



STUDY OF ASSOCIATION OF RED CELL DISTRIBUTION WIDTH WITH HYPERTENSION

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ABSTRACT

Objectives: To study the clinical profile of patients of hypertension and prehypertension and to study the association of red cell distribution in hypertensive and prehypertensive. **Methodology:** This was a cross-sectional study total of 150 adult patients admitted in a tertiary care teaching hospital who are willing to participate will be recruited for the study, these patients divided in 3 groups hypertensive, prehypertensive and normal group. All the adult patients >18years who fulfil the criteria of Prehypertension and hypertension as per JNC 8 classification will be enrolled for the study. All patients will be subjected to standardized interview. A detailed history will be taken in each case. All the patients meeting inclusion and exclusion criteria will be evaluated thoroughly. **Result:** The mean RDW was higher in hypertensive patients (16.1±3.1) compared to prehypertensive patients (14.5±2.0) and normal patients (12.4±0.8). The difference was found statistically significant (p<0.05). **Conclusion:** In this study shows that higher RDW values are strongly associated with hypertension. RDW is reported in routine Complete hemogram and is therefore easily identified without additional costs.

KEYWORDS: Red blood cell width, hypertension, prehypertension.

INTRODUCTION

Red cell distribution width (RDW), a component of routine complete blood count (CBC) is a measure of the variation in the size of circulating erythrocytes. It is routinely measured by automated haematology analyzers and is often expressed as a direct measurement of the width of the distribution, which gives a measure in femtoliters (fl).^[1] RDW is an index of the heterogeneity of erythrocytes (i.e. anisocytosis).^[2] Used in normal clinical setting as tool to differentiate between different types of anaemia, recent studies have shown RDW as predictor of mortality in multiple clinical conditions.^[3-4] RDW's association as a prognostic marker predicting a worse prognosis in several diseases such as coronary heart disease (CHD), stroke, peripheral artery disease (PAD), heart failure (HF), venous thromboembolism (VTE) and pulmonary arterial hypertension (PAH) is well documented.^[5-11] Approximately 90% of hypertension cases are classified as essential hypertension, where the precise cause is unknown.

Hypertension is associated with inflammation; however, whether inflammation is a cause or effect of hypertension is not well understood.^[12] Patients with hypertension and prehypertension have elevated RDW.^[4] The purpose of this study is to determine the role of RDW monitoring in the management of hypertension. Raised values of RDW will suggest the role of inflammation in the aetiology of hypertension. Hence, monitoring of this inflammatory marker may be of value in the prediction of complications of hypertension. This research will provide us with a baseline for future studies and will add to the existing pool of knowledge.

METHODOLOGY

This was a cross-sectional study total of 150 adult patients admitted in a tertiary care teaching hospital who are willing to participate will be recruited for the study. The study was conducted from January 2016 to April 2017 and was approved by Institutional Ethics Committee.

All the adult patients >18years who fulfil the criteria of Prehypertension (BP-120-139/80-89) and hypertension (BP- >140/90) as per JNC 8 classification will be enrolled for the study. Then patient who fulfilled the criteria of hypertensive and prehypertensive will be included in the case group and the patients who did not will be included in the control group.

Haematological-disorder, Coronary artery disease Diabetic, Chronic liver failure, Chronic kidney disease, Pregnancy, Malignancy patients are excluded.

After taking written and informed consent about enrolment in the study and maintaining privacy and confidentiality, Patient's Socio demographic data: Age, sex, marital status, education, occupation and socioeconomic class were recorded. Disease related history like chief complaints and origin, duration and progress. Past history like medical history, drug history and history of allergy. Family history clinical examination, ECG, laboratory routine investigation, random blood sugar and other investigations will be performed as a part of routine diagnosis, all patients will be subjected to standardized interview. All the patients meeting inclusion and exclusion criteria will be evaluated thoroughly. Patients will be categorized applying joint national committee 8 classification.

Patients will be subjected to further detailed investigations comprising of : Complete blood count, Renal function tests, Liver function tests, Serum electrolyte, Serum Lipid profile, Random blood sugar, Electrocardiogram, Ultrasonography.

RESULTS

In hypertensive patients, majority of the patients were in 46 to 60 years (66.7%) and 60 to 75 years (23.3%) age group. In prehypertensive patients, majority of the patients (33.3%) were in 18 to 30 years age group. In normal patients, majority of the patients were in 46 to 60 years (40%) and 31 to 45 years (28.9%) age group. The difference was found statistically significant ($p < 0.05$) In hypertensive patients, majority of the patients were male (63.3%) while in prehypertensive patients, majority of the patients (53.3%) were female. The difference was not found statistically significant ($p > 0.05$).

The mean BMI was higher in hypertensive patients (24.6 ± 1.3) compared to prehypertensive patients (23.3 ± 0.9) and normal patients (21.8 ± 1.0). The difference was found statistically significant ($p < 0.05$).

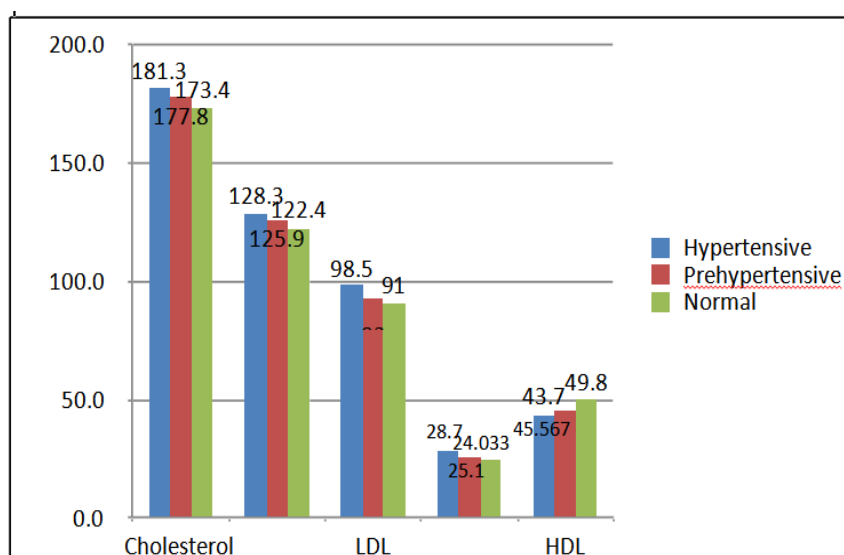
Cardiac symptoms like Headache, Gabbhraman and Dizziness were observed more in hypertensive patients compared to prehypertensive patients and normal patients. The difference was found statistically significant ($p < 0.05$).

1. Table: Distribution of the patients according to RDW.

2. RDW	3. Hypertensive	4. Prehypertensive	5. Normal
6. Mean	7. 16.1	8. 14.5	9. 12.4
10. SD	11. 3.1	12. 2.0	13. 0.8
14. P value	0.0001		

The mean RDW was higher in hypertensive patients (16.1 ± 3.1) compared to prehypertensive patients (14.5 ± 2.0) and normal patients (12.4 ± 0.8). The difference was found statistically significant ($p < 0.05$).

The hematological profile among patients. No statistically significant difference was observed in Haemoglobin, Total count and Platelets Count value in between three groups ($p > 0.05$).



Mean Cholesterol, Triglycerides and VLDL was significantly higher in hypertensive patients compared to prehypertensive patients and normal patients ($p < 0.05$). Mean HDL was significantly lower in hypertensive patients compared to prehypertensive patients and normal patients ($p < 0.05$). No statistically significant difference was observed in LDL value in between three groups ($p > 0.05$).

In ECG findings, LAD with LVH was observed in 53.3%, LAD in 20% and LVH in 6.7% of the Hypertensive patients. No any abnormality was found in ECG among prehypertensive and normal patients. The difference was not found statistically significant ($p > 0.05$).

In Chest Xray findings, Cardiomegaly was observed in 6.7% of the hypertensive patients. No any abnormality was found in Chest Xray among prehypertensive and normal patients. The difference was not found statistically significant ($p > 0.05$).

In USG Abdo pelvis findings, Fatty Liver was observed in 13.3%, Hepatomegaly in 6.7% and Right Renal Stone in 3.3% of the hypertensive patients. No any abnormality was found in USG Abdo pelvis among prehypertensive and normal patients. The difference was not found statistically significant ($p > 0.05$).

DISCUSSION

Hypertension ranks as the second leading risk factor for men and the leading risk factor for women globally, accounting for about 90 million disability adjusted life years (DALYs) among women and about 125 million DALYs among men.^[13] The overall prevalence of hypertension among adults in India is about 30% with urban prevalence of 34% and rural prevalence of 28%.^[14] Risks of chronic kidney diseases and concomitant cardiovascular diseases make hypertension a serious health problem. The damage to the blood vessels due to damage of vascular endothelium in hypertension can lead to complications in other parts of the body.^[15] RDW, a part of the normal complete blood count, is a measure of the variation in the size of circulating erythrocytes and is measured by automated haematology analysers. RDW has been shown to be raised in various diseases that show inflammatory stress including prehypertension and hypertension.^[15] It has been well documented in various studies that RDW can be used as a novel predictor of mortality in diseases such as coronary heart disease, stroke, peripheral artery disease, heart failure, venous thromboembolism, and pulmonary arterial hypertension.^[16]

In present study, the mean age of the patients was 55.0 ± 8.9 in hypertensive patients, 40.5 ± 14.8 in prehypertensive patients and 40.4 ± 11.5 in normal patients. The difference was found statistically significant ($p < 0.05$). Tanindi et al.^[16] also found that the

mean age of the patients was significantly higher in hypertensive patients (53.0 ± 6.7) and prehypertensive patients (45.4 ± 6.1) compared to normal patients (38.0 ± 7.9) ($p = 0.001$). The mean age of the patients was significantly higher in hypertensive patients (52 ± 13) and prehypertensive patients (45 ± 13) compared to normal patients (39 ± 12) in the ATTICA study^[17] ($p = 0.001$). Mean age of the hypertensive patients was observed 37.0 ± 6.3 years in S.G. Seo et al.^[18] and the 51.48 ± 10.08 years in Bilal et al. study.^[8] In present study, majority of the hypertensive patients were more than 46 to 60 years (66.7%) and 60 to 75 years (23.3%) age group. Erem C et al.^[20] also found the highest prevalence in the 60 to 69-year-old age group (84.4%). So that the prevalence of HT increased steadily with age.

In present study, majority of the patients were male (63.3%) in hypertensive patients. In the ATTICA study^[17], majority of the patients were male in hypertensive (60.4%) and prehypertensive patients (54.9%) and female in normotensive patients (64.7%). Male predominance among hypertensive patients was also observed in S.G. Seo et al.^[18] (56% male) and Bilal et al.^[19] (69% male). Whereas, in Tanindi et al.^[16], majority of the patients were female (57%) in hypertensive patients. Erem C et al.^[20] also found different findings in which prevalence of hypertension was higher in women (46.1%) than that in men (41.6%) ($P = 0.001$).

In present study, mean BMI was significantly higher in hypertensive patients (24.6 ± 1.3) and prehypertensive patients (23.3 ± 0.9) compared to normal patients (21.8 ± 1.0) ($p < 0.05$). Tanindi et al.^[16] also found significantly higher BMI in hypertensive patients (26.5 ± 1.5) and prehypertensive patients (26.1 ± 1.6) compared to normal patients (24.6 ± 1.8) ($p = 0.001$). BMI was observed significantly higher in hypertensive patients (26 ± 4) and prehypertensive patients (27 ± 4) compared to normal patients (24 ± 4) in the ATTICA Study^[17] ($p = 0.001$). BMI among the hypertensive patients was 23.0 ± 3.1 in S.G. Seo et al. study.^[18] Among subjects in Erem C et al.^[20], 13.7% of the normotensive versus 21.9% of the pre hypertensives and 42.4% of the hypertensives were categorised as obese. So, the prevalence of hypertension was higher among the overweight patients.

In present study, no statistically significant difference was observed in Haemoglobin, Total count and Platelet Count value in between three groups ($p > 0.05$). Tanindi et al.^[16] also observed no significant difference in Haemoglobin, Total count and Platelet Count value among patients.

In present study, Cholesterol, Triglycerides and VLDL was significantly higher in hypertensive patients

compared to prehypertensive patients and normal patients ($p < 0.05$). HDL was significantly lower in hypertensive patients compared to prehypertensive patients and normal patients ($p < 0.05$). No statistically significant difference was observed in LDL value in between three groups ($p > 0.05$). In Tanindi et al.^[16], Triglycerides and LDL was significantly higher and HDL was significantly lower in hypertensive patients compared to prehypertensive patients and normal patients. Triglycerides and LDL was also found significantly higher in hypertensive compared to prehypertensive and normal patients in the ATTICA Study^[17] and Erem C et al.^[20] study.

Hypertension is a well-known risk factor for diseases like stroke, cardiovascular disease (CVD) and renal failure.^[15] RDW is found to be increased in prehypertension and hypertension.^[15] Chronic inflammation may cause RDW elevation, and increased RDW levels might reflect an underlying chronic inflammation, which would explain the relationship between raised RDW in CVD. All these underlying causes result in an increased risk of CVD.^[22]

In present study, the RDW level was significantly higher in hypertensive patients (16.1 ± 3.1) compared to prehypertensive patients (14.5 ± 2.0) and normal patients (12.4 ± 0.8) ($p < 0.05$). Our findings resemble that of Tanindi et al.^[16] who analyzed 128 patients with hypertension, 74 patients with prehypertension, and 36 healthy controls and found that RDW is higher in hypertensive and prehypertensive patients than in healthy controls after adjusting for age, inflammatory status, and anaemia. A study by Gunebakmaz et al.^[22] analyzed 123 hypertensive patients and 65 normotensive subjects and found that hypertensive patients had higher RDW levels. Similarly, Dan Su, et al.^[23] showed increased RDW values in hypertensives and Wen, et al.^[24] found that there was a close relationship between RDW levels in patients with hypertension. Another community-based prospective cohort study conducted by Perlstein TS et al.^[25] reported that increased RDW levels were associated with higher blood pressure levels. Jiang et al.^[26] analyzed 302,527 health checkup participants in China. Interestingly, the participants demonstrated an inverted U-shaped relationship between RDW and systolic and diastolic blood pressure. In contrast, Fukuta et al.^[27] divided 226 patients who underwent coronary angiography into two groups according to RDW values and they did not find any significant difference with respect to mean aortic pressure and hypertension.

The mechanism underlying the association between high RDW and the development of hypertension is uncertain. High RDW may have a direct effect on hypertension through endothelial dysfunction. Patel et al.^[28] showed

that elevated RDW is associated with decreased red blood cell deformability, which can cause regional circulation impairment and hypoxia.^[29] Hypoxia is an important mechanism causing endothelial cell death and dysfunction.^[30] A previous clinical study showed that high RDW is independently related to endothelial dysfunction measured by decreased flow-mediated dilatation.^[31] Endothelial dysfunction is an important pathogenesis underlying hypertension, and a complex and bidirectional relationship exists between endothelial dysfunction and hypertension.^[32,33] High RDW may be a mere marker of comorbidities or pathophysiology related to hypertension rather than a direct inducer of hypertension. Older age, obesity, and metabolic syndromes are associated with the high RDW and are also well-known risk factors for hypertension.^[34,35] Similarly, high RDW is thought to be a sign of inflammation and oxidative stress, which are important pathogeneses underlying hypertension.^[36]

CONCLUSION

In this study shows that higher RDW values are strongly associated with hypertension. RDW is reported in routine Complete hemogram and is therefore easily identified without additional costs. It can be used as an early warning system for physicians to identify prehypertension and hypertension in patients. Screening for hypertension with a regular check-up and preventing hypertension through lifestyle modification would be a reasonable approach for individuals with high RDW. Studies with larger sample size are recommended to find out the mechanism underlying this association.

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