascular inflammation and endothelial dysfunction[4,5]. However, there is limited research on stable ambulatory hypertensive patients compared to non-hypertensive individuals.

This study aims to compare RBC count, WBC count, platelet count, MCV, MCH, and MCHC among stable ambulatory hypertensive patients and a non-hypertensive population.

Materials and Methods

Study Design and Population

A cross-sectional study was conducted at Shahid Gangalal National Heart Centre Janakpur from August 16, 2022, to February 15, 2023. The study included 250 hypertensive patients and 250 non-hypertensive individuals. Hypertension was diagnosed per JNC 7 criteria[6].

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Inclusion Criteria:

- Diagnosed hypertension (JNC 7 criteria [9])
- Age 40-75 years
- Stable ambulatory status

Exclusion Criteria:

- Acute illness
- Hematological disorders
- Recent transfusion (<3 months)

Sample Size Calculation

Using a 95% confidence level (Z = 1.96) and a 2% margin of error and 80% power a minimum of 460 participants was required. Considering attrition, 500 participants were recruited.

Data Collection and Blood Analysis

Data Collection: Demographics, BP measurements (average of two readings), clinical history.

Laboratory Analysis: Blood samples in EDTA tubes, analyzed with Sysmex XN-1000 hematology analyzer:

- RBC, WBC, Platelet counts
- MCV, MCH, MCHC

Statistical Analysis

Data were analyzed using IBM SPSS version 25. Continuous variables were expressed as mean ± SD, and group differences were analyzed using independent t-tests. A p-value < 0.05 was considered statistically significant.

Results

Demographic Characteristics

Characteristic	Hypertensive (n=250)	Non-Hypertensive (n=250)	p-value
Age (years)	66 ± 6	65 ± 7	0.45
Male (%)	62%	59%	0.67
Hypertension Duration (years)	5 ± 2	NA	-

Blood Cell Parameters

Parameter	Hypertensive (Mean ± SD)	Non-Hypertensive (Mean ± SD)	p-value
RBC count (10^{12}/L)	4.78 ± 0.52	4.81 ± 0.50	0.72
WBC count (10^9/L)	7.02 ± 1.4	6.89 ± 1.3	0.61
Platelet count (10^9/L)	298.2 ± 45.6	271.4 ± 39.2	<0.05*
MCV (fL)	86.5 ± 4.2	87.2 ± 4.5	0.38
MCH (pg)	28.6 ± 1.9	28.4 ± 2.0	0.51
MCHC (g/dL)	32.9 ± 1.4	33.0 ± 1.3	0.75

Discussion

Our study demonstrated a significantly higher platelet count in hypertensive patients compared to non-hypertensive individuals, suggesting a possible link between platelet activation and hypertension pathophysiology[7,8]. Platelets play a crucial role in thrombus formation, and their increased levels may contribute to a heightened risk of atherosclerosis, vascular dysfunction, and cardiovascular events in hypertensive individuals[9,10]. This finding aligns with previous research indicating that increased platelet reactivity is associated with endothelial dysfunction and inflammation, both of which are hallmarks of hypertension[11].

In contrast, no significant differences were observed in RBC count, WBC count, MCV, MCH, or MCHC, indicating that these parameters may not be directly associated with hypertension[12]. This suggests that while hypertension is known to affect vascular integrity, its impact on routine hematological parameters, apart from platelets, remains minimal in stable ambulatory patients. However, the absence of significant differences does not rule out potential microvascular changes or altered erythropoiesis that may manifest in more severe or long-term hypertension.

Our results highlight the need for further studies exploring the functional aspects of platelets, such as mean platelet volume and platelet aggregation potential, to determine their role in hypertension-related complications[13]. Additionally, future research should incorporate inflammatory markers like C-reactive protein and fibrinogen to provide a more comprehensive understanding of hematological changes in hypertension.

Limitations

This study has some limitations. First, the cross-sectional design prevents the establishment of causality. Second, we did not assess platelet function, which could provide deeper insights into their role in hypertension. Third, potential confounders such as dietary habits, medication use, and lifestyle factors were not extensively controlled. Future longitudinal studies with larger sample sizes and additional functional assays are required to validate and extend these findings.

Conclusion

This study highlights the potential role of platelets in hypertension. Further research is needed to explore the clinical implications of these findings.

Conflicts of Interest: None declared.

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