

Original article

## Red cell distribution width and Mean platelet volume: a simple marker for predicting preeclampsia

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### Abstract

**Aim and objectives:** To determine the correlation of red cell distribution width (RDW) and mean platelet volume (MPV) in PIH patients in their third trimester.

**Materials and methods:** The Study was carried out in Department of Physiology in collaboration with Department of Obstetrics and Gynecology, Dr. BVP Rural Medical College, Loni. Total of 152 subjects were studied. 82 healthy pregnant women (control group) and 70 PIH patients (case group). PIH patients were diagnosed cases by the department of Obstetrics and gynecology. Laboratory findings i.e. red blood cells distribution width (RDW) and mean platelet volume (MPV) of the given patients and control was noted.

**Results:** The present study shows increase in RDW and MPV in preeclampsia women as compared to the control. There is a significant difference in RDW in severe preeclampsia patient and control with P-value <0.05. MPV is also significant in cases and control.

**Conclusion:** The present study shows an increase in RDW and MPV in preeclampsia as compared to healthy pregnant women. The RDW and MPV can be used as prognostic markers as it is easily accessible and that do not imply an additional expense and can thus improve decision-making in patients with pre-eclampsia.

**Keywords:** Red blood cell distribution width (RDW), mean platelet volume (MPV), preeclampsia

### INTRODUCTION

Many of the pregnant women suffers from complications like miscarriage, premature baby, intrauterine death (IUD), still birth, polyhydramnios, oligohydramnios, gestational diabetes, hypertensive disorder also called as pregnancy induced hypertension (PIH). PIH they form one of the deadly triad accompanied with haemorrhage and infection that contribute greatly to the maternal morbidity and mortality rates [1]. PIH develops in pregnancy and regresses after delivery. It is defined as hypertension starting after 20 weeks of gestation with or without proteinuria. Most deaths in PIH occur due to its complications & not due to hypertension per se.

The incidence of pre-eclampsia in India varies from 5% to 15%, preeclampsia (PE) complicates 3–8%, eclampsia (1.5%) of all pregnancies and lead to health risks for both mother and fetus [2, 3]. PIH is usually diagnosed in late pregnancy by the presence of high blood pressure with proteinuria and/or edema it is one of the reason of increased mortality. Severe hypertension

in pregnancy increases the mother's risk of multiorgan damage and cerebral vascular accidents. In addition, there is also the risk of complications to the fetus leading to poor fetal outcome. The reasons for poor fetal outcome are supposed to be poor placental transfer of oxygen and placental abruption.[4]

For the prevention of any disease process there is a need of awareness of its prevalence, etiology and pathogenesis. Due to variable clinical presentations, the diagnosis of the patients with PIH is difficult. In some cases, the patients with such disorder remains asymptomatic even with the severe disease. This makes the condition complex to manage and entirely unattainable in deprived communities [5]. Early assessment of preeclampsia and eclampsia especially in rural communities is necessary to prevent PIH complications and to reduce associated increased maternal and fetal morbidity and mortalities. Thus the present study aim was to investigate the red cell distribution width (RDW) and mean platelet volume (MPV) in PIH patients in their third trimester.

## METHODS

### Study design

The present study is a case control study

### Study area

The Study was carried out in Department of Physiology in collaboration with Department of Obstetrics and Gynecology, Dr. BVP, Rural Medical College, Loni.

### Study subjects

Total of 152 subjects were studied. 82 healthy pregnant women (control group) and 70 PIH patients (case group).

### Study conduct

The study was carried out after ethical approval of the Institute and after taking informed consent from the subjects. The demographic details of the patient like age, weight, height was noted. The BMI of the subject was calculated using weight and height. The study population was divided in two groups, PIH patients (cases) and healthy pregnant women (control). PIH patients were diagnosed cases by the department of Obstetrics and gynecology.

The cases was further categorized into 2 different categories

**Group A** - Non-severe/mild pre-eclampsia: Systolic blood pressure between 140 and 160 mm Hg and diastolic blood pressure between 90 and 110 mm Hg, proteinuria up to 1+.

**Group B** - Severe/moderate pre-eclampsia: Systolic blood pressure between >160 mm Hg and diastolic blood pressure >110 mm Hg, proteinuria >1. Red blood cell distribution width (RDW) and mean platelet volume

(MPV) were counted using Automated Haematology System. Laboratory findings i.e. RPW and MPV of the given patients and control was noted.

### Inclusion Criteria:

- Patients with preeclampsia as defined by American College of Obstetricians and Gynaecologists guidelines.
- Non-smoker
- Healthy pregnant women and PIH patients with age of 20-35yrs
- Healthy pregnant women and PIH patients with gestational weeks of 30-42

### Exclusion Criteria:

- History of hypertension before pregnancy or before 20 week and on antihypertensive treatment for the same.
- Pre-existing medical disorders - diabetes mellitus, renal disease, any coagulopathies, chronic hypertension, and thyroid disorder.
- Smokers, alcoholics.
- Any ongoing infection, systemic inflammatory condition or any autoimmune disease.
- Patients with any pregnancy complications like membrane rupture, intrauterine fetal death (IFUD) or multifetal gestation.
- Placental abruption or previa.

## RESULTS

Total of 152 subjects were studied. In which 82 healthy pregnant women (control group) and 70 PIH (case group) was present.

**Table.1:** Demographic details of control and case

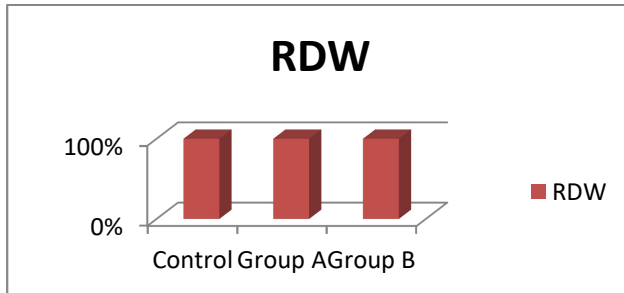
| Parameter | Control (N-82) | Group A (N-49) | Group B (N-21) | P- value |
|-----------|----------------|----------------|----------------|----------|
| Age       | 23.6 ± 3.103   | 24.76 ± 3.67   | 23.29 ± 3.82   | 0.099    |
| Weight    | 58.35 ± 7.8    | 58.12 ± 7.05   | 56.95 ± 4.81   | 0.799    |
| Height    | 156.2 ± 8.02   | 155.59 ± 7.22  | 153.04 ± 4.018 | 0.230    |
| BMI       | 24.013 ± 3.46  | 24.016 ± 2.52  | 24.33 ± 2.10   | 0.915    |

There was no significant difference in the mean age, weight, height and BMI of cases and control as shown in (Table.1)

The mean of RDW in normotensive pregnant women is (44.85±9.47) and the mean value of Group A (mild preeclampsia) patient is

(47.014±7.10) and Group B (severe preeclampsia) patient is (46.852±8.23) using Kruskal-Wallis test with a significant difference between normotensive pregnant women and group B patient (p-value 0.22) as shown in graph.1

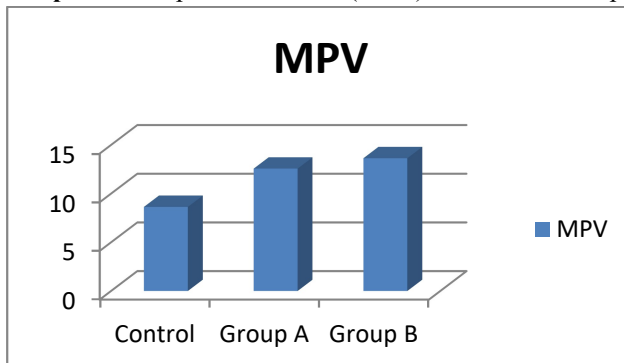
**Graph.1** Red cell distribution width in normotensive pregnant women and preeclampsia



The mean of MPV in normotensive pregnant women is (8.63± 0.83) and the mean value of Group A (mild preeclampsia) patient is (12.57 ± 1.62) and Group B (severe preeclampsia) patient is (13.63 ± 2.38) using Kruskal-Wallis test with a

significant difference between normotensive pregnant women and cases both Group A ,Group B (p-value 0.00) as shown in graph.2

**Graph.2** Mean platelet volume (MPV) in normotensive pregnant women and preeclampsia



## DISCUSSION

The incidence of pre-eclampsia in India varies from 5% to 15% [6, 7], leading to health risks for both mother and fetus. In addition, the fetus is also compromised with the risk of complications leading to poor fetal outcome. The exact pathophysiology of PIH is still a concern, present study was undertaken to evaluate red blood cell distribution width (RDW) and mean platelet volume (MPV) role in preeclampsia. In the current study there was no significant difference in the demographic details like age, weight, height and BMI.

The current study found that there is an increase in RDW in preeclampsia as compared to the healthy pregnant women and there is a significant increase in RDW in severe preeclampsia as compared to mild preeclamptic patient which is in accordance with the finding of Mendoza EAV and colleagues [6], who found that there is a significant relation of RDW with preeclampsia patients. Study done by Kurt et.al [7] also found increase in RDW in severe preeclampsia patient with a systolic blood pressure >160mmHg as compared to normotensive pregnant women. Manuja et.al found in terms of RDW, the mean RDW among cases as 15.64±2.08 compared

to  $14.91 \pm 1.64$  among controls [8]. These findings were similar to the present study. Sachan R et al., also reported a mean RDW of  $15.05 \pm 0.46$  among non severe PE,  $15.05 \pm 0.46$  among severe PE and  $12.96 \pm 0.51\%$  among controls, showing a significant increase in RDW among pre-eclampsia cases compared to controls [9] which is similar to the present findings. The present finding is different from the results of Abdullahi et al. [10] which shows no difference in the RDW among preeclampsia and control. RDW is a measure of the erythrocyte volume showing the variability in size of the erythrocytes (anisocytosis) in the circulation. Shortening of the lives of erythrocytes by defective erythropoiesis, by inflammation or hemolysis, results in elevation of RDW [11]. Recent studies have revealed the RDW value is associated with both acute and chronic cardiovascular conditions such as myocardial infarction (MI), heart failure, stroke and Peripheral arterial disease. RDW is also found to be increased in other clinical conditions like thrombotic thrombocytopenic purpura, inflammatory bowel disease.

One of the pathogenesis considered for preeclampsia is an alteration in the invasion of the extra villous trophoblast resulting in placental hypoperfusion that generates reactive oxygen species and cytokines pro-inflammatory [12]. The chronic hypoperfusion of the maternal-fetal circulation could compromise the erythrocytes, this whose main function is the transport of oxygen. The erythrocyte distribution width (RDW) describes the percentage variation in the size of the erythrocytes. It indicates a heterogeneous population of erythrocytes, that is, increased RDW values are related to when there is excessive destruction of red blood cells or a deficit in its production [13]. Chronic inflammation and increased inflammatory activity which occurs in

preeclampsia might be one of the reason for the increase in RDW in preeclampsia [14].

The current study also found a significant increase in MPV in preeclampsia as compared to control. The present finding is similar to the finding of Manuja et.al [8] who reported mean MPV of  $9.86 \pm 1.14$  among cases and  $8.92 \pm 1.40$  among controls, showing a significant difference between the two groups. Kashyap D et.al also observed a significant increase in MPV with the mean MPV among cases was  $12.19 \pm 1.38$  and among controls it was  $12 \pm 1.68$  [15]. Gezer et al. reported a decrease in RDW and MPV in cases as compared to control. Their results were conflicting with our findings. Recently, MPV is also another commonly studied inflammatory marker which is a determinant of platelet activity. Studies had reported MPV as a risk factor for hypertension, myocardial infarction, and poor prognosis in cardiovascular disease [16]. MPV was elevated in inflammatory process in several diseases such as, chronic Hepatitis B, myocardial infarction, rheumatoid arthritis, and cardiovascular disease [17,18]. It reflected the severity of many clinical conditions. It was suggested that the activation of platelets during trophoblast invasion differs in preeclamptic patients from normal pregnancies. There also occurs altered platelet activity before the clinical onset of preeclampsia [19]. This might be the probable reason for an association between MPV and preeclampsia.

#### CONCLUSION

The present study shows an increase in RDW and MPV in preeclampsia as compared to healthy pregnant women. The RDW and MPV can be used as prognostic markers as it is easily accessible and that do not imply an additional expense in their care and can thus improve decision-making in patients with pre-eclampsia in order to stratify the risk of these patients.

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