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THE RED CELL DISTRIBUTION WIDTH AS A MARKER OF PREECLAMPSIA SEVERITY IN PBM HOSPITAL, BIKANER

Obstetrics & Gynaecology

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ABSTRACT

Introduction & Aim:-Preeclampsia is a serious disease and a leading cause of maternal and perinatal mortality and morbidity. Red cell distribution width, used traditionally to differentiate various types of anaemia is also documented to be associated with severity of hypertension in non-pregnant population. However, there is scarcity of its usefulness in hypertensive disorders of pregnancy. This study was undertaken to examine the role of red cell distribution width in predicting the severity of preeclampsia.

Method:-A prospective case- control study was conducted in the Department of Obstetrics and Gynaecology in S.P Medical College, Bikaner. The study population consisted of 100 patients with preeclampsia (50 mild: In this classification blood pressure is greater than 140 systolic or 90 diastolic. In these patients mild proteinuria is also present. and 50 severe: In this classification blood pressure is greater than 160 systolic or 110 diastolic. There were signs of severe headache, blurring of vision, altered mental status, nausea, vomiting with epigastric pain and thrombocytopenia. Here a significant proteinuria is present.) and 50 control participants matched for maternal and gestational age.

Results:- Red cell distribution width was significantly higher in severe preeclampsia group ($p<0.001$). The maximum numbers of patients in the study were found to be in the age group of <26 years. Out of these 52 % were normotensive and 42% were in mild preeclampsia group, 48% were in severe preeclampsia group in age <26 years. Total 150 patients were found in age between 25 to 29 years out of which 30% were normotensive, 22% were in mild preeclampsia group, 38% were found in severe preeclampsia group. It is evident according to age from table no.1 that Mean±SD in Group C severe preeclampsia (26.56±5.06), Group B mild preeclampsia is (27.48±5.49) and normal control group is (26.48±5.04) were found no significant difference in patients according to age.According to the pathological parameters(CBC RDW CV, CBC RDW SD) observed that patient according to Mean±SD in normotensive as control group compare with case mild preeclampsia, severe preeclampsia were found to be (14.17±0.69),(17.42±1.15), (21.51±1.57) and (36.41±2.01), (47.03±2.24), (54.46±2.61) respectively and found significantly raised.

Conclusions:- Red cell distribution width is associated with preeclampsia and has a good diagnostic significance in severe preeclampsia.

KEYWORDS

Preeclampsia, Red Cell Distribution Width, Hypertension.

INTRODUCTION

Preeclampsia is a multi-organ disease characterized by the development of hypertension. The World Health Organization estimates that preeclampsia is directly responsible for 10% of direct maternal mortality in Asia and also leads to significant neonatal morbidity and mortality.[1] Major pathophysiological process in the development of this disorder include incomplete invasion of the trophoblasts into spiral arterioles leading to endothelial dysfunction and activation.[2] Increased erythropoietic stimulation due to placental hypoxia has also been described in the literature.[3]

Red Cell Distribution Width (RDW) estimates the degree of heterogeneity of the erythrocyte volume. It is evaluated in a fully automated haematology analyser as a part of Complete Blood Count (CBC) and has a high sensitivity in the differential diagnosis of anaemia. However, recent evidence has shown that increased levels are also seen in hypertension and other cardiovascular disorders.[4,5] It is also associated with diabetic ketoacidosis, thrombotic disorders, malignancies and hepatorenal diseases.[6,7,8] However, there is limited data on the usefulness of RDW in pregnant population and especially the hypertensive disorders of pregnancy.[9] Red cell distribution width (RDW) is a marker of anisocytosis and shows the variation of red blood cell volume and evaluated in automated hematology analyzer, as a part of the complete blood count [10]. It is a marker used especially for detecting iron deficiency anemia and also increased in nutritional deficiencies of vitamin B12 and folate [8]. Recent studies show that there is significant association between RDW and cardiovascular diseases (CVD) and thrombotic disorders. It is found that RDW is higher in pre-hypertension andhypertension (HT) patients [11]. Even more importantly, the high RDW value is considered as a strong and independent risk factor for death in the general population [2]. Although there are studies showing an association between RDW and HT on non-pregnant patients, there is insufficient data on pregnant population. The aim of this study is to investigate if there is association between RDW and preeclampsia and with its severity and the relationship between RDW and preeclampsia in Indian population and to investigate if it can be used as a severity marker.

MATERIAL AND METHODS

It is a hospital-based prospective case- control study was conducted in the Department of Obstetrics and Gynaecology in S.P Medical College, Bikaner. The study population consisted of 100 patients with preeclampsia (50 mild: In this classification blood pressure is greater than 140 systolic or 90 diastolic. In these patients mild proteinuria is also present. and 50 severe: In this classification blood pressure is greater than 160 systolic or 110 diastolic. There were signs of severe headache, blurring of vision, altered mental status, nausea, vomiting with epigastric pain and thrombocytopenia. Here a significant proteinuria is present.) and 50 control participants matched for maternal and gestational age.

Inclusion Criteria:

1. Singleton third trimester pregnant women.
2. Pregnant women with hypertention after 20 week of gestation.

Exclusion Criteria:

3. Pregnant women with multiple gestation.
4. Pregnant women diabetes mellitus.
5. Patients with chronic hypertension, infectious diseases, premature rupture of membranes.
6. Patients with cardiac diseases, asthma, severe liver and renal diseases.

LABORATARY DIAGNOSIS:

All the participants underwent blood collection via antecubital vein

puncture. Red cell distribution width was measured using automated hematology analyser. RDW was measured using automated hematology analyzer sysmex 1800i by technique of hydro dynamic focusing method using semiconductor laser. Continuous data were summarized in the form of Mean± SD. The difference in mean was analysed using ANOVA test and post hoc test. The level of confidence was kept 95% for all statistical analysis.

Statistical Analysis:

Data analysis were performed using the Statistical Package for Social Sciences for Windows, version 16.0 (SPSS Inc., Chicago, IL, USA). Significance was set at $p<0.05$. The sample size included in this study yields more than 80% power to detect a 0.5 Standard Deviation (SD) difference in levels of RDW between groups with a significance level of $\alpha=0.05$. Continuous data was expressed as Mean ±SD, while categorical data was presented as number of patients. A One-Way Analysis of Variance (ANOVA) was used to compare the characteristics between healthy pregnant women and pregnant women with preeclampsia. Statistical significance was determined using multiple comparisons between the groups performed by a One-Way ANOVA. The participants' CBCs were analysed by the same statistical method. The strength of the association between RDW and Mean Arterial Pressure (MAP) was estimated using the Pearson correlation coefficient (r). To estimate the sensitivity value of RDW as a severity marker of preeclampsia, Receiver Operating Characteristic (ROC) analysis was performed.

Ethical Approval:

The goal and methodology of the study was described to all patient relatives after approval of hospital ethics committee. Both verbal and written consents were taken both from the patient and her relatives. The potential benefits and inconvenience of all aspects of the study was clearly stated to the parents.

RESULTS: -

Red cell distribution width was significantly higher in severe preeclampsia group ($p<0.001$). The maximum numbers of patients in the study were found to be in the age group of <26 years. Out of these 52 % were normotensive and 42% were in mild preeclampsia group, 48% were in severe preeclampsia group in age <26 years. Total 150 patients were found in age between 25 to 29 years out of which 30% were normotensive, 22% were in mild preeclampsia group, 38% were found in severe preeclampsia group. It is evident according to age from table no.1 that Mean±SD in Group C severe preeclampsia (26.56±5.06), Group B mild preeclampsia is (27.48±5.49) and normal control group is (26.48±5.04) were found no significant difference in patients according to age.Distribution according to gravidity in both groups. The results observed according to distribution of patient with gravidity were found to be primi gravida in Group C severe preeclampsia 35 (70%), Group B mild preeclampsia 28 (56%) and Group A normotensive subjects 23 (46%) in maximum percentage than second gravida. While in case of third gravida severe preeclampsia 1 (8%), Group B mild preeclampsia 6 (12%) and Group A normotensive subjects 10 (20%) in maximum subjects. The observations of patient according to presenting complaints in normotensive as control group compare with case mild preeclampsia, severe preeclampsia were found to be most common pedal edema in severe preeclampsia 45 (90%), mild preeclampsia 39 (78%) and normotensive subjects 11 (22%) control group. In case of headache were found in severe preeclampsia 49 (98%), mild preeclampsia 17 (34%) and normotensive subjects 1 (2%) group. While, in excessive weight gain severe preeclampsia 16 (32%), mild preeclampsia 3 (6%) and normotensive subjects no one observed control group. In condition of nausea and vomiting severe preeclampsia 39 (78%), mild preeclampsia 13 (26%) and normotensive subjects 8 (16%) were observed control group. In condition of vision problem severe preeclampsia 46 (92%), mild preeclampsia 9(18%) and normotensive subjects 0 (0%) were observed control group. In condition of oliguria severe preeclampsia 36(72%), mild preeclampsia 12(24%) and normotensive subjects 3 (6%) were observed control group. Thus, remaining complaint of abdominal pain severe preeclampsia 25 (50%), mild preeclampsia 7 (14%) and normotensive subjects 4 (8%) were found to be control group. According to past history with surgical clinical features in normotensive as control group compare with case mild preeclampsia, severe preeclampsia. Appendectomy was found to be only in 1 (2%) in Group B mild preeclampsia, while previous 2 LSCS was also observed in mild preeclampsia 1 (2%) and previous LSCS was found in normotensive and mild preeclampsia, 1 (2%),2 (4%) respectively. Thus, nill past history were found in normotensive and mild preeclampsia, 49 (98%), 46 (92%) respectively. According to the pathological parameters (CBC RDW CV, CBC RDW SD) observed that patient according to Mean±SD in normotensive as control group compare with case mild preeclampsia, severe preeclampsia was found to be (14.17±0.69), (17.42±1.15), (21.51±1.57) and (36.41±2.01), (47.03±2.24), (54.46±2.61) respectively and found significantly raised.

OBSERVATION TABLES

Table: - 1 Group Wise Analysis Of Cases According To Age.

Age Group (Years)	Group A Normotensive		Group B Mild Preeclampsia		Group C Severe Preeclampsia	
	No.	%	No.	%	No.	%
<26	26	52	21	42	24	48
26-30	15	30	11	22	19	38
31-35	7	14	16	32	05	10
36-40	2	4	01	2	01	2
>40	0	0	01	2	01	2
Total	50	100	50	100	50	100
Mean	26.48		27.48		26.56	
SD	5.04		5.49		5.06	

Table 2: - Distribution Of Patients According To Gravidity.

Gravida	Group A Normotensive		Group B Mild Preeclampsia		Group C Severe Preeclampsia	
	No.	%	No.	%	No.	%
G_1	23	46	28	56	35	70
G_2	11	22	13	26	10	20
G_3	10	20	6	12	1	2
$\geq G_4$	6	12	3	6	4	8
Total	50	100	50	100	50	100

Table3:- Distribution Of Patients According To Presenting Complaints

Presenting Complaints	Group A Normotensive		Group B Mild Preeclampsia		Group C Severe Preeclampsia	
	No.	%	No.	%	No.	%
Pedal edema	11	22	39	78	45	90
Headache	1	2	17	34	49	98
Excessive weight gain	0	0	3	6	16	32
Nausea and vomiting	8	16	13	26	39	78
Vision problem	0	0	9	18	46	92
Oliguria	3	6	12	24	36	72
Abdominal pain	4	8	7	14	25	50

Table: - 4 Distribution Of Patients According To Past History (Surgical)

Past History	Group A Normotensive		Group B Mild Preeclampsia		Group C Severe Preeclampsia	
	No.	%	No.	%	No.	%
Appendectomy	0	0	1	2	0	0
Previous 2 LSCS	0	0	1	2	0	0
Previous LSCS	1	2	2	4	0	0
Nil	49	98	46	92	0	0
Total	50	100	50	100	50	100

Table: - 5 Distribution Of Patients According To Mean And SD Of CBC RDW

Investigation	Group A Normotensive		Group B Mild Preeclampsia		Group C Severe Preeclampsia	
	Mean	SD	Mean	SD	Mean	SD
CBC RDW CV	14.17	0.69	17.42	1.15	21.51	1.57
CBC RDW SD	36.41	2.01	47.03	2.24	54.46	2.61

DISCUSSION

The results from our study showed that there is a relationship between RDW and preeclampsia with significantly higher levels seen in severe preeclampsia cases. We have also demonstrated that RDW can be used to differentiate between mild and severe forms of preeclampsia.

RDW, a marker of erythrocyte anisocytosis, is traditionally used for differential diagnosis of anaemia. However, recent studies have found that it is correlated strongly with heightened systolic and diastolic blood pressure and is a poor prognostic indicator in cardiovascular disorders.[4,5,11] Ozcan et al have attributed the rise of RDW in

hypertensive disorders to the increased inflammatory response.[12] By impairment of iron metabolism and disturbance in erythropoiesis, it could also result in the release of excess of reticulocytes and disruption in erythrocyte maturation.[13]

Preeclampsia is a syndrome characterized by the new onset of hypertension affecting both mother and foetus. The association between RDW and preeclampsia can be explained by several theories. In preeclampsia, there is incomplete invasion of trophoblasts into spiral arterioles leading to endothelial dysfunction and activation. This leads to excessive maternal vascular inflammatory response. [14] Preeclampsia is associated with rise in tumour necrosis factor α and interleukin 6 levels.[15] The increased inflammation results in destruction of RBCs and disturbance in erythropoietin release. Hence, there is release of young RBCs and reticulocytes into the circulation causing anisocytosis in preeclampsia. Reticulocytosis in peripheral blood can also be attributed to the deposition of fibrinoid material and foam cells around the arteriole in preeclampsia.[16] Hence, there is placental hypoxia and increased erythropoietic activity, which was also demonstrated by Troeger et al in their study involving preeclamptic patients.[3] This results in stimulation of bone marrow leading to increased release of immature RBCs. However, the resulting anisocytosis measured by RDW, is due to the disease itself or a reflection of an underlying cause or both elements is still unclear.

Our study is in concordance with findings of study done by Kurt et al involving 35 patients with mild preeclampsia and 17 patients of severe preeclampsia. They have also shown that severe preeclamptic cases had higher RDW values. They also demonstrated a positive correlation between RDW and C- reactive protein.[9] In addition our study shows that RDW can also be used to differentiate the severe form of preeclampsia from the mild form. However, a study done by Abdullahi et al involving 65 patients of preeclampsia in Sudanese population did not show correlation between RDW and preeclampsia.[17] The probable cause could be due to a high prevalence of anaemia in their study population, which could have resulted in high RDW.[18]

CONCLUSIONS

Due to its varied clinical presentation, proper diagnosis of preeclampsia is still an issue, especially in community health centres. There is a need for an affordable test that could offer a pre-symptomatic diagnosis of preeclampsia. RDW is a simple, inexpensive and routinely used parameter available to health care givers as a part of CBC. In the present study, we have demonstrated that RDW is associated with the presence and severity of preeclampsia and can be used to identify the severe preeclampsia. Further studies involving larger population are required to evaluate the usefulness of RDW as a candidate marker for predicting the occurrence of severe preeclampsia.

DISCLOSURE STATEMENT

This study is investigator initiated. The authors declare that they have no competing/conflict of interests in relation to this article.

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CONSENT FOR PUBLICATION

- Not applicable.
- Ethics approval and consent to participate.
- The study protocol was approved by the medical ethics committee of the Rajasthan University of Health Sciences, Jaipur, Rajasthan (State), India.

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