International Journal of Sciences & Applied Research

www.ijsar.in

Association of Red Cell Distribution Width with the presence and severity of Preeclampsia

Haritha Mannem*, Lata Rajoria, Mohan Meena, B. S. Meena

Department of Obstetrics and Gynaecology, SMS Medical College, Jaipur, India.

Correspondence Address: *Haritha Mannem, Department of Obstetrics and Gynaecology, SMS Medical College, Jaipur, India.

Abstract

Objective(s): To investigate the correlation of red cell distribution width with preeclampsia and its severity.

Method(s): This study was a hospital based observational descriptive comparative analysis type done at Department of Obstetrics and gynecology, SMS medical college, Jaipur. Study participants included singleton third trimester pregnant women admitted in Department of obstetrics and gynecology, SMS medical college, Jaipur after applying selection criteria.25 severe preeclampsia cases were included on first cum first basis after beginning the study. Normotensive and mild preeclampsia cases just next to each severe preeclampsia case were also included in the study for comparative group. All participants underwent blood collection via antecubital vein puncture. Red cell distribution width was measured using automated hematology analyzer.

Result(s): The mean RDW-SD and RDW-CV values of severe preeclampsia group were significantly higher compared to mild preeclampsia and normotensive group.($p<0.0001$)It was also observed that the mean values of RDW-SD were more significantly associated with the severity of preeclampsia than the mean values of RDW-CV.

Conclusion(s): We conclude from our study that inflammatory process has a significant role in pathophysiology of preeclampsia. The severity of inflammation is depicted by the increase in RDW values in preeclampsia. In our study RDW values are definitely raised among the preeclampsia groups compared to the controls which signify their role in contributing to the early diagnosis of the condition.RDW values are also associated with the severity of the condition which is further helpful in the management of these high risk patients. We further observed that RDW-SD values are more closely associated than RDW-CV values to the severity of the disease. Our study concludes that simple determination of RDW values help in both diagnosing and assessing the severity of preeclampsia.

Keywords: Preeclampsia, Red cell distribution width

Introduction

Hypertensive disorders complicate 5 to 10% of all pregnancies and contribute greatly to maternal morbidity and mortality .Importantly more than half of this hypertension related deaths are preventable

[2]. The reported incidence of HDP in India was 5.38 % while preeclampsia, eclampsia and HELLP syndrome accounted for 44%, 40% and 7% of complications, respectively[3]

Preeclampsia diagnosis was achieved based on the 2002 criteria of the American College of Obstetricians and Gynecologists; a systolic BP of 140 mm Hg or higher or a diastolic BP of 90 mm Hg or higher occurring after 20 weeks of gestation in a woman whose BP has been previously normal and detectable urinary protein (>1 + by dipstick or 0.3 g/24 hour and more). Blood pressure recordings to establish the diagnosis should be no more than 7 days apart. Proteinuria is defined as a protein concentration of 300 mg/L or more (1 + on dipstick) in at least two random urine samples taken at least 4–6 h apart. The urine dipstick measurements used to establish proteinuria should be no more than 7 days apart.[4] Clinical definition of severe preeclampsia was as follows: a BP of 160 mm Hg/ 110 mm Hg, with either a proteinuria greater than 5 g over 24 hours or a urine dipstick showing 3+ or 4+ in a random urine analysis. Eclampsia, pulmonary edema, increased serum creatinine, oliguria (less than 500 mL/24 hour), fetal growth restriction, oligohydramnios, and symptoms suggestive of significant end organ involvement (headache and visual disturbance) were accepted as other evidences of the severe disease.[4,5]

The various pathological factors responsible for development of preeclampsia have been proposed to be

a. placental implantation with abnormal trophoblastic invasion of uterine vessels
b. immunological maladaptive tolerance between maternal, paternal and fetal tissues
c. maternal maladaptation to cardiovascular or inflammatory changes of normal pregnancy
d. genetic factors including inherited predisposing genes and epigenetic influences[2]

Since erythrocytes have a poor repair mechanism, they are destroyed by any minor event causing damage. Increased inflammatory process (eg, neutrophil, monocyte, and macrophage) in preeclampsia leads to the destruction of red blood cells by acting with oxygen radicals and proteolytic enzymes[6,7,8,]Tissue hypoxia induced erythropoietin secretion stimulates bone marrow. Thus, the number of immature erythrocytes increases in the blood flow, andreticulocytosis takes place.[9]

Red cell distribution width (RDW) is a readily available hematologic index that shows a variation in erythrocyte volume (anisocytosis). Although the exact mechanism behind this relationship is not known, high RDW levels are believed to reflect increased inflammation. [10,11]

The RDW, previously used only as an index for the diagnosis of anemia, has been recently shown to be associated with the presence and severity of hypertension.[12]

The mechanism of the relationship between RDW and hypertension is not clearly known. There are several proposed theories. The most probable theory shows increased inflammation as the main cause. Red cell distribution width (RDW) which is reported as part of complete blood count in routine clinical practice, is a measure of variability in size of the erythrocytes in the circulation[13,14]Inflammation likely increases RDW levels via impairment of iron metabolism, disruption of response to erythropoietin, and shortening of the lives of red blood cells. Furthermore, inflammatory cytokines have been shown to cause the immature erythrocytes to enter the

circulation by impairing erythrocyte maturation.[15]

The reference range for RDW is as follows[16,17]

RDW-SD = 39-46fL

RDW-CV = 11.6-14.6%

RDW is also useful in the following conditions

- elevated RDW helps provide a clue for a diagnosis of early nutritional deficiency such as folate or vitamin B12 deficiency as it becomes elevated earlier than other red blood cell parameters
- it aids in distinguishing between uncomplicated iron deficiency anemia and uncomplicated heterozygous thalassemias
- it also helps in distinguishing between megaloblastic anemia such as folate or vitamin B12 deficiency anemia and other causes of macrocytosis.[16,17]

Materials and methods

The study was a hospital based observational descriptive comparative analysis conducted in the department of Obstetrics and Gynaecology, SMS Medical College, Jaipur from March 2014 onwards. The study participants included singleton third trimester pregnant women admitted in department of obstetrics and gynecology, SMS medical college and associated hospitals, Jaipur. Pregnant women with multiple gestation, diabetes mellitus, chronic hypertension, infectious diseases, premature rupture of membranes; anemia and kidney diseases were excluded from the study.

The singleton third trimester pregnant women attending in the department of obstetrics and gynecology, SMS medical college, Jaipur were categorized into normotensive pregnant women, mild preeclamptic and severe preeclamptic after measuring their blood pressure and urine albumin by random selection.25 severe preeclampsia cases were included in first cum first basis after beginning the study. Normotensive and mild preeclampsia cases just next to each severe preeclampsia case were included in the study for comparative group.

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 hemotology analyzer sysmex 1800i by technique of hydro dynamic focusing method using semiconductor laser.

Continuous data was 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.

Results

Our study was done among 25 mild preeclampsia patients(group A),25 severe preeclampsia patients(groupB) and 25 controls(group C).Complete blood count including RDW-CV and RDW-SD were done in these patients and the data collected and analysed.

Following results could be drawn from our study

1. The mean age of mild preeclampsia group was 26.08±4.36 yrs. The mean age of severe preeclampsia group was 25.32±4.75 years. The mean age of control group was 24.64±3.22 years. We obsereved that the incidence of severe preeclampsia is more in younger age groups.
2. The majority of subjects in all the three groups belong to hindu religion, Hailing from urban area and belonging to lower and lower middle socio economicstatus.
3. The majority of subjects in preeclampsia grous A and B are illiterate while the Majority in group C are literate.
4. Most of the patients in severe preeclampsia group are primigravidas.
5. Maximum number of patients in all the groups is nonsmokers.

6. Majority of subjects in all the three groups belong to underweight and normal weight.this reflects the nutrition status of developing countries like India.
7. The mean systolic blood pressure is highest in group B ie 170±15.49 followed by group A ie 144±4.9 and the least in group c ie 114.32±5.7.
8. The mean diastolic blood pressure is highest in group B ie 104±11.3 followed by group A ie 94±6.9 and the least in group c ie 71.2±7.1
9. The mean haemoglobin of all the 3 groups is almost similar with only minor variation indicating the overall anemic status.
10. The mean TLC of group B is significantly higher ie 13843.2±5957.4 compared to 11928±6238.8 of group A and 8816.3±1093.5 of group C
11. The mean MCV, MCH and MCHC values of the three groups are almost similar with least among group B.
12. There is no significant difference in the mean platelet count of the three groups with group c showing the highest counts.
13. The mean RDW-SD value of group B are significantly higher ie49.56±7.9 compared to 43.63±9.22 of group a and 37.58±5.83 of group C. We observed that RDW-SD values are associated with the severity of preeclamsia
14. The mean RDW-CV value of group B are significantly higher ie19.72±5.3 compared to 18.65±3.76 of group A and 14.06±1.57 of group C. We observed that RDW-CV values are also associated with the severity of preeclampsia
15. We also observed that the mean values of RDW-SD are more significantly associated with the severity of preeclampsia (CD-4.31) than the mean values of RDW-CV(CD-2.38).

Demographic profile of our study shows that preeclampsia is more common among unbooked, nulliparous, illiterate, hindu women of urban background belonging to lower and lower middle socioeconomic status.

Table 1: Mean+SD of SBP and DBP of various group subjects.

Parameter	Group-A Mild preeclampsia	Group-B Severe preeclampsia	Group-C Normotensive	P value
SBP	144.00 + 4.90	170.00 + 15.49	114.32 + 5.79	<0.0001 Highly significant
DBP	94±6.93	104±11.31	71.20±7.11	<0.0001 Highly significant

Table 2: Mean RDW-SD and mean RDW-CV of various group subjects.

Parameter	Group-A Mild preeclampsia	Croup-B Severe preeclampsia	Group-C Normotensive	P value
RDW-SD	43.63±9.22	49.56±7.92	37.58±5.83	<0.0001 Highly significant
RDW-CV	18.65±3.76	19.72±5.38	14.06±1.57	<0.0001 Highly significant

Table 3: Table showing other CBC parameters of various group subjects.

Parameter	Group-A Mild preeclampsia	Group-B Severe preeclampsia	Group-C Normotensive	P value
Hemoglobin	10.85±1.79	10.54±2.15	10.50±0.91	>0.5 Non significant
TLC	11928.05±6238.80	13843.20±5957.42	8816.32±1093.57	<0.003 significant
Platelet count	1.85±0.52	2.17±0.87	2.57±0.57	<0.001 Highly significant
MCV	83.16±9.29	78.48±8.79	79.28±3.80	>0.05 Non significant
MCH	25.38±4.17	24.37±3.96	25.93±2.61	>0.05 Non significant
MCHC	30.72±2.39	30.67±3.12	31.48±1.23	>0.05 Non significant

Discussion

Throughout the history, care for expectant mothers has been based on one over-riding objective that each pregnancy should result in a healthy mother and a healthy baby. Whilst the majority of pregnancies will progress satisfactorily with minimal intervention from caring professions, there will always be the need to identify those groups for whom a greater degree of care is required. These 'High Risk' group requires early diagnosis to develop a plan of care that is to tailored to the needs simultaneously with the lives of (at least two) intricately interwoven patients-the mother and her baby(ies).

Preeclampsia is a major cause of maternal morbidity and mortality and also premature delivery and perinatal death. This accounts for about 50,000 deaths worldwide annually. The incidence in developing countries is around 10-15% posing a great burden. Early diagnosis and management of preeclampsia therefore is a necessity.

Red cell distribution width is a component of simple and basic complete blood count. This investigation is simple to perform, cost effective, easily available and acceptable.

Diagnosis and severity assessment of preeclampsia by using this investigation might help in timely interpretation and reduction in the complication rates of pregnancy.

The purpose of my study is to evaluate the role of red cell distribution width determination in diagnosis of preeclampsia and as well as assessing the severity of preeclampsia.

Conclusion

We conclude from our study that inflammatory process has a significant role in pathophysiology of preeclampsia.

The severity of inflammation is depicted by the increase in RDW values in preeclampsia.

In our study RDW values are definitely raised among the preeclampsia groups compared to the controls which signify their role in contributing to the early diagnosis of the condition.

RDW values are also associated with the severity of the condition which is further helpful in the management of these high risk patients.

We further observed that RDW-SD values are more closely associated than RDW-CV values to the severity of the disease.

Our study concludes that simple determination of RDW values help in both diagnosing and assessing the severity of preeclampsia.

References

1. RaziyeKeskin Kurt, Zinnur Aras, DilekBenkSilfeler, CigdemKunt, Mine Islimye and OzlemKosar.Relationship of red cell distribution width with the presence and severity of preeclampsia. Clinical and Applied Thrombosis/ Hemostasis, 2013; 00(0): 1-4.
2. Cunningham, Leveno, Bloom et al. Williams textbook of obstetrics, 24th edition.
3. Li Z, Zhang Y, Ying Ma J, Kapoun AM, Shao Q, KerrI, et al. Recombinant vascular endothelial growth factor attenuates hypertension and improves kidney damage in a rat model of preeclampsia. Hypertension 2007; 50:686 –92.
4. ACOG practice bulletin. Diagnosis and management of preeclampsia and eclampsia. Number 33, January 2002. American College of Obstetricians and Gynecologists. Int J Gynaecol Obstet. 2002;77(1):67-75.
5. Sibai B, Dekker G, Kupferminc M. Pre-eclampsia. Lancet. 2005; 365(9461): 785-799
6. Catarino C, Rebelo I, Belo L, et al. Erythrocyte changes in preeclampsia: Relationship between maternal and cord blood erythrocyte damage. J Perinat Med. 2009;37(1):19-27.
7. Munazza B , Raza N, Naureen A, Khan SA,SulamanM.Liver function tests in preeclampsia. J Ayub Med Coll Abbottabad.2011 Oct-Dec;23(4):3-5.
8. Weiss DJ, Aird B, Murtaugh MP. Neutrophil induced immunoglobulin binding to erythrocytes involves proteolytic and oxidative injury. J Leukoc Biol. 1992;51(1):19-23
9. Brovelli A, Castellana MA, Minetti G, et al. Conformational changes and oxidation of membrane proteins in senescent human erythrocytes. AdvExp Med Biol. 1991;307:59-73.
10. Lippi G, Targher G, Montagnana M, Salvagno GL, Zoppini G, Guidi GC. Relationship between red blood cell distribution width and kidney function tests in a large cohort of unselected outpatients. Scand J Clin Lab Invest. 2008;68(8):745-748.
11. Tanindi A, Topal FE, Topal F, Celik B. Red cell distribution width in patients with prehypertension and hypertension. Blood Press. 2012;21(3):177-181.
12. Gunebakmaz O, Kaya MG, Duran M, Akpek M, Elcik D, Eryol NK. Red blood cell distribution width in 'non-dippers' versus 'dippers'. Cardiology. 2012;123(3):154-159.
13. Ozcan F, Turak O, Durak A, et al. Red cell distribution width and inflammation in patients with non-dipper hypertension. Blood Press. 2013; 22(2):80-85.
14. Kronborg CS, Gjedsted J, Vittinghus E, Hansen TK, Allen J, Knudsen UB. Longitudinal measurement of cytokines in preeclamptic and normotensive pregnancies. ActaObstetGynecol Scand. 2011;90(7):791-796.
15. Pierce CN, Larson DF. Inflammatory cytokine inhibition of erythropoiesis in patients implanted with a mechanical circulatory assist device. Perfusion. 2005;20(2):83-90.
16. Choladda Vejabhuti Curry, MD. Red cell distribution width (RDW).
17. Eric B Staros MD .Mean corpuscular volume (MCV).
18. Shehata HA, Ali MM, Evans Jones JC, Upton GJ, ManyondaIT.Red cell distribution width changes in pregnancy. Int J gynaecolobstet 1998;62(1)43-4.