Red Cell Distribution Width as a Predictor for Systemic Hypertension

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Abstract— Red cell distribution width (RDW) is a hematological parameter routinely obtained as a part of Complete blood count. Red cell distribution width (RDW) is a measurement of the variation in the size and volume of red blood cells (RBCs). It's a standard parameter of a complete blood count (CBC) and is calculated by dividing the standard deviation of the mean cell size by the mean corpuscular volume (MCV) of the RBCs and multiplying by 100 to convert to a percentage. The normal range for RDW - Coefficient of Variation is approximately 11.0–15.0%. RDW is raised in several hematological disorders, inflammatory conditions, chronic diseases, altered neurohormonal conditions. RDW is an important marker for both diagnostic and prognostic purposes in various clinical cardiovascular settings.

Index Terms **— RED CELL DISTRIBUTION WIDTH (RDW), HYPERTENSIVES, PRE-HYPERTENSIVES**

Introduction

Red cell distribution width (RDW) is a hematological parameter routinely obtained as a part of Complete blood count. A high RDW means that there's a major difference between the size of your smallest and largest red blood cells. RDW is elevated in accordance with variation in red cell size (anisocytosis); that is, when elevated RDW is reported on complete blood count, marked anisocytosis (increased variation in red cell size) is expected on peripheral blood smear review. Recently, RDW has emerged as a potential independent predictor of clinical outcome in patients with established hypertension and cardiovascular disease. In disorders other than anemia, the prognostic importance of high RDW levels previously received insufficient attention because of lack of knowledge. However, high RDW levels are associated with a poor prognosis in certain disorders such as acute Myocardial Infarction, stroke and peripheral artery disease. Inflammation may contribute to morphologic changes in red cells by changing membrane glycoproteins and ion channels. Chronic inflammation, oxidative stress and neurohumoral activation may contribute to the development of atherosclerosis. Hence elevated RDW may be a useful parameter to follow the development of hypertension, atherosclerosis and hence stroke also.

Study Design : Cross sectional study. Patient's presenting to medicine department OPD in Dr.Balasaheb Vikhe Patil Rural Medical College, Loni, Maharashtra.

Sample Size : 200 patients

Sampling Method : Convenience sampling.

Duration of Study : From September 2024 to September 2025.

Inclusion Criteria :

Both males and females were included between the age 30 to 60 years who are either Prehypertensive or hypertensive patients

Exclusion Criteria :

- Patients with anemia.
- Patients with diabetes mellitus.
- Patients with dyslipidemia.

- Patients with known case of coronary artery disease, cerebrovascular stroke or chronic kidney disease .
- Terminally ill patients.
- Individuals with tobacco & alcohol usage.

Statistical Analysis :

SPSS (Statistical Package for Social Sciences) version 20. (IBM SPASS statistics [IBM corp. released 2011] was used to perform the statistical analysis. One - way ANOVA test was used to compare the between different clinical features. P value < 0.05 was taken as level of significance.

Results :

- In the study, 200 individuals were divided into three groups: 100 patients were hypertensive, 30 patients were pre–hypertensive and 70 patients were normotensive individuals.
- Hypertensives were more in the age group 41 – 50 yrs (70%). Prehypertensive & non hypertensives were more among age 30 - 40yrs (50 % & 57.14 %).
- Hypertensives and Normotensives were more in males group. Pre hypertensives were more among females.

Table 1 : Number of participants in various group

Group	No. of patients
Hypertensive	**100 (50%)**
Pre-Hypertensive	**30 (70%)**
Normotensive	**70 (30%)**
Total	**200**

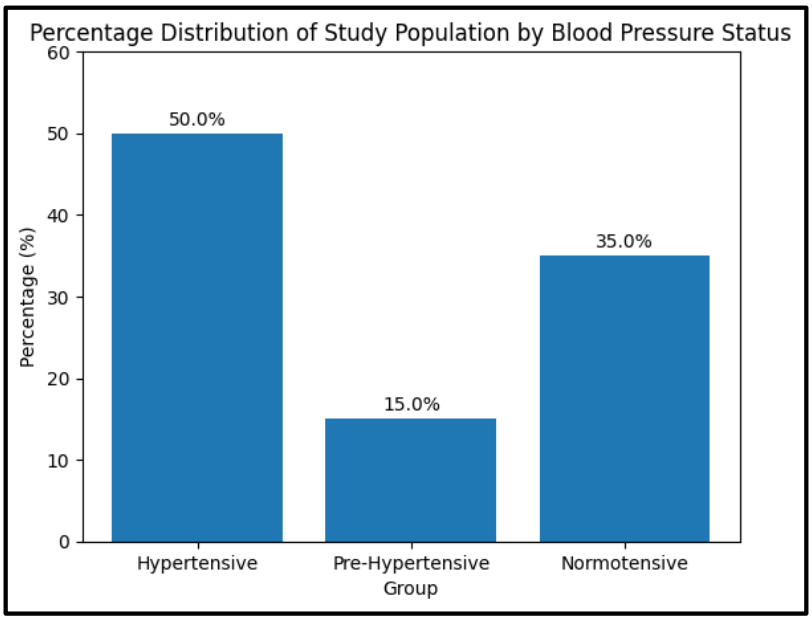


Table 2 : Distribution of Age among Participants

Age	Hypertensive	Pre-Hypertensive	Normotensive	Total
30-40	**10 (10%)**	**15 (50%)**	**40 (57.14%)**	**65**
41-50	**60 (70%)**	**10 (33.34%)**	**20 (28.57%)**	**90**
51-60	**30 (30%)**	**5 (16.67%)**	**10 (14.29%)**	**45**
Total	**100**	**30**	**70**	**200**

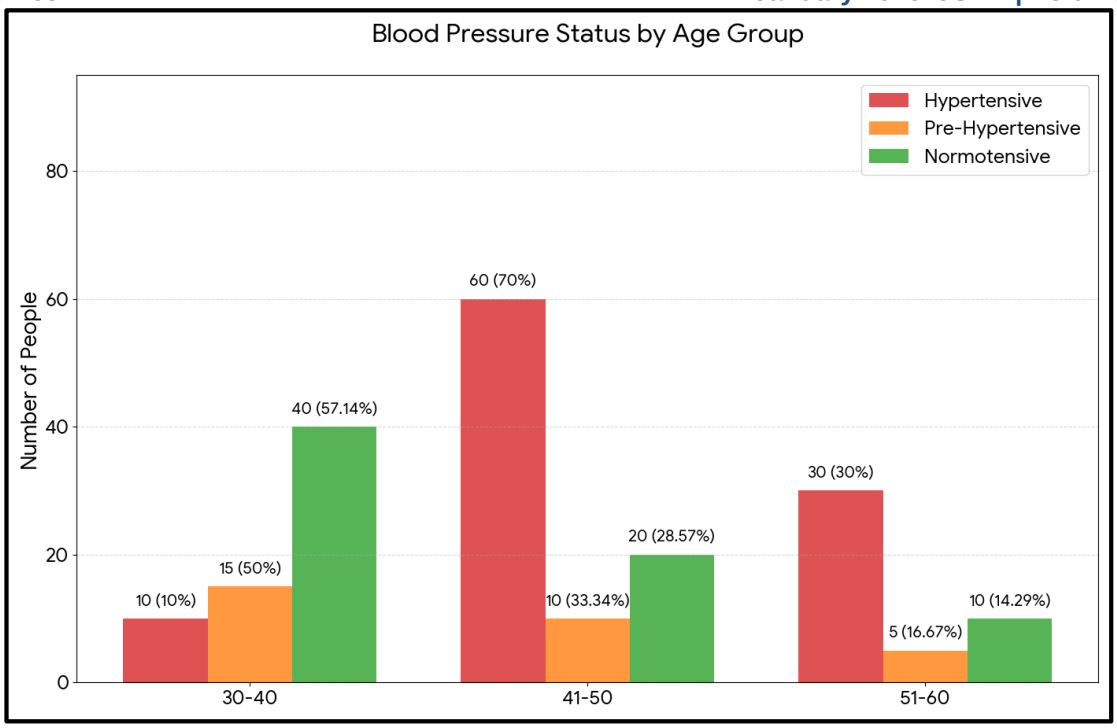
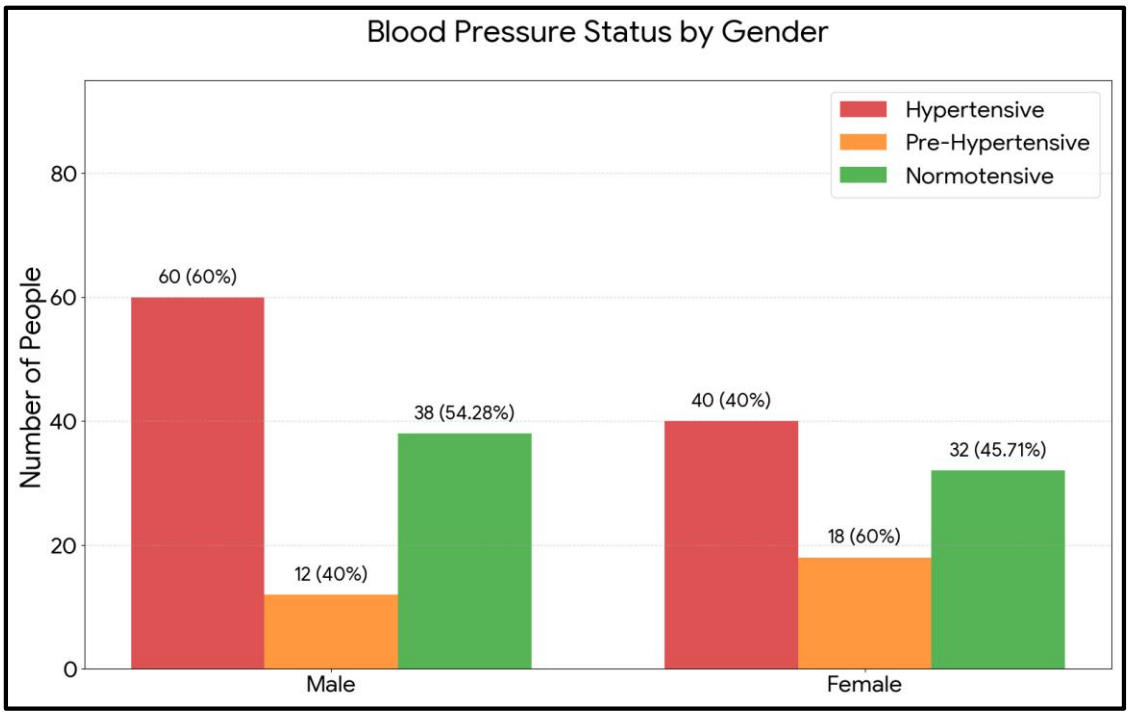


Table 3 : Distribution of Gender among Participants

Gender	Hypertensive	Pre-Hypertensive	Normotensive	Total
Male	60 (50%)	12 (40%)	38 (54.28%)	110
Female	40 (40%)	18 (60%)	32 (45.71%)	90
Total	100	30	70	200

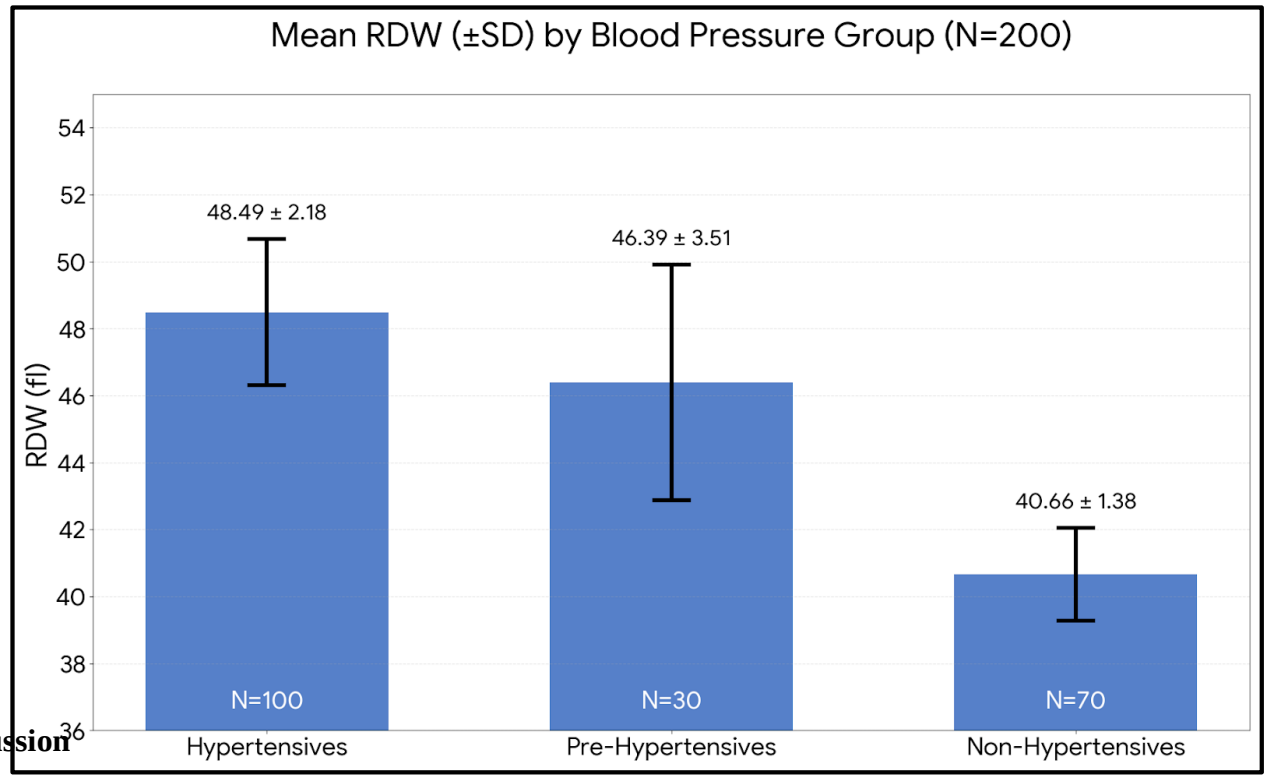


- **Red Cell Distribution Width (RDW) Results :**
  - **Hypertensives**: The average RDW (fl) - SD is 48.49 ± 2.18
  - **Prehypertensive**: The average RDW (fl) - SD is 46.39 ± 3.51
  - **Non-hypertensives**: The average RDW (fl) - SD is 40.66 ± 1.38
- **Increased RDW in Hypertensive**: 76 % of hypertensives (76 out of 100 in the specific sub-group) have increased RDW.

- **Increased RDW in Prehypertensive**: 66.7 % of prehypertensive (20 out of 30) have increased RDW.
- **Comparative Significance**: The study demonstrated that RDW was greater in hypertensive and prehypertensive patients compared to normal controls.
- **Standard Range**: The typical range for RDW, SD is 39-46 femtoliters (fL).
- **Stability of Findings**: These results remained true even after correcting for variables such as age and hemoglobin.

Table 4 : Result of RDW among Participants

RDW (fL) - SD	Hypertensives	Pre-Hypertensives	Non-Hypertensives
Mean ± SD	48.49 ± 2.18	46.39 ± 3.51	40.66 ± 1.38
Min	40	39	39
Max	52	52	45
Standard Error Mean	0.45	0.36	0.31



Discussion

The findings of this study involving 200 patients demonstrate a significant correlation between blood pressure levels and Red Cell Distribution Width (RDW). The data indicates that as blood pressure severity increases from normotensive to hypertensive states, there is a corresponding and measurable elevation in RDW values.

Anisocytosis increases RDW. Abnormal RDW values have been linked to inflammation and neurohumoral activation. Inflammation increases RDW by interfering with normal iron metabolism suppressing the response to erythropoietin and shortening the lifespan of RBC'S. RDW value independently predicted mortality among Cardiovascular co-morbidities such as hypertension, heart failure, diabetes mellitus (DM), peripheral artery disease and ischemic heart disease.

Conclusion

Hypertensives and pre - hypertensives have considerably higher RDW levels than normal controls. RDW is a sensitive index of inflammatory status and a potential predictor of hypertension in pre - hypertensive and normal individuals. RDW can be utilized to provide primordial prevention in individuals with pre - hypertension. RDW is a straightforward metric obtained from routine CBC, therefore can be observed as a surrogate marker for predicting hypertension.

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