"PLATELET INDICES IN PREECLAMPSIA AND NORMOTENSIVE PREGNANCY IN A TERTIARY CARE CENTER"

By

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Dr .KRATIKA KAMATH

Contents

List of Tables

List of Graphs

List of Figures

ABSTRACT

Among the major health problems causing morbidity and mortality in a mother, preeclampsia is one among the leading cause[1]. Worldwide, 10% of the pregnant women are identified with hypertensive disorders of pregnancy. Preeclampsia, eclampsia, gestational hypertension and chronic hypertension are included in the hypertensive disorders of pregnancy. One tenth of the maternal mortality are associated with increased blood pressure recordings in pregnancy in Asia and Africa. PE is a disorder affecting multiple systems in pregnancy and is characterized by the presence of high blood pressure and proteinuria after completed 20 th week of pregnancy [2] . Early-onset preeclampsia is defined as disease developing before 34 weeks' gestation, whereas late-onset preeclampsia is defined as disease developing at or after 34 weeks' gestation [3] .

The presence of preeclampsia complicate around 3–8% of pregnancies [2] .The prevalence of preeclampsia in the developing countries ranges between 1.8 to 16.7% [4] .In India, incidence of preeclampsia is reported to be 8-10%. The prevalence of hypertensive disorders of pregnancy in India was found to be as 7.8% with preeclampsia in 5.4%. Around 16-18% of maternal perinatal deaths and up to 40% of foetal and neonatal deaths are caused due to preeclampsia [3] .

The preeclamptic patients are observed with higher level of mean platelet volume (MPV) and platelet distribution width (PDW) as compared to normal pregnancy women [12] .The pathophysiology of the disease involve placental vascular under-perfusion, maternal endothelial damage and elevated vascular

permeability[13].The defective placental trophoblastic invasion causes the injured endothelium to activate the platelets [14] .Coagulation system gets contracted by the activated platelets. It leads to an increased consumption and bone marrow production of megakaryocyte[15] . As a result young PLTs are released by the bone marrow which are larger in size resulting in increased MPV, PDW and PLCR , which are platelet indices [16,17] .

AIMS AND OBJECTIVES:

1. To document platelet indices in normotensive pregnancy.

2. To document platelet indices in pre eclampsia.

3. To assess the platelet indices in pre eclampsia and normotensive pregnancy

Materials and Methods:

Study site: The current study is conducted in the department of Obstetrics and gynaecology at RLJH hospital Kolar.

Study population:All the pregnant women with normal BP readings and preeclampsia patients delivered at RLJH hospital were considered as study population.

Study design: The current study was a cross sectional study

Sample size:

There are 2 groups considered ,

Group B –66 singleton normotensive pregnant women after completed 20 week of gestation.

Group A- 66 singleton pregnancy with hypertension developed after 20 weeks of pregnancy.

Conclusion

This study concluded that there is decrease in platelet count and increase in the platelet indices like MPV, PDW, P-LCR in preeclampsia women as compared to normal pregnant women. Adverse neonatal outcomes like intrauterine growth restriction and foetal distress are also found to be more in women with preeclampsia. Particularly in developing countries like India , the platelet indices can be used as effective biomarkers which are both easy and economical to obtain.

Platelet indices can be used as a prognostic tool, for prediction of pre eclampsia and help in improving the fetomaternal outcome.

INTRODUCTION

INTRODUCTION

Among the major health problems causing morbidity and mortality in a mother, preeclampsia is one among the leading cause[1].Worldwide, 10% of the pregnant women are identified with hypertensive disorders of pregnancy. Preeclampsia, eclampsia, gestational hypertension and chronic hypertension. are included in the hypertensive disorders of pregnancy. One tenth of the maternal mortality are associated with increased blood pressure recordings in pregnancy in Asia and Africa. PE is a disorder affecting multiple systems in pregnancy and is characterized by the presence of high blood pressure and proteinuria after completed 20 th week of pregnancy [2]. Early-onset preeclampsia is defined as disease developing before 34 weeks' gestation, whereas late-onset preeclampsia is defined as disease developing at or after 34 weeks' gestation[3].

The presence of preeclampsia complicate around 3–8% of pregnancies[2].The prevalence of preeclampsia in the developing countries ranges between 1.8 to 16.7%[4]. In India, incidence of preeclampsia is reported to be 8-10%. The prevalence of hypertensive disorders of pregnancy in India was found to be as 7.8% with preeclampsia in 5.4%. Around 16-18% of maternal perinatal deaths and up to 40% of foetal and neonatal deaths are caused due to preeclampsia [3].

Women with moderate pre-eclampsia are usually reported with no symptoms. Headache, upper abdominal pain, or visual disturbances are seen in women with severe pre-eclampsia, or with very high blood pressure[5].Preterm delivery, foetal growth restriction, intrauterine foetal death and HELLP syndrome with increased risk

of liver rupture and convulsions due to increased BP readings are the most common complications in preeclampsia. Heart failure, peripartum cardiomyopathy, pulmonary oedema, disseminated intravascular coagulation, cerebrovascular incidents, liver failure and acute renal failure are the severe maternal multi-organ dysfunction identified in preeclampsia[6].

Antiphospholipid syndrome, relative risk of preeclampsia, previous preeclampsia, insulin dependent diabetes, multiple pregnancy, nulliparity family history of preeclampsia, obesity, age and pre existing hypertension are the increased risk factors for the development of hypertension in pregnancy. The early stages of clot formation leading to hemostasis and prevention of bleeding is the primary function of platelets[7,8]. The platelet values obtained from complete blood count are the platelet count and platelet indices, including mean platelet volume, platelet distribution width and large cell ratio[9].

The pathogenesis of preeclampsia involve the alterations in the coagulation and fibrinolysis[10]. The most frequent abnormality observed is the fall in the platelet count occurs due to the consumption during low-grade intravascular coagulation[10]. Platelet count, platelet distribution width, plateletcrit and MPV are the markers of platelet activation[11]. These indices are derived from routine blood investigations hence they are cost-effective and easily available[1].

The patients with preeclampsia are observed with higher level of MPV and platelet distribution width as compared to normal pregnancy women[12].The pathophysiology of the disease involve placental vascular under-perfusion, maternal endothelial damage and elevated vascular permeability[13].The defective placental

trophoblastic invasion causes the injured endothelium to activate the platelets[14]. Coagulation system gets contracted by the activated platelets. It leads to an increased consumption and bone marrow production of platelets[15]. As a result young PLTs are released by the bone marrow which are larger in size resulting in increased platelet indices such as MPV, PDW and PLCR[16,17].

Thalor N, et al., [1]study in 60 patients concluded that the platelet indices, mainly the MPV and PDW are beneficial in the prediction and early diagnosis of preeclampsia. It can also consider as a marker for the severity of preeclampsia. In a cross sectional study performed by TesfayF,et al. [17], in which lower PC was identified in pregnant women with severe preeclampsia. All platelet indices was increased with severity of PE.

The screening of preeclampsia is performed in the first trimester ie during the routine 11-13-week ultrasound examination. It also includes doppler evaluation of blood flow in uterine arteries and measurement of plasma concentrations of several factors, such as PlGF, sFlt-1, sEng, and PAPP-A. The positive predictive value for developing preeclampsia later in pregnancy even at the level of about 96% can be indentified with a combination of maternal risk factors (history of preeclampsia, multiple pregnancy, obesity, black race), ultrasound indices, and biochemical measurements[6].

NEED OF THE STUDY

Preeclampsia is considered as one among the major health problems associated in pregnancy, owing to maternal morbidity and mortality. Therefore detection of markers to detect pre eclampsia or its severity is beneficial. The most

commonly identified hematological changes in preeclampsia is the alterations in platelet parameters. There is less accord regarding changes in platelet indices during pregnancy. India aims to reduce the maternal mortality rate to 70 per 1000 live births by 2030, therefore cost effective study for evaluating risk factors which can lead to complication in pregnancy need to be evaluated. Early detection of maternal and fetal complications can be facilitated by the utilization of these markers. Thereby, it plays a important role as a prognostic marker in the management of PE. Studies in developed countries have evaluated risk factors for pre eclampsia, however there are only few studies in developing countries, where the patient profile is different. Patients in developing countries present at a later stage of pre eclampsia, thereby compromising the effectiveness and the outcome of the treatment. Platelet indices are not routinely analysed in pregnant women. However considering the fact that MPV increases and platelet count decreases, even before the onset of preeclampsia.

AIMS & OBJECTIVES

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1. To document platelet indices in normotensive pregnancy.

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REVIEW OF LITERATURE

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1. Hypertensive disorders of pregnancy –

a) Definition, Classification,

Based on clinical abnormalities the hypertensive disorders of pregnancy can be graded into mild or severe. Diastolic BP <100 mmHg, trace to 1+ proteinuria and minimal hepatic enzyme elevation are the characteristics of mild HDP whereas, diastolic BP ≥110 mmHg, persistent severe proteinuria, clinical symptoms of eclampsia such as convulsions and pulmonary oedema, elevated serum creatinine and hepatic enzymes with thrombocytopaenia and foetal growth restriction for severe HDP.

International Society for the Study of Hypertension in Pregnancy classified the hypertensive disorders in pregnancy into chronic hypertension, gestational hypertension, pre-eclampsia – de novo or superimposed on chronic ypertension, white coat hypertension.

The American College of Obstetricians and Gynecologists classified hypertension during pregnancy into the following categories:

1. Pre-eclampsia–eclampsia:

2. Chronic hypertension: BP ≥140/90 mmHg before detection of pregnancy or diagnosed before completed 20 weeks' gestation and persistent after 12 weeks' postpartum can be defined as chronic hypertension. The ventricular hypertrophy, decompensation of cardiac system, cerebrovascular accidents

and renal damage are the complications associated with chronic hypertension. Around 25% of superimposed pre-eclampsia are caused due to the presence of chronic hypertension.

3. Chronic hypertension with superimposed pre-eclampsia:

4. Gestational hypertension: A BP ≥140/90 mmHg detected for the very first time in pregnancy, which returns to normal by 12 weeks' in postpartum period and no proteinuria can be defined as the gestational hypertension[18].

b) Etiology, pathogenesis, risk factors

Increased maternal age, history of preeclampsia in the family, short duration of sexual relationship before the pregnancy, primiparity, primipaternity and an interpregnancy interval of >5 years, CKD are the factors that are less strongly associated with the development of preeclampsia[19].

Hypertensive disorders of pregnancy is found to be with reduced placental perfusion that can induce the systemic vascular endothelial dysfunction[20]. This occurs due to the less effective cytotrophoblastic invasion of the uterine spiral arteries[21]. A cascade of inflammatory events is induced by the resultant placental hypoxia, It disrupts the balance of angiogenic factors and also induces the platelet aggregation. All of these can lead to the endothelial dysfunction manifested clinically as the preeclampsia syndrome[21,22]. Decreased concentrations of angiogenic factors such as the VEGF and placental growth factor and increased concentration of their antagonist, the placental sFlt-1 are the angiogenic imbalances associated with the formation of preeclampsia[23,24].

The reduction of nitric oxide synthesis can be caused by the binding of VEGF and PIGF to their receptors. It is considered as a crucial factor in vascular remodeling and vasodilation. Early-onset preeclampsia is caused by the syncytiotrophoblast stress leading to poor placentation, whereas late-onset preeclampsia is considered as secondary to the placenta outgrowing its own circulation[25]. Due to a longer duration of placental dysfunction EOPE is more commonly associated with fetal growth restriction[26].

Prior preeclampsia, chronic hypertension, pregestational diabetes mellitus, maternal body mass index >30 kg/m2, antiphospholipid syndrome, and receipt of assisted reproduction are the increased risk of developing hypertensive disorders in pregnancy**.**

c) Epidemiology- Global, India,

The maternal, fetal and infant mortality, and severe morbidity are identified in women with hypertensive disorders. The complications associated with the preeclampsia is identified in 3% of pregnancies. Around 5–10 % of pregnancies are affected with the hypertensive disorders. (27) The presence of gestational hypertension complicates around 2-3% of deliveries in Pakistan, whereas, 6.6% in south India and 28.9% in southwest Nigeria[28-31].

2. Pre-eclampsia

Early- and late-onset are the two types of preeclampsia. Around 80% of pre-eclamptics is comprise of early onset type in which the clinical signs appear before 33 gestational weeks. Whereas, in the late-onset type they occur at and after 34 weeks[32]. Preeclampsia is gestational hypertension accompanied by ≥1 of the following new-onset conditions at /after 20 weeks' of pregnancy:

- Proteinuria
- Maternal organ dysfunction such as AKI (creatinine ≥90umol/L; 1 mg/dL)
- Liver with / without right upper quadrant involvement or abdominal pain in epigastric area (elevated transaminases, eg, ALT or AST >40 IU/L)
- Neurological complications: For example; convulsions, alteration of mental status, visual disturbances, cerebrovascular accident, hyper reflexia, headache of severe degree, and persistent visual scotomata.
- Hematological complications
- Uteroplacental dysfunction includes FGR , abnormality in the umbilical artery Doppler wave form analysis, or stillbirt[19].
- Diagnostic Criteria of preeclampsia ACOG 2019

Blood pressure	-≥140/90 mmHg on two different occasions at least 4 hours apart after 20 weeks of gestation in previously normal BP readings - ≥160/90 mmHg (severe preeclampsia can be confirmed within minutes to facilitate timely antihypertensive therapy)
Proteinuria	- ≥300 mg/24 h, or - Urine protein: creatinine ratio ≥0.3, or - Dipstick 2+ persistent
Thrombocytopenia	-Platelet count <100,000/μL
Renal insufficiency	-Creatinine level >1.1mg/dL or doubling of baseline
Liver involvement	-Serum transaminase levels twice normal
Pulmonary edema	-New onset headache unresponsive to medication and not accounted for by alternative diagnosis or visual symptoms.

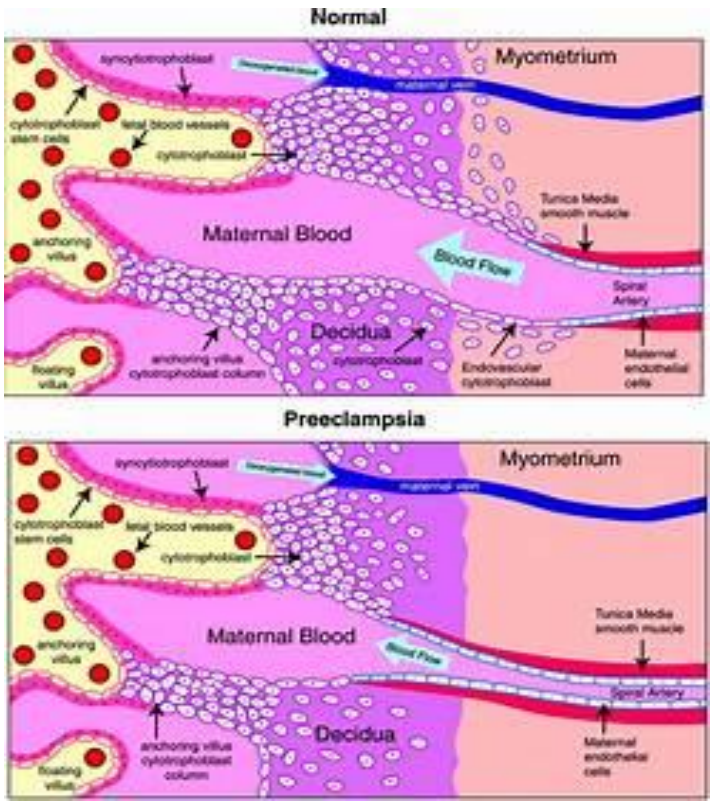

Fig. 1 Trophoblastic invasion in normal pregnancy and preeclampsia

e) Epidemiology of Pre-eclampsia

In India, the incidence of pre-eclampsia in hospital practice ranges between 5% to 15% whereas, for eclampsia is 1.5%[33,34].Around 10–15 % of maternal deaths are caused by preeclampsia and eclampsia[27].Worldwide, preeclampsia accounts around 50 000–60 000 deaths annually[32].

f) Clinical presentation

Blood pressure elevations, proteinuria, oliguria (less than 500 mL of urine in 24 hours), cerebral or visual disturbances and pulmonary oedema or cyanosis are identified in patients with severe preeclampsia.

Table: Symptoms presented by patients with preeclampsia[35].

Symptom	Mild PE	Severe PE
Blood Pressure	Systolic ≥140 mm Hg or diastolic ≥90 mm Hg, over 20 weeks of gestation (in a woman with previously normal blood pressure)	Systolic ≥160 mm Hg or diastolic ≥110 mm Hg (on two occasions at least six hours apart; in a woman on bed rest)
Proteinuria	24-hour urine collection protein ≥0.3 g (urine dipstick test ≥1+)	24-hour urine collection protein ≥5 g (urine dipstick test ≥3+; in two random urine samples collected at least four hours apart)
Others	N/A	• Oliguria • Cerebral or visual disturbances • Pulmonary oedema or cyanosis • Epigastric or right upper quadrant pain • Impaired liver function • Thrombocytopenia • Intrauterine growth restriction

g) Diagnosis

A blood pressure (BP) ≥140/90 mmHg after completed 20 weeks' gestation and proteinuria ≥300 mg/24 h or ≥1+ with dipstick are the minimum criteria needed for the diagnosis of pre-eclampsia. A BP ≥160/110 mmHg, proteinuria 2.0 g/24 h or ≥2+ dipstick, serum creatinine >1.2 mg/dL unless known to be previously elevated, platelets <100,000/mm^3, micro-angiopathic haemolysis (increased lactate dehydrogenase), elevated AST or ALT, persisting headache or other CNS or visual disturbance and epigastric pain are the clinical and laboratory findings that can increases the certainty of pre-eclampsia[18].

Urine dipsticks can be affected by variable excretion, maternal dehydration and bactriuria hence 24-hour determination is considered as more accurate. Systolic pressure more than 30 mm Hg above baseline and diastolic pressure more than 15 mm Hg above baseline is the "30-15" rule used to diagnose the preeclampsia.

h) Complications,

Preeclampsia complicated by generalized tonic–clonic convulsion can be defined as eclampsia. Severe hypertension, coagulopathy, thrombocytopenia, liver function abnormalities and fetal growth restriction are associated with the severe forms of preeclampsia. Severe proteinuria hypertension and symptoms of CNS dysfunction, hepatocellular injury thrombocytopenia, oliguria, pulmonary edema, cerebrovascular accident, and severe intrauterine growth restriction are the features of severe preeclampsia[36].

Sudden loss of vision due to involvement of the occipital cortex or the retina, pulmonary edema and subcapsular hepatic hematoma caused by the development of

disseminated intravascular coagulation are the rare complications identified with severe preeclampsia[37-39].

i) Management and prognosis

Early detection and managed delivery are the mainstay of treatment in preeclampsia. It can minimize both maternal and fetal risks. If the pregnancy is at term, then the baby should be delivered. In women with mild preeclampsia the delivery is not generally indicated until 37 to 38 weeks of gestation. It should occur only by 40 weeks.

If remote from term, the mother should be admitted for evaluation. She will require:

- Baseline and serial laboratory tests: It includes the complete blood cell count, BUN, creatinine, uric acid, ALT and AST.
- Ultrasonography: In order to measure the growth of the fetus and amniotic fluid volume.
- Doppler ultrasonography: To measure the umbilical artery systolic/diastolic ratios. It may help to detect early uteroplacental insufficiency.
- Antenatal testing (nonstress test or biophysical profile). Fetuses that are well oxygenated behave normally by twisting, squirming, flexing and extending extremities and breathing Whereas, the fetuses that are hypoxic lie still, trying to conserve oxygen.
- A 24-hour urine collection for protein. Prevent seizures, lower blood pressure to avoid maternal end-organ damage and expedite delivery are the goals of treatment.

The drug used for preventing and arresting the eclamptic seizures is magnesium sulfate. It can also reduce the incidence of placental abruption. Women with elevated serum creatinine levels, decreased urine output or absent deep tendon reflexes should be monitored for the serum magnesium levels. Respiratory paralysis, CNS depression and cardiac arrest can be caused due to magnesium toxicity. Calcium gluconate, 1 g infused intravenously over two minutes is the antidote preferred for magnesium toxicity.

Maternal morbidity can be prevented with the usage of antihypertensive medications. Hydralazine (5-10 mg intravenous bolus every 10-15 minutes), labetalol, nicardipine, and sodium nitroprusside are the preferred medications. After the administration of antihypertensive, if the blood pressure lowered too fast then it can leads to a dramatic effect on uteroplacental perfusion. It can also cause an already compromised fetus to rapidly decompensate and become bradycardic. Therefore, it should be administered with caution.

Acute cases of preeclampsia can be managed through the administration of intravenous labetalol and hydralazine. Because of the collapsed intravascular volume diuretics are contraindicated in preeclampsia. But, diuretics are required in case with high pulmonary capillary wedge pressure. Intravenous hydration for oliguria should be administered in caution in order to avoid pulmonary edema, ascites and cardiopulmonary overload. A trial of fluid resuscitation (500 mL over an hour) should be practiced, in case if there is no evidence of pulmonary edema.

Low-dose aspirin and calcium are needed for the prevention of preeclaampsia. Women at elevated risk for preeclampsia is treated with less dose of aspirin

(preferably 150 mg/d). It is started before 16 weeks of pregnancy. If the intake of calcium is less than 600 mg.dl then calcium is given with 1.2 to 2.5 g/day in mother at increased risk. Exercise for at least 3 days per week for an average 50 minutes using a combination of aerobic exercise, strength, and flexibility training can reduce the incidence of pre eclampsia [19] .

Common antihypertensive medications used in pregnancy.

	Urgent BP lowering		**Outpatient BP control**	
Labetalol	Intravenous	10–20 mg, then 20–80 mg every 10–30 min, maximum 300 mg OR 1–2 mg/min infusion	Oral	200–2400 mg/day, divided into two to three doses
Hydralazine	Intravenous	5 mg, then 5–10 mg every 20–40 min, maximum 20 mg OR 0.5–10 mg/h infusion	Not commonly used first-line	
Nifedipine	Oral Immediate release	10–20 mg every 2–6 h*, maximum 180 mg/day *May repeat initial dose after 20 min if needed	Oral Extended Release	30–120 mg/day
Methyldopa	Not commonly used first-line		Oral	500–3000 mg/day, divided into two to four doses

3. Platelet indices

a) Define all indices

Platelets are cytoplasmatic fragments of bone marrow megakaryocytes, with a diameter of 3-5 μm and a volume of 4.5–11 fL.

Table: Platelet indices [40].

Parameter	Description	Unit
Mean platelet volume (MPV)	Measure of thrombocyte volume	(fL)
Platelet volume distribution width (PDW)	Indicator of volume variability in platelets size	(%)
Plateletcrit (PCT)	Volume occupied by platelets in the blood	(%)
Mean platelet component (MPC)	Measure of mean refractive index of the platelets	(g/dL)
Mean platelet mass (MPM)	MPM is calculated from the platelet dry mass histogram	(pg)
Platelet component distribution width (PCDW)	Measure of the variation in platelet shape	(g/dL)
Platelet larger cell ratio (P-LCR)	Indicator of larger (> 12 fL) circulating platelets	(%)
Immature platelet fraction (IPF)	Percentage of immature platelets	(%)

b) Normal values in adults

Table: Normal values of platelet indices in adults (40)

Parameters	Normal Value in adults
MPV	**8.6-15.5 fL**
PDW	**8.3-25 fL**
PDW	**8.3-56.6%**
PCT	**0.22-0.24%**
IPF	**1.1-6.1%**
P-LCR	**15-35%**

5. Platelet indices in Pre-eclampsia

a) Correlation of platelet indices with severity of Pre-eclampsia

Dhakre R, et al. [41],conducted a study in 100 participants in which severe type of preeclampsia was found to be in 48% of the patients, out of which platelet count <1.5 lac, PDW of 15-16fl and MPV in the range of 10-11 fl were observed with 54%. 83% and 54% respectively. Buch DAC, et al. [42], performed a study in pregnant women in which the mean ± SD of platelet counts (lakhs/mm^3), MPV (fL), PDW and PLCR (percentage) in mothers with mild to moderate preeclampsia were 1.75± 0.67, 10.87 ± 2.09, 15.71 ± 2.98 and 35.56 ± 13.42 whereas, 1.65 ± 0.71, 11.92 ± 1.08, 17.19 ±1.26 and 39.34 ± 8.40 in patients with severe preeclampsia.

Alkholy, et al. [43], performed a cross sectional study in 150 participants in which the mean platelet count/mm3, platelet volume (fL) and platelet width distribution in patients with mild preeclampsia were 183.940 ± 37.380, 9.82 ± 0.68 and 14.26 ± 1.84 whereas, 139.340 ± 32.610, 11.07 ± 1.08 and 17.09 ± 2.12 in severe preeclampsia. In another cross sectional study done by Tesfay F, et al., (17) in which

the mean ± SD of platelet count (10^9/L), MPV (fL), PDW (fL) and PLCR (%) in patients with mild preeclampsia were 226 ± 56.5, 11.5 ±2.1, 11.1 ± 1.6 and 30.8 ± 6.6 whereas, 185.3 ± 60.2, 12.3 ± 1.7, 14.3 ± 3.4 and 35.3 ± 8.9 in severe preeclampsia.

b) Compare differences in normotensive pregnancy and Pre-eclampsia

In a population of 150 pregnant mother , Singh A, et al. [44], performed a study in which the platelet count (10^3/ Cu,mm). MPV (fL), PDW (fL) and plateletcrit in normal pregnancy were 280 ± 89.8, 8.1 ± 1.1, 16.5 ± 0.86 and 0.22 ± 0.06 whereas, 196.2 ±88.7, 9.0 ± 0.9, 16.9 ± 1.09 and 0.17 ± 0.07 in preeclampsia.

Buch DAC, et al. [42], performed a study in pregnant women in which the mean ± SD of platelet counts (lakhs/mm3), MPV (fL), PDW and PLCR (%) in normal pregnancy were 1.89 ± 0.52, 8.62 ± 1.38, 14.56 ± 1.71 and 21.19 ± 5.84 while 1.73 ± 0.67, 10.98 ± 1.99, 15.88 ± 2.88 and 35.08 ± 13.02 in preeclampsia group. Platelet count decreases whereas, MPV and PDW increase as pregnancy advances and these are more pronounced in women with preeclampsia as compared to the normotensive pregnancy[41].

c) Role in early prediction of Pre-eclampsia

The PC and MPV are estimated during a routine whole blood count and nowadays these are commonly available parameters. This simplifies the indirect measure of the rate of production of platelet and platelet activation by deducing the indices from the result of the blood count. Early detection of complications of mother and fetus can be made by the utilization of these simple markers. Thereby, it plays a role in determining the prognosis and helps in the early management of preeclampsia[45-47].

MOST RELEVANT STUDIES:

Thalor N, et al. [1], conducted a case-controlled study in 60 patients The objective of the study was to determine the assessment between platelet indices and preeclampsia. MPV and PDW was correlated positively with the increasing blood pressure. Preeclampsia patients was identified with lower values of PC and PCT. The present study showed that the platelet indices are useful in the prediction and early diagnosis of preeclampsia.

Gogoi P, et al. [48], conducted a cross sectional study in 67 patients. The study intended to compare the neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio and platelet indices between women with pre-eclampsia and normotensive pregnant women. Women with pre-eclampsia was identified with high NLR. PLR and MPV were identified higher in the study group with 14.18 ± 14.4 and 9.45 ± 1.19 respectively. Pre-eclamptic women was observed with low platelet count and higher RDW. The study concluded that measuring NLR and PLR were useful in predicting pre-eclampsia

TesfayF,et al. [17],conducted a cross sectional comparative study. The study was to compare the platelet count, platelet indices , platelet distribution width and platelet large cell ratio between preeclamptic and pregnant women with increased BP readings and also to assess their role in diagnosis and prediction of PE development. Lower PC was identified in pregnant women with severe preeclampsia. All platelet indices was increased with severity of PE. There was a negative correlation identified between PC and platelet indices. MPV had the largest area under the ROC curve with a sensitivity, specificity, PPV and NPV of 83.5%, 86.4%, 77.6% and

90.3% respectively. .The study concluded that the assessment of parameters of platelets can be considered a another biomarker for prediction and prognosis of PE.

Yang SW, et al. [49], conducted a study in 935 patients. The objective of this study was to assess the platelet distribution width and other platelet indices in preeclampsia. The study results revealed that the platelet count and plateletcrit were decreased as the disease progressed. Whereas, the mean platelet volume and the PDW were increased as the disease progressed. The severe PE patients were pointed out with an increased PDW. There was association that was identified between PDW and mean arterial pressure in the mild and severe PE groups. This concluded that the PDW can serve as a candidate marker for predicting the severity of PE.

Sitotaw C, et al. [50], performed a cross-sectional study. The objective of this study was to assess the platelet and WBC parameters in women with preeclampsia. The study results revealed an increase in the means of WBC, absolute Neutrophil count, Absolute middle cell count, mean Platelet count, Platelet distribution width, neutrophil-to-lymphocyte ratio and median of platelet-to-large cell ratio whereas, a decrease in the absolute lymphocyte count and platelet count in the PE group. There was a positive correlation identified between WBC, ANC, MPV, PDW, P-LCR, NLR and MAP Whereas a negative correlation between PTC and MAP in PE group. The study showed that the PTC can decrease with the severity of the disease.

AlSheeha, M. A., et al[2]. have conducted a study to compare platelet indices, namely platelet count (PC), mean platelet volume (MPV) and platelet distribution width (PDW), and PC to MPV ratio in women with preeclampsia compared with healthy controls. A case-control study. Sixty preeclamptic women were the cases and

an equal number of healthy pregnant women were the controls. There were no significant changes in age, parity, and BMI in between the study groups. Sixteen and forty four of the patients were severe and mild preeclampsia, respectively. There were no significant change in PDW and MPV between the preeclamptic and control women. Both PC and PC to MPV ratios were significantly lower in the women with preeclampsia compared with the controls. There was no significant difference in the PC, PDW, MPV, and PC to MPV ratio when women with mild and severe preeclampsia were compared. Using receiver operating characteristic (ROC) curves, the PC cutoff was $248.0\times10^3/\mu L$ for diagnosis of pre-eclampsia (*P*=0.019; the area under the ROC curve was 62.4%). Binary regression suggests that women with PC $<248.010\times10^3/\mu L$ were at higher risk of preeclampsia (odds ratio =2.2, 95% confidence interval =1.08-4.6, *P*=0.03). The PC/MPV cutoff was 31.2 for diagnosis of preeclampsia (*P*=0.035, the area under the ROC curve was 62.2%). In conclusion PC $<248.010\times10^3/\mu L$ and PC to MPV ratio 31.2 are valid predictors of preeclampsia.

Freitas, L. G., et al. [51] have investigated whether platelet count (PC) and indices of the platelet (mean platelet volume (MPV), plateletcrit (PCT) and platelet distribution width (PDW)) could predict severe form of preeclampsia (sPE).Three groups were evaluated; G1-pregnant with sPE (N = 29); G2-normotensive pregnant (N = 28) and Group 3: non-pregnant women (N = 30).Lower PC and PCT were observed in sPE comparing to normal pregnant (P = 0.031 and 0.035, respectively) and to non-pregnant women (P < 0.001 and 0.004, respectively). PDW was higher in sPE comparing to normotensive pregnant (P = 0.028) and to non-pregnant women (P < 0.001). MPV was higher in sPE comparing to normotensive pregnant and non-pregnant women (P = 0.05 and P < 0.001, respectively). Analysis from the receiver

operating characteristic curve and its areas for each variable showed that the parameters have regular diagnostic significance, except for PCT, considered as not good for this purpose.Study findings have concluded that PC emerges as a ideal candidate for sPE diagnosis, since it is a easy, simple and habitually done method, with lower cost and greater accessibility in the clinical laboratory.

Han, L., et al. [52]aimed to evaluate blood coagulation parameters and platelet indices as potential predictors for the onset and severity of PE. Blood samples from 3 groups of subjects, normal pregnant women (n = 79), mild preeclampsia (mPE) (n = 53) and severe preeclampsia (sPE) (n = 42), were collected during early and late pregnancy. During late pregnancy in the normal pregnancy group, the activated partial thromboplastin time (APTT), prothrombin time (PT), thrombin time (TT) and platelet count decreased, while the fibrinogen level and mean platelet volume (MPV) increased compared to early pregnancy ($p<0.05$). However, the PE patients presented with increased APTT, TT, MPV and D-dimer (DD) during the third trimester. In the analysis of patients with and without PE, TT showed large AUC (0.743) and high predictive value. In PE patients with different severities, MPV showed the largest AUC (0.671) and ideal predictive efficiency. Normal pregnancy causes a maternal physiological hypercoagulable state in late pregnancy. PE may trigger complex disorders in the endogenous coagulative pathways and consume platelets and FIB, subsequently activating thrombopoiesis and fibrinolysis. Thrombin time and MPV may serve as early monitoring markers for the onset and severity of PE, respectively.

Kim MA et al[53]Investigated that the clinical effectiveness of the platelet-to-lymphocyte ratio (PLR) in mother with PE and compare this measurement to platelet

indices as a prognostic marker of PE. A total of 471 healthy pregnant women, 126 women diagnosed with mild PE, and 227 with severe PE were included as study participants in retrospective study. Platelet distribution width, MPV, and PLR levels in women with PE were significantly different from those of healthy pregnant women. PLR was significantly lower in severe PE than milder PE (with P = .001), but PDW and MPV increased as severe form of PE progressed; however, the differences in PDW and MPV between mothers with mild and severe PE were not significant. ROC curve assessment suggested that PLR was more predictive of PE than PDW and mean platelet volume (Area under the curve = 0.759 vs 0.621, 0.638). Additionally, the time interval from admission to delivery was significantly shorter in women with PLR-positive (≤116) than in women with PDW-positive (>58) and MPV-positive (>9). The PLR is an easily accessible and cost-effective parameter, which may be used as a more useful indicator for prediction of PE compared to indices of platelet. Our study showed that PLR can serve as a diagnostic marker of PE.

Yücel B et al[54]have evaluated changes in NLR, PLR, RDW, MPV and PCT in preeclampsia and their use in detecting the severity of PE. Authors have included 219 patients in their retrospective cohort study. Of them, 27 had mild PE, 82 had severe PE, and 110 were healthy, normotensive pregnant patients. There were no significant differences in NLR between the groups (p=0.423). Both PLR and PCT were lesser in the cases with severe PE than in the control group, and these differences showed a statistical significance (p=0.007 and p<0.001). On the other hand, both RDW and MPV were statistically higher in the cases with severe pre eclampsia as compared to the other group (p=0.011 and p<0.001). ROC analyzes were utilized to examine the ability of markers to predict those with severe PE from those with mild PE. Areas

under the curve for NLR, PLR and RDW were not significant according to statistics (p=0.636, 0.104 and 0.36, respectively). For MPV and PCT, the values of area under the curve were 0.641 and 0.712, respectively, and the p value for these parameters statistically differed (p=0.028, p=0.001). Study findings have concluded that MPV or PCT may be clinical useful markers in the prediction of severe PE.

Yavuzcan A, et al[55] have compared the changes in the values of leukocytes, neutrophils, lymphocytes, MPV, and systemic inflammatory response (SIR) markers (neutrophil-lymphocyte ratio/ platelet-lymphocyte ratio) in mothers with severe PE of healthy pregnant and non-pregnant women. MPV and PLR did not show statistically prominent differences between the 3 groups (p=0.081, p=0.098). NLR showed a statistically prominent difference between the 3 groups (p=0.000). NLR values of patients with severe PE were statistically significantly higher than healthy non-pregnant women (p=0.000). No statistically significant difference was found between patients with severe PE and healthy pregnant women (p=0.721). The cut-off value of the leukocyte number for severe PE was 7.6 x 10(3)/ml, with 76.7% sensitivity and 60.6% specificity. The cut-off value of neutrophil number was 6.4 x 10(3)/ml in the group with severe PE, with 76.7% sensitivity and 69% specificity. Study results showed that MPV level did not differ among patients with severe PE, healthy normotensive pregnant mother and non-pregnant women. NLR cannot be utilized to identify patients with severe PE. PLR measured before termination of pregnancy is not an effective marker for severe PE, either.

Mannaerts D etal[56] explored the clinical usability of neutrophil/lymphocyte ratio (NLR), platelet/lymphocyte ratio (PLR), and/or mean platelet volume (MPV) in

discriminating between women that will and those that will not develop PE. In the PE group, gravidity, parity, gestational age, and birth weight were significantly lower compared to the control group. Before the 20th pregnancy week, MPV was significantly elevated in the PE group compared to the controls (p = .006), hence analysis revealed an cut-off point of 8.15 (sensitivity 66.7%, specificity 56.3%) for predicting PE. As the pregnancy progressed, NLR and MPV appeared to be higher and PLR lower in the PE group compared to the controls, which strengthens the current knowledge on the pathogenesis of PE. Study findings have concluded that MPV is significantly elevated in the first half of pregnancy in women who later develop PE and might therefore be implemented in combination with other parameters in a PE prediction model.

Bellos I et al[57] have evaluated the reported MPV differences in patients that develop preeclampsia and to compare them to those of otherwise healthy women. The meta-analysis was based on outcomes reported from 50 studies that included 14,614 women. MPV was significantly higher in preeclamptic than healthy pregnant women (7905 women, MD: 1.04 fl, 95% CI [0.76, 1.32]). The difference in mean was less evident among the mothers with mild preeclampsia (6604 women, MD: 0.65 fl, 95% CI [0.19, 1.11]), compared to the severe ones (6119 women, MD: 1.28 fl, 95% CI [0.75, 1.80]). The results of the univariate meta-regression analysis suggested that region, sample size, time to analysis, anticoagulant, count of the platelet and NOS score did not hinder the outcomes of the meta-analysis. The findings of this meta-analysis suggest that mean platelet volume represents a promising biomarker for the detection and follow-up of patients that develop preeclampsia. However, given that the available evidence is drawn from case-control studies, future cohorts are needed in

this field to accurately determine the timing and cut-off values that may be used in the setting.

Özdemirci Ş et al[58]have evaluated the predictive and clinical utilization of the mean platelet volume (MPV) in severe preeclamptic women. The severe preeclamptic mother with and without preeclampsia were divided into subgroups depending on the week early, (<34), late (34-37) preterm birth and term (≥37) gestational weeks. Their MPV was analyzed 24 hours before birth and compared with all subgroups as per the gestational week. The study subgroups were performed from early (n = 87), late (n = 48) preterm and term (n = seventy six) with severe preeclampsia, whereas early (n = 69), late (n =sixty three) and term (n = 228) without gestational hypertensive disorders were recruited in the control subgroups. The MPV of the early, late preterm and term preeclamptic subgroups was statistically greater compared to control subgroups (9.4 ± 1.3fL vs 8.6 ± 1.2 fL, $p < 0.001$; 9.5 ± 1.0 fL vs 8.5 ± 0.9 fL, $p < 0.001$ and 10.2 ± 1.1 fL vs 8.9 ± 1.2 fL, $p < 0.001$), whereas the mean platelet count of all the study subgroups was significantly lower (237.3 ± 81.3 × 10^9 /L, 270.0 ± 83.9 × 10^9/L, $p = 0.015$; 232.3 ± 80.1 × 10^9/L vs 268.8 ± 92.7 × 10^9/L, $p < 0.001$ and 221.8 ± 70.3.9 × 10^9/L vs 232.9 ± 82.3 × 10^9/L, $p = 0.03$). The sensitivity and specificity of the cut-off MPV for all the subgroups were lesser than 80%.In conclusion the MPV may be a predictor of severe preeclampsia.

Kanat-Pektas **M**et al[59] aimed to assess whether MPV suggested in first trimester of pregnancy can be used to detect pre-eclampsia and IUGR. Average PAPP-A MoM value was lower and MPV was higher in pre-eclamptic pregnancies ($P = 0.001$ for both). MPV values of 10.5 fl or more can predict pre-eclampsia with

66.7% sensitivity and 63.8% specificity. The combination of MPV of 10.5 fl or more and PAPP-A MoM of 0.33 or less can predict PE with 75% sensitivity and 70.0% specificity. MPV values of 10.5 fl or more can predict IUGR with 82.4% sensitivity and 60.0% specificity. The combination of MPV of 10.5 fl or more and PAPP-A MoM of 0.33 or less can predict IUGR with 85.3% sensitivity and 62.0% specificity.Increased MPV reflects enhanced platelet activation which may be caused by impairment in uteroplacental circulation. When MPV of 10.1 or more and PAPP-A MoM of 0.33 or less are combined as a threshold, the pregnancies that are destined to develop IUGR and pre-eclampsia can be predicted with considerably high sensitivity and specificity. The MPV and PAPP-A combination can be addressed as a useful biochemical tool for the prediction of IUGR and pre-eclampsia in late first trimester.

Viana-Rojas JA et al[60] have assessed the relationship between RDW and MPV with the severity of preeclampsia.In Analytic cross-sectional study they included 64 patients with preeclampsia (26 mild, 38 severe) and 70 patients with normotensive pregnancy. Hemoglobin and platelet count measures were similar between groups. Preeclamptic patients had levels of RDW (14.7 ± 1.4 vs. 13.4 ± 0.7, p = 0.0001) and MPV (11.8 ± 2.4 vs. 11.0 ± 1.4, p = 0.03) more elevated than control group. Moreover, severe preeclamptic subgroup had more elevated levels of RDW (15.0 ± 1.6 vs. 14.0 ± 0.6, p = 0.001) and MPV (12.7 ± 2.8 vs. 10.8 ± 1.8, p = 0.01) in comparison with mild preeclamptic patients.Authors have demonstrated that RDW and MPV are accessible and inexpensive measures associated with the severity of preeclampsia.

Dadhich S,et al[10] have accessed the association between changes in platelet indices (platelet count, MPV,PDW) and development of preeclampsia. Two hundred pregnant women at 20 to 24 weeks of gestation with singleton pregnancy and normal blood pressure were enrolled after taking well-informed consent. At monthly intervals CBC (complete blood count) was done from 20 to 24 weeks till 40 weeks and 7 days after delivery. Platelet count reduced in significant amount in patients with preeclampsia compared to normal patients (19.4% vs 7.4%). Mean platelet volume increased significantly in preeclampsia patients (44.5% vs 9.22%). Increase in PDW was observed significantly in patients with preeclampsia (47.19% vs 29.4%). Conclusion: Patients with preeclampsia are more likely to have significant reduce in platelet count, increase in PDW and MPV. These changes can be seen at an earlier gestational age than significant rise in BP can be observed and are directly proportional to progressive rise in hypertension. Thus, estimation of platelet indices can be considered as an early, simple and cost-effective procedure in the assessment of severity of preeclampsia.

Alkholy et al[61]evaluated the association between platelet count and platelet indices; MPV and PDW and severity of preeclampsia and to evaluate their role in prediction of preeclampsia. Platelet count was lower in mother with severe PE compared to mother with mild PE, which was significant and normal pregnant women groups (139.340 ± 32.610,183.940 ± 37.380 and 249.120 ± 38.350with $P < 0.001$) respectively. Mean platelet volume and platelet width distribution were significantly higher in women with severe PE compared to women with mild PE and normal pregnant women groups (11.07 ± 1.08 vs. 9.82 ± 0.68 and 8.50 ± 0.75with $p < 0.001$ for MPV and 17.09 ± 2.12 vs. 14.26 ± 1.84 and 11.01 ± 1.77 with $p < 0.001$ for

PDW). respectively. In conclusion due to increased platelet destruction and platelet turn over in patient with preeclampsia, decreasing platelet count and increasing MPV and PWD may play a role in predicting preeclampsia. Platelet indices are simple, cheap and practical tools in predicting severity of PE.

Gopi A et al[62]compared the changes of platelet parameters in patients diagnosed with pre-eclampsia and eclampsia compared with the control group of women who are pregnant. A random selection of 50 pregnant women with normal BP reading as controls and 50 patients with pre-eclampsia or eclampsia were considered in the study. The PDW is greater in the cases than controls and shows that there was a statistically significant difference between the values of the cases versus the controls. MPV was mildly increased and platelet count mildly decreased in cases versus controls. Platelet count and MPV did not show significant difference satistically among the cases and controls. Conclusion: The significant difference in the PDW and the increase in MPV can contribute to the pathophysiology of preeclampsia and eclampsia. The changes in these parameters can provide a cue towards early diagnosis or potential worsening of pre-eclampsia and eclampsia status. However, platelet count alone is not always a potential indicator in detecting preeclampsia and eclampsia. Assessing the PDW can also be beneficial as an indicator of pre-eclampsia and eclampsia.

Reddy SG et al[63]have evaluated the use of PLT indices as severity markers in nonthrombocytopenic preeclampsia cases. In their prospective study authors have recruited 120 cases of severe preeclampsia, 115 cases of preeclampsia without severe features, and 203 normal pregnant women admitted in the obstetrics wards during the

study period of 1 year. Even in the absence of thrombocytopenia, MPV and PDW were significantly higher in severe preeclampsia group ($P < 0.001$) and were also positively correlating with mean arterial pressure ($r = 0.38$ and 0.20, respectively). ROC curve analysis showed that MPV had the greater area under the curve of 0.78 (95% confidence interval [0.719-0.842]). Cutoff value of >10.95 fl for MPV was found to have significant predictive value for disease progression in preeclampsia. Study findings have concluded, Even in the absence of thrombocytopenia, PLT indices, especially MPV, have a good diagnostic significance in detecting severe preeclampsia. Further studies are necessary to evaluate their role as biomarkers in preeclampsia.

LACUNAE OF LITERATURE

Platelet parameters alterations are one of the most commonly identified hematological changes in preeclampsia. However, their functions as a tool for predicting and suggesting the prognosis of PE have not been extensively studied in developing countries. There is less accord regarding changes in platelet indices during pregnancy. Studies in developed countries have evaluated risk factors for pre eclampsia, still there are only few studies in developing countries , when the patient profile may be different.

MATERIAL & METHODS

MATERIALS AND METHODS

Study site: The current study is conducted in the department of Obstetrics and gynaecology at RLJH hospital Kolar.

Study population: All the pregnant women with normal BP readings and preeclampsia patients delivered at RLJH hospital were considered as study population.

Study design: The current study was a cross sectional study

Sample size:

There are 2 groups considered ,

Group B –66 singleton normotensive pregnant women after completed 20 week of gestation.

Group A- 66 singleton pregnancy with hypertension developed after 20 weeks of pregnancy.

The sample size is deduced based on the difference in the mean platelet distribution width (PDW) between normotensive pregnant women and pre eclamptic women in the study –Evaluation of Platelets Count and Indices in Pre-Eclampsia Compared to Normal Pregnancies[10] ,done in the year 2016.Observed variance estimate of 6.7 /fl, 80%power , 5% alpha and with 95% confidence interval.

Formula

$$n = \frac{2s_p^2\left[Z_{1-\alpha/2} + Z_{1-\beta}\right]^2}{\mu_d^2}$$

$$s_p^2 = \frac{s_1^2 + s_2^2}{2}$$

Where,

S_1^2 : Standard deviation in the first group

S_2^2 : Standard deviation in the second group

μ_d^2 : Mean difference between the samples

α : Significance level

1- β : Power

Sampling method: All the eligible subjects were recruited into the study consecutively by convenient sampling till the sample size is reached.

Study duration: The data collection for the study was done between October 2018 to July 2020 for a period of 1 year.

Inclusion Criteria:

- There are 2 groups considered

Group B –66 singleton normotensive pregnant women .

Group A- 66 singleton pregnancy with hypertension developed after 20 weeks of pregnancy.

Exclusion criteria:

Patient with coagulation disorders like Idiopathic thrombocytopenia, sickle cell disease,

viral hepatitis, cholestatic jaundice,

acute fatty liver,

malaria,

drug induced hepatitis

dengue

chronic hypertension

Ethical considerations:

Study was approved by institutional human ethics committee. Informed written consent was taken from all the participants and only those participants willing to sign the informed consent were included in the study. The risks and benefits associated in the study and voluntary nature of participation were explained to the participants before obtaining consent. Confidentiality of the study participants was maintained.

Data collection tools:

All the relevant parameters were documented in a structured study proforma.

Methodology:

After the written informed consent and the patient fulfilling the inclusion criteria were included in the study. A minimum of 66 normotensive and 66 pre eclamptic patients were considered .A detailed clinical history along with the antenatal examination were done .The BP recording were documented. And for the patient with hypertension repeat BP recording after 4 hours were documented. Urine

was examined for protienuria .Complete blood count was sent for all the patients and WBC , platelet count , MPV , PDW were documented in all patients . Then a comparison was made between the platelet indices of normotensive pregnant women and women with pre eclampsia. An attempt was made to find out whether there was a association between platelet indices and the severity of pre eclampsia .

Statistical Methods:

Fetal outcome, place where baby was shifted post-delivery and maternal outcome were considered as primary outcome variable.

Age, gestational age, platelet count, MPV (fl), PDW (fl) and mode of delivery was considered as other study relevant variables.

Study Group (Group A v/s Group B) was considered as explanatory variable. All Quantitative variables were checked for normal distribution within each category of explanatory variable by using visual inspection of histograms and normality Q-Q plots. Shapiro- wilk test was also conducted to assess normal distribution. Shapiro wilk test p value of >0.05 was considered as normal distribution.

Data was also represented using bar chart, error bar chart and clustered bar chart. For normally distributed Quantitative parameters the mean values were compared between study groups using Independent sample t-test (2 groups).

Categorical outcomes were compared between study groups using Chi square test. P value < 0.05 was considered significant statistically. IBM SPSS version 22 was used for statistical analysis.(1)

RESULTS

RESULTS

A total of 132 participants were included in the final analysis with 66 participants in each group A (Hypointensive) and Group B (Nomointensive).

Table 1: Comparison of age between study group (N=132)

Age	**Study Group**		**Chi square**	**P value**
	Group A (N=66)	**Group B (N=66)**		
Age (in years)				
18-20	13 (19.7%)	23 (34.85%)	6.840	*0.145*
21-25	27 (40.91%)	29 (43.94%)		
26-30	16 (24.24%)	10 (15.15%)		
31-35	8 (12.12%)	3 (4.55%)		
36-40	2 (3.03%)	1 (1.52%)		
Gestational Age				
25-25+6Weeks	3 (4.55%)	5 (7.58%)	2.240	*0.692*
30-32+6 Weeks	6 (9.09%)	5 (7.58%)		
33-35+6Weeks	9 (13.64%)	6 (9.09%)		
36-36+6Weeks	6 (9.09%)	10 (15.15%)		
37-39+6 Weeks	42 (63.64%)	40 (60.61%)		

Out of 66 participants in group A, 13 (19.7%) participants belonged to age group 18-20 years, 27 (40.91%) participants belonged to age group 21-25 years, 16 (24.24%) participants belonged to age group 26-30 years, 8 (12.12%) participants belonged to age group 31-35 years and 2 (3.03%) participants belonged to age group 36-40 years. Out of 66 participants in group B, 23 (34.85%) participants belonged to age group 18-20 years, 29 (43.94%) participants belonged to age group 21-25 years, 10 (15.15%) participants belonged to age group 26-30 years, 3 (4.55%) participants where in the age group of 31-35 years and 1 (1.52%) participants where in age group 36-40 years.

There were not any statistical significant difference in age group of participants between the study group (P Value>0.05).

Out of 66 participants in group A, 3 (4.55%) participants had gestational age 25-25+6 Weeks, 6 (9.09%) participants had gestational age 30-32+6 Weeks, 9 (13.64%) participants had gestational age 33-35+6 Weeks, 6 (9.09%) participants had gestational age 36-36+6 Weeks and 42 (63.64%) participants had gestational age 37-39+6 Weeks. Out of 66 participants in group B, 5 (7.58%) participants had gestational age 25-25+6 Weeks, 5 (7.58%) participants had gestational age 30-32+6 Weeks, 6 (9.09%) participants had gestational age 33-35+6 Weeks, 10 (15.15%) participants had gestational age 36-36+6 Weeks and 40 (60.61%) participants had gestational age 37-39+6 Weeks. There was no statistical significant difference in gestational age of participants between the study group (P Value>0.05). (Table 1, Figure 1&2)

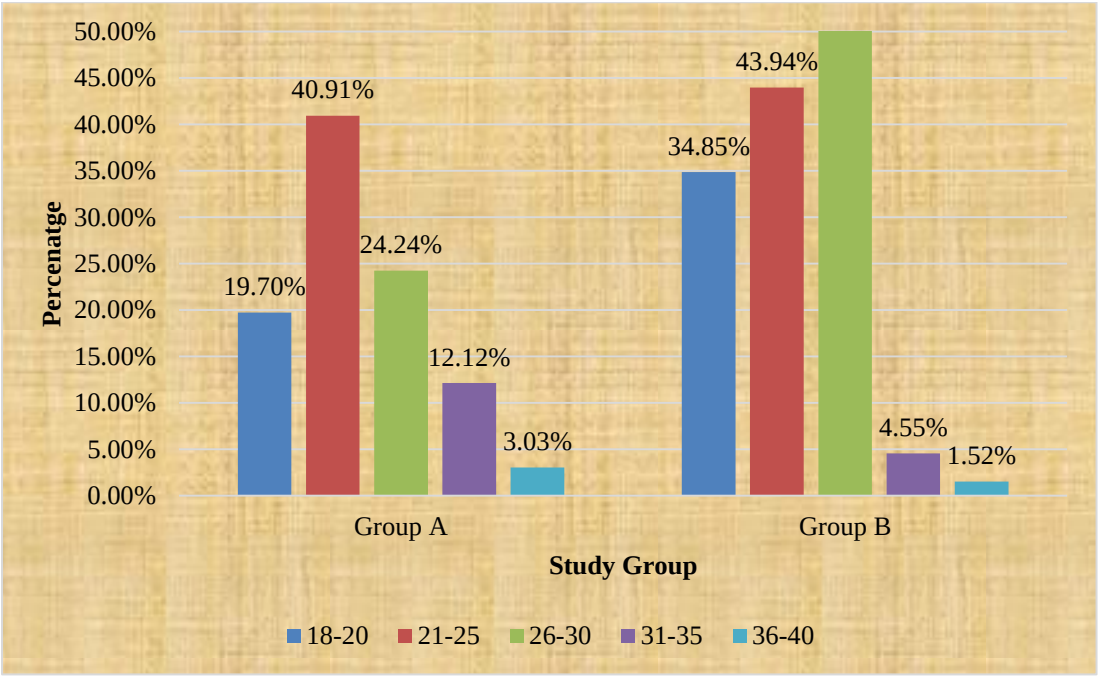

Figure 1: Clustered bar chart for comparison of age group between study group (N=132)

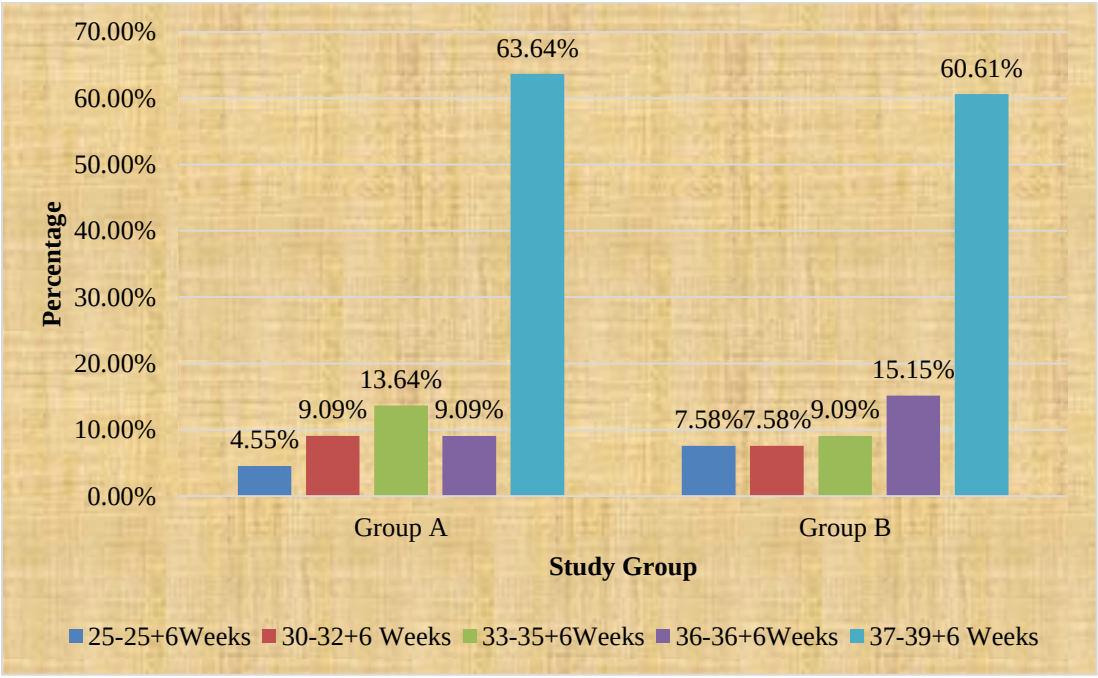

Figure 2: Clustered bar chart for Gestational age between study group (N=132)

Table 2: Comparison of gravida between study group (N=132)

Gravida	Study Group		Chi square	P value
	Group A (N=66)	Group B (N=66)		
Primigravida	31 (46.97%)	25 (37.88%)	2.310	*0.511*
Gravida 2	21 (31.82%)	22 (33.33%)		
Gravida 3	11 (16.67%)	12 (18.18%)		
Gravida 4	3 (4.55%)	7 (10.61%)		

Out of 66 participants in group A, gravida was Primigravida for 31 (46.97%) participants, Gravida 2 for 21 (31.82%) participants, Gravida 3 for 11 (16.67%) participants and Gravida 4 for 3 (4.55%) participants. Out of 66 participants in group B, gravida was Primigravida for 25 (37.88%) participants, Gravida 2 for 22 (33.33%) participants, Gravida 3 for 12 (18.18%) participants and Gravida 4 for 7 (10.61%) participants There was no statistical significant difference in gravida between the study group (P Value>0.05). (Table 2 & Figure 2)

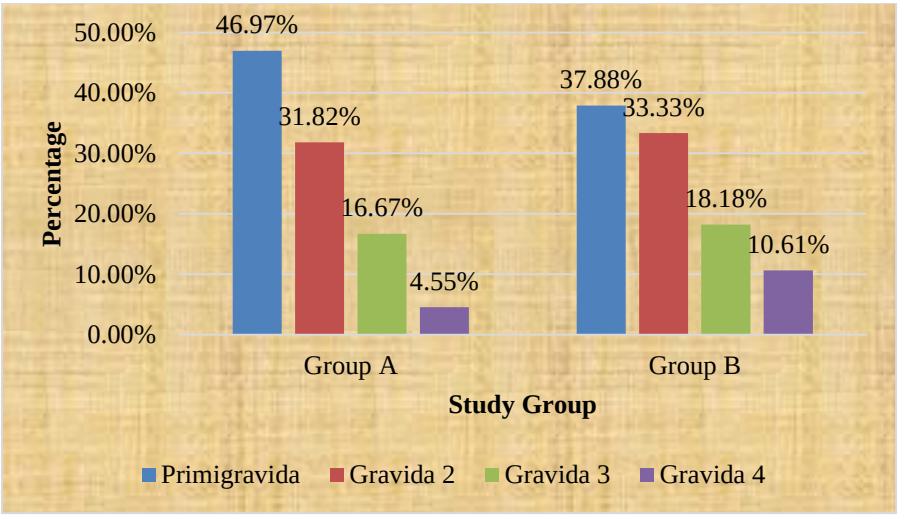

Figure 3: Clustered bar chart for comparison of gravida between study group (N=132)

Table 3: Descriptives of platelet count between study group (N=132)

Platelet Count	Study Group	
	Group A (N=66)	**Group B (N=66)**
<=50000	1 (1.52%)	0 (0%)
51000-1Lakh	5 (7.58%)	0 (0%)
1.1-1.5Lakh	21 (31.82%)	4 (6.06%)
1.5-2Lakh	20 (30.3%)	13 (19.7%)
2-2.5Lakh	16 (24.24%)	43 (65.15%)
2.5-3Lakh	2 (3.03%)	4 (6.06%)
>3Lakh	1 (1.52%)	2 (3.03%)

Out of 66 participants in group A, platelet count was <=50000 for 1 (1.52%) participant, 51000-1Lakh for 5 (7.58%) participants, 1.1-1.5Lakh for 21 (31.82%) participants, 1.5-2Lakh for 20 (30.3%) participants, 2-2.5Lakh for 16 (24.24%) participants, 2.5-3Lakh for 2 (3.03%) participants and >3Lakh for 1 (1.52%) participant. Out of 66 participants in group B, platelet count was <=50000 for no participant, 51000-1Lakh for no participant, 1.1-1.5Lakh for 4 (6.06%) participants, 1.5-2Lakh for 13 (19.7%) participants, 2-2.5Lakh for 43 (65.15%) participants, 2.5-3Lakh for 4 (6.06%) participants and >3Lakh for 2 (3.03%) participants. (Table 3)

Table 4: Descriptive of PDW (fl) & MPV (fl) between study group (N=132)

Parameters	Study Group	
	Group A (N=66)	**Group B (N=66)**
PDW (fl)		
10	12 (18.18%)	21 (31.82%)
11	10 (15.15%)	35 (53.03%)
12	16 (24.24%)	5 (7.58%)
13	10 (15.15%)	1 (1.52%)
14	3 (4.55%)	3 (4.55%)
15	6 (9.09%)	1 (1.52%)
16	4 (6.06%)	0 (0%)
17	5 (7.58%)	0 (0%)
MPV(fl)		
9	21 (31.82%)	35 (53.03%)
10	16 (24.24%)	15 (22.73%)
11	18 (27.27%)	9 (13.64%)
12	9 (13.64%)	4 (6.06%)
13	1 (1.52%)	2 (3.03%)
>13	1 (1.52%)	1 (1.52%)

Out of 66 participants in group A, the PDW (fl) was 10 for 12 (18.18%) participants, 11 for 10 (15.15%) participants, 12 for 16 (24.24%) participants, 13 for 10 (15.15%) participants, 14 for 3 (4.55%) participants, 15 for 6 (9.09%) participants, 16 for 4 (6.06%) participants and 17 for 5 (7.58%) participants. Out of 66 participants in group B, the PDW (fl) was 10 for 21 (31.82%) participants, 11 for 35 (53.03%)

participants, 12 for 5 (7.58%) participants, 13 for 1 (1.52%) participant, 14 for 3 (4.55%) participants, 15 for 1 (1.52%) participant, 16 and 17 for no participant.

Out of 66 participants in group A, the MPV(fl) was 9 for 21 (31.82%) participants, 10 for 16 (24.24%) participants, 11 for 18 (27.27%) participants, 12 for 9 (13.64%) participants, 13 for 1 (1.52%) participant and >13 for 1 (1.52%) participant. Out of 66 participants in group B, the MPV(fl) was 9 for 35 (53.03%) participants, 10 for 15 (22.73%) participants, 11 for 9 (13.64%) participants, 12 for 4 (6.06%) participants, 13 for 2 (3.03%) participant and >13 for 1 (1.52%) participant. (Table 4)

Table 5: Comparison of clinical parameters between study group (N=132)

Parameter	**Study Group (Mean± SD)**		**P value**
	Group A (N=66)	**Group B (N=66)**	
Platelet Count			
50,000 - 1.5lakhs	26 (39.4%)	4 (6.06%)	*<0.001*[#]
1.5lakhs – 2lakhs	20 (30.3%)	13 (19.7%)	
>2lakhs	19 (28.8%)	49 (74.2%)	
PDW(fl)	12.62 ± 2.14	10.98 ± 1.06	*<0.001*[*]
MPV(fl)	10.27 ± 1.11	9.81 ± 1.01	*0.018**

[#] *denotes Chi-square test.*
**denotes Independent Samples T-test*

Out of 66 participants in group A, the platelet count was 50,000 - 1.5lakhs for 26 (39.4%) participants, 1.5lakhs – 2lakhs for 20 (30.3%) participants and >2lakhs for 19 (28.8%) participants.

Out of 66 participants in group A, the platelet count was 50,000 - 1.5lakhs for 4 (6.06%) participants, 1.5lakhs – 2lakhs for 13 (19.7%) participants and >2lakhs for 49 (74.2%) participants.

The mean PDW (fl) was 12.62 ± 2.14 in group A and it was found to be 10.98 ± 1.06 in group B. The mean MPV (fl) was 10.27 ± 1.11in group A and it was 9.81 ± 1.01 in group B.

There was a significant difference statistically in clinical parameters like platelet count, PDW (fl) and MPV (fl) between the study groups. (P Value<0.05) (Table 5, Figure 4, 5 & 6)

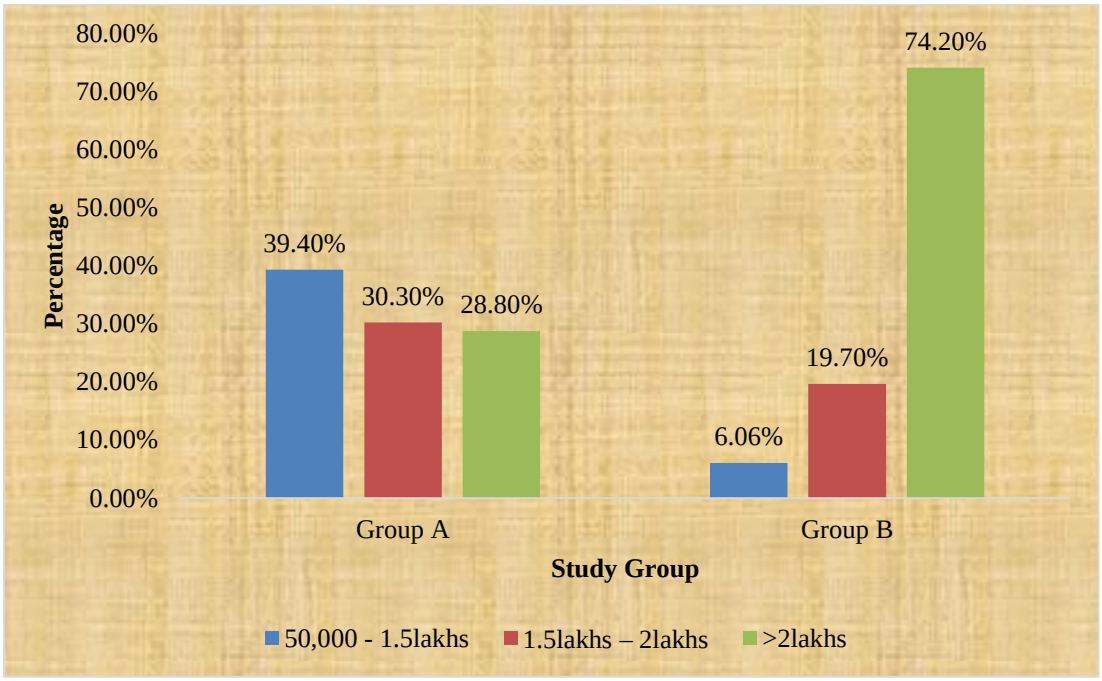

Figure 4: Clustered bar chart for comparison of platelet group between study group (N=132)

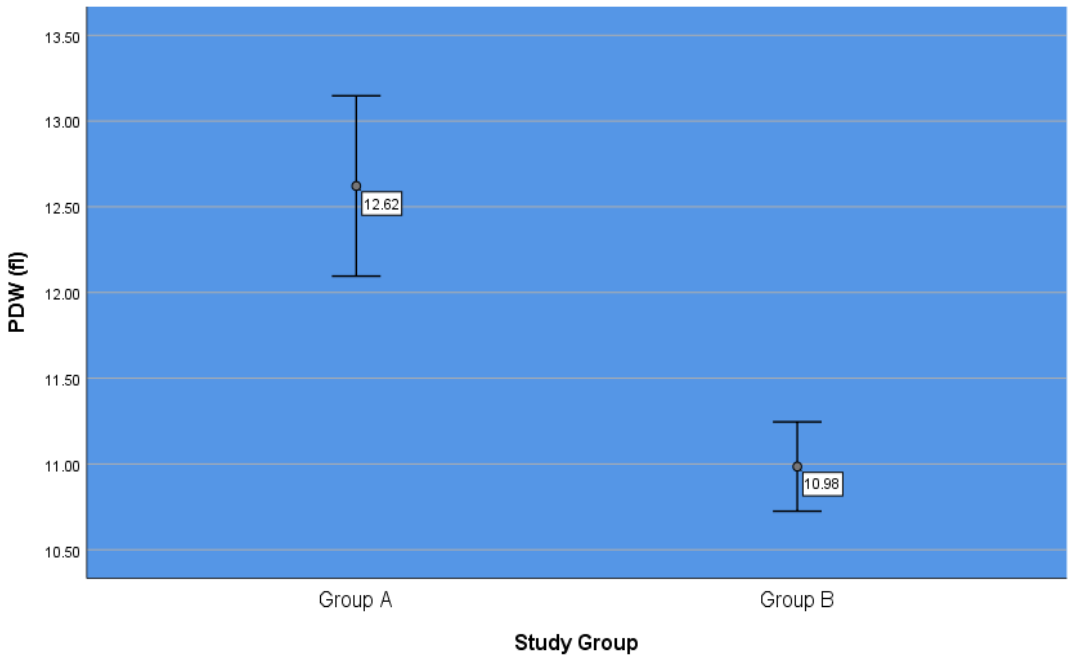

Figure 5: Error bar chart for comparison of PDW (fl) between study group (N=132)

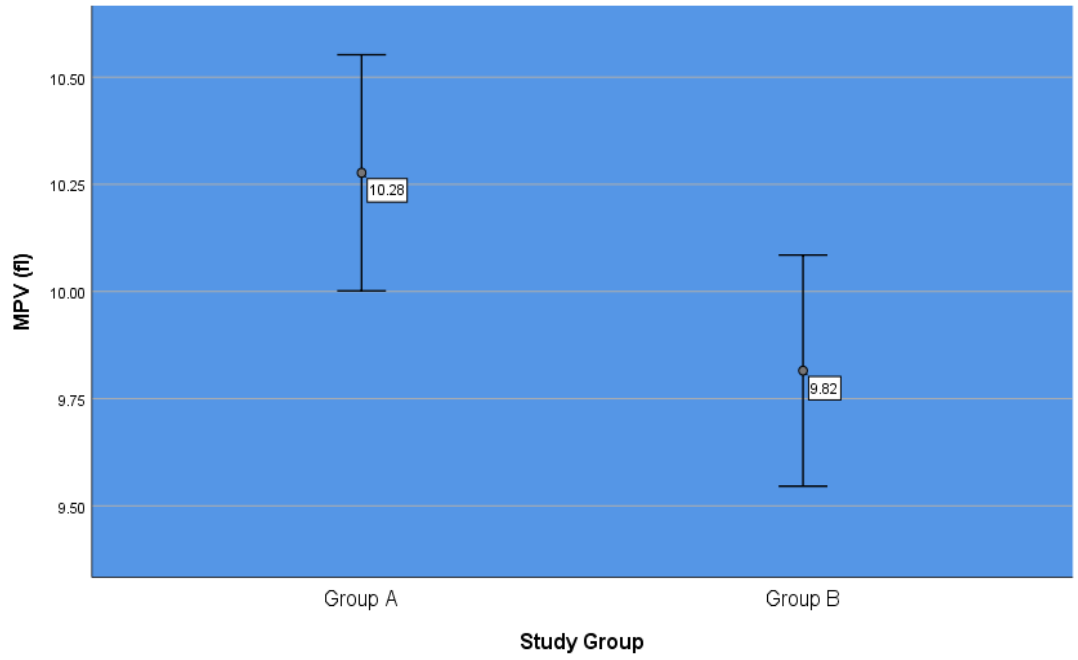

Figure 6: Error bar chart for comparison of MPV (fl) between study group (N=132)

Table 6: Comparison of mode of delivery between study group (N=132)

Mode Of Delivery	Study Group		Chi square	P value
	Group A (N=66)	Group B (N=66)		
Vaginal	23 (34.85%)	26 (39.39%)	0.292	*0.589*
LSCS	43 (65.15%)	40 (60.61%)		

Out of 66 participants in group A, the mode of delivery was vaginal for 23 (34.85%) participants and LSCS for 43 (65.15%) participants. Out of 66 participants in group B, the mode of delivery was vaginal for 26 (39.39%) participants and LSCS for 40 (60.61%) participants. There was no statistically significant difference in mode of delivery between study group. (P Value>0.05) (Table 6 & Figure 7)

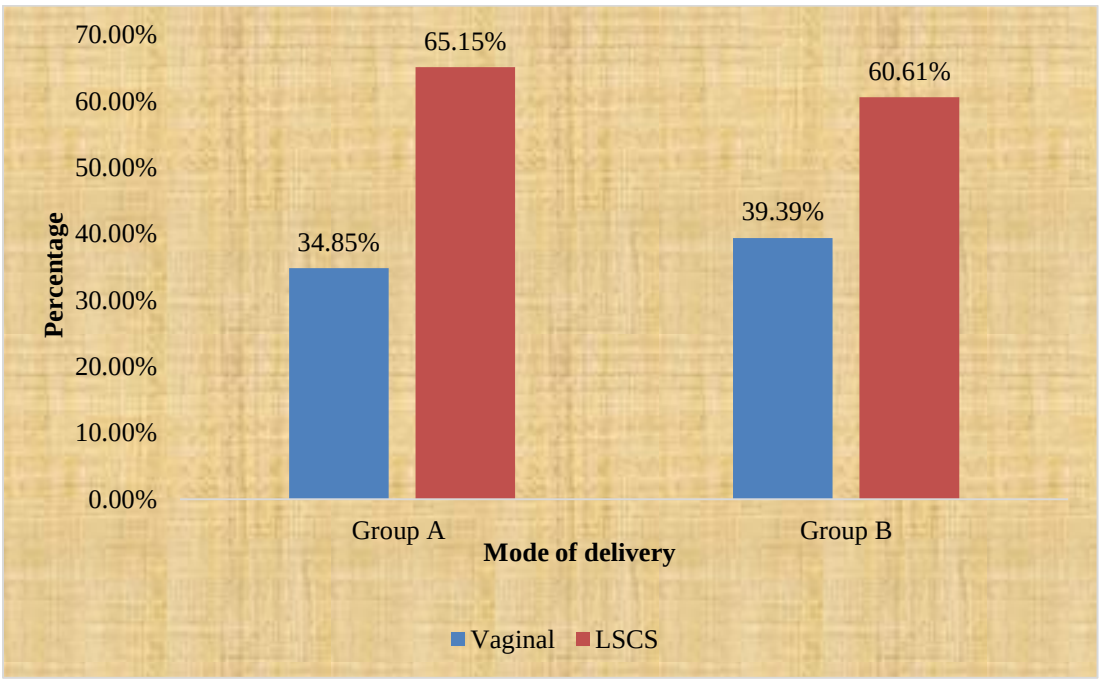

Figure 7: Clustered bar chart for comparison of mode of delivery between study group (N=132)

Table 7: Comparison of indication for LSCS in pre-Eclamptic (Group A) in study population (N=43)

Indication For LSCS In Pre-Eclamptic (Group A)	Frequency	Percentage
Previous LSCS	6	9.09%
Previous 2 LSCS	2	3.03%
Fetal Distress	15	22.73%
Severe Pe ,With Uncontrolled BP Readings	4	6.06%
Cephalopelvic Disproportion	3	4.55%
Prolonged Labor	6	9.09%
Placenta Previa	1	1.52%
Malpresentation	2	3.03%
Maternal Desire	4	6.06%

Among the Pre-Eclamptic women (Group A) in study population, indication for LSCS was

Previous LSCS for 6 (9.09%) participants, Previous 2 LSCS for 2 (3.03%) participants, Fetal Distress for 15 (22.73%) participants, Severe Pe, With Uncontrolled BP Readings for 4 (6.06%) participants, Cephalopelvic Disproportion for 3 (4.55%) participants, Prolonged Labor for 6 (9.09%) participants, Placenta Previa for 1 (1.52%) participants, Malpresentation for 2 (3.03%) participants and Maternal Desire for 4 (6.06%) participants. (Table 7 & Figure 8)

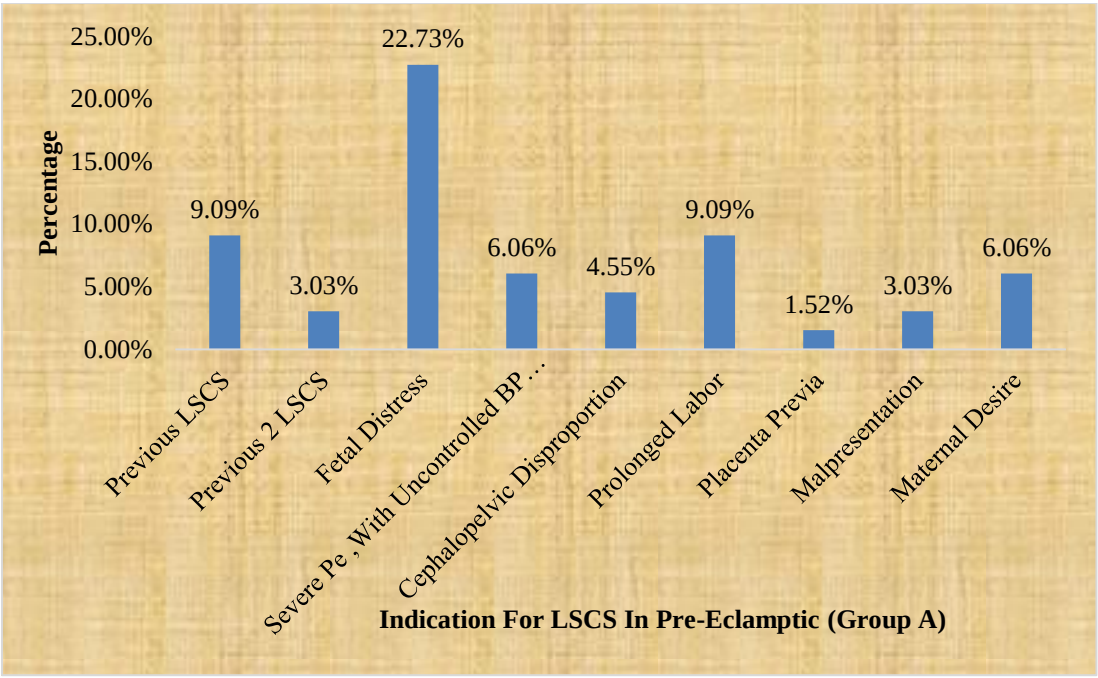

Figure 8: Bar chart for indication for LSCS in pre-Eclamptic (Group A) in study population (N=43)

Table 8: Comparison of fetal outcome between study group (N=53)

Fetal Outcome	Study Group		Chi square	P value
	Group A (N=40)	Group B (N=13)		
IUGR	12 (30%)	3 (23.08%)	1.547	*0.818*
Fetal Distress	12 (30%)	6 (46.15%)		
Fetomaternal Insufficiency	3 (7.5%)	1 (7.69%)		
Doppler Changes	7 (17.5%)	1 (7.69%)		
Intrauterine Fetal Demise	6 (15%)	2 (15.38%)		

Out of 40 participants in group A, the fetal outcome was IUGR for 12 (30%) participants, Fetal Distress for 12 (30%) participants, Fetomaternal Insufficiency for 3

(7.5%) participants, Doppler Changes for 7 (17.5%) participants and Intrauterine Fetal Demise for 6 (15%) participants. Out of 13 participants in group B, the fetal outcome was IUGR for 3 (23.08%) participants, Fetal Distress for 6 (46.15%) participants, Fetomaternal Insufficiency for 1 (7.69%) participant, Doppler Changes for 1 (7.69%) participant and Intrauterine Fetal Demise for 2 (15.38%) participants. There was no statistically significant difference in fetal outcome between study group (P Value>0.05). (Table 8)

Table 9: Comparison of place where baby was shifted post-delivery between study group (N=132)

Baby	Study Group		Chi Square	P Value
	Group A (N=66)	Group B (N=66)		
IUD	6 (9.09%)	2 (3.03%)	2.860	*0.239*
Mothers SDIE	32 (48.48%)	39 (59.09%)		
NICU	28 (42.42%)	25 (37.88%)		

Out of 66 participants in group A, the baby was IUD for 6 (9.09%) participants, Mothers SDIE for 32 (48.48%) participants and NICU for 28 (42.42%) participants. Out of 66 participants in group B, the baby was IUD for 2 (3.03%) participants, Mothers SDIE for 39 (59.09%) participants and NICU for 28 (42.42%) participants. There was no statistically significant difference in place where baby was shifted post-delivery between study group (P Value>0.05). (Table 9 & Figure 9)

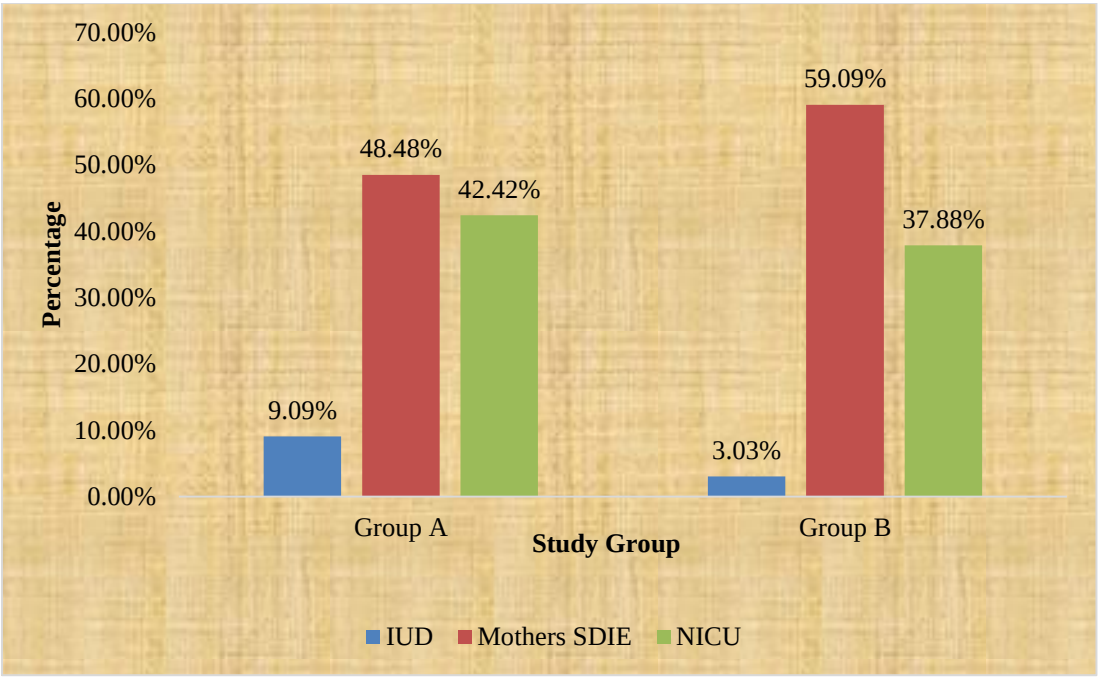

Figure 9: Clustered bar chart for of place where baby was shifted post-delivery between study group (N=132)

Table 10: Comparison of maternal condition between study group (N=65)

Maternal Condition	Study Group		Chi square	P value
	Group A (N=39)	Group B (N=26)		
Oligohydramnios	5 (12.82%)	4 (15.38%)	9.116	*0.105*
Abruption	9 (23.08%)	2 (7.69%)		
Rh Negative	3 (7.69%)	6 (23.08%)		
Anaemia	9 (23.08%)	7 (26.92%)		
Hypothyroid	5 (12.82%)	6 (23.08%)		
Prom	8 (20.51%)	1 (3.85%)		

Out of 39 participants in group A, the maternal condition was Oligohydramnios for 5 (12.82%) participants, Abruption for 9 (23.08%) participants, Rh Negative for 3 (7.69%) participants, Anaemia for 9 (23.08%) participants, Hypothyroid for 5 (12.82%) participants and Prom for 8 (20.51%) participants. Out of 26 participants in group B, the maternal condition was Oligohydramnios for 4 (15.38%) participants, Abruption for 2 (7.69%) participants, Rh Negative for 6 (23.08%) participants, Anaemia for 7 (26.92%) participants, Hypothyroid for 6 (23.08%) participants and Prom for 1 (3.85%) participants There was no statistically significant difference in maternal outcome between study group (P Value>0.05). (Table 10 & Figure 10)

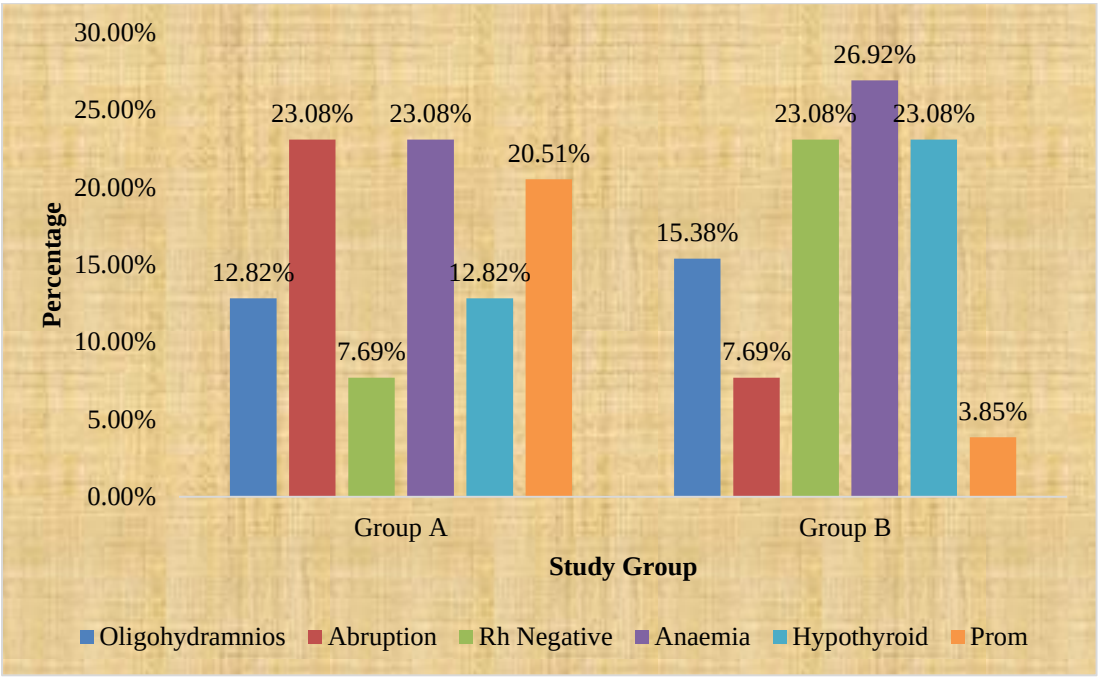

Figure 10: Clustered bar chart for comparison of maternal condition between study group (N=65)

DISCUSSION

DISCUSSION

India contributes to large number of maternal deaths occurring globally even with rapid economic progress in past two decades because of many factors like less female literacy rate and lesser access and use of reproductive health services. In developing countries like India preeclampsia is a cause for about one-third of maternal mortality[64]. Preeclampsia is defined by high blood pressure and proteinuria after completed 20th week of pregnancy. It is one among the major complications of pregnancy leading to maternal and foetal morbidity or mortality. Main causes of preeclampsia are placental vascular under perfusion, maternal endothelial damage and increased vascular permeability. Platelet consumption increases during preeclampsia due to abnormal platelet endothelium interaction. Platelets are activated by injured endothelium leading to increased platelet consumption which in turn triggers bone marrow to produce more platelets. The platelets produced are bigger in size resulting in increase of platelet indices like MPV,PDW[65]. Clinical presentation of preeclampsia is highly variable and can sometimes be even asymptomatic. Early onset of preeclampsia causes foetal growth restriction while late onset causes many long-term consequences like metabolic syndromes, inflammation, and chronic endothelial impairment. Preeclampsia requires earlier diagnosis and apt intervention as it can progress rapidly. PE can progress to eclampsia and cause adverse foetal outcomes such as preterm birth, small-for-gestational-age babies, placental abruption, perinatal death and increase the risk of cardiovascular and cerebrovascular diseases and venous thromboembolism later in life.[66] It has been found that identifying women at risk of developing preeclampsia and administration of prophylactic aspirin reduces risk of

preeclampsia by 17% and 14% reduction of foetal death risk. [67] Measurement of blood pressure and proteinuria are told to be gold standards for diagnosis of preeclampsia are difficult in low resource settings and the measurements may not be always accurate. Sensitive, cost-effective, easy to perform biomarkers are necessary particularly in developing countries like India for detection of pregnant patients at risk of developing preeclampsia. Blood or urinary biomarkers that help in diagnosis of preeclampsia will help in easy detection and subsequent management which helps in reducing preeclampsia associated complications. [68] Platelet indices can be easily obtained through routine blood investigations and can used to predict preeclampsia. Early detection or prediction of PE is imperative and non-invasive diagnostic methods based on biomarkers holds a potential use. [64] This study has its objective to document indices of the platelet in normotensive pregnancy, to document platelet indices in pre-eclampsia, to compare and assess the platelet indices in pre-eclampsia and normotensive pregnancy.

Two groups of pregnant women were involved in the study. One group included pregnant mother who were normotensive (Group B) and second group (Group A) included pregnant women with high blood pressure. A total of 132 participants were included in the final analysis with 66 participants in each group. Foetal outcome, place where baby was shifted post-delivery and maternal outcome were considered as primary outcome variable. Age, gestational age, platelet count, MPV (fl), PDW (fl) and mode of delivery were considered as other study relevant variables. In this study, the maximum number of participants were in the age group of 21 to 25 in both the groups which is normally the age for pregnancy in India. In group A with preeclampsia there were slightly a greater number of participants in age group

ranging from 26 to 35 than in group B with normal blood pressure. This observation could be related to the fact that advanced maternal age is one among many risk factors for preeclampsia. The majority of participants being in the age group of 21 to 25 is similar to that observed in similar studies like a study by Vamseedhar, A., et al. [69] and another study by Chirag Buch, A., et al. [70] where the mean age of participants was found to be 24.57±3.46 and 26.11±4.21. respectively. Majority of participants in group with preeclampsia were primigravida in the study. 46.97%) participants were primigravida in group A whereas 37.88% participants were primigravida in group B. This finding of more primigravida women developing preeclampsia is similar to that found in two similar studies. One is study by Chirag Buch, A., et al. [70] and another is study by Dadhich, S., et al. [8] in which 53% and 53.84% of cases were primigravida respectively. Primiparity is often considered as an important risk factor for preeclampsia. Maternal immune tolerance develops during pregnancy and it is essential for successful completion of pregnancy. Multiple mechanisms are responsible for establishing maternal immune tolerance which helps in retaining maternal immune defence mechanism against infections. Primiparous women have increased risk when compared with multiparous women because immune tolerance will be developed during first pregnancy which will be carried over to subsequent pregnancies. This is applicable only when the first pregnancy is free from preeclampsia.

On observing platelet count in two groups in the study it was found that in preeclampsia group the platelet count was <=50000 1.52% participants, 51000-1Lakh for 7.58% participants, 1.1-1.5Lakh for 31.82% participants, 1.5-2Lakh for 30.3% participants. On the whole it is observed that 71.22% participants had a platelet count

less than 2 lakhs whereas in group comprising normal pregnant women 25.76% participants only had a platelet count of lower than 2 lakhs and among these only 4% had a platelet count of lower than 1.5 lakhs. This observation of low platelet count in women with preeclampsia is similar to that found in studies like study by Kamel Ammar., et al. [72], Mohapatra., et al. [73], Annam., et al. [69], Dogru, H, Y., et al. [74], Chirag Buch, A., et al. [70]and Freitas, L, G., et al. [75]. The main reason for decrease in platelet count in preeclampsia is endothelial cell activation and dysfunction which causes increased consumption of platelets.

Platelet activation causes morphological changes of platelets. These changes include changes to spherical shape and pseudopodia formation. Platelets with increased number and size of pseudopodia differ in size thus increasing platelet distribution width. [76] In the current study the PDW values of 12 (fl) and above were noticed in 66.67% of participants in preeclampsia group as against 15.17% of participants in group B which comprised of normal pregnant women. This finding of increased PDW in women having preeclampsia was reported in studies by , Mohapatra., et al. [73], Chirag Buch, A., et al. [70] and Freitas, L, G., et al[75]. Platelet activation causes endothelial dysfunction and increased platelet consumption during low grade intravascular coagulation. This results in release of younger platelets by bone marrow which increase Mean Platelet Volume (MPV) because of their larger size. In the current study a 68.19% of participants in preeclampsia group had MPV 10 and greater than 10 against 46.98% in normal group. The increase in MPV associated with preeclampsia is reported in study by Chirag Buch, A., et al. [70] and in another study by S. Gioia, J., et al. [77], a study by Safak Ozdemirci., et al. [78] Another study Kanat Petkas, M., et al. [79] by concluded that when mean platelet volume of

10.1 or more and PAPP-A MoM of 0.33 or less are conjoined as a threshold, the pregnancies can be predicted with high sensitivity and specificity that they are at risk of developing preeclampsia. Another two studies one study by Yang, S, W., et al. [80] and another by Bellos, I., et al. [81] also reported MPV as a good predictor for preeclampsia.

Study	Conclusion
Chirag Buch, A., et al. [70]	increase in MPV associated with preeclampsia
S. Gioia, J., et al. [77]	increase in MPV associated with preeclampsia
Safak Ozdemirci., et al. [78]	increase in MPV associated with preeclampsia
Kanat Petkas, M., et al. [79]	MPV of 10.1 or more and PAPP-A MoM of 0.33 or less are conjoined as a threshold, the pregnancies can be predicted with high sensitivity and specificity that they are at risk of developing preeclampsia
Yang, S, W., et al. [80]	increase in MPV associated with preeclampsia
Bellos, I., et al. [81]	increase in MPV associated with preeclampsia

Out of 66 participants in group A, the mode of delivery was vaginal for 34.85% participants and LSCS for 65.15% participants. Out of 66 participants in group B, the mode of delivery was vaginal for 39.39% participants and LSCS for

60.61% participants. Regarding the mode of delivery to be opted for women with preeclampsia there is not sufficient evidence supporting either vaginal delivery or LSCS. In a study by Melania, A, R., et al.[82] which assessed the better mode of delivery among vaginal and LSCS for preeclampsia and it was found that there was not strong evidence on this but it can be concluded that even in cases of eclampsia, vaginal birth did not result in an increased risk of complications; instead, in one small study, caesarean section was associated with higher maternal and perinatal risks.

On comparing the neonatal outcomes, it was documented that intrauterine growth restriction was noted in 30% in preeclampsia group as against 23% in normal group. This finding is supported in a study by Odegard, R, A., et al. [7083] which concluded that Severe and early-onset preeclampsia were associated with significant foetal growth restriction. Foetal distress was also noted to be in a greater number of participants with preeclampsia. There was not much difference in percentage of neonates shifted to NICU after birth in two groups in the study.

CONCLUSION

CONCLUSION

This study concluded that there is decrease in platelet count and increase in the platelet indices like MPV, PDW, P-LCR in preeclampsia women as compared to normal pregnant women. Adverse neonatal outcomes like intrauterine growth restriction and foetal distress are also found to be more in women with preeclampsia. Particularly in developing countries like India , the platelet indices can be used as effective biomarkers which are both easy and economical to obtain.

Platelet indices can be used as a prognostic tool, for prediction of pre eclampsia and help in improving the fetomaternal outcome.

LIMITATION

The main limitation is small sample size and generalization of results require support of evidence from similar large studies.

Recommendation:

This study recommends use of platelet indices for early detection of preeclampsia in pregnant women so that appropriate management methods can be initiated at the earliest for better maternal and neonatal outcome.

The following are findings of the study:

Platelet count is low in women with preeclampsia in comparison with normal pregnant women.

Platelet indices like MPV and PDW are increased in women with preeclampsia in comparison with normal pregnant women.

Intrauterine growth restriction and neonatal distress were found to be more in women with preeclampsia.

SUMMARY

SUMMARY

- The presence of preeclampsia complicates around 3–8% of pregnancies. The prevalence of preeclampsia in the developing countries ranges between 1.8 to 16.7%. In India, incidence of preeclampsia is reported to be 8-10%. The prevalence of hypertensive disorders of pregnancy in India was identified as 7.8% with preeclampsia in 5.4%. Around 16-18% of maternal perinatal deaths and up to 40% of foetal and neonatal deaths are caused due to preeclampsia. The patients with preeclampsia are observed with higher level of MPV and PDW as compared to normal pregnancy women.

- This study aims to document platelet indices in normotensive pregnancy, to document platelet indices in pre-eclampsia, to compare and assess the platelet indices in pre-eclampsia and normotensive pregnancy.

- A total of 132 participants were included in the final analysis with 66 participants in each group.

    - Group A included 66 singleton pregnant women with hypertension developed after 20 weeks of pregnancy. Group B included 66 singleton normotensive pregnant women after 20 week of gestation.

    - Majority of participants in the study were in the age group of 21 to 25 years both in group A and group B.

    - Majority of participants in group A and group B were primiparous.

- Group A which comprised of women with hypertension reportedly 71.22% participants had a platelet count less than 2 lakhs, the PDW values of 12 (fl) and above were noticed in 66.67% of participants in preeclampsia group, and a 68.19% of participants in preeclampsia group had MPV 10 and greater than 10.

- Group B which comprised of pregnant women with normal blood pressure 25.76% participants had a platelet count of lower than 2 lakhs, PDW values of 12 (fl) and above were noticed in 15.17% of participants and MPV 10 and greater than 10 was found in 46.98% participants.

- The mode of delivery was vaginal for 34.85% participants and LSCS for 65.15% participants in group A and in group B, the mode of delivery was vaginal for 39.39% participants and LSCS for 60.61% participants.

- On comparing neonatal outcomes intrauterine growth restriction was noted in 30% in preeclampsia group as against 23% in normal group.

- This study concluded that there is decrease in platelet count and increase in the platelet indices like MPV, PDW, P-LCR in preeclampsia women as compared to normal pregnant women. Adverse neonatal outcomes like intrauterine growth restriction and foetal distress are also found to be more in women with preeclampsia.

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ANNEXURE

ANNEXURE I

PATIENT CONSENT FORM

Comparison of platelet indices in pre eclampsia and normotensive pregnancy in a tertiary care center.

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I have understood that I have the right to refuse consent or withdraw it at any time during the study and this will not affect my treatment in any way. I consent voluntarily to participate in this study

Name of Participant_____

Signature/ thumb print of Participant _____

Date _____

Statement by the researcher/person taking consent:

I have accurately read out the information sheet to the potential participant and to the best of my ability made sure that the participant understands that the following will be done: 2 ml venous blood sample taken for measurement of **platelet indices in complete blood count (**platelet count , mean platelet volume(MPV) and platelet distribution width (PDW)**.**

I confirm that the participant was given an opportunity to ask questions about the study and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Name of Researcher/person taking the consent: Dr. Kratika Kamath

Signature of Researcher /person taking the consent_____

Date _____

Name and Address of Principal Investigator:

Dr.Kratika Kamath
R.L Jalappa Hospital
Tamaka, Kolar.

ANNEXURE II

PROFORMA

- Name :
- I.P.No:
- Age:
- Occupation:
- Address:
- Husband's Occupation:
- Socio-economic Status:
- History of presenting illness:

- Menstrual history:

- obstetric history:
- Past Medical history
- Family History:
- Personal History:
  Sleep:
  Appetite:
  Diet:
  Bowel & Bladder:

- G.P.E:

- Build: Nourishment:
- Pallor: Icterus: Cyanosis: Clubbing:
  Lymphadenopathy: Pedal edema:

- Pulse: B.P.: Temp:
- Breast: Thyroid:

Systemic examination:

- CVS:
- RS:
- CNS:

- Abdominal Examination:

- Per speculum examination:

- Per vaginum examination:

- Investigations:

- Complete blood picture with platelet count, mean platelet volume and platelet distribution width.

- BT, CT
- SEROLOGY
- Random Blood sugar
- LFT
- Coagulation profile
- LDH
- Serum Uric acid

ANNEXURE III

LIST OF ABBREVIATIONS

PE	Pre Eclampsia
HELLP	Haemolysis, Elevated Liver Enzymes, Low Platelet Count
MPV	Mean Platelet Volume
PDW	Platelet Distribution Width
PLCR	Platelet Large Cell Ratio
PlGF	Placental Growth Factor
sFlt-1	Soluble Fms-Like Tyrosine Kinase 1
PAPP-A	Pregnancy-Associated Plasma Protein-A
BP	Blood Pressure
CKD	*Chronic Kidney Disease*
VEGF	Vascular endothelial growth factor
EOPE	Early Onset Pre-Eclampsia
AKI	*Acute Kidney Injury*
ACOG	*American College of Obstetricians and Gynecologists*
N/A	Not Applicable
BUN	Blood Urea Nitrogen
ALT	Alanine Aminotransferase
AST	Aspartate Aminotransferase
PCT	Plateletcrit
P-LCR	Platelet-large cell ratio
PDW	Platelet Distribution Width
NLR	Neutrophil/Lymphocyte Ratio

MAP	Mean arterial pressure
APTT	Activated Partial Thromboplastin Time
PT	Prothrombin Time
TT	thrombin time
DD	D-dimer
AUC	Area Under Curve
PLR	Platelet-to-lymphocyte ratio
SIR	Systemic inflammatory response
IUGR	Intrauterine growth restriction
SD	Standard Deviation
MoM	Multiples Of The Median
WBC	White Blood Cells
PC	Platelet Count
PPV	Positive predictive value
NPV	Negative predictive value

ANNEXURE IV

KEY TO

MASTER CHART

KEYS				
A	AGE	18-20 YRS		1
		21-25YRS		2
		26-30YRS		3
		31-35YRS		4
		36-40YRS		5
B	GESTATIONAL AGE	25-25+6WEEKS		1
		30-32+6 WEEKS		2
		33-35+6WEEKS		3
		36-36+6WEEKS		4
		37-39+6 WEEKS		5
C	GRAVIDA	PRIMIGRAVIDA		1
		GRAVIDA2		2
		GRAVIDA 3		3
		GRAVIDA 4		4
D	PLATELET COUNT	<=50000		1
		51000-1LAKH		2
		1.1-1.5LAKH		3
		1.5-2LAKH		4
		2-2.5LAKH		5
		2.5-3LAKH		6
		>3LAKH		7
E	PDW(fl)		10	1
			11	2
			12	3
			13	4
			14	5
			15	6
			16	7
			17	8

F	MPV(fl)		9	1
			10	2
			11	3
			12	4
			13	5
		MORE THAN 13		6
G	MODE OF DELIVERY	VAGINAL		1
		LSCS		2
H	INDICATION FOR LSCS IN PRE ECLAMPTIC	PREVIOUS LSCS		1
		PREVIOUS 2 LSCS		2
		FETAL DISTRESS		3
		SEVERE PE ,WITH UNCONTROLLED BP READINGS		4
		CEPHALOPELVIC DISPROPORTION		5
		PROLONGED LABOUR		6
		PLACENTA PREVIA		7
		MALPRESENTATION		8
		MATERNAL DESIRE		9
I	FETAL OUTCOME	NONE		1
		IUGR		2
		FETAL DISTRESS		3
		FETOMATERNAL INSUFFICIENCY		4
		DOPPLER CHANGES		5
		INTRAUTERINE FETAL DEMISE		6
J	BABY	IUD		1
		MOTHERS SDIE		2
		NICU		3

K	MATERNAL CONDITION	NONE	1
		OLIGOHYDRAMNIOS	2
		ABRUPTION	3
		RH NEGATIVE	4
		ANAEMIA	5
		HYPOTHYROID	6
		PROM	7

MASTER CHART

ANNEXURE VI

MASTER CHART HTN (group A)

SL.NO HYPERTENSIVE GROUP	IP.NO	A	B	C	D	E	F	G	H	I	J	K
1	649049	3	5	4	4	2	1	1	0	6	1	1
2	671513	2	5	2	4	1	1	2	1	1	2	0
3	675762	1	4	1	5	3	3	1	0	1	2	5
4	678056	3	4	1	3	3	1	1	0	6	1	0
5	678477	2	5	3	3	3	2	2	2	2	3	7
6	680241	3	5	3	5	3	2	2	2	1	2	0
7	684373	3	5	2	4	2	2	1	0	2	3	0
8	689921	2	5	2	5	4	2	2	3	3	3	3
9	688464	2	5	2	2	8	6	2	4	2	3	3
10	674018	3	2	1	2	6	4	2	6	2	3	6
11	689658	1	5	1	4	1	1	2	7	1	2	5
12	692144	3	5	1	3	2	1	2	3	3	2	3
13	671881	2	5	3	4	3	1	2	3	3	2	2
14	676884	1	5	1	4	3	3	2	5	1	2	0
15	728167	1	5	1	3	7	4	1	0	1	2	0
16	675792	4	3	3	4	8	4	2	3	3	2	3
17	690414	2	4	1	3	4	3	2	3	4	2	2
18	673694	2	5	2	2	8	4	1	0	1	2	4
19	674934	3	5	1	4	3	3	1	0	6	1	5
20	733907	2	3	1	5	1	2	2	3	3	3	3
21	727624	1	5	1	6	3	1	2	4	1	2	3
22	736118	2	3	1	4	1	1	2	6	2	3	6
23	676884	1	5	1	3	3	2	2	3	3	2	2
24	720909	3	1	2	3	5	3	1	0	5	3	7
25	730486	2	5	4	2	4	3	1	0	1	2	0
26	679574	3	5	1	3	6	3	2	3	3	2	3
27	686401	1	5	1	4	8	5	2	6	1	2	0
28	689916	2	5	3	3	4	3	2	3	3	2	2
29	700597	2	2	2	4	1	1	1	0	6	1	5
30	685920	4	5	2	4	3	1	2	1	1	2	0
31	687852	2	5	1	5	1	1	1	0	2	3	7
32	683844	2	3	4	3	8	4	1	0	6	1	5
33	690917	4	5	1	5	3	1	2	6	2	3	0
34	764249	2	3	1	3	3	3	2	3	3	3	2
35	765241	2	5	2	3	7	4	2	1	5	3	5
36	708307	2	5	1	5	5	3	1	0	2	3	7
37	763711	1	4	2	4	3	1	1	0	1	2	0
38	760896	3	5	1	1	5	4	1	0	6	1	0
39	768297	2	5	3	6	3	2	2	6	1	2	0
40	685016	5	3	3	3	4	2	2	1	5	3	7
41	787273	1	2	1	3	6	3	1	0	2	3	5
42	788725	4	5	2	5	2	2	2	3	3	3	0
43	790540	1	5	1	3	7	4	2	3	4	2	6
44	795574	2	5	1	3	4	3	2	4	1	2	3
45	805476	4	3	1	5	6	4	2	9	5	3	7
46	807861	2	2	2	5	6	3	2	1	1	3	0
47	813925	4	1	2	2	6	1	1	0	5	3	0
48	815859	1	2	3	3	2	1	2	3	3	3	7
49	817355	3	5	1	3	2	2	2	3	3	2	6
50	780668	2	5	1	5	1	1	1	0	1	2	4
51	813869	2	3	2	5	4	3	2	1	2	3	0
52	744128	3	2	2	4	1	1	2	8	5	3	0
53	783226	2	5	1	4	1	1	2	9	1	3	0
54	766288	5	5	3	4	2	2	1	0	1	3	7
55	708415	1	5	1	5	4	3	1	0	2	3	0
56	814135	3	3	2	4	4	3	2	9	1	3	0
57	803175	2	4	1	4	1	1	1	0	5	3	5
58	791852	3	5	2	3	1	1	1	0	1	2	0
59	774965	4	5	2	3	2	2	2	9	1	2	0
60	803981	2	1	1	7	3	2	2	8	2	3	6
61	815995	2	4	3	5	3	2	2	5	1	2	0
62	801325	2	5	2	5	2	2	2	4	1	2	3
63	778304	4	5	2	4	2	2	1	0	1	2	0
64	805284	1	5	1	3	7	3	2	6	1	2	0
65	794245	3	5	2	4	1	1	2	5	1	2	4
66	798731	3	5	3	5	4	3	2	3	4	2	5

MASTER CHART NORMOTENSIVE (group B)

SL.NO	IP.NO	A	B	C	D	E	F	G	H	I	J	K
1	758352	1	5	1	4	3	2	2	0	1	2	5
2	465186	1	4	2	6	4	2	1	0	1	2	1
3	766740	2	5	2	5	2	2	1	0	2	3	6
4	766749	2	5	1	5	1	1	2	0	3	3	1
5	760962	3	4	1	6	1	1	2	0	0	3	2
6	760945	2	5	2	4	2	2	2	0	1	2	1
7	760925	2	5	2	3	5	3	2	0	1	2	1
8	760945	2	5	2	3	3	2	2	0	1	2	1
9	765313	2	5	1	3	2	1	2	0	3	3	4
10	765282	2	5	3	4	2	1	2	0	1	2	1
11	762271	2	5	4	5	1	2	2	0	1	3	1
12	762289	1	4	1	3	3	1	2	0	1	2	5
13	764276	2	5	2	5	2	1	1	0	1	2	6
14	762260	1	4	1	5	2	2	2	0	1	3	2
15	763683	2	5	3	4	1	1	2	0	1	2	1
16	764255	1	3	1	5	2	2	1	0	2	3	1
17	764257	2	5	2	5	1	1	2	0	4	3	5
18	764275	3	4	4	4	2	1	2	0	1	2	7
19	764278	2	5	3	5	2	1	1	0	1	3	1
20	764274	1	5	1	5	1	1	1	0	3	3	4
21	765294	1	5	1	5	2	2	2	0	1	2	6
22	765146	3	5	2	4	1	1	1	0	6	1	3
23	768374	2	3	3	5	2	1	1	0	5	3	1
24	768376	1	4	1	4	2	1	2	0	1	2	1
25	769838	2	5	2	5	1	1	1	0	1	2	5
26	769839	1	2	1	5	2	2	2	0	1	3	1
27	768375	2	5	4	7	1	1	1	0	1	2	2
28	769767	3	5	4	5	2	1	1	0	1	2	5
29	762261	1	5	1	5	3	3	2	0	1	2	1
30	685469	3	5	2	4	2	3	2	0	1	3	1
31	762279	1	5	1	5	2	1	2	0	1	2	5
32	763447	1	3	1	5	1	2	1	0	1	2	1
33	812119	2	4	3	5	2	3	2	0	1	2	4
34	823243	2	5	2	4	5	4	1	0	1	3	1
35	827564	1	5	1	5	2	1	1	0	1	2	1
36	801762	2	3	3	4	2	2	2	0	2	3	1
37	794210	2	2	2	5	1	1	2	0	3	3	6
38	857152	1	5	1	5	2	1	1	0	1	2	1
39	783526	2	4	4	5	2	4	2	0	1	2	1
40	809092	2	5	2	5	2	3	2	0	1	3	1
41	799182	3	2	3	5	2	1	2	0	1	2	2
42	777726	4	5	2	4	1	3	1	0	1	2	1
43	797307	1	1	1	5	2	2	1	0	1	2	1
44	707835	2	5	2	5	3	1	2	0	1	3	1
45	760993	2	4	3	5	1	5	2	0	1	2	1
46	796973	3	5	2	6	2	1	2	0	1	2	4
47	801302	4	3	3	5	2	1	1	0	1	2	1
48	693500	1	5	1	5	2	2	2	0	1	3	1
49	749204	2	5	2	5	1	1	2	0	1	2	1
50	707779	1	5	1	5	2	3	2	0	1	2	1
51	785050	4	2	3	5	1	1	1	0	3	3	1
52	749204	3	5	2	5	2	1	1	0	1	2	1
53	793295	2	5	4	7	1	3	2	0	1	3	1
54	769373	1	5	1	5	6	1	2	0	6	1	3
55	749462	2	3	2	4	2	4	2	0	1	2	6
56	788472	1	2	1	5	2	1	1	0	1	3	4
57	801302	3	5	3	5	1	2	1	0	1	2	1
58	679745	2	1	2	5	5	1	2	0	1	2	1
59	764165	1	5	1	5	2	5	2	0	1	2	1
60	788242	1	5	1	5	1	1	2	0	1	3	4
61	777366	2	1	2	5	1	6	2	0	1	2	1
62	783198	1	1	1	5	2	1	1	0	1	2	5
63	798731	5	1	3	4	1	4	1	0	3	3	1
64	780221	3	5	2	5	2	1	2	0	1	2	1
65	805284	2	5	4	6	1	3	1	0	1	2	1
66	768884	1	4	1	5	2	1	1	0	1	3	6