

Research Article

HS-C reactive protein and red blood cell distribution width as effective markers for hypertension

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Received: 23 March 2016

Revised: 04 April 2016

Accepted: 06 April 2016

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ABSTRACT

Background: Hypertension or elevated blood pressure is one of the leading causes of morbidity and mortality. Hs-CRP, which is a known marker for CVD, is also one of the predictive markers of inflammation processes which result in hypertension. Increased RDW is also believed to be associated with CVD morbidity and mortality in patients with previous myocardial infarction, brain vascular disease, strokes, septicemia, chronic obstructive pulmonary disease and hepatitis B.

Methods: 200 patients 100 male and 100 females and 50 each of controls were selected for the study. Complete demographic details were collected from all the patients including the age, sex, height, weight, BMI, smoking/non-smoking status, alcoholism etc. After a thorough clinical examination, venous blood was collected from all the patients after an overnight fast for lipid profile, hs-CRP and complete blood count.

Results: The patients in both males and females had a higher BMI than that of the controls. Hs-CRP levels in males was 1.64 mg/L and in females it was 1.47 mg/L. Significant difference was seen in the RDW values also in the patients.

Conclusions: Hs-CRP levels and RDW levels are both equally effective as a predictive marker for hypertension.

Keywords: Hs-CRP, Red blood cell distribution width, Hypertension

INTRODUCTION

Hypertension or elevated blood pressure is one of the leading causes of morbidity and mortality in developed as well as the developing nations. Often known as the 'Silent Killer', it is one of the risk factors for cardiovascular diseases and chronic kidney diseases, this making it one of the serious health problems of today's world.¹

Hypertension as a risk factor for cardiovascular disease accounts for 20-50% of the morbidity and mortality.² Hypertension is the cause of 4.5% of morbidity and 5.8% of mortality 1.9% of the years of life lost and 1.4% disability adjusted life years throughout the world.³ Hypertension is reported to be responsible for 57% deaths

caused due to stroke and 24% due to coronary heart disease in India.⁴

Apart from risk for CVD, hypertension also can affect the kidneys, brain, peripheral circulation and eyes.⁵ The mechanism of such wide spread complications is due to the damage to the vascular endothelium in the blood vessels.⁶ Renal hypertension puts a lot of pressure on the kidney leading to hypertensive nephropathy, thereby causing damage to the kidney. This is one of the leading causes of death in the elderly. Other complications which are often associated with hypertensive nephropathy include glomerular damage resulting in proteinuria and haematuria.⁷ Many adverse outcomes are associated with hypertension, including progressive loss of kidney function leading to kidney failure, early development and accelerated progression of CVD and premature death.⁸

C-reactive protein is a member of the pentaxin family, having characteristic circular pentameric disc shaped proteins. It is normally synthesized in the liver through the influence of cytokines particularly Interleukin-6 (IL6), secreted from the inflamed tissue.⁹ Hs-CRP is said to be a nonspecific marker for inflammatory response and it is emerging as an independent marker of CVD. Normally, it is present in low levels in the serum, but an acute inflammatory reaction can increase the levels of hs-CRP to several folds in the serum.⁹ Apart from CVD, it is also one of the predictive markers of inflammation processes which result in hypertension.⁸

Red blood cell distribution width (RDW) is a numerical measure of the size variability of circulating erythrocytes and is routinely reported as a component of complete blood count in the differential diagnosis of anemia.¹⁰ RDW in recent studies has been reported to be strongly associated with and an independent predictor of adverse outcomes in the general population.¹¹ Increased RDW is also believed to be associated with CVD morbidity and mortality in patients with previous myocardial infarction.¹² brain vascular disease, strokes, septicemia, chronic obstructive pulmonary disease and hepatitis B.^{13,14}

The specific mechanism of action of RDW remains unclear. There have been a few studies who have reported that inflammatory status is significantly related to ineffective erythropoiesis and that inflammatory cytokines, such as interleukin (IL)-1 β , IL-6, tumor necrosis factor (TNF)- α , desensitize bone marrow erythroid progenitors to erythropoiesis, inhibit red blood cell maturation and thereby promote anisocytosis. Elevated RDW may be due to an underlying inflammatory state.¹⁵

Though there are many studies on RDW and hs-CRP as markers for inflammation, there are not many studies

assessing the association of both these markers in hypertensive patients. Therefore this study was conducted to evaluate the association between RDW and hs-CRP and hypertension.

METHODS

This study was performed in the Department of Medicine at Deccan College of Medical Sciences Over a period of 3 years. A total of 300 patients were included in the study out of which 150 were males and 150 were females, all below the age of 70 years. 100 patients out of the 150 were hypertensive and 50 were normotensive and were considered as controls. Patients with diabetes mellitus and other hematological system diseases or any other diseases that could affect the white blood, red blood or hemoglobin count were excluded from the study.

After obtaining the clearance from the Institutional Ethical Committee and Informed consent from the patients, complete demographic details were collected including the age, sex, height, weight, BMI, smoking/nonsmoking status, alcoholism etc. All the patients were subjected to thorough clinical examination. Venous blood was collected from all the patients after an overnight fast in K₃ EDTA tubes and plain tubes and sent to the laboratory. From the EDTA tubes, complete blood count including parameters such as red cell distribution width (RDW), hemoglobin level, white blood corpuscles count, mean corpuscular volume was performed. Erythrocyte sedimentation rate was also done for all the samples. The serum was collected from the clotted blood in the plain tubes and subjected to various biochemical tests including hs-CRP, total cholesterol, high density lipoprotein-cholesterol, low density lipoprotein-cholesterol, triglyceride levels.

Statistical analysis was calculated as mean \pm SD.

RESULTS

Table 1: General variables of the patients and controls.

Variables	Males		Females	
	Patients (n=100)	Controls (n=50)	Patients (n=100)	Controls (n=50)
Age (years)	59.8 \pm 0.7	55.4 \pm 5.1	57.3 \pm 3.9	55.7 \pm 3.1
Weight (in kg)	81.2 \pm 4.1	74.2 \pm 1.9	67.2 \pm 5.1	59.1 \pm 3.1
BMI				
<25	43	39	39	41
\geq 25	57	11*	61	09*
Systolic BP	137 \pm 5	111 \pm 3*	138 \pm 5	107 \pm 4*
Diastolic BP	91 \pm 2	77 \pm 4*	93 \pm 4	75 \pm 4*
Smoking				
Never	22	24	91	49
Occasionally	49	21	09	01
Regularly	29	05	00	00
Alcoholism (yes/no)				
Never	24	28	93	50
Occasionally	55	17	07	00
Regularly	21	05	00	00

300 patients, 150 males and 150 females were included in the study. Out of 150 in each group, 50 were controls, with no known hypertension and no elevated blood pressure on the routine check prior to the study. 100 were hypertensive patients, either known or newly diagnosed. The patients in both males and females had a higher BMI than that of the controls (Table 1).

Among the blood investigations, significant difference was observed in the triglyceride levels of the patients in both males and females which were considerably higher than the controls. The erythrocyte sedimentation rate was considerably higher in the patients as was the hs-CRP levels. Hs-CRP levels in males was 1.64 mg/L and in females it was 1.47 mg/L. Significant difference was seen in the RDW values also in the patients (Table 2).

Table 2: Clinical parameters among the patients and controls.

Variables	Males		Females	
	Patients	Controls	Patients	Controls
Total cholesterol (mg/dL)	236.7±6.2	196.9±6.2	221.9±4.6	192.3±4.1
HDL-cholesterol (mg/dL)	42.8±4.2	51.3±5.2	40.5±4.1	49.3±4.2
LDL-cholesterol (mg/dL)	161.1±4.1	99.2±1.9	117.4±3.9	86.3±3.2
Triglycerides (mg/dL)	201.5±4.3	132.9±5.1*	215±6.2	123.3±6.1*
Fasting plasma glucose (mg/dL)	116.1±7.1	98±7.2	122.7±4.1	88.4±6.2
Hb (g%)	13.4±0.9	12.1±0.3	12.9±0.4	11.1±0.6
ESR (mm/h)	31.7±1.4	11.4±0.7*	36.4±2.1	12.1±2.2*
RDW (%)	14.7±0.4	12.9±1.4	13.9±0.5	12.6±0.8*
hs-CRP (mg/L)	1.64±0.09	0.62±0.12*	1.47±1.01	0.55±0.1*

*p<0.001

DISCUSSION

Hypertension can damage the blood vessels throughout the body resulting in endothelial dysfunction and vascular damage. Hs-CRP levels may serve as a screening test for the development of CVD^{16,17}.

In our study, though none of the patients had a cardiovascular disease, some of them had significantly high levels of hs-CRP, showing that they were at risk for CVD. The hs-CRP was 1.64 mg/l in who reported a hs-CRP levels of 1.68 mg/l and 1 mg/l in males and females respectively males and 1.47 mg/L in females. This was in accordance to a similar study by Jithesh et al.¹⁸

RDW is routinely reported in the laboratories for identifying the size of circulating red blood cell (anisocytosis) and diagnosing certain anemias, especially those that are microcytic caused due to iron deficiency or vitamin B₁₂ deficiency or Folic acid deficiency. An increased RDW can also result from conditions that modify the shape of red blood cells due to the premature release of immature cells into the bloodstream (severe blood loss), abnormal hemoglobins (eg, sickle cell anemia), hemolysis or hemolytic anemias.^{19,20}

In recent times, there is evidence of a strong association between elevated RDW and the occurrence of chronic heart failure, as well as fatal and nonfatal cardiovascular disease events. This has resulted in RDW becoming a new prospective markers for predicting the outcomes of CVD. As it is routinely done in the laboratory, there is no

extra cost incurred by the patient, nor is there any extra time lapse for treatment.²¹

In our study we have observed a considerable raise of the RDW levels among the patients in comparison to the controls. The elevation was more prominent in males than in females. This was observed by Jithesh et al in their study as well as by Wen et al.²²

Since both these markers are associated with inflammation, it can be concluded that hypertension is also associated with inflammation, thereby causing CVD or CKD.

CONCLUSION

It is observed that hs-CRP levels and RDW levels are both equally effective as a predictive marker for hypertension. This can be done routinely and easily in the laboratories, thereby giving the clinician a good supportive tool for diagnosing and preventing an adverse outcome.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Reddy GPK, Rao KVM. HS-c reactive protein and red blood cell distribution width as effective markers for hypertension. *Int J Adv Med* 2016;3:254-7.