MATERNAL AND FETAL OUTCOME IN WOMEN WITH SEVERE PREECLAMPSIA WITH HELLP SYNDROME

By

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IN

OBSTETRICS AND GYNAECOLOGY

Under the Guidance of

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LIST OF ABBREVIATIONS USED

ACOG	American College of Obstetricians and Gynecologists
AFI	Amniotic Fluid Index
AFLP	Acute Fatty Liver of Pregnancy
BUN	Blood Urea Nitrogen
CTG	Cardiotocography
DIC	Disseminated Intravascular Coagulation
HELLP	Hemolysis, Elevated Liver enzymes, Low Platelet
HLA G	Human Leukocyte Antigen -G
Hp	Haptoglobin
HUS	Hemolytic Uremic Syndrome
INR	International Normalized Ratio
IUFD	Intra Uterine Fetal Demise
IUGR	Intra Uterine Growth Restriction
IQR	Inter Quartile Range
LDH	Lactate Dehydrogenase
PE	Preeclampsia
SD	Standard Deviation
SGA	Small for Gestational Age
SLE	Systemic Lupus Erythematosus
TNF-α	Tumor Necrosis Factor - Alpha
TTP	Thrombotic Thrombocytopenic Purpura

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

MATERNAL AND FETAL OUTCOME IN WOMEN WITH SEVERE PREECLAMPSIA WITH HELLP SYNDROME

INTRODUCTION:

Hypertension disorders is pregnancy remain among the most significant problems in pregnancy. Of hypertensive disorders, the preeclampsia syndrome is dangerous complicating 5-10% of all pregnancies.

Generally, the disease is considered as placenta instigated, liver targeted acute inflammatory condition with elements of disordered immunological process. The hemolysis which characterizes the syndrome is of microangiopathic in origin.

HELLP syndrome (Hemolysis, Elevated Liver enzymes, Low Platelet) is considered to be a severe form of preeclampsia. HELLP syndrome occurs in 0.5-0.9% of all pregnancies and 10-20% of patients with severe preeclampsia.

Haptoglobin is an acute phase glycoprotein which binds to the hemoglobin and plays an important role in neutralizing oxidation reactions stimulated by heme derived iron. Haptoglobin binds to the free hemoglobin caused by hemolysis, forms Hp-Hb complex thereby preventing and subsequent oxidative damage caused by free iron in vascular system of the kidney.

A decrease in haptoglobin can serve as a sensitive marker for hemolytic component of HELLP syndrome and to control the coarse of the disease. HELLP syndrome and its management still poses a problem in modern obstetrics and requires a prompt diagnosis and management with multidisciplinary approach.

Objectives

1. To assess maternal and fetal outcome in severe preeclampsia with HELLP syndrome and severe preeclampsia without HELLP syndrome.

2. To evaluate haptoglobin to assess hemolysis for early diagnosis of severe preeclampsia with HELLP syndrome.

STUDY DESIGN

A cross sectional observational study conducted in the department of Obstetrics and Gynaecology, R.L Jalappa Hospital, Tamaka, Kolar from January 2018 to may 2019.

MATERIAL AND METHODS

All pregnant who visit labour word, RLJH hospital were screened for severe preeclampsia by clinical examination. At the time of enrolment, an informed written consent was obtained from the pregnant women. 5-7 ml of blood sample is taken and complete blood count, serology, liver function test, coagulation profile, LDH, uric acid, RFT, serum electrolytes, serum haptoglobin levels are evaluated. Severe preeclampsia without HELLP (Group A) syndrome and severe preeclampsia with HELLP syndrome (Group B) were evaluated according to the laboratory diagnosis which mainly include serum haptoglobin as a biomarker of hemolysis.

Each pregnant women is followed up until delivery and the maternal and fetal outcome is recorded.

RESULTS

Mean age among the study groups was comparable. Subjects in group B had significantly higher parity. In our study, Group B subjects had significantly higher preterm and more vaginal deliveries. Maternal and perinatal morbidity and mortality were significantly higher in Group B subjects. Due to more number of patients with anemia, blood transfusion requirement was statistically significant ($p<0.005$). Haptoglobin was significantly decreased in the women with HELLP syndrome which was statistically significant ($p<0.05$) The occurrence of HELLP syndrome in patient with severe preeclampsia without HELLP syndrome, over a period of time was significantly more if the haptoglobin levels were low ($p<0.05$). Haptoglobin is a good predictor of HELLP syndrome with area under the curve (0.87; 95% CI:0.798 to 0.923) at cut off point of $\leq$ 74.19. Sensitivity and specificity of haptoglobin was 92.06% and 71.43% respectively with PPV and NPV of 76.3% and 90% respectively.

CONCLUSION

Preeclampsia and HELLP syndrome are the most common complications of pregnancy and posing a severe problem worldwide. This study demonstrates that pregnancies complicated by severe preeclampsia with HELLP syndrome have significantly higher maternal as well as perinatal mortality and morbidity

Haptoglobin was significantly decreased in the women with HELLP syndrome. There was no significant association of haptoglobin with fetomaternal outcome in women with and without HELLP. Serum Haptoglobin is statistically significant ($p<0.001$) between severe preeclampsia and HELLP syndrome in this study. Though not a sole marker, it is usefull for

early detection of the disease, to grade the severity of the disease, and to prevent severe preeclampsia progressing into HELLP syndrome. This inturn helps in proper management and would improve maternal and perinatal outcome

INTRODUCTION

INTRODUCTION

Every pregnant woman dreams of a healthy pregnancy and a healthy baby. But unfortunately, sometimes pregnancy may end up in complications which ultimately leads to adverse maternal and fetal complications. One among these is hypertensive disorders that include preeclampsia and HELLP syndrome.

Hypertensive disorders remain among the most significant and intriguing unsolved problems in obstetrics. Of hypertensive disorders, the preeclampsia syndrome is most dangerous, complicating 5 to 10 percent of all pregnancies.[1]

Hypertension during the pregnancy is diagnosed when the systolic pressure is ≥140 mmHg and/or diastolic pressure ≥ 90 mmHg, measured on two occasions at least 6 hours within 7 days.

Preeclampsia is best described as a pregnancy specific syndrome that affects virtually every organ system which manifests as onset of hypertension and proteinuria after 20 weeks of gestation and resolves by 12 weeks postpartum. Preeclampsia is present in only 2-8% of all pregnancies even in developed countries.

Generally, the disease is considered as placenta instigated, liver targeted acute inflammatory condition with elements of disordered immunological process. The hemolysis which characterizes the syndrome is of microangiopathic in origin.

HELLP (Hemolysis, Elevated Liver enzymes, Low platelets) syndrome is considered to be a severe form of preeclampsia. HELLP syndrome occurs in 0.5-0.9% of all pregnancies and 10-20% of patients with severe preeclampsia.[2]

Right upper quadrant pain or epigastric pain and nausea or vomiting, malaise have been reported with a frequency ranging from 30% to 90%. HELLP syndrome is

associated with many complications which include eclampsia, DIC, shock, sepsis, IUGR, IUFD. Prediction of maternal and perinatal outcomes at early and late gestation is important for management of both disorders.

Worst prognosis estimated at 19-27% with disseminated intravascular coagulation (DIC) that can occur when platelet count decreases to less than 50,000/mm.[3]

Haptoglobin (Hp) is an acute phase glycoprotein which binds to the hemoglobin and plays an important role in neutralizing oxidation reactions stimulated by heme derived iron. Hp binds to the free hemoglobin caused by hemolysis, forms Hp-Hb complex thereby preventing iron loss and subsequent oxidative damage caused by free iron in vascular system of the kidney.

Preeclampsia syndrome ia a pregnancy related disease that is thought to be caused by increase in oxidative stress. The role of Hp polymorphism in determining preeclampsia with HELLP syndrome has been addressed by several studies but the results are contradictory.

A decrease in haptoglobin levels can serve as a sensitive and early marker for hemolytic component of HELLP syndrome and to control the coarse of the disease.

Incidence of HELLP syndrome in our hospital is 1-2% according to our hospital records. As our hospital is a tertiary care centre and a significant number of patients with preeclampsia and HELLP syndrome were referred from outside without adequate antenatal care, we provide treatment and get an opportunity to conduct such study to know regarding clinical course, pathogenesis, maternal and fetal outcome. This can help us in early diagnosis and improvement of management which ultimately leads to better maternal and perinatal outcomes.

AIMS & OBJECTIVES

OBJECTIVES OF THE STUDY

1. To assess maternal and fetal outcome in severe preeclampsia with HELLP syndrome and severe preeclampsia without HELLP syndrome.

2. To evaluate haptoglobin to assess hemolysis for early diagnosis of severe preeclampsia with HELLP syndrome.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

HISTORY

Since the end of 19th century, pre-eclampsia presenting with atypical clinical presentation is well known. Dieckmenn called this spectrum the toxemias of pregnancy.[4]

Coagulation defects and microthrombi was first described in 1892 by Schimorl. Dacie described the pathogenesis of microangiopathic hemolytic anemia in 1962.

Pritchard and McKay (1972) described the characteristics of this syndrome in fatal cases of preeclampsia and attributed the cause to DIC.[5]

Occult microangiopathic hemolytic anemia in severe cases of PIH was observed by Sheehan (1973). Pritchard (1976) proposed that the cause of hemolysis in PIH patients is microangiopathy.

Kitzmiller (1974) and Pritchard (1976) described that thrombocytopenia results from platelets adherence to sites of endothelial injury.

Chesley in 1978 added descriptions of hemolysis and thrombocytopenia with severe preeclampsia with abnormally elevated serum liver transaminase levels that indicated hepatocellular necrosis.

Weinstein in 1982 referred to this combination of events as the HELLP syndrome.[6]

Review

Women with preeclampsia and HELLP syndrome typically have worst outcomes than preeclamptic women without HELLP constellation in a study by Martin et al.[1]

Haram k Et al in 2009 found that early onset of disease, extremely low birth weight, were more frequent in HELLP syndrome, supporting a more severe clinical picture in these cases.[7]

In a study by Campos A et al in 2016, dexamethasone was used according to Mississippi protocol in presence of moderate or severe thrombocytopenia for faster mother recovery, observed an elevation of platelet count and also reduction of transfusion needs.[2]

Sabai et al in 2005 said that Maternal and perinatal morbidities and mortalities are increased in women who develop the disorder before 33 weeks of gestation in those with pre-existing medical disorders, and in those from developing countries. Growth restriction is now recognized as a major risk factor for premature atherosclerosis, according to the so called fetal origins of the adult disease hypothesis.[8]

Peters and colleagues in 2005 confirmed that sperm exposure causes mucosal alloimmunization. Limited sperm exposure is the most likely explanation for the high incidence of pre-eclampsia in teenagers.

Drakeley and coworkers (2002) described 72 women with preeclampsia and renal failure. Half had HELLP syndrome, and a third had placental abruption. In one review of 183 women with HELLP syndrome, 5 percent had kidney injury. Of those with renal injury, half had placental abruption, and most had postpartum hemorrhage. Last, irreversible renal cortical necrosis develops rarely.[9]

In the first delivery, almost 50% of women with Hp2-2-phenotype or Hp 2-1 phenotype developed preeclampsia while only 25% of women with Hp 1-1 phenotype developed preeclampsia. Hp 1-1 has a protective role in preventing preeclampsia,

possibly due to its role in preventing oxidative damage caused by free Hb explained in a study by Goldenstein el al. This study also showed that Hp 1-1 phenotype was significantly more prevalent (28%) among women with preeclampsia than in healthy women (16%).

In a study by Wilke G et al, concluded that decrease in serum haptoglobin is a very sensitive method for detecting hemolysis. In his study all 25 patients with HELLP syndrome had reduced serum haptoglobin levels at the time of diagnosis. A rapid decrease in haptoglobin levels was observed within a matter of hours in 3 cases who had a normal lower range on admission. They also concludes that haptoglobin appears to be a sensitive parameter for the control of the course of the disease.[10]

A study Kinay T et al showed that perinatal morbidity and mortality were similar in HELLP syndrome cases and severe preeclampsia cases at the same gestational age. Some maternal adverse outcomes were more frequent in HELLP syndrome cases. Eclampsia risk was higher in HELLP syndrome, especially at <34 weeks of gestation. Induction of labour might be considered earlier in HELLP syndrome cases than in severe preeclampsia at <34 weeks' gestation.[11]

Clinical symptoms of HELLP syndrome almost always worsen in the first 72 hours of delivery. Administration of haptoglobin in early post operative period prevents renal damage by reducing the serum free hemoglobin level in patients with HELLP syndrome, thereby reduces the morbidity associated with the disease, concluded in a study by Yamamoto H.[12]

In Sibai et al case series of 442 patients with HELLP syndrome, laboratory evidence of DIC was detected in 21%. 16% experienced placental abruption. DIC tended to complicate HELLP syndrome when associated with placental abruption, severe

intrapartum or postpartum blood loss, or subcapsular hepatic hematoma. In a review by Haddad, 2000 out of 183 women with HELLP syndrome, 5% had kidney injury.[13]

Urgent delivery is a rule in cases of HELLP syndrome. Vaginal route of delivery is preferred and in this study 90% were vaginal deliveries, misoprostol induction supplemented by oxytocin drip.[14]

In a prospective observational study, HELLP syndrome develops with a peak frequency between 27^{th} and 37^{th} gestational week. The postpartum cases of HELLP syndrome usually develop within the first 48 hours after delivery. The risk of recurrence is 24% after the index pregnancy.[15]

In a study conducted in tertiary care centre concluded that the rate of caesarean delivery increases with increased occurrence of hypertensive disorders during pregnancy. Fetal distress was the most frequent indication for caesarean section.

The mean gestation and birth weight at the time of delivery in HELLP syndrome group were lower than those in severe preeclampsia group patients, so HELLP syndrome is dependent on gestational age of delivery and not diagnosis dependent.[3]

According to a study performed in Turkey, the mean interval between diagnosis and delivery is 0.9 days for HELLP syndrome and 2.2 days for severe preeclampsia cases in pregnancies before a gestational age of 32 weeks. This short interval between diagnosis and delivery is due to high rate of complicated cases referred to the institution and also because the condition was not recognized as promptly in the medical centre already visited by the women. The overall rate of adverse maternal complications in HELLP syndrome was 16.20% compared with severe preeclampsia was 11.8%.

In a prospective longitudinal study conducted in ESI PGIMSR, New Delhi, antenatal complications were more in HELLP syndrome which include oligohydramnios,

preterm, PROM, IUGR, IUFD. 1-25% of affected female developed serious complications such as DIC, placental abruption, ARDS, hepatorenal failure, pulmonary edema, subcapsular hematoma and hepatic rupture. HELLP syndrome had significantly higher IUFD, low birth weight, NICU admissions, increase transfusion requirement and perinatal morbidity and mortality.[16]

In a prospective observational study conducted in Shivamogga, Overlapping of presenting features, clinical findings, and many laboratory findings with HELLP syndrome includes differential diagnosis such as upper respiratory tract infection, hepatitis, cholecystitis, pancreatitis, acute fatty liver of pregnancy(AFLP) or thrombotic thrombocytopenic purpura(TTP).[17]

A retrospective study conducted in Andra Pradesh needed intensive care management for 60% of HELLP syndrome and all of them treated with Fresh frozen plasma (FFP), platelet and other blood products transfusion. Maternal mortality of 6.66% is because of late referral. So this study concludes early registration and regular antenatal checkups, availability of better transport facilities, prompt referral to tertiary care centre with multidisciplinary team approach is very essential for better ,maternal and neonatal outcome.[18]

HYPERTENSIVE DISORDERS IN PREGNANCY

Hypertensive disorders are among the most common medical complications of pregnancy and major cause of maternal and perinatal mortality and morbidity worldwide.

American College of Obstetricians and Gynecologists (ACOG 2013) describes four types of hypertensive disorder in pregnancy: [19]

1. Preeclampsia and eclampsia syndrome
2. Chronic hypertension of any etiology
3. Preeclampsia superimposed on chronic hypertension
4. Gestational hypertension

PREECLAMPSIA

Preeclampsia is a disorder of pregnancy associated with new onset hypertension, which occurs most often after 20 weeks of gestation and frequently near term.

A pregnancy-specific syndrome that can affect virtually every organ system.

Diagnostic Criteria of preeclampsia[19] ACOG 2019

Blood pressure	• ≥140/90 mmHg on two occasions at least 4 hours apart after 20 weeks of gestation in previously normotensive women • ≥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.

Indicators of severity of Gestational Hypertensive Disorders [20]

Abnormality	Non severe PE	Severe PE
Diastolic BP	< 110 mm Hg	≥ 110 mm Hg
Systolic BP	< 160 mm Hg	≥ 160 mm Hg
Proteinuria	None to positive	None to positive
Headache	Absent	Present
Visual disturbances	Absent	Present
Upper abdominal pain	Absent	Present
Oliguria	Absent	Present
Convulsion (eclampsia)	Absent	Present
Serum creatinine	Normal	Elevated
Thrombocytopenia (< 100,000/μL)	Absent	Present
Serum transaminase	Minimal	Marked
Fetal-growth restriction	Absent	Present
Pulmonary edema	Absent	Present
Gestational age	Late	Early

HELLP SYNDROME

The severe form of preeclampsia with the acronym of Hemolysis (H), Elevated Liver enzymes (EL)and low Platelet count (LP) coined by Dr. Louis Weinstein in 1982,[21] one of the more severe forms of preeclampsia.

CLASSIFICATION OF HELLP SYNDROME

Classification system has been formulated to enable physicians to identify patients at risk for significant maternal morbidity, to guide therapeutic intervention and assess efficacy or outcome, and to provide common platform for comparison of research results.

Mississippi Classification[22]

Class I	Platelet < 50,000/mL AST or ALT > 70 IU/L LDH > 600 IU/L
Class II	Platelet 50,000-1,00,000/mL AST or ALT > 70 IU/L LDH > 600 IU/L
Class III	Platelet 1,00,000-1,50,000/mL AST or ALT > 40 IU/L LDH > 600 IU/L

Tennessee Classification[22]

True or complete HELLP: Platelet < 1, 00,000 /mL, AST/ALT>70I/L, LDH > 600 IU/L

Partial or incomplete HELLP: Severe PE with any one of the following ELLP, HEL, EL, LP

EPIDEMIOLOGY

HELLP syndromes occurs about 0.5 to 0.9% of all pregnancies, and in 10-20% cases with severe preeclampsia.[2]

A strong association between HELLP syndrome and eclampsia is reported in Miles et al. from the university of Mississippi, also reported an incidence of 30% in patients with postpartum eclampsia and 28% in patients with antepartum eclampsia.

The incidence of HELLP syndrome was 7.6/1000 live births which was accounted for 24.4% of preeclampsia cases between January 1981 and June 1997 was reported at the university of Mississippi Medical centre. Between 1980 and 1991 another study conducted at the same university reported that 1/3rd of the cases of preeclampsia developed HELLP syndrome.

Sowjanya et al and Ara S et al showed the incidence of HELLP syndrome was 15.5% and 6.5 % respectively.[23,24]

10% of all pregnancies complicated by severe preeclampsia and eclampsia are affected by HELLP syndrome, a hallmark of critical illness in the parturient.

A study in 1985 by Sabai B M et al showed incidence of HELLP syndrome as 9.7% among 115 pregnancies complicated by preeclampsia or eclampsia.

Among 327 cases of severe preeclampsia , complete HELLP cases were 21% and partial HELLP cases were 22% reported in a study conducted at a regional Medical centre in Memphis.

A study done at the university of Tennessee, Memphis between 1992 and 1997, 25% were diagnosed with HELLP syndrome among 442 patients of preeclampsia. 70% of patients were in antepartum which further subdivided as 10% before 27 weeks, 20% after 37 weeks and 70% between 27 and 37 weeks. Postpartum in 30% usually is seen within 48 hours of delivery.[22]

RISK FACTORS [20,25]

Factors	Preeclampsia	HELLP syndrome
Parity	Nulliparous	Multiparous
Age	<20 years or >45 years	>25 years
Race	Caucasian	White
Others	Family h/o preeclampsia Poor prenatal care Diabetes mellitus Chronic hypertension Multiple gestation Antiphospholipid antibody Prior preeclampsia Prior abruption BMI >30 Assisted reproductive technology Chronic kidney disease Prior still birth Systemic lupus erythematosus	History of poor pregnancy outcome Previous HELLP syndrome

ETIOLOGY [20,46]

Preeclampsia, eclampsia and HELLP syndrome were traditionally described as the disease of unknown etiology.

Normally, pregnancy is a hypercoagulable state characterised by vasodilatation, decrease vascular reactivity tone and increased prostacyclines. In contrast **preeclampsia** is evidenced by vasoconstriction, increased vascular tone, platelet aggregation and an alteration in the thromboxane- prostacyclin ratio.

Preeclampsia syndrome widely varies in its clinical phenotypic expression. But, at least two major subtypes are differentiated by whether or not remodelling of uterine spiral arterioles by endovascular trophoblasts is defective.

Two stage disorder theory of preeclampsia

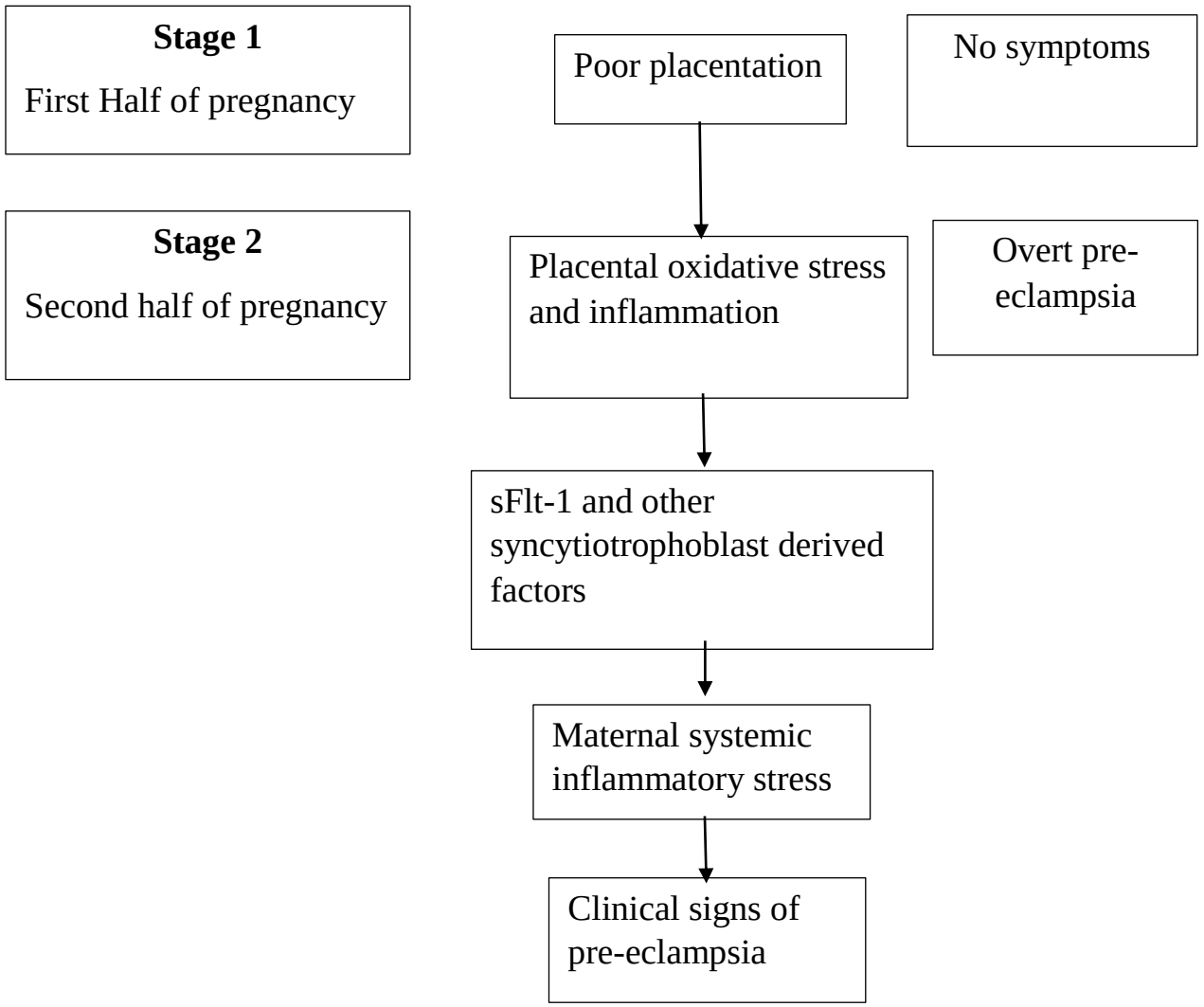
According to Redman and co-workers (2005a)

Stage 1: Endovascular trophoblastic remodelling

Stage 2: clinical syndrome

Importantly stage 2 is modified by pre-existing maternal conditions that are also manifest by endothelial cell activation or inflammation such as diabetes, obesity, cardiovascular or renal disease, immunological disorders, or hereditary influences.

THE TWO STAGES OF PREECLAMPSIA



Mechanisms that explain the cause of preeclampsia

1. Placental implantation with abnormal trophoblastic invasion of uterine vessels
2. Immunological maladaptation tolerance between maternal, paternal (placental), and fetal tissues
3. Maternal maladaptation to cardiovascular or inflammatory changes of normal pregnancy
4. Genetic factors including inherited predisposing genes and epigenetic influences

1. Abnormal trophoblastic invasion

Normal implantation is characterised by extensive remodelling of spiral arterioles with in decidual basalis. Endovascular trophoblasts replace the vessel diameter.[27] The veins are invaded only superficially.

Trophoblastic invasion may be incomplete in some cases of preeclampsia. With this, decidual vessels but not myometrial vessels, become lined with endovascular trophoblasts. The deeper myometrial arterioles thus do not lose their endothelial lining and musculoelastic tissue, and their mean external diameter is only half that of corresponding vessels in normal placentas.

Physiological change takes place in two phases:

PHASE I- This phase starts at the time of early implantation and ends by 12 to 14 weeks of gestation. In this phase the trophoblastic tissue invades the myometrial segment of the vasculature.

PHASE II- This phase begins at 12-14weeks of gestation and proceeds on till 20 to 24 weeks of gestation. During this phase there is further invasion of trophoblastic

tissue into the Myometrial segment of the spiral arteries. This leads to dilatation of the arteries, by increasing their capacitance and there by converting high resistance system into low resistance system. This facilitates better exchange of gases and nutrients across the maternal-fetal circulation leading to enhanced intra uterine fetal growth.

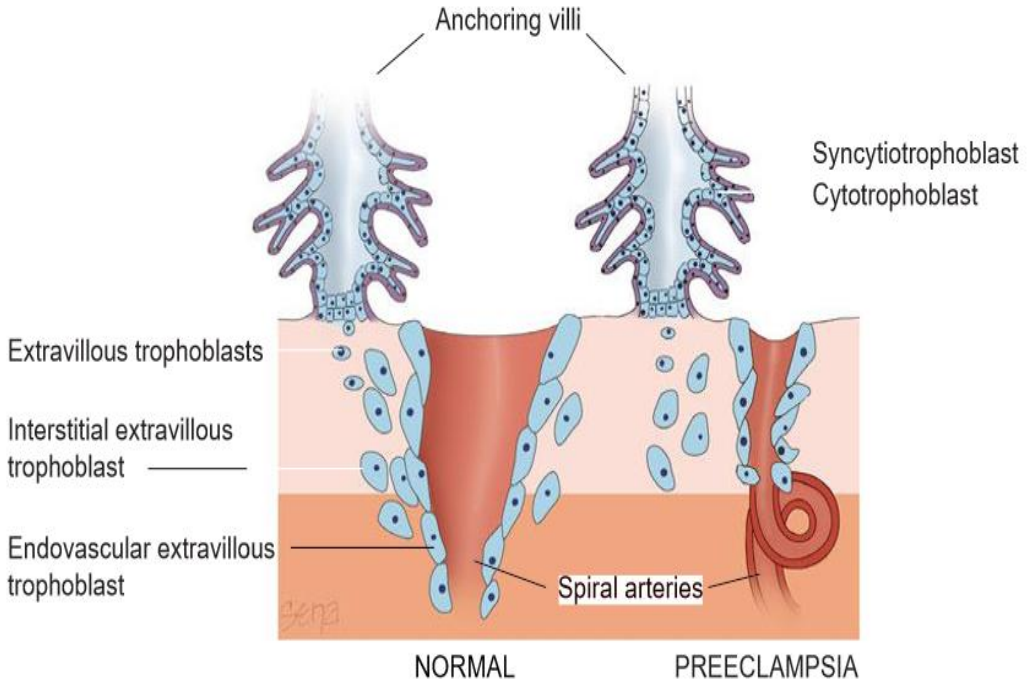


Figure 1: Schematic representation of normal placental invasion and defective Trophoblastic invasion in Preeclampsia

In general, magnitude of defective trophoblastic invasion correlates with the severity of the hypertensive disorder.

Mcmohan and associates (2014) found that lower levels of soluble antiangiogenic growth factors may be involved in faulty endovascular remodelling.

2. Immunological factors:[28]

Loss of maternal immune tolerance to paternally derived placental and fetal antigens is another cited theory for preeclampsia

Preeclampsia is an immune mediated disorder. Tolerance dysregulation might also explain an elevated risk when the paternal antigenic load increased, that is, with two sets of paternal chromosomes – a "double dose". These women have elevated serum levels of antiangiogenic factors and the gene for these factors is soluble fms-like tyrosine kinase 1.

In women destined to be preeclamptic, extra villous trophoblasts early in pregnancy express reduced amounts of immunosuppressive non classic human leukocyte antigen G(HLA G), explains the possible role of immune maladaption. (Redman and colleagues 2015a). T-helper (Th1) cells action is increased in early second trimester in women who develop preeclampsia which is known to stimulate inflammatory cytokine secretion. (Redman 2012, 2015a)

3. Endothelial cell activation [29]

In response to the ischemia or other inciting causes, placental factors are released and begin a cascade of events. Antiangiogenic and metabolic factors and other inflammatory leucocyte mediators are thought to provoke systemic endothelial cell injury.

Cytokines such as tumor necrosis factor-α (TNF- α) and the interleukins may contribute to the systemic oxidative stress, characterised by reactive oxygen species and free radicals that lead to formation of self-propagating lipid peroxides which in turn are highly toxic radicals and interfere with prostaglandin balance by production of nitric oxide.

4. Genetic factors:

An incident risk for preeclampsia of 20-40% for daughters of preeclamptic mother , 11-37% for sisters of preeclamptic women, and 22-47 % for twins.

Ethno-racial factors are important, as evidenced by high incidence in African-American women. Majander and associates have linked preeclampsia predisposition to even fetal genes on chromosome 18.[30]

Genes with Possible Associations with Preeclampsia Syndrome

MTHFR (C677T) – Methylene tetrahydrofolate reductase

Factor V Leiden

AGT (M235T) – Angiotensinogen

HLA – Human leukocyte antigen

NOS3 (Glu 298 Asp) – Endothelial nitric oxide

F2 (G20210A) – Prothrombin (Factor II)

ACE – Angiotensin converting enzyme

CTLA4 – Cytotoxin T-lymphocyte- associated protein

LPL – Lipoprotein lipase

SERPINE – Serine peptidase inhibitor

PATHOGENESIS

1. **Vasospasm:**

   Systemic endothelial activation causes vasospasm that elevates resistance to produce subsequent hypertension.[31]

   With diminished blood flow because of maldistribution from vasospasm and endothelial leakage, ischemia of surrounding tissues can lead to necrosis, hemorrhage, and other end-organ disturbances characteristic of the syndrome.

2. **Endothelial cell injury:**

   Injury to systemic endothelial cells is now a centre piece of pathogenesis. Intact endothelium has anticoagulant properties and also, endothelial cells by releasing nitric oxide, blunt the response of vascular smooth muscle to agonists.[32]

   Plasma ET-1 levels are elevated in normotensive pregnant women, but women with preeclampsia have even higher levels.

3. **Angiogenic and Antiangiogenic Proteins:**

   Placental vasculogenesis is evident by 21 days after conception.

   Angiogenic imbalance describes excessive amounts of antiangiogenic factors, which are stimulated by worsening hypoxia at the uteroplacental interface.

   Trophoblast of women destined to develop preeclampsia overproduces at least two antiangiogenic peptides that enter the maternal circulation. Soluble fms-like tyrosine kinase 1 (sFlt-1) is a receptor for VEGF. Elevated maternal sFlt-1 levels inactivate and reduce circulating free placental growth factor (PlGF) and VEGF concentrations, leading to endothelial dysfunction.[32]

Importantly, sFlt-1 levels begin to rise in maternal serum months before preeclampsia is evident. These high levels in the second trimester are associated with a doubling of the risk for preeclampsia.[34]

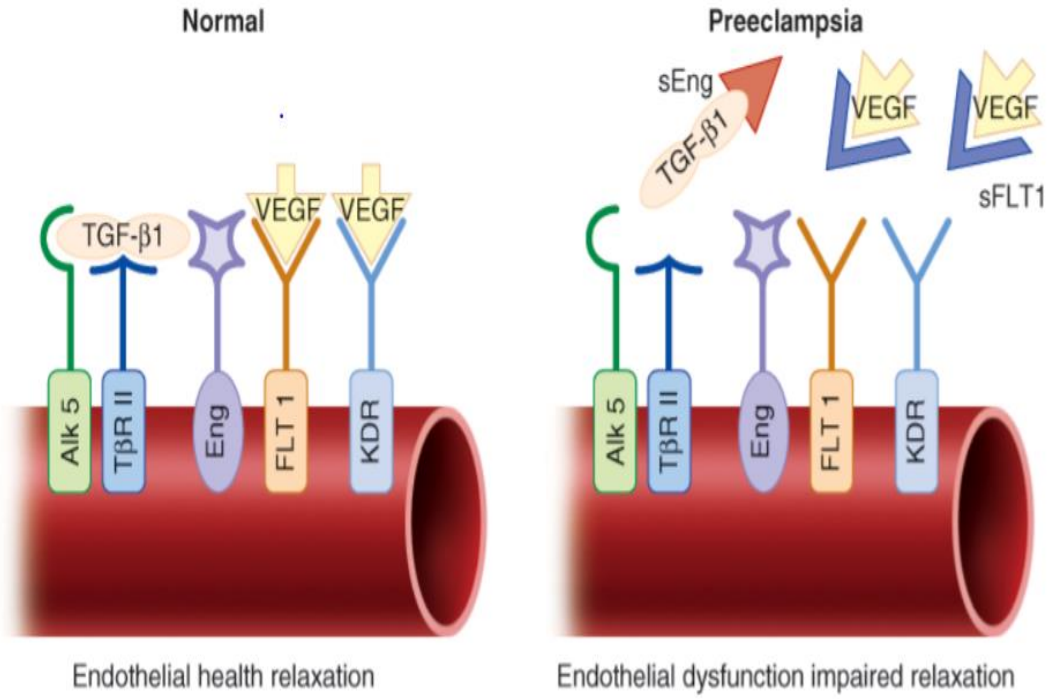


Figure 2: <u>Schematic of the receptor blocking action of sFlt-1 (soluble fms-like tyrosine kinase 1) and soluble endoglin (sEng)</u>

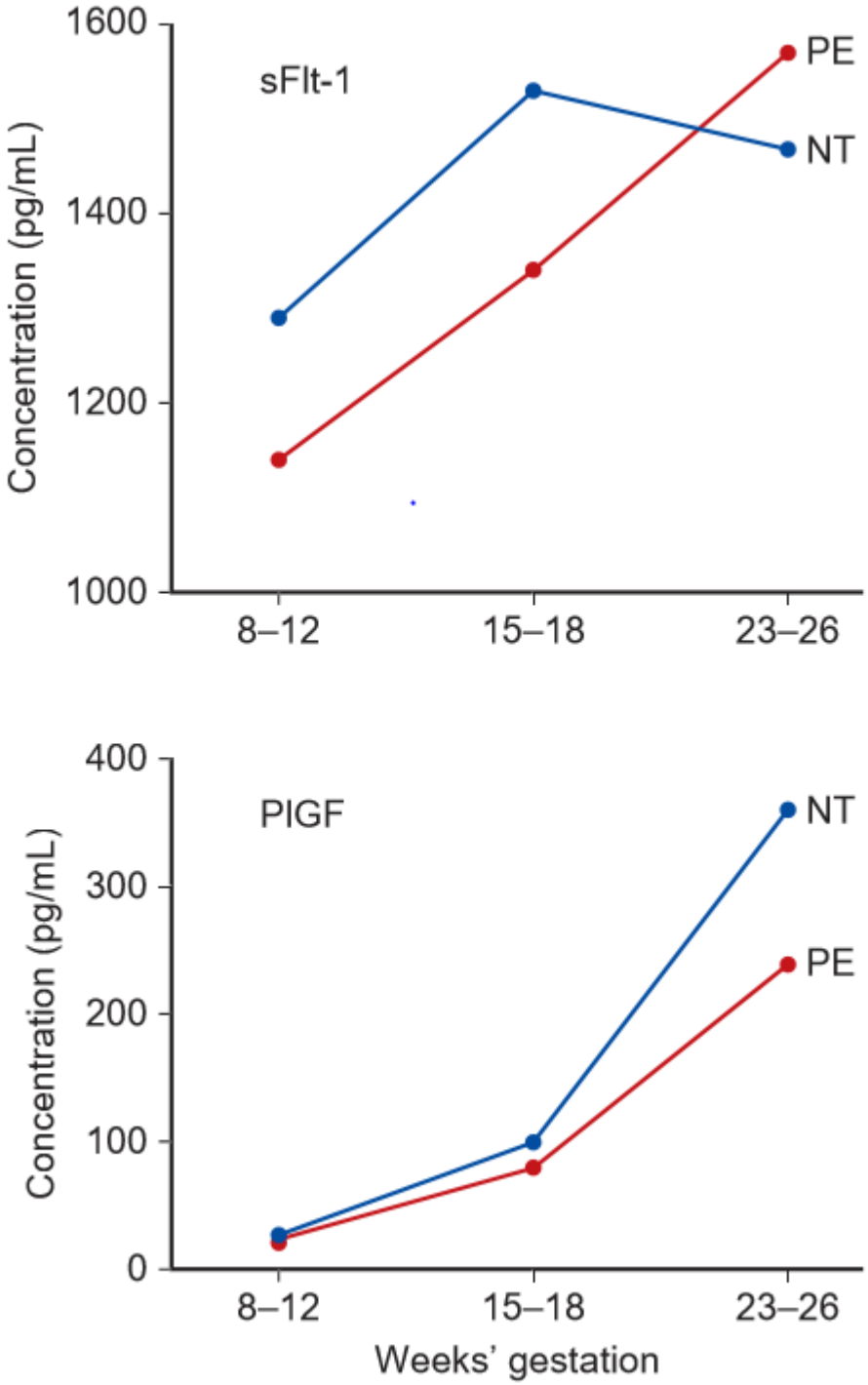


Figure 3: Angiogenic and antiangiogenic factors in normotensive (NT) and preeclamptic (PE) women across pregnancy. Both pairs of factors are significantly divergent by 23 to 26 weeks' gestation. sFlt = soluble fms-like tyrosine kinase 1; PlGF = placental growth factor. (Data from Myatt, 2013)

Red Cell Morphology

In pregnancy RBC volume is increased by 20%-30%.

Microangiopathic hemolysis caused by endothelial disruption with platelet adherence and fibrin deposition. Fragmentation of the RBCs results from their high velocity passage through this damaged endothelium.

Peripheral smear may reveal the appearance of injured RBCs which include schizocytosis, spherocytosis, and reticulocytosis.

Platelet Morphology

Platelets are small granulated bodies that aggregate at the site of vascular injury.

The frequency and intensity of thrombocytopenia vary and are dependent on the severity and duration of the preeclampsia syndrome. In general, the lower the platelet count, the higher the rates of maternal and fetal morbidity and mortality.[35]

In vitro platelet aggregation is reduced compared with the normal increase that is characteristic of pregnancy. Levels of platelet-bound and circulating platelet-bindable immunoglobulins are elevated, which suggests platelet surface alterations.

Coagulation changes:

Disseminated intravascular coagulation (DIC) may be a component of HELLP syndrome, evidenced by sensitive laboratory indicators, including antithrombin III, fibrinopeptide A2, fibrin monomer and D-dimer, α2 antiplasmin, plasminogen, pre kallikrein, and fibronectin.

Some coagulation changes include elevated factor VIII consumption, increased levels of fibrinopeptides A and B and of D-dimers, reduced levels of regulatory proteins – antithrombin III and protein C and S.

Hepatic changes

The constellation of hemolysis, hepatocellular necrosis, and thrombocytopenia was termed HELLP syndrome by Pritchard and associates (1954).

Initially, hemorrhage into the hepatic cellular columns occurs because of vasodilatation of the arterioles, with dislocation and deformation of hepatocytes in their stromal sleeves.

Later, intense vasospasm causes hepatic infarction, ranging from small to large areas beginning near the sinusoids and extending towards the portal vessels.

A major pathogenic mechanism CD95 (APO-1, Fas) mediated apoptosis of hepatocytes, a Fas-Fas ligand system is a well studied cell death system.

Caspases 3, 8, 9 required to affect apoptotic cell death are detected in liver extracts of HELLP syndrome.

Renal changes

Renal perfusion and glomerular filtration are reduced. Diminished filtration causes serum creatinine levels to rise to values seen in nonpregnant individuals, that is, 1 mg/mL, and sometimes higher. The risk of acute renal failure is defined as a creatinine clearance of >20 ml/min and has been reported as approximately 7%.[36]

Increase in the urine osmolality is seen along with the Oliguria. Acute tubular necrosis is seen in some of the cases

Glomerular changes	Non glomerular changes
Light microscopy Decreased glomerular size Protrusion of glomerular tuft into the proximal tubule Decreased diameter of the capillary lumen Increased cytoplasmic volume within endothelial mesangial cells **Electronic microscopy** Glomerular capillary endotheliosis (greatly increased size of endothelial cells which can occlude capillary lumen)	Dilatation of proximal tubules with thinning of epithelium Tubular necrosis Enlargement of juxtaglomerular apparatus Hyaline deposition in renal tubules Necrosis of loop of Henle seen with hyperuricemia Fat deposition associated with prolonged and heavy proteinuria

<u>PROTEINURIA</u> (ACOG 2013)

- ≥300 mg/24 h, or
- Urine protein: creatinine ratio ≥0.3, or
- Dipstick 2+ persistent

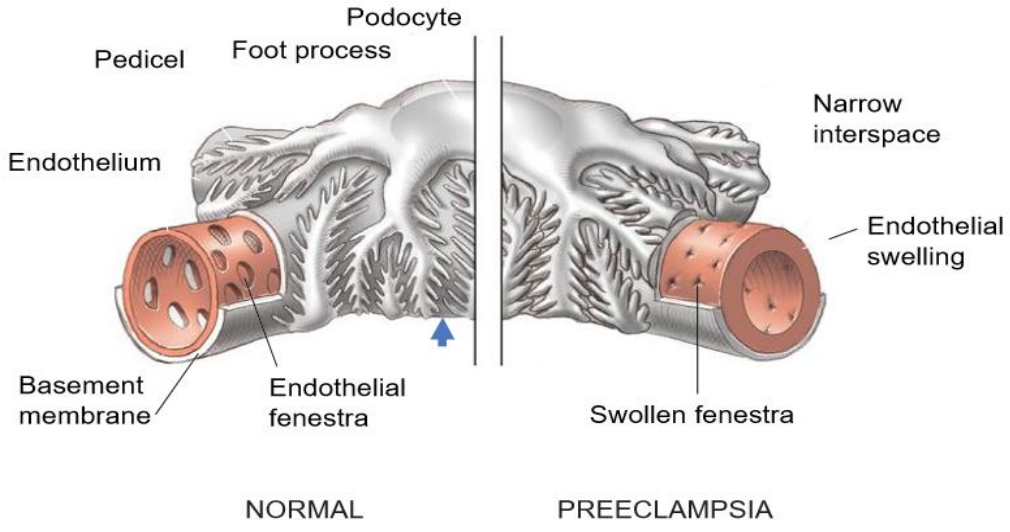


Figure 4: <u>Schematic showing glomerular capillary endotheliosis</u>

Visual changes

Fundoscopy reveals localised arteriolar narrowing is visualised as segmental spasm, and generalised narrowing is indicated by a decrease in the ratio of arteriolar-venous diameter from the usual 3:5 to1:2 or even 1:3.

Scotomas, blurred vision, or diplopia are common with preeclampsia syndrome. Blindness from retinal lesions is caused either by serous retinal detatchment or rarely by retinal infarction, termed as Purtsscher retinopathy

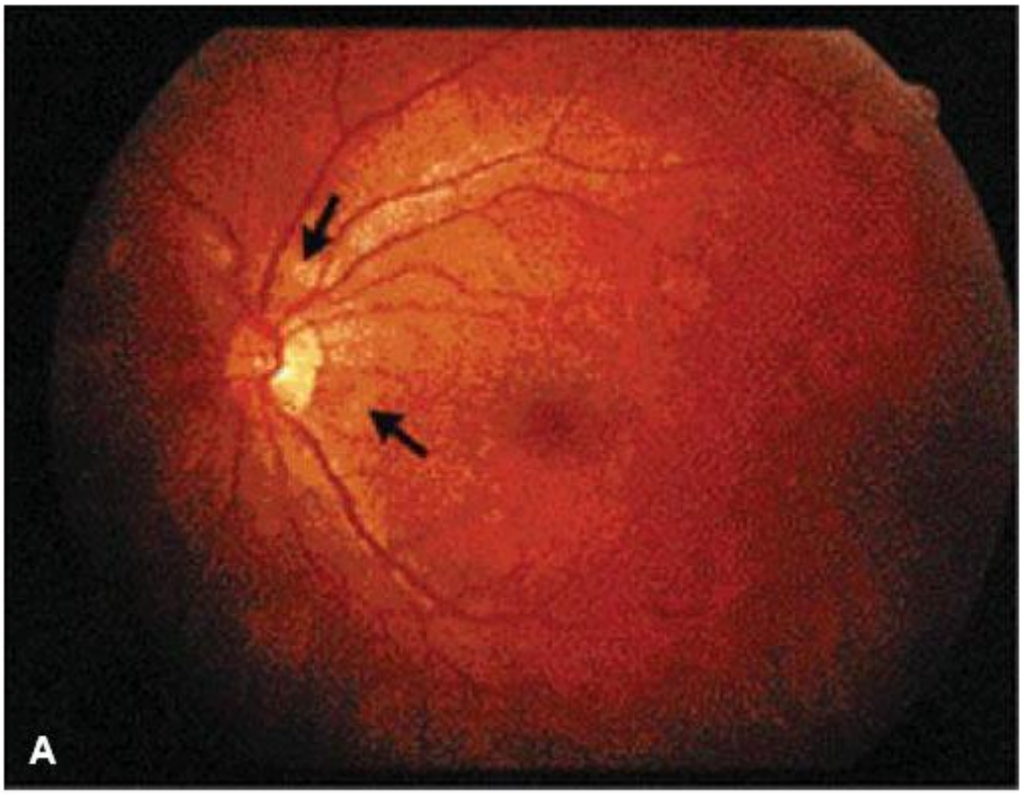


Figure 5: Purtscher retinopathy caused by choroidal ischemia and infarction in preeclampsia syndrome. Ophthalmoscopy shows scattered yellowish, opaque lesions of the retina (arrows)

CLINICAL FEATURES

High degree of suspicion is required to diagnose HELLP syndrome.

Typical clinical symptoms are right upper abdominal quadrant or epigastric pain, nausea and vomiting. The upper abdominal pain may be fluctuating, colic-like. Many patients report a history of malaise some days before presentation. Up to 30–60% of women have headache, about 20% visual symptoms.[62] However, women with a HELLP syndrome might also have unspecific symptoms or subtle signs of preeclampsia or non-specific viral syndrome-like symptoms.

Signs and symptoms of HELLP syndrome: [37]

Symptoms and Signs	Percentage (%)
Malaise	**90**
Right upper quadrant tenderness	**90**
Proteinuria	**87**
Hypertension	**85**
Right quadrant (epigastric) pain	**65**
Headache	**60**
Nausea, vomiting	**36**
Visual changes	**17**
Bleeding	**9**
Ascites	**8**
Jaundice	**5**
Shoulder/Neck pain	**5**
Pulmonary edema	**6**

HELLP syndrome clinically presents as a case of severe preeclampsia with mild jaundice in second or third trimesters of pregnancy in few cases. The symptoms usually continuously progress and their intensity often changes spontaneously.

Hypertension and Proteinuria[37]

Blood pressure is elevated to the severe range (systolic ≥ 160 mmHg or diastolic ≥ 110 mmHg) in two thirds of patients with HELLP syndrome but DBP < 90 mmHg in 15%.

Proteinuria is present to the level of ≥ 2+ on dipstick in 85% of patients, minimal proteinuria (1+) in 9% and absent in 6%.

As many as 14% of patients with HELLP syndrome had no protein detected or at most trace proteinuria at the time of hospital admission, and 10% of the patients with class 1 HELLP syndrome and 17% of the patients with class 2 HELLP syndrome never had more than trace urinary proteinuria according to dipstick assessment.[38]

Differential Diagnosis [37,39]

Differential diagnosis is necessary to distinguish HELLP syndrome from other condition which mimic the syndrome, and for early detection and appropriate management.

1. Diseases related to pregnancy
    - Benign thrombocytopenia of pregnancy
    - Acute fatty liver of pregnancy (AFLP)
2. Infectious and inflammatory diseases, not specifically related to pregnancy
    - Virus hepatitis
    - Cholangitis
    - Cholecystitis
    - Upper urinary tract infection
    - Gastritis Gastric ulcer
    - Acute pancreatitis
3. Thrombocytopenia
    - Immunologic thrombocytopenia (ITP)
    - Folate deficiency
    - Systemic lupus erythematosus (SLE)
    - Antiphospholipid antibody syndrome (APAS)
    - Gestational thrombocytopenia
    - Thrombotic thrombocytopenic purpura (TTP)
    - Haemolytic uremic syndrome (HUS)

DISTINGUISHING FEATURES OF HELLP SYNDROME FROM OTHERS CLINICAL CONDITIONS [37,39,40,41]

	ITP	TTP	HELLP	AFLP	HUS	ICP	Viral Hepatitis
Incidence	-	-	1 in 1000	1 in 7000 to 16000		1 in 1000 to 10000	1 in 1000
Timing	-	Variable	28 weeks antepartum to 48 hours postpartum	Third trimester	Variable	Third trimester	Variable
Fever	-	+	-	+/-	-	-	+
Hypertension	-	-	+/-	+/-	-	-	-
CNS finding	-	+	+	-	-	-	-
MAHA	-	-	+	-	+	-	-
AST/ALP	-	N/↑	<500	<1000	N/↑	<500	500-1000
LDH	N	↑	↑	↑	↑	-	-
Antibody to platelet	+	-	-	-	-	-	-
Creatinine / BUN levels	N	↑	↑	N/↑	↑↑	-	-
Bilirubin	-	-	<2 mg/dl	2-10 mg/dl	-	<5 mg/dl	>5 mg/dl
Others	-	-	-	-	-	Intense pruritis	Abnormal serology

Maternal mortality and morbidity [42]

The reported maternal mortality rate of HELLP syndrome ranges from 0-24%.

A consistent increasing trend towards maternal mortality was related to decreasing platelet concentration in patients with HELLP syndrome. This was most clearly seen in relation to the categories of hematologic and coagulation abnormalities and disorders of cardiopulmonary system.

Hepatic abnormalities occurred more commonly with HELLP syndrome, that emphasis on HELLP syndrome as a "liver disorder" in contrast to severe preeclampsia without HELLP syndrome as more of a "renal disorder" misrepresents this condition.[20]

Maternal deaths may occur due to[43,44]

- Sepsis
- Shock
- Haemorrhage
- Intracranial bleeding
- Cardiopulmonary arrest

Maternal deaths were attributed to hepatic complication in approximately 16%.

Maternal Complications [45,46]

Maternal morbidity in HELLP syndrome ranges from 2-24%.

Maternal Complication	**Occurrence (%)**
Eclampsia	4-9
Abruption Placentae	9-20
DIC	5-56
Acute renal failure/ATN	7-36
Severe ascites	4-11
Cerebral edema	1-8
Pulmonary edema	3-10
Laryngeal edema	1-2
Wound hematoma/infection	7-14
Subcapsular liver hematoma	Between 0.9% and <2%
Liver rupture	About 1.8%
Hepatic infarction	>30 cases combined with APS
Retinal detachment	1
Cerebral infarction	<2
Cerebral Haemorrhage	1.5-40
Maternal death	1-25
Others ARDS Sepsis Pancreatitis Diabetes insipidus	1

Perinatal mortality and morbidity [47,48,49,50]

HELLP syndrome is associated with higher perinatal mortality and morbidity and depending on the gestational age when the condition develops.

Rate of perinatal mortality ranges from 7.4% and 34%. Highest risk of deaths are seen in neonates delivered before 32 completed weeks of gestation.

According to Guletal et al, perinatal mortality was 34% before 32 weeks of gestation and 8% after 32nd week.

Leading cause of neonatal deaths are prematurity, placental insufficiency with or without intrauterine growth restriction (IUGR) and abruptio placenta. Hepatic rupture leads up to 80% of perinatal mortality.

Small for gestational age (SGA), increased risk of perinatal asphyxia and RDS are significantly high in infants of patients with HELLP syndrome leading to respiratory and cardiovascular morbidity.

Kandler et al in his study reported patients with HELLP syndrome has a poor neonatal outcome before 5 weeks or with birth weight <700 grams, after 25 weeks or with birth weight >700 grams, neonatal outcome is better.

HAPTOGLOBIN

Serum Haptoglobin was discovered by Max Fernand Jayle in 1938.

An acute phase heterogeneous plasma protein α2- sialoglycoprotein, characterised by molecular heterogeneity. [51]

MOLECULAR STRUCTURE[51]

The haptoglobin (Hp) consists of two different polypeptide chains

1. Two heavy chains - Beta chains (40 kD) – contains 83 amino acids
2. Two light chains - Alpha chains – contains 245 amino acids

   Alpha 1 (9 kD)

   Alpha 2 (16 kD)

The heavy beta chains are identical in all haptoglobins. Alpha 1 and Alpha 2 are linked by disulfide bonds, modifications of these result in different Hp phenotypes.

Three major haptoglobin types[51]

1. Hp1-1 is monomer (98kD)
2. Hp1-2 is linear polymer (200 kD)
3. Hp2-2 cyclic polymer (400 kD)

SYNTHESIS

The gene coding for Haptoglobin (HP) is located on chromosome 16q22

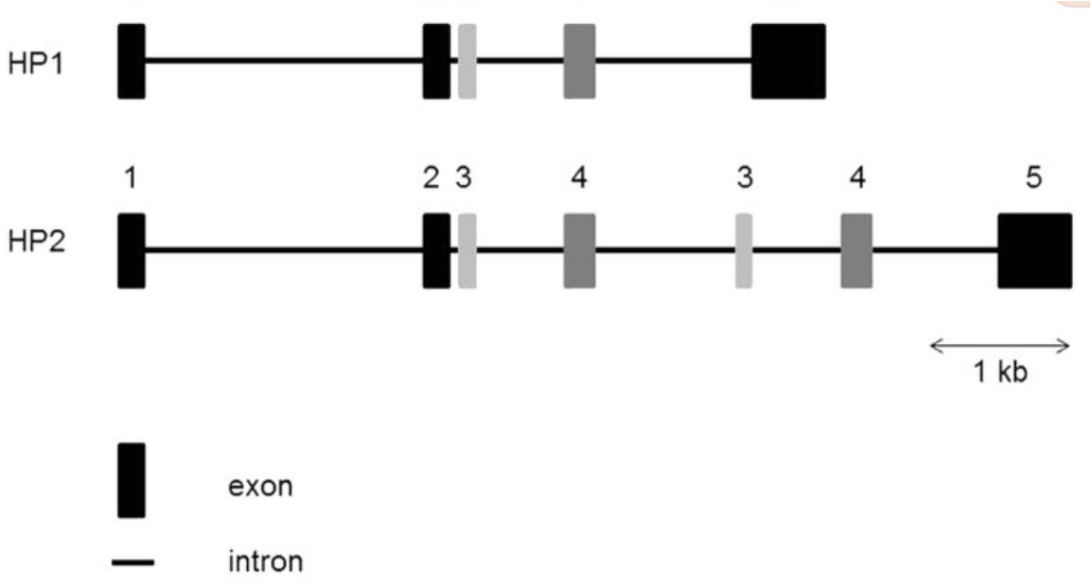


Figure 6: Structure of the human *HP* gene. The human HP2 allele arose by duplication of exons 3 and 4 of the HP1 allele. HP, Haptoglobin; kb, kilobase

Hp is mainly produced by hepatocytes, and to a lesser extent by cells in other tissues such as lung, skin and kidney, under inflammatory conditions. Its synthesis is induced by IL-6, IL-1β and TNF.[52]

Haptoglobin is also produced by endometrium and decidual cells and during pregnancy the levels increase. Haptoglobin is synthesized as a single polypeptide chain, which is being cleaved into alpha and beta chains joined by disulphide bonds.
Hp 1-1 and Hp 2-2 are homozygous, Hp1-2 is heterozygous. Hp allele 1 is common to human and animals, allele 2 is unique to humans, created during evolution from an unequal crossing over between two Hp1 alleles.[51,53]

The prevalence of Hp1-1, 2-2 and 2-1 genotypes in most western countries is 16%, 36% and 48% respectively

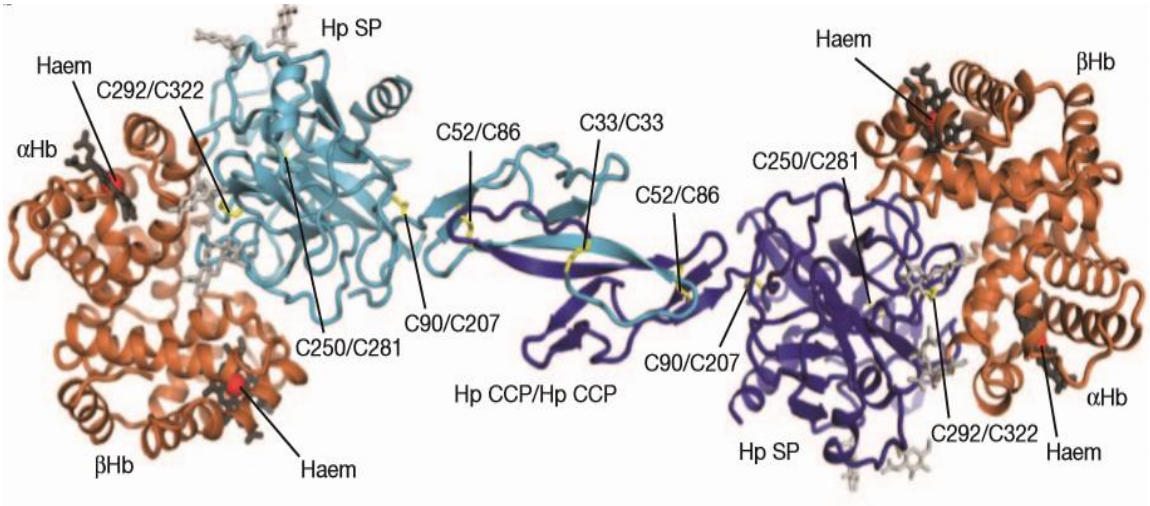


Figure 7: <u>Structure of porcine Hp– Hb</u>[54]

Hp is coloured blueandcyan,α Hb and β Hb are orange. Haem groupsare shown as dark grey sticks. Red spheres represent Fe ions. Glycosylations are shown as light grey sticks and disulphide bridges as yellow sticks

Anderson et al reported elucidation of the crystal structure of porcine Hp-Hb complex. Haemoglobin is released into the plasma during intravascualar haemolysis, which is captured by the acute phase protein haptoglobin leading to the formation of the haptoglobin-haemoglobin complex.

Hp-Hb complex represents a virtually irreversible non covalent protein-protein interaction. Haptoglobin can bind approximately 0.07 to 0.15 g/dl of haemoglobin allotype.

Hp mediates rapid clearance of Hb through high affinity binding to the macrophage scavenger receptor CD163. In addition, Hp protects tissues and cells from Hb-induced oxidative damage and preserves the structural integrity of Hb through which its clearance is retained. Hp–Hb complex formation also prevents renal filtration of Hb and toxic effects in the kidneys.

After exposure to haem induced reactive oxygen species, many haemoglobin residues prone to oxidative modification are buried in haptoglobin-haemoglobin interface, showing a direct protective role of haptoglobin.

Clearance of Haptoglobin[10]

Liberated hemoglobin is converted to unconjugated bilirubin in the spleen or may be bound in the plasma by haptoglobin.

The Haptoglobin-haemoglobin complexes rapidly cleared in a matter of minutes form the circulation by the mononuclear-phagocyte system

Half life of Haptoglobin (t½) : 4 days

Normal serum haptoglobin level : 36-195 mg/dL

Functions of Haptoglobin[51,55]

1. Prevents iron loss by capturing haemoglobin and subsequent oxidative damage generated by free iron in vascular system of kidneys
2. Protective against cell damage by scavenging free radicals, such as the hydroxyl radical, the formation of which is promoted by the presence of free haemoglobin

3. Hp-Hb complex inhibits the vasodilatory effect of nitric oxide and provides non-specific defence against bacterial invasion
4. Hp has the ability to suppress monocyte production of tumor necrosis factor (TNF), interleukin (IL)-10 and IL-12
5. HP1 have a superior anti-inflammatory effect compared with HP2
6. A serum angiogenic factor and plays a role in proliferation and differentiation of vascular endothelium
7. Hp 2-2 has stronger angiogenic function than Hp1-1
8. Hp1-1 has highest affinity for haemoglobin and associated with antioxidant capacity of Hp.

Haptoglobin has been shown to be a sensitive parameter for monitoring the course of HELLP syndrome, and a sensitive early marker for the hemolytic component of HELLP syndrome.(Wilke et al 1992)

The diagnostic sensitivity of haptoglobin in hemolytic disease has been reported as 83% with a specificity of 96%.

INVESTIGATIONS

1. Haematological abnormalities

(a) Peripheral smear: shows features of microangiopathic haemolytic anaemia. Presence of Schistocytes, Echinocytes, burr cells, triangular cells

(b) Complete blood count

(c) Platelet count : Value of >2,50,000/µL can be classified as normal value, <1,50,000/µL as abnormal.

(d) Coagulation profile (DIC profile)

- PT: 11-16 sec
- APTT: 22-37 sec
- D-Dimer: <0.5 mg/L
- Fibrinogen: 150-600 mg/dl
- Fibrin degradation products: <10 µg/dl

Serum Haptoglobin

Low haptoglobin concentration can be used to diagnose hemolysis and is preferred marker of hemolysis. Thus, the diagnosis of hemolysis is supported by demonstration of low or undetectable haptoglobin concentration is a more specific indicator.

2. Laboratory abnormalities reflecting altered liver functions

A rise in the liver enzymes is always significant and needs to be followed carefully because severe liver impairment is associated with liver rupture.

- Elevated AST: 70 IU/L
- ALT: 70 IU/L
- LDH: 600 IU/L
- Decreased albumin level in blood

- Increased bilirubin level in blood >1.2 mg/dl
- LDH also reflects haemolysis

3. <u>Laboratory findings reflecting altered renal functions</u>

(a) **Proteinuria:** Proteinuria of preeclampsia is nonselective.

Degrees of proteinuria are detected by (random urine samples) sulpha salicylic acid test.

- Traces: 0.1 g/L (cloudiness only visible against background)
- 0.3 g/L (cloudy, not flocculant)
- 1 g/L (cloudy granular but not flocculant)
- 3 gm/L (thick flocculant cloudy)
- 10+ gm/L (thick deposit to solid mass)

According to Meyer (1994) urinary dip stick 1+ proteinuria or greater was predictive of at least 300 mg per 24 hours in 92% cases. 3+,4+ is a positive predictor of severe preeclampsia in 36%. Though random urine sample proteinuria is easier to perform, 24 hour urine protein estimation remains the Gold standard. This is because degree of proteinuria may fluctuate widely over a 24 hour period. Significant proteinuria is defined by 24 hour urinary protein exceeding 300 mg/24 hour.

(b) Blood urea:

Normal BUN value during pregnancy is 9 mg/dL and values greater than 13 mg/dL is abnormal. The elevation of blood urea in preeclampsia/eclampsia rarely exceeds 43.55 mg/dL in the absence of complication.

(c) Serum creatinine:

The average concentration during pregnancy is 0.6 mg/dL.

Normal blood urea and serum creatinine with increase in serum uric acid indicates preeclampsia. Increase in blood urea and serum creatinine with normal uric acid levels indicates chronic hypertension.

(d) Serum uric acid:

The upper limit in normal pregnancy is 4.5 mg/dL. The reasons for the rise in uric acid in preeclampsia are due to impairment of renal tubular function reducing the excretion. Some of the rise is due to increased production secondary to tissue damage from ischemia. Values greater than 6 mg/dL are considered as significant elevation.

4. <u>Fundoscopy</u>:

In preeclampsia the abnormality originates in the occipital cortex which accounts for most of the visual symptoms. Most common findings are an increase in the vein to artery ratio (N-4:3) and segmental vasospasm.

The presence of hemorrhages: Exudates or extensive arteriolar changes will signify chronic hypertension, while presence of micro aneurysms indicates diabetes.

<u>The American Ophthalmological Society has graded the retinal changes</u>

GRADES	**FUNDOSCOPY FINDINGS**
Grade 0	Normal fundus
Grade I & II	Stage of angiospasm, slight or moderate degrees of reflex, A-V narrowing and spasm
Grade III	Stage of toxaemic retinopathy, A-V narrowing and spasm with oedema hemorrhage and exudates
Grade IV	Papilledema

Diagnostic Criteria for HELLP syndrome [37,56]

1. **Haemolysis (at least 2 of these)**

- Abnormal peripheral smear - schistocytes, burr cells, Echinocytes, triangular cells, helmet cells
- Increased total bilirubin mainly indirect component to > 1.2 mg/dl
- Low serum haptoglobin level <0.4 gm
- Drop in the haemoglobin level unrelated to blood loss

2. **Elevated liver enzymes**

- Increased transaminases ALT or AST to more than double their upper limits of normal values or >70 IU/L
- Increased lactate dehydrogenase (LDH) > 600 IU/dl
- Increased total bilirubin >1.2 mg/dl
- LDH and haptoglobin are sensitive markers of HELLP syndrome

3. **Thrombocytopenia**

- Platelet count < 1,00,000 – 1,50,000/µL (degree of severity based on platelet count)
- Mild < 1,50,000 - 1,00,000/µL
- Moderate 1,00,000 – 50,000/µL
- Severe <50,000/µL

MANAGEMENT

Since the identification of importance of HELLP syndrome and its associated high maternal and perinatal adverse outcomes, many investigators have advocated multimodality treatment, though definitive treatment is the delivery or termination of pregnancy.

PREVENTION

Some methods to prevent preeclampsia that have been evaluated in Randomised trials

Dietary manipulation – low- salt diet, calcium or fish oil supplementation

Exercise — physical activity, stretching Cardiovascular drugs—diuretics, antihypertensive drugs

Antioxidants — ascorbic acid (vitamin C), α-tocopherol (vitamin E), vitamin D

Antithrombotic drugs — low-dose aspirin, aspirin/ dipyridamole, aspirin + heparin, aspirin + ketanserin

Management of severe preeclampsia (ACOG Practice Bulletin 2019)[57]

- **Term Gestation (≥37 weeks)** : Prompt delivery

  The risks associated with continued expectant management overweigh the benefits to the fetus of continuing the pregnancy

- **Late preterm gestation (34 to $36^{6/7}$):** Prompt delivery

  The risks associated with continued expectant management overweigh the benefits to the fetus of continuing the pregnancy. Consideration may be given to administration of corticosteroids, however delivery should not be delayed particularly in non reassuring fetal status or worsening maternal disease.

- **Early Preterm Gestation (<34 weeks):**

  Expectant management may result in fetal benefit and pregnancy can be extended by 5 to 19 days on average. Antenatal corticosteroids can be administered if there are no contraindications for expectant management.

Delivery indications <34 weeks after completion of steroid course

- HELLP
- Persistent neurologic symptoms or epigastric/right upper quadrant pain
- Maternal serum laboratory abnormalities (platelets <100,000/µL, transaminase twice the upper limit of normal, serum creatinine >1.1 mg/dL)
- Fetal growth restriction less than 5th percentile
- Oligohydramnios (amniotic fluid index <5 cm)
- Reversed end diastolic flow in the umbilical artery
- Labor or premature rupture of membranes

Expectant management of severe preeclampsia (ACOG 2019)

- Intensive monitoring of vital signs, urine output, symptoms including headache, visual changes, epigastric and right upper quadrant pain – monitored at least every 8 hours
- Laboratory assessment (platelet count, liver enzymes, serum creatinine levels – at least every other day
- Daily nonstress test, twice weekly biophysical profile, fetal growth assessment every 2 weeks, umbilical artery dopplers should be reserved for cases of fetal growth restriction.

- Oral antihypertensives can be initiated to control blood pressures for a goal less than 160/105mmHg.

Route of Delivery

Typically vaginal, with caesarean reserved for the usual obstetric indication. Cervical ripening agents may be used if the cervix is unfavourable.

In a cohort study, the success rate is over 60% for all inductions less than 34 weeks. For those at 24 to 28 weeks, the success rate is 39%.

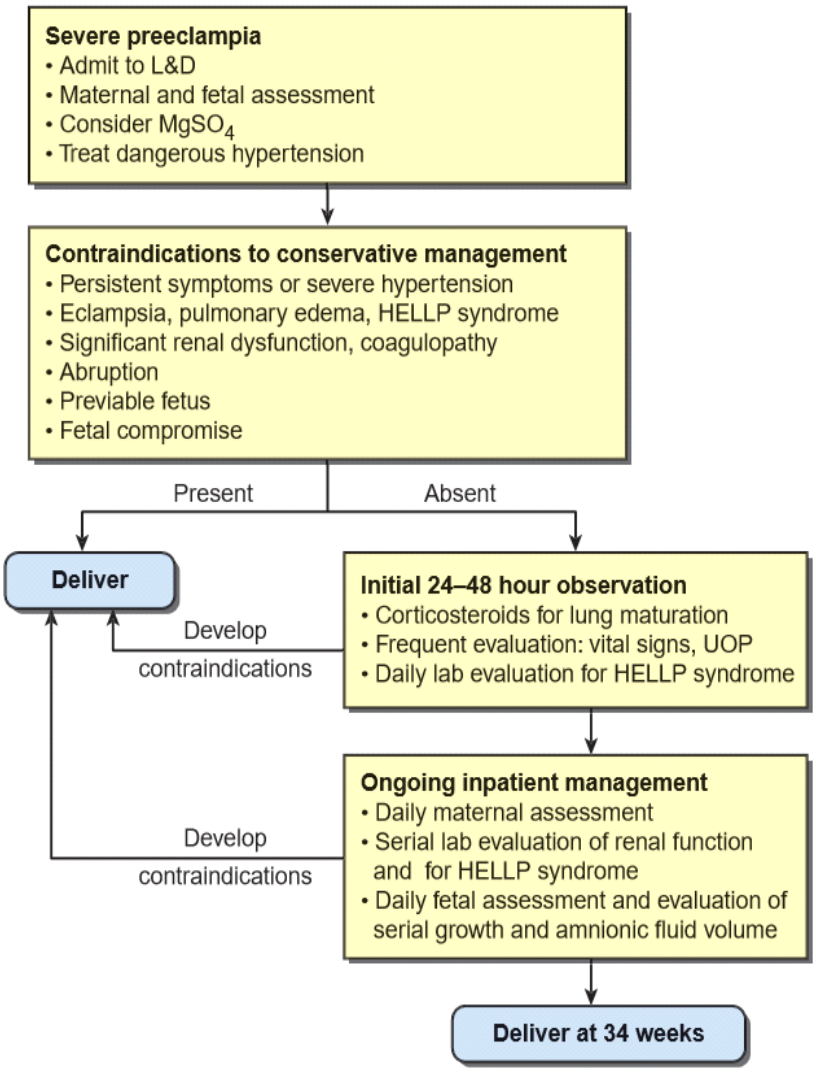


Figure 8: Schematic clinical management algorithm for suspected severe preeclampsia at < 34 weeks. (Adapted from the Society for Maternal-Fetal Medicine, 2011)

Management of HELLP syndrome

The clinical course of HELLP syndrome is characterized by progressive and sometimes sudden deterioration in the maternal condition, hence many authors consider its presence to be an indication of immediate delivery.

Patients with suspected HELLP syndrome should be hospitalized immediately.

University Mississippi Medical Centre has advocated 12 step approaches for the optimal treatment of patients with HELLP syndrome

1. Anticipate and make the diagnosis

The suspicion and anticipation increases the detection rate. Pregnant women from second trimester onwards with symptoms of malaise, nausea, vomiting, right upper quadrant pain, recent excessive weight gain and nonspecific viral syndromes like malaise and muscle aches should make the clinicians suspect the possibility of HELLP syndrome to prevent grave consequences.

2. Assessment of maternal condition

Pregnant women with signs and symptoms suggestive of PE and HELLP syndrome should be evaluated with complete blood count with platelet levels, urine analysis, serum creatinine, LDH, uric acid, bilirubin levels and AST/ALT. [58]

Serial assessment of platelet count, LDH, liver enzymes every 12-24 hours if indicated. Incidence of hemorrhagic complication is higher when platelet count are <40,000/mm3.[34, 59]

3. Assessment of fetal condition

Fetal well being is evaluated by NST, CST, Doppler and BPP.

A well known reason to administer corticosteroids is to achieve fetal lung maturity. Pregnant women between 24-34 weeks at risk for preterm delivery should be administered with corticosteroids to achieve fetal lung maturity.[60,61]

Platelet count stabilized or increased. LDH levels stabilized or decreased. AST and ALT levels stabilized or decreased during therapy.

Other benefits of corticosteroids[60,62]

- In neonates, reduction in neonatal intensive care unit length of stay was observed.
- Less occurrence of grade II and IV intra ventricular haemorrhage, less NEC, less retrolental fibroplasias were observed.
- Reduced need for transfusion of blood and blood products to the mother.
- Facilitates timely transfer of the mother and fetus to tertiary care facility if indicated and speeds up maternal recovery with reduced overall health care costs.
- Also postpones the delivery of some previable fetus.

Significant increase in platelet count, urine output, duration of study entry to delivery interval were observed with double strength Dexamethasone (10 mg every 12 hours until delivery) given at University of Mississippi Medical Centre

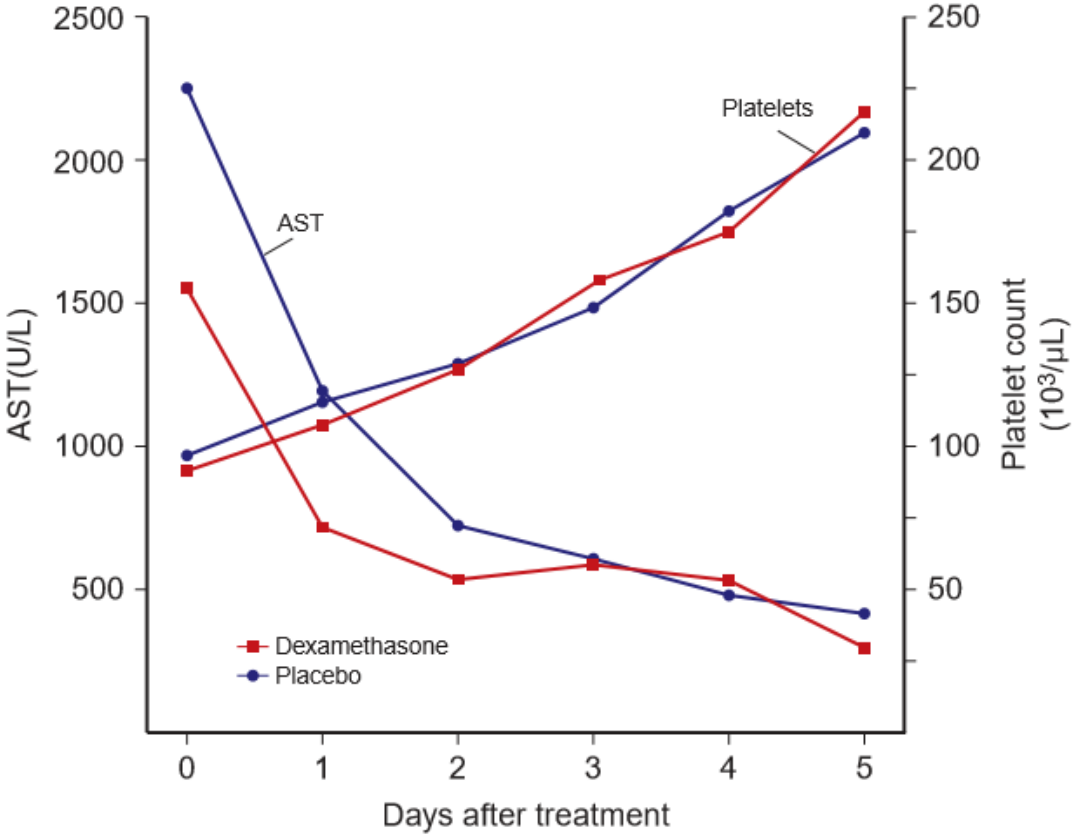


Figure 9: Recovery times for platelet counts and serum aspartate aminotransferase (AST) levels in women with HELLP syndrome assigned to receive treatment with dexamethasone or placebo. (Data from Katz, 2008.)

4. <u>Control of blood pressure</u>

Goal is to reduce maternal complication and possible risk of abruption (maintain diastolic BP 90-100 mmHg).

There is widened pulse pressure such that systolic pressure exceeds 160 mmHg and often without accompanying diastolic hypertension.

The placental under perfusion must be prevented by maintaining the diastolic pressure not lower than 80-90 mmHg.

Antihypertensive drugs that are currently used in the treatment in severe hypertension in PE with HELLP syndrome[63]

SI NO	DRUGS	CLASS	ONSET (in mins)	PEAK (in min)	DOSE
1.	Hydralazine	Vasodilator	10-20	60	5-10mg IV at 20 min interval till BP is controlled . Later 5 mg IV 3rd hourly
2.	Labetolol	$\alpha+_{\beta}$ blocker	5	60	20 mg IV bolus, increase to 40 mg and then 80 mg every 10 min till BP is controlled. Max 220 mg 100mg 12th hourly orally
3.	Nifedepin	Calcium channel blocker	10	60	10-20mg orally, repeat every 30 min if needed
4.	Sodium Nitroprusside	Vasodilator	0.5-5	5	0.2µl/kg/min

5.Management of fluid and electrolytes

Intravascular volume is very much reduced. One recommended fluid regimen is to alternate litres of 5% dextrose and half normal saline solution with litres of 5% lactated Ringer' s solution at 100ml/ hr to maintain urinary output at more than 20ml/hr (preferably 30-40ml/hr).

Fluid status can be guided reliably with CVP and preferably with pulmonary capillary wedge pressure using Swan Ganz catheter.

6. Judicious hemotherapy

Spontaneous hemorrhage is common when the platelet count is < 50,000/µL. Below the 40,000/µL platelet threshold, these special patients are at risk for post partum bleeding.[64]

For any patient undergoing vaginal delivery with HELLP syndrome, transfusion is required when the platelet count is <20,000/µL. For that of caesarean delivery, the cut off is 40,000/µL.[59]

Patient with refractory HELLP syndrome and the detection of anti- phospholipid antibodies have been refractory to postpartum medical intervention including corticosteroids, but have responded to plasma exchange.

7.Management of labour and delivery

Cervical status and inducibility are important factor to be considered, when vaginal delivery is attempted in patients with gestations beyond 32 weeks or in the presence of active labour or membrane rupture. Induction/Augmentation of labour is done with prostaglandin or oxytocin.

Gestational age ≥34 weeks: Prompt delivery

Gestational age <34 weeks: Prompt delivery if there is obvious multiorgan dysfunction, DIC, liver infarction or hemorrhage, renal failure, suspected abruptio placenta, or non reassuring fetal status.

Gestational age ≤34 weeks: Administration of corticosteroids to accelerate fetal lung maturity followed by delivery after 24 hours. Some authors recommend prolonging pregnancy until development of maternal and fetal indications for delivery or until fetal lung maturity is achieved by bedrest, antihypertensive agents, antithrombotic agents, plasma volume expanders, steroids.

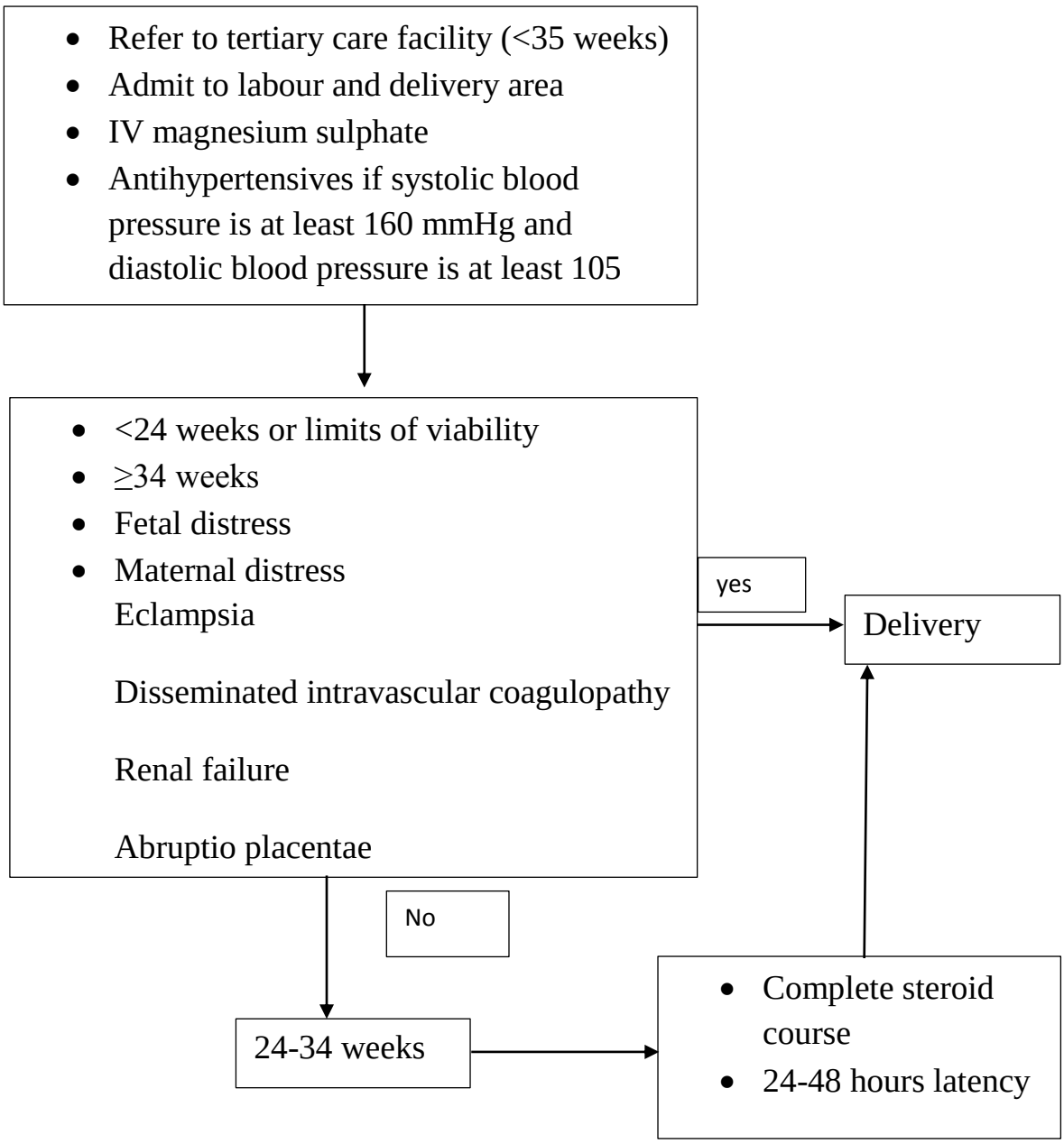
Expectant management : Possible in a very selected group of suspected HELLP syndrome before 34 weeks gestation. The overall perinatal outcome was not improved in some cases of suspected HELLP syndrome despite prolongation of pregnancy compared with fetuses at similar gestational age who delivered within 48 hours after diagnosis of HELLP syndrome

Cesarean section rate is high (60-70%) in these patients usually undertaken on the basis of a deteriorating maternal or fetal condition, abnormal fetal manifestation or failure to progress during attempted vaginal delivery. When cesarean delivery is indicated, careful attention to hemostasis is emphasized. In class I and some class II patients, general anesthesia with intubation remains the anesthesia of choice.

Indication for caesarean section [19]

- Non-reassuring fetal status
- Abnormal fetal presentation
- <30 week gestation with bishop of <5
- <32 week gestation with IUGR, oligohydramnios and low bishop score <5
- Known subcapsular liver hematoma
- Suspected abruption with bishop of <5

Algorithm for management of HELLP syndrome



Optimize perinatal care

The primary risk to the fetus in HELLP syndrome is prematurity.

Administer corticosteroids to the mother as soon as possible to enhance fetal lung maturity and to decrease risk of necrotizing enterocolitis and intraventricular hemorrhage in pregnancies between 24 and 34 weeks.

Because of the association of maternal low platelet count and an increased risk of intraventricular hemorrhage in the fetus, early routine assessment of neonatal platelet count is recommended in mothers with HELLP syndrome.

It appears that the respiratory and cardiovascular instability and the intrauterine growth restriction are further exacerbated in pregnancies delivered before 32 weeks gestation.

Intensive management of postpartum period

30-40% of HELLP syndrome cases are recognized postnatally, most likely during the first 24-48 hr postpartum. HELLP syndrome can first manifest itself in the postpartum period in the first 48 hours (may take up to 7 days).

Severe PE – HELLP syndrome patients are managed in recovery room/ intensive care unit as many hours as it takes until;

• Maternal platelet count exhibits a consistent upward trend and there is a consistent downward trend in values of LDH.

• Patient begins a diuresis (>100 ml/hr for over 2 consecutive hours without a fluid bolus or diuretic.)

• Hypertension is well controlled with BP <150/100 mmHg.

• Clinical improvement is obvious to providers and there are no significant complications.

Corticosteroids should be continued in the postpartum care of patients with HELLP syndrome for 24-48 hours.

If patient condition deteriorates after delivery, exclude other diagnosis such as TTP, HUS and AFLP.

Counselling regarding future pregnancy

Recurrence risk of PE-eclampsia was 42-43% with risk of HELLP syndrome ranging from 19-27%.[59]

Sibai group projected a much lower recurrence of 3-4%.

A retrospective cohort study done in Netherlands over a period of 3 years in 6 hospitals showed an incidence of recurrence of HELLP syndrome as 10%.[65]

The rate of recurrent HELLP syndrome is only 6% according to Chames et al in study done in 2003.[66]

MATERIALS & METHODS

MATERIALS AND METHODS:

- Source of the data: Pregnant ≥ 20 weeks of gestation visiting labour ward in RLJH hospital during the period of study.
- Study design: Cross sectional observational study
- Study period: January 2018- May 2019

METHOD OF COLLECTION OF DATA:

A cross sectional observational study conducted in the Department of Obstetrics and Gynaecology, R.L Jalappa Hospital, Tamaka from January 2018 to may 2019. All antenatal cases with gestational age >/= 20 weeks diagnosed as severe preeclampsia were selected and were divided into Group A and Group B.

Group A - women with severe preeclampsia without HELLP syndrome

Group B - women with severe preeclampsia with HELLP syndrome

Subjects in each group were observed for maternal mortality, morbidity and fetal outcomes

INCUSION CRITERIA: All pregnant women above 20 weeks of gestational complicated with severe preeclampsia

EXCLUSION CRITERIA:

- Chronic hypertension
- Molar pregnancy
- Other causes of thrombocytopenia (dengue, gestational hypertension)
- Liver disorders in pregnancy

SAMPLE SIZE:

- Variance estimate of 28.6^2 in a study comparison of maternal and neonatal outcomes in women with HELLP syndrome and women with sever preeclampsia without HELLP syndrome with 95% confidence interval and 5% absolute error, the calculated sample is 126.

Formula: $n = \frac{Z^2 \alpha \times \sum^2}{d^2}$

Z – standard deviation

∑ - VARIANCE

D – Absolute error

METHODOLOGY:

All pregnant ≥ 20 weeks of gestation who visited labour ward, RLJH hospital were screened for severe preeclampsia by clinical examination. At the time of enrolment, an informed written consent was obtained from the pregnant.

5-7 ml of blood sample was collected and complete blood count, serology, liver function test, coagulation profile, LDH, uric acid, RFT, serum electrolytes and levels were evaluated.

Serum was separated and serum haptoglobin was measured.

Severe preeclampsia with HELLP syndrome and severe preeclampsia without HELLP syndrome were evaluated according to the laboratory diagnosis which mainly include serum haptoglobin as a biomarker of hemolysis.

Each pregnant was followed up until delivery and the maternal and fetal outcome was recorded.

Serum haptoglobin

Serum haptoglobin level was estimated by a principle reflectance photometry by using 5.1 FS chemistry analysis supplied by MISPA-i2 from AGAPPE diagnostic limited, India.

Principle: The reagents containing polyclonal goat anti- human haptoglobin when missed with serum sample containing haptoglobin cause changes in absorbance, due to the development of immune complex, which is directly proportionate to the concentration of haptoglobin in the sample.

MISPA-i2 analyser used for measurement of Haptoglobin

STATISTICAL ANALYSIS

Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD and median. Normality od data was tested by Kolmogorov-Smirmov test. If the normality was rejected then non parametric test was used.

Statistical tests were applied as follows –

1. Quantitative variables were compared using Independent t test/Mann-Whitney Test (when the datasets were not normally distributed) between the two groups.
2. Qualitative variables were correlated using Chi-square test/Fisher's Exact test.

A p Value of <0.05 was considered statistically significant. The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

RESULTS

OBSERVATION AND RESULTS

This cross-sectional observational study was conducted at Department of Obstetrics and Gynaecology, R.L. Jalappa Hospital, Tamaka, Kolar from January 2018 to May 2019. After applying inclusion/exclusion criteria and taking informed consent, 126 women with gestational age ≥20 weeks diagnosed as severe preeclampsia were included in the study, which were divided in 2 groups. Group A included women with severe preeclampsia without HELLP syndrome and Group B included women with severe preeclampsia with HELLP syndrome. Necessary lab investigations including serum haptoglobin level were done. Participants were observed for maternal mortality, morbidity, and fetal outcomes. Following were the results related to the study:

Table 1: Descriptive analysis of study groups in the study population

Study Group	Number (N=126)	Percentage
Group A	63	50.00%
Group B	63	50.00%

In the study, 63 (50%) women were in Group A (severe preeclampsia without HELLP syndrome) and remaining 63 (50%) women were in Group B (severe preeclampsia without HELLP syndrome). (Table 1)

Table 2: Distribution of age between the study groups

Age distribution(years)	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
18-20	8 (12.70%)	11 (17.46%)	19 (15.08%)	0.708*
21-25	40 (63.49%)	36 (57.14%)	76 (60.32%)	
26-30	13 (20.63%)	12 (19.05%)	25 (19.84%)	
31-36	2 (3.17%)	4 (6.35%)	6 (4.76%)	
Mean ± SD	23.81 ± 3.48	23.89 ± 3.65	23.85 ± 3.55	0.933#
Median(IQR)	23(22 - 25)	23(21 - 25.750)	23(21 - 25)	

***-Chi square test**

#-Mann Whitney Test

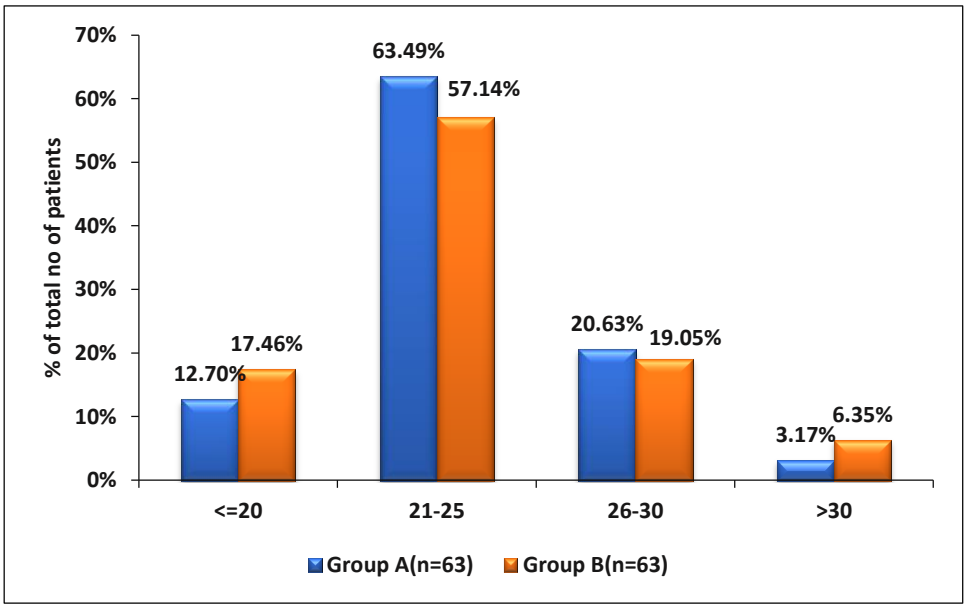


Figure 10: Distribution of age between the study groups

The mean age of the subjects in the study were 23.85 ± 3.55 years. Most of them were in the age group of 21-25 years (60.32%). Compared to Group B, Group A subjects had comparable median age (23 vs 23 years, P=0.933)

It is shown in Table 2 and Figure 10.

Table 3: Distribution of socioeconomic status between the study groups

Socio economic status	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
Upper	1 (1.59%)	1 (1.59%)	2 (1.59%)	0.909*
Upper middle	23 (36.51%)	20 (31.75%)	43 (34.13%)	
Lower middle	27 (42.86%)	27 (42.86%)	54 (42.86%)	
Upper lower	12 (19.05%)	15 (23.81%)	27 (21.43%)	
Total	63 (100.00%)	63 (100.00%)	126 (100.00%)	

***-Chi square test**

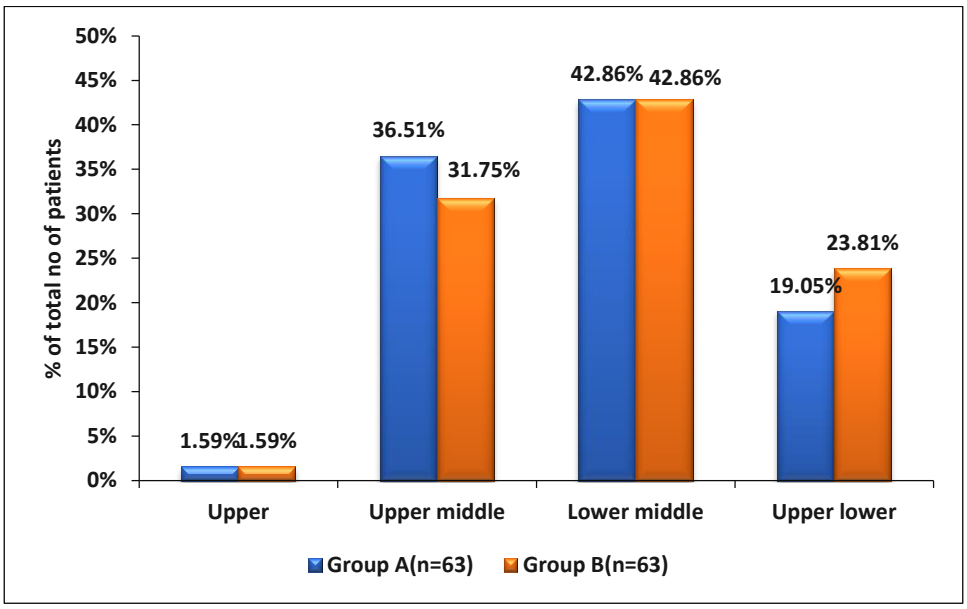


Figure 11: Distribution of socioeconomic status between the study groups

The mean age of the patients in the study were 23.85 ± 3.55 years. Most of patients in the study (42.86%) belonged to lower middle socioeconomic status followed by 34.13% of upper middle class. Compared to Group B, Group A patients had comparable socio economic status (P=0.909) It is shown in Table 3 and Figure 11.

Table 4: Distribution of parity between the study groups

Parity	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
Primigravida	41 (65.08%)	26 (41.27%)	67 (53.17%)	0.039*
Gravida 2	14 (22.22%)	24 (38.10%)	38 (30.16%)	
Gravida 3	7 (11.11%)	8 (12.70%)	15 (11.90%)	
Gravida 4	0 (0.00%)	4 (6.35%)	4 (3.17%)	
Gravida 5	1 (1.59%)	1 (1.59%)	2 (1.59%)	
Total	63 (100.00%)	63 (100.00%)	126 (100.00%)	

***-Chi square test**

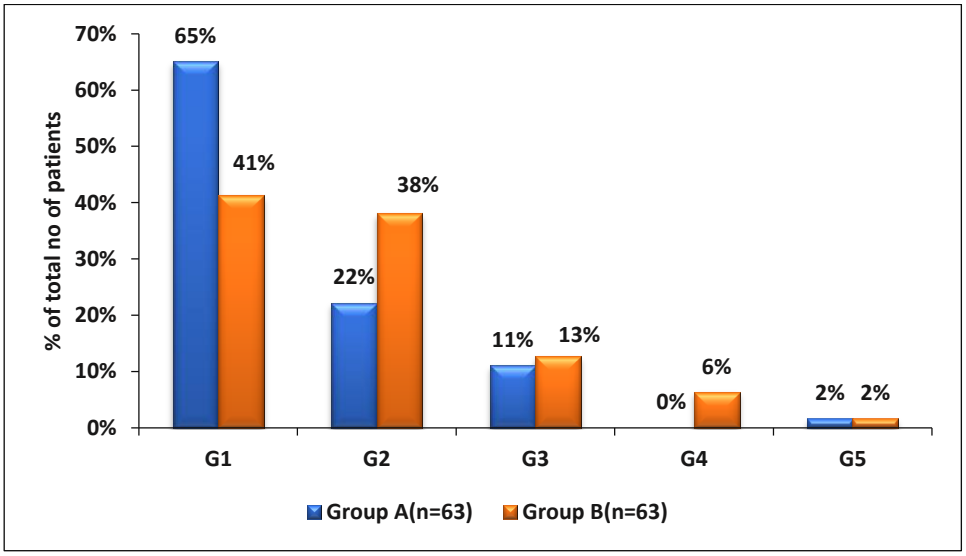


Figure 12: Distribution of socioeconomic status between the study groups

Most of the patients in the study were Primigravida (53.17%). Compared to Group B, Group A patients had significantly lower number of Primigravida (41.27% vs 65.08%), significantly higher number of G2 (38.10% vs 22.22%, P=0.039); significantly higher number of G3 and G4 (19.05% vs 11.11%, P=0.039). It is shown in Table 4 and Figure 12.

Table 5: Distribution of booked/unbooked cases between study groups

Booked/unbooked	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
Booked	60 (95.24%)	50 (79.37%)	110 (87.30%)	0.014*
Unbooked	3 (4.76%)	13 (20.63%)	16 (12.70%)	
Total	63 (100.00%)	63 (100.00%)	126 (100.00%)	

***-Fisher's Exact test**

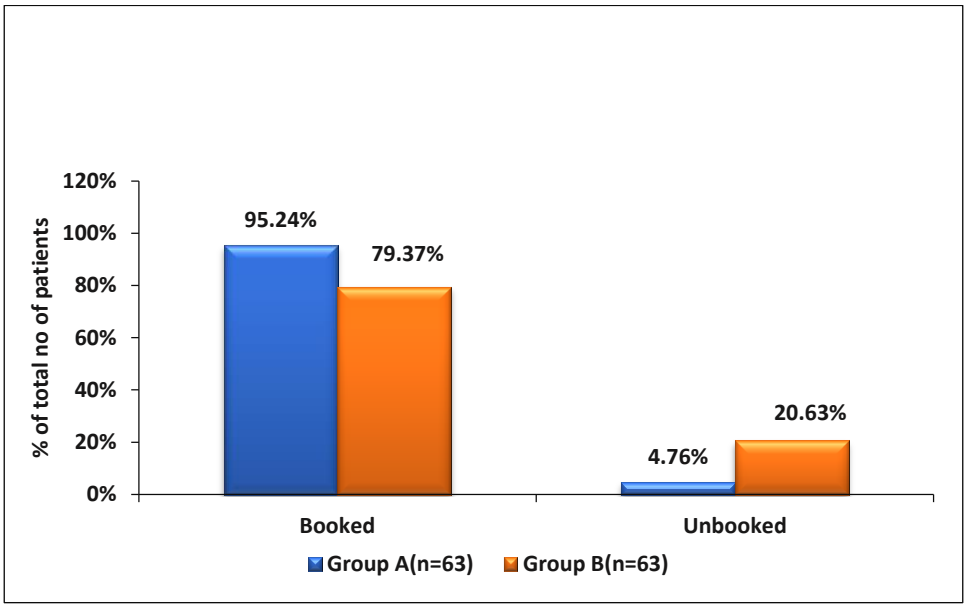


Figure 13: Distribution of booked/unbooked cases between study groups

Most of the patients in the study were in the booked (87.30%). Compared to Group B, Group A had significantly higher number of booked subjects (95.24% vs 79.37%, P=0.014) It is shown in Table 5 and Figure 13.

Table 6: Distribution of gestational age between study groups

Gestational age		Groups		Total	p value
		Group A(n=63)	Group B(n=63)		
Early preterm/Late preterm/Early term/Full term/Late term	Early preterm (<34 weeks)	6 (9.52%)	16 (25.40%)	22 (17.46%)	0.0007*
	Late preterm (34-36+6 weeks)	9 (14.29%)	21 (33.33%)	30 (23.81%)	
	Early term (37-38+6 weeks)	25 (39.68%)	19 (30.16%)	44 (34.92%)	
	Full term (39-40+6 weeks)	22 (34.92%)	6 (9.52%)	28 (22.22%)	
	Late term (>40 weeks)	1 (1.59%)	1 (1.59%)	2 (1.59%)	
Preterm/Term	Preterm (<37 weeks)	15 (23.81%)	37 (58.73%)	52 (41.27%)	<.0001*
	Term (≥37 weeks)	48 (76.19%)	26 (41.27%)	74 (58.73%)	
Gestational age in weeks	Mean ± SD	37.62 ± 2.96	35.42 ± 3.14	36.52 ± 3.24	<.0001#
	Median(IQR)	38.14(37.07 1 - 39.536)	35.86(33.57 1 - 37.571)	37.43(34.85 7 - 38.857)	

***-Chi square test**

#-Mann Whitney test

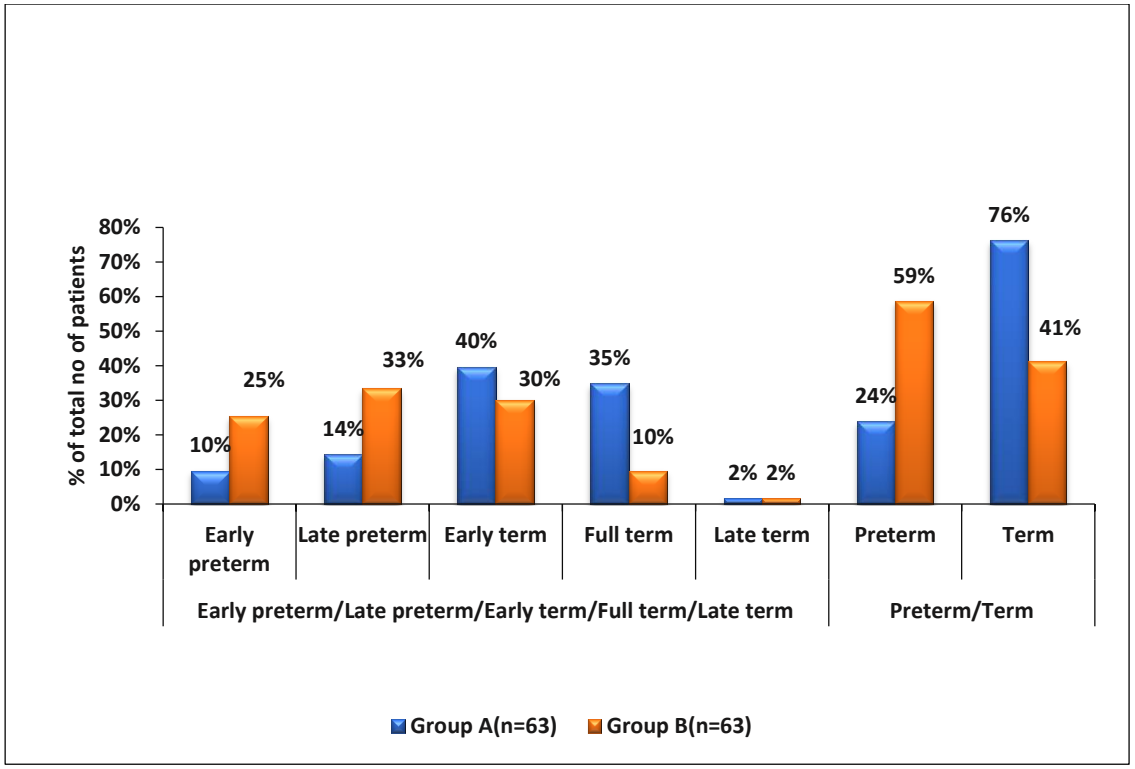


Figure 14: Distribution of gestational age between study groups

Majority of the subjects (34.92%) were early term, followed by 23.81% late preterm. Compared to Group B, Group A subjects had significantly lesser early preterm (9.52% vs 25.40%), significantly lesser late preterm (14.29% vs 33.33%); and significantly higher early term (39.68% vs 30.16%), and significantly higher late term (34.92% vs 9.52%) (P=0.0007 for all).

Most of the pregnancies were full term (58.73%). Compared to Group B, Group A subjects had significantly higher number of term pregnancies (76.19% vs 41.27%, P<.0001).

Median gestational age in the study was 37.43 weeks. Compared to Group B, Group A subjects had significantly higher median gestational age (weeks) (38.14 vs 35.86, P<.0001).

It is shown in Table 6 and Figure 14.

Table 7: Comparison of signs and symptoms between study groups

Signs and symptoms		Groups		Total	p value*
		Group A(n=63)	Group B(n=63)		
Nausea/vomiting	No nausea	58 (92.06%)	35 (55.56%)	93 (73.81%)	<.0001
	Complaints of nausea	5 (7.94%)	28 (44.44%)	33 (26.19%)	
Headache	No headache	51 (80.95%)	38 (60.32%)	89 (70.63%)	0.011
	Complaints of headache	12 (19.05%)	25 (39.68%)	37 (29.37%)	
Pain abdomen	No pain abdomen	31 (49.21%)	43 (68.25%)	74 (58.73%)	0.030
	Complaints of pain abdomen	32 (50.79%)	20 (31.75%)	52 (41.27%)	
Pedal edema	Grade1	26 (41.27%)	23 (36.51%)	49 (38.89%)	0.694
	Grade2	27 (42.86%)	25 (39.68%)	52 (41.27%)	
	Grade3	8 (12.70%)	13 (20.63%)	21 (16.67%)	
	Nil	2 (3.17%)	2 (3.17%)	4 (3.17%)	

***-Chi square test**

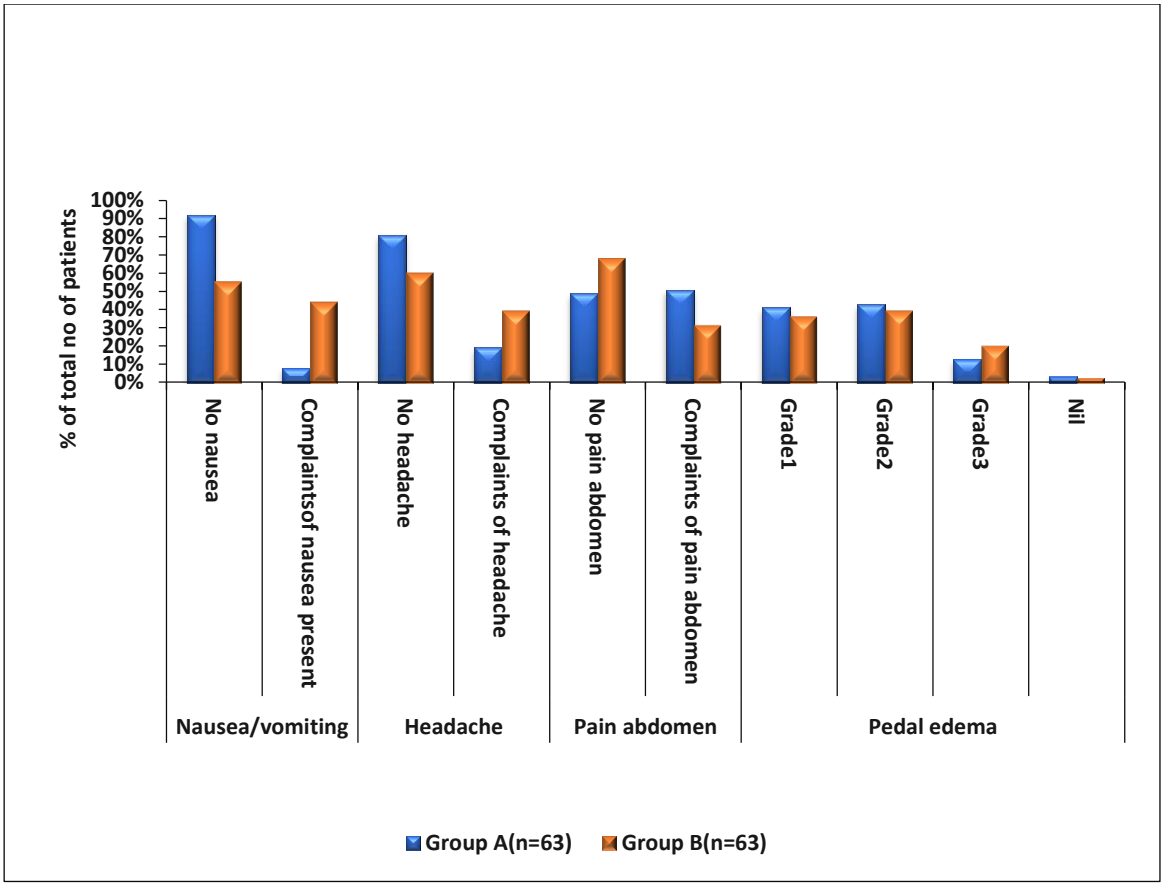


Figure 15: Comparison of signs and symptoms between study groups

Compared to Group B, Group A subjects had significantly lower occurrence of nausea/vomiting (7.94% vs 44.44%, P<.0001), significantly lesser headache (19.05% vs 39.68%, P=0.011); and significantly higher pain in abdomen (50.79% vs 31.75%, P=0.030), and comparable pedal edema (P=0.694).

It is shown in Table 7 and Figure 15.

Table 8: Comparison of blood pressure between study groups

Blood pressure	Group A(n=63)		Group B(n=63)		p value*
	Mean ± SD	Median(IQR)	Mean ± SD	Median(IQR)	
Systolic blood pressure(mmHg)	168.79 ± 10.1	166(160 - 172)	172.86 ± 14.76	170(160 - 180)	0.311
Diastolic blood pressure(mmHg)	113.87 ± 5.72	110(110 - 120)	114.51 ± 5.58	112(110 - 120)	0.355

***-Mann Whitney test**

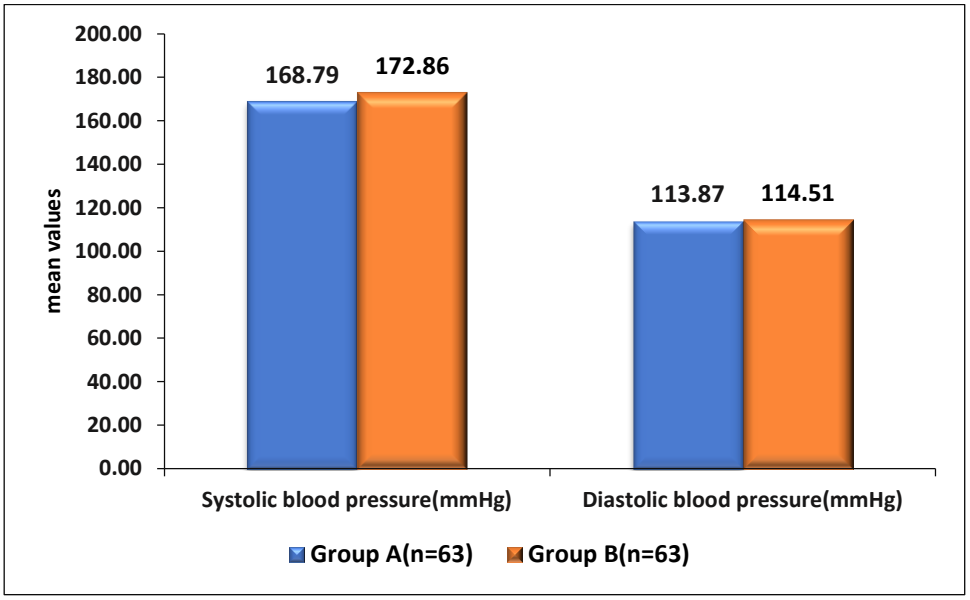


Figure 16: Comparison of blood pressure between study groups

Compared to Group B, Group A subjects had comparable mean systolic blood pressure (mmHg) (170 vs 166, P<.0001), and comparable mean diastolic blood pressure (mmHg) (112 vs 110, P=0.355).

It is shown in Table 8 and Figure 16.

Table 9: Comparison of Amniotic Fluid Index between study groups

Amniotic Fluid Index	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
Normal liquor (AFI >5 cm)	52 (82.54%)	46 (73.02%)	98 (77.78%)	0.199*
Oligohydramnios (AFI <5 cm)	11 (17.46%)	17 (26.98%)	28 (22.22%)	
Total	63 (100.00%)	63 (100.00%)	126 (100.00%)	

***-Chi square test**

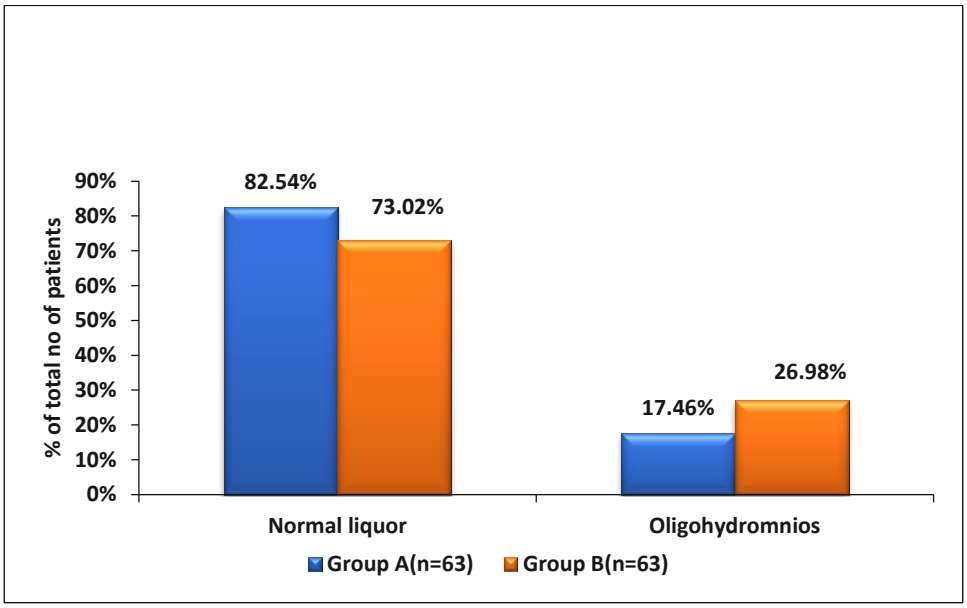


Figure 17: Comparison of Amniotic Fluid Index between study groups

In this study, oligohydramnios was noted in 22.22% subjects. Compared to Group B, Group A subjects had comparable normal liquor (82.54% vs 73.02%, P=0.199) and comparable oligohydramnios (17.46% vs 26.98%, P=0.199).

It is shown in Table 9 and Figure 17.

Table 10: Comparison of urine albumin between study groups.

Urine albumin	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
1+	0 (0.00%)	2 (3.17%)	2 (1.59%)	0.456*
2+	33 (52.38%)	29 (46.03%)	62 (49.21%)	
3+	29 (46.03%)	30 (47.62%)	59 (46.83%)	
4+	1 (1.59%)	2 (3.17%)	3 (2.38%)	
Total	63 (100.00%)	63 (100.00%)	126 (100.00%)	

***-Chi square test**

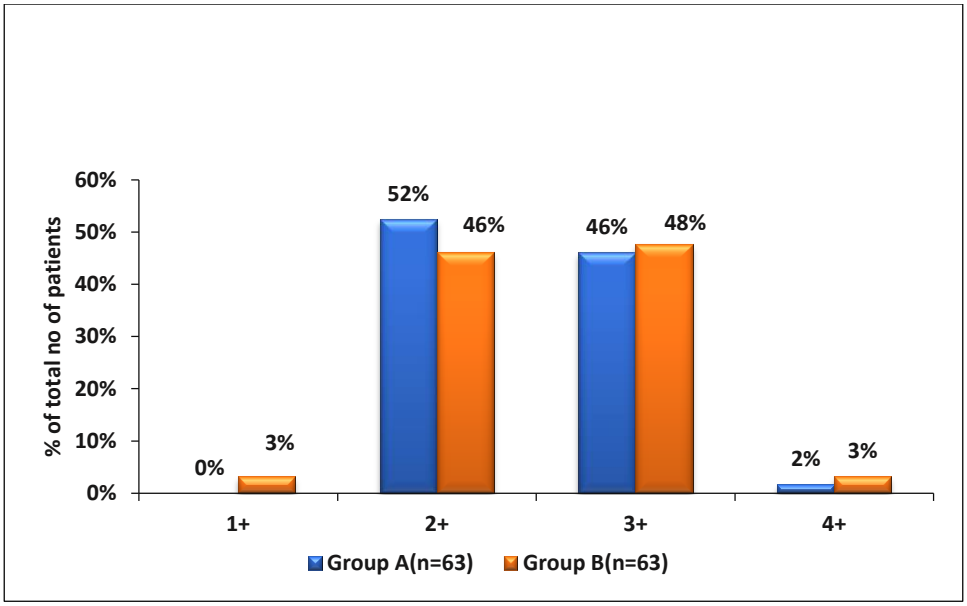


Figure 18: Comparison of urine albumin between study groups

In this study, in majority (49.21%) of the subjects, urine albumin was 2+. Compared to Group B, Group A subjects had comparable urine albumin (P=0.456).

It is shown in Table 10 and Figure 18.

Table 11: Comparison of fundoscopy between study groups

Fundoscopy	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
Normal	63 (100.00%)	55 (87.30%)	118 (93.65%)	0.014*
Grade I	0 (0.00%)	5 (7.94%)	5 (3.97%)	
Grade II	0 (0.00%)	3 (4.76%)	3 (2.38%)	
Total	63 (100.00%)	63 (100.00%)	126 (100.00%)	

***-Chi square test**

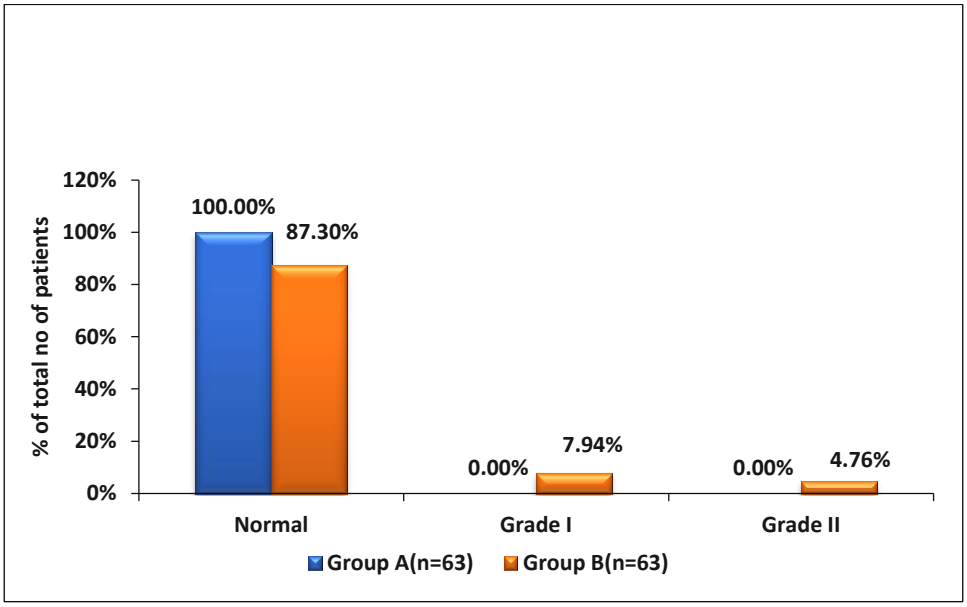


Figure 19: Comparison of fundoscopy between study groups

On fundoscopy, most of the subjects were Grade I (3.97%). Compared to Group B, Group A subjects had significantly lower Grade I (0.00% vs 7.94%, P=0.014) and significantly lower Grade II (0.00% vs 4.76%, P=0.014).

It is shown in Table 11 and Figure 19.

Table 12: Comparison of peripheral smear between study groups

Peripheral smear	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
Normocytic Normochromic blood picture	55 (87.30%)	38 (60.32%)	93 (73.81%)	0.003*
Microcytic hypochromic blood picture	5 (7.94%)	15 (23.81%)	20 (15.87%)	
Dimorphic blood picture	3 (4.76%)	10 (15.87%)	13 (10.32%)	
Total	63 (100.00%)	63 (100.00%)	126 (100.00%)	

***-Chi square test**

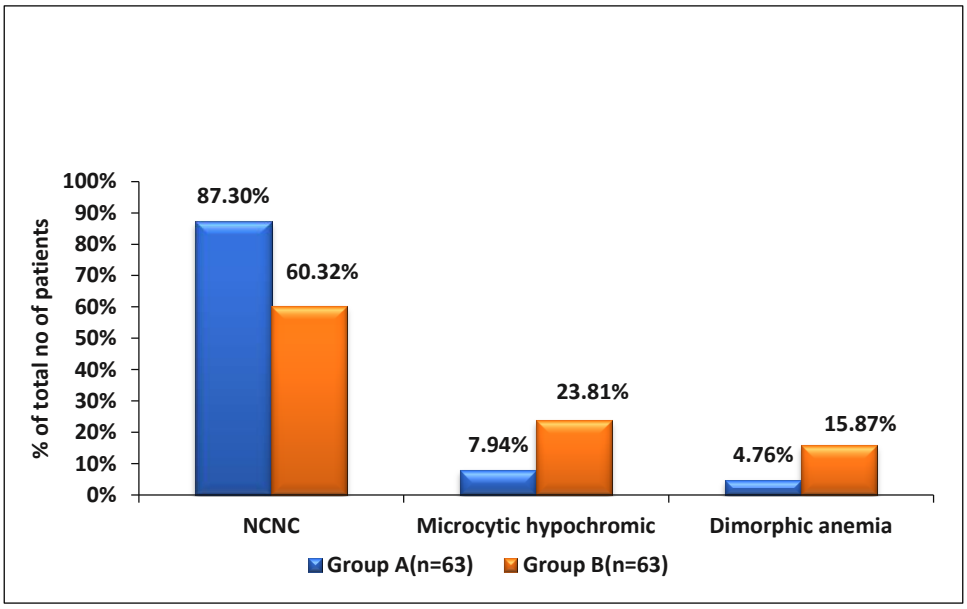


Figure 20: Comparison of peripheral smear between study groups

Peripheral smear showed normocytic normochromic blood picture (NCNC) in majority (73.81%). Compared to Group B, Group A subjects had significantly higher normocytic normochromic blood picture (87.30% vs 60.32%, P=0.003); significantly lower microcytic hypochromic (7.94% vs 23.81%, P=0.003) and significantly lower dimorphic anemia (4.76% vs 15.87%, P=0.003). It is shown in Table 12 and Figure 20.

Table 13: Comparison of cells in peripheral smear between study groups

Cells in Peripheral smear	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
Nil	62 (98.41%)	44 (69.84%)	106 (84.13%)	0.001*
Echinocytes	0 (0.00%)	5 (7.94%)	5 (3.97%)	
Schizocytes	1 (1.59%)	5 (7.94%)	6 (4.76%)	
Spherocytes	0 (0.00%)	2 (3.17%)	2 (1.59%)	
Spherocytes, schizocytes	0 (0.00%)	2 (3.17%)	2 (1.59%)	
Target cells	0 (0.00%)	5 (7.94%)	5 (3.97%)	
Total	63 (100.00%)	63 (100.00%)	126 (100.00%)	

***-Chi square test**

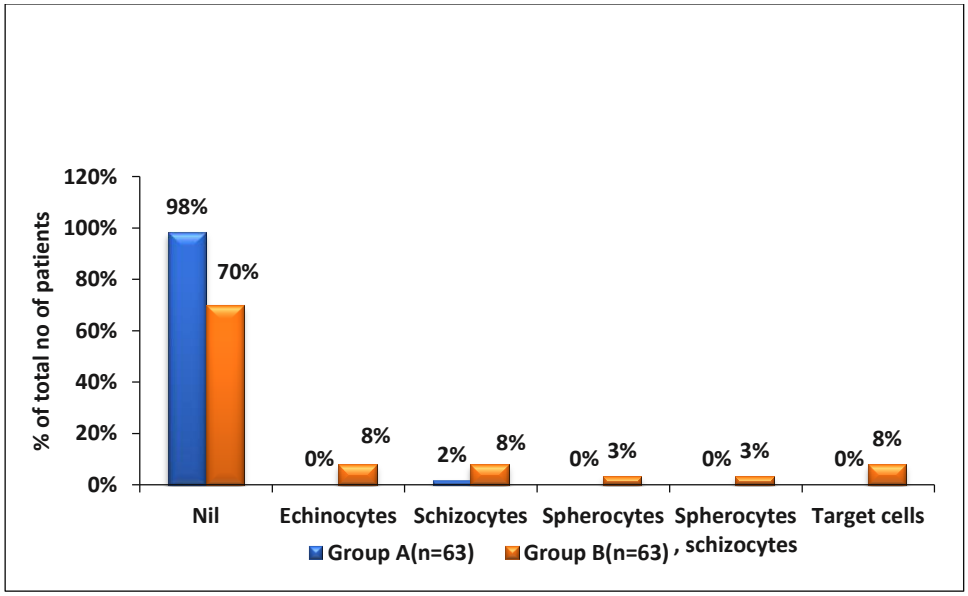


Figure 21: Comparison of cells in peripheral smear between study groups

In majority of subjects, (4.76%) schizocytes were present, followed by echinocytes and target cells in 3.97% patients each. Compared to Group B, Group A patients had significantly lesser Echinocytes (0.00% vs 7.94%, P=0.001), significantly lesser Schizocytes (1.59% vs 7.94%, P=0.001); significantly lesser Spherocytes (0.00% vs 3.17% P=0.001); significantly lesser Spherocytes, schizocytes (0.00% vs 3.17%, P=0.001), and significantly lesser Target cells (0.00% vs 7.94%, P=0.001).

It is shown in Table 13 and Figure 21.

Table 14: Comparison of liver function test between study groups

Liver function test	Group A(n=63)		Group B(n=63)		p value
	Mean ± SD	Median(IQR)	Mean ± SD	Median(IQR)	
Total bilirubin(mg/dl)	0.44 ± 0.72	0.3(0.125 - 0.600)	0.82 ± 0.98	0.6(0.225 - 0.900)	0.0004*
Direct bilirubin(mg/dl)	0.23 ± 0.27	0.2(0.100 - 0.300)	0.36 ± 0.51	0.2(0.100 - 0.375)	0.561*
Serum glutamic oxaloacetic transaminase(U/L)	22.64 ± 6.56	23(17.250 - 26.750)	123.8 ± 186.32	67(32 - 98.750)	<.0001*
Serum glutamic pyruvic transaminase(U/L)	21.54 ± 17	19(15 - 25)	71.19 ± 71.56	39(24.250 - 89.500)	<.0001*
Alkaline phosphatase(U/L)	203.19 ± 72.48	195(162.500 - 246.500)	213.36 ± 57.91	218(181 - 252)	0.386#

***-Mann Whitney test**

#-Independent t test

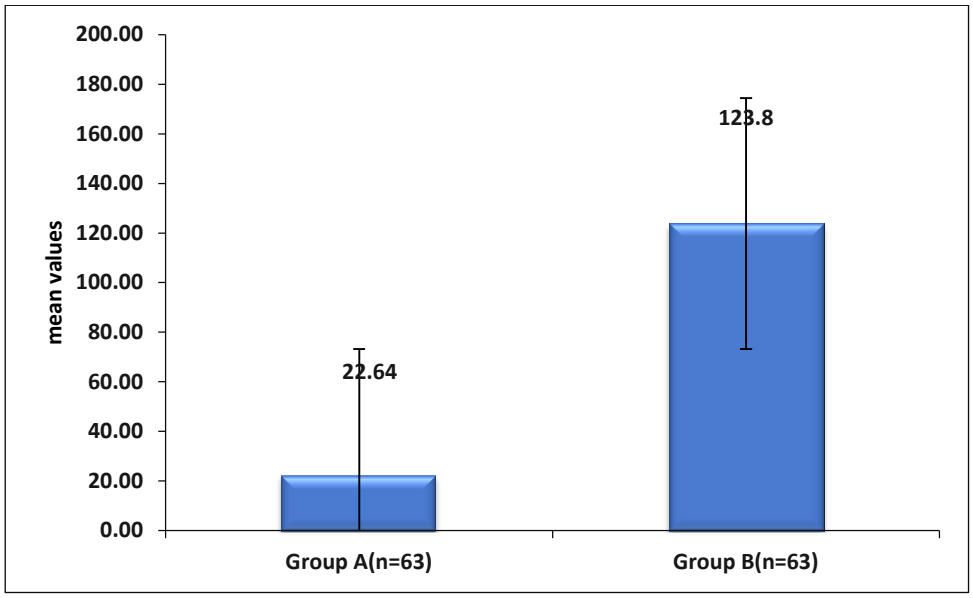


Figure 22(a): Comparison of serum glutamic oxaloacetic transaminase between study groups

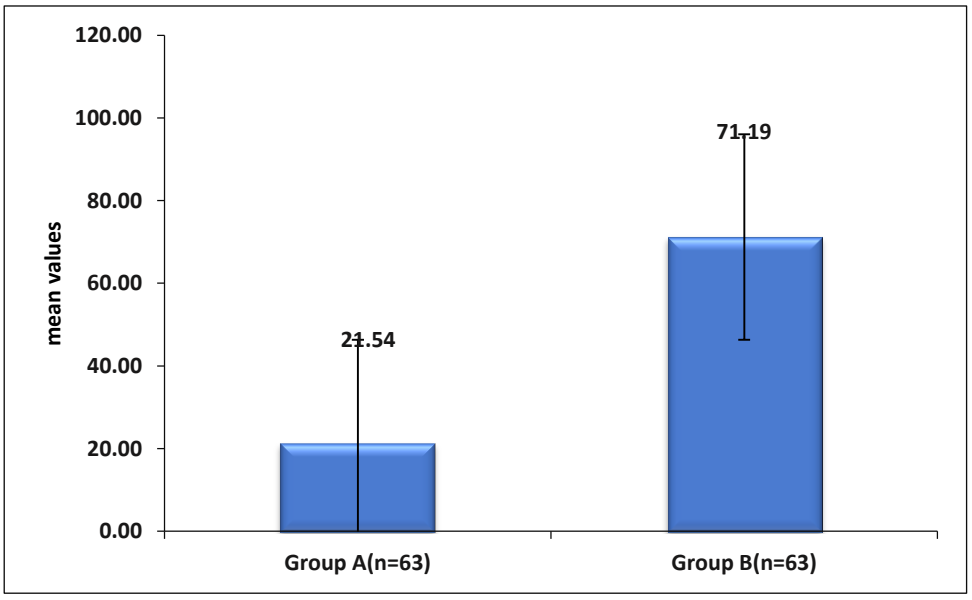


Figure 22(b): Comparison of serum glutamic pyruvic transaminase between study groups

Compared to Group B, Group A patients had significantly lower Total bilirubin(mg/dl) (0.44 ± 0.72 vs 0.82 ± 0.98, P=0.004), comparable Direct bilirubin(mg/dl) (0.23 ± 0.27 vs 0.36 ± 0.51, P=0.561); significantly lower Serum glutamic oxaloacetic transaminase(U/L) (22.64 ± 6.56 vs 123.8 ± 186.32, P<.0001); significantly lower Serum glutamic pyruvic transaminase(U/L) (21.54 ± 17 vs 71.19 ± 71.56, P<.0001), and significantly lower median Alkaline phosphatase(U/L) (195 vs 218, P=0.386).

It is shown in Table 14 and Figure 22a and 22b

Table 15: Comparison of laboratory investigations between study groups

Investigations		Groups		Total	P value
		Group A(n=63)	Group B(n=63)		
Renal function test	Normal	63 (100.00%)	59 (93.65%)	122 (96.83%)	0.119#
	Abnormal	0 (0.00%)	4 (6.35%)	4 (3.17%)	
Lactate dehydrogenase(U/L)	Mean ± SD	278.27 ± 76.14	1140.97 ± 900.01	709.62 ± 769.54	<.0001*
	Median(IQR)	257(235.250 - 313.500)	743(665 - 998)	582.5(257 - 743)	
Uric acid(mg/dl)	Mean ± SD	5.97 ± 1.51	6.69 ± 2.22	6.33 ± 1.93	0.035@
	Median(IQR)	5.8(4.925 - 7.100)	6.9(5.250 - 8.325)	6.2(5.200 - 7.500)	
Prothrombin time(seconds)	Mean ± SD	13.62 ± 2.97	13.12 ± 2.54	13.37 ± 2.76	0.014*
	Median(IQR)	13(12.300 - 14.375)	12.3(11.725 - 13.175)	12.55(12.100 - 13.900)	
Alkaline partial thromboplastin time(seconds)	Mean ± SD	31.45 ± 5.7	31.88 ± 6.04	31.66 ± 5.86	0.426*
	Median(IQR)	30.6(29.225 - 33.100)	31.1(29.215 - 33.375)	31.1(29.200 - 33.200)	
International normalized ratio	Mean ± SD	1.06 ± 0.13	1.02 ± 0.23	1.04 ± 0.19	0.080*
	Median(IQR)	1.01(1 - 1.100)	1(0.900 - 1.060)	1(1 - 1.090)	

***-Mann Whitney test**

#-Fisher's Exact test

@-Independent t test

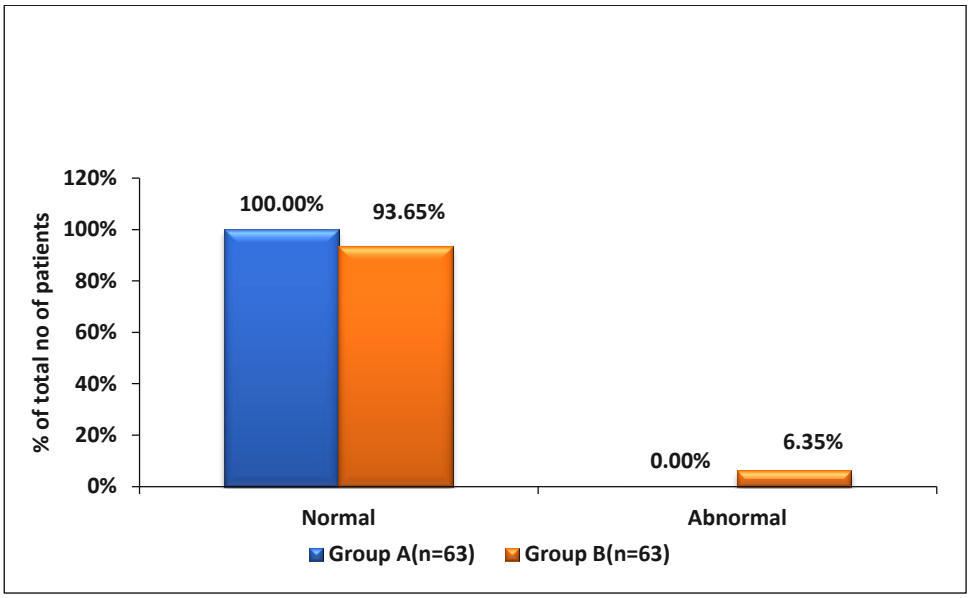


Figure 23(a): Comparison of renal function test between study groups

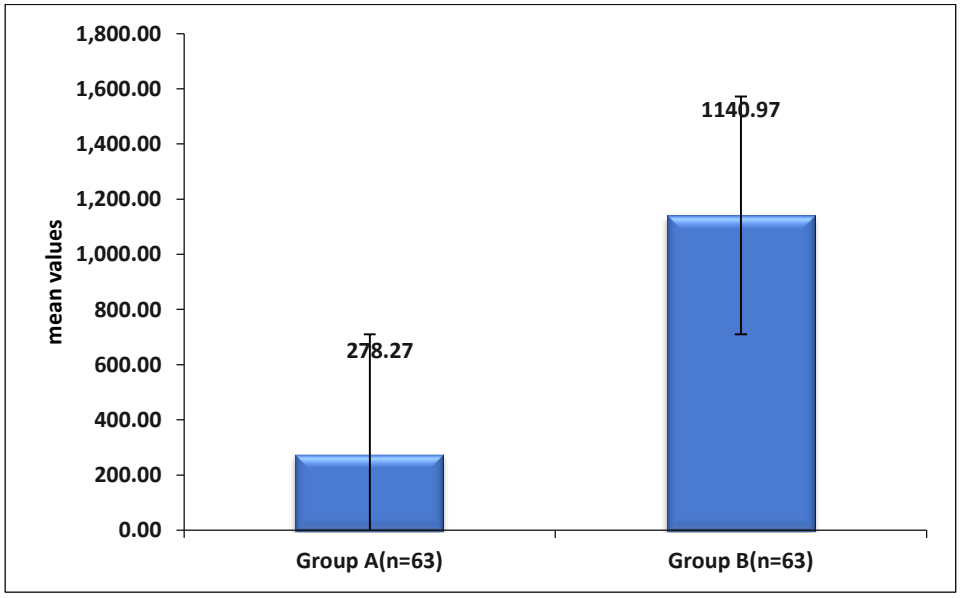


Figure 23(b): Comparison of lactate dehydrogenase between study groups

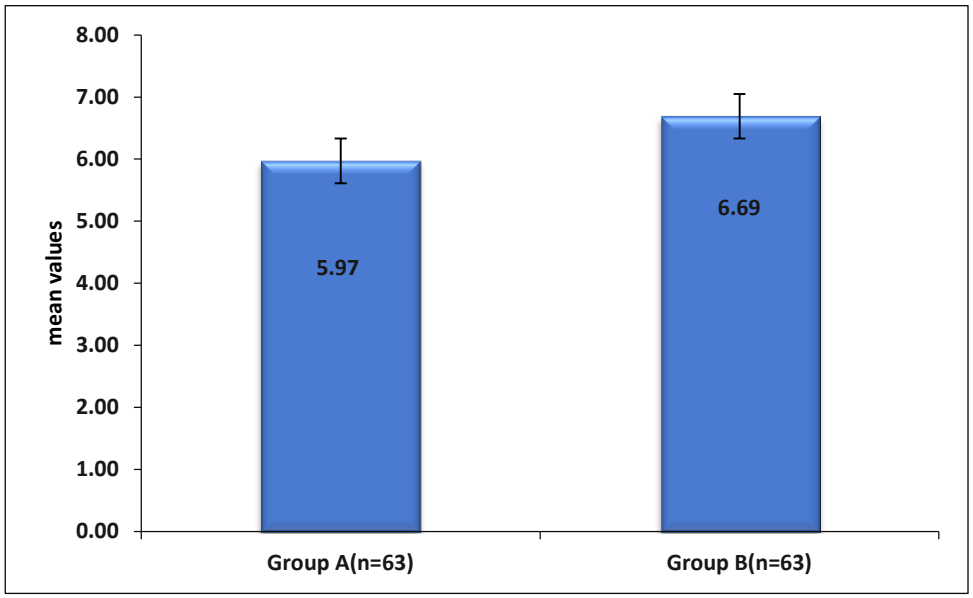


Figure 23(c): Comparison of uric acid between study groups

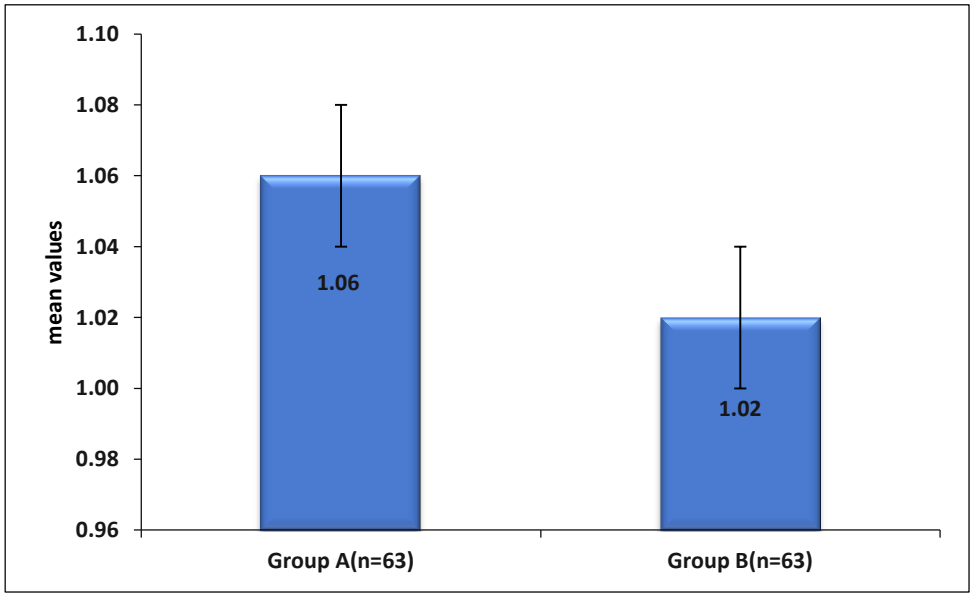


Figure 23(d): Comparison of international normalized ratio between study groups

Abnormal renal function test was noted in 3.17% subjects. Compared to Group B, Group A subjects had comparable abnormal renal function test (0.00% vs 6.35%, P=0.119).

Mean lactate dehydrogenase was 709.62 ± 769.54 U/L. Compared to Group B, Group A subjects had significantly lower lactate dehydrogenase(U/L) (278.27 ± 76.14 vs 1140.97 ± 900.01, P<.0001).

Mean Uric acid was 6.33 ± 1.93 mg/dl. Compared to Group B, Group A subjects had significantly lower mean uric acid (5.97 ± 1.51 vs 6.69 ± 2.22, P=0.035).

Mean Prothrombin time was 13.37 ± 2.76 seconds. Compared to Group B, Group A subjects had significantly higher mean Prothrombin time (13.62 ± 2.97 vs 13.12 ± 2.54, P=0.014).

Mean alkaline partial thromboplastin time was 31.66 ± 5.86 seconds. Compared to Group B, Group A subjects had comparable mean alkaline partial thromboplastin time (31.45 ± 5.7 vs 31.88 ± 6.04, P=0.426)

Mean international normalized ratio was 1.04 ± 0.19. Compared to Group B, Group A subjects had comparable mean INR (1.06 ± 0.13 vs 1.02 ± 0.23, P=0.080)

It is shown in Table 15 and Figure 23a-d.

Table 16: Comparison of hemoglobin and platelets between study groups

Hemoglobin and platelets	Group A(n=63)		Group B(n=63)		P value
	Mean ± SD	Median(IQR)	Mean ± SD	Median(IQR)	
Hemoglobin(gm%)	10.61 ± 1.7	10.6(9.400 - 12)	10.12 ± 2.57	10.3(8.675 - 12.275)	0.206#
Platelets(cells/mm3)	252507.94 ± 76606	243000(200250 - 287500)	91126.98 ± 55857.68	82000(58250 - 104000)	<.0001*

***-Mann Whitney test**

#-Independent t test

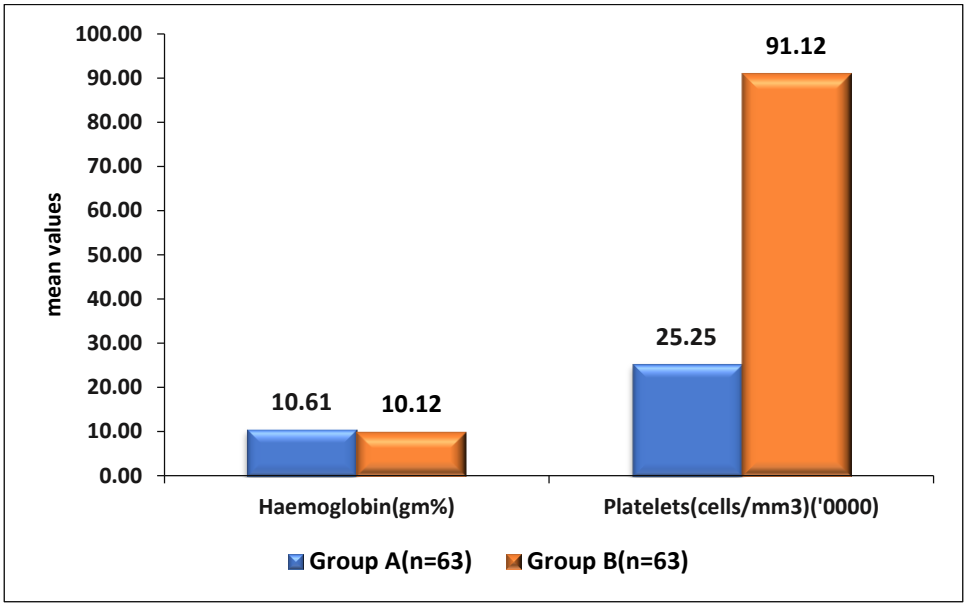


Figure 24: Comparison of hemoglobin and platelets between study groups

Compared to Group B, Group A subjects had comparable median Hemoglobin(gm%) (10.3 vs 10.6, P=0.206) and significantly lower Platelets(cells/mm3) (252507.94 ± 76606 vs 91126.98 ± 55857.68, P<.0001)

It is shown in Table 16 and Figure 24.

Table 17: Comparison of mode of delivery between study groups

Mode of delivery	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
Vaginal delivery	28 (44.44%)	44 (69.84%)	72 (57.14%)	0.004*
Caesarean section	35 (55.56%)	19 (30.16%)	54 (42.86%)	
Total	63 (100.00%)	63 (100.00%)	126 (100.00%)	

***-Chi square test**

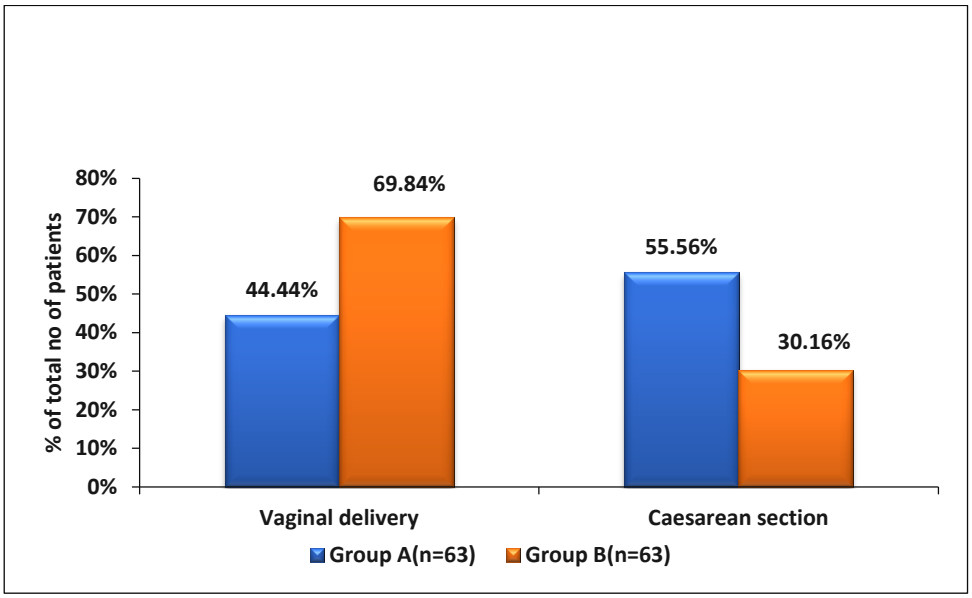


Figure 25: Comparison of mode of delivery between study groups

In this study, in majority of patients (57.14%), mode of delivery was vaginal delivery. Compared to Group B, Group A subjects had significantly higher number of Cesarean section (55.56% vs 30.16%, P=0.004).

It is shown in Table 17 and Figure 25.

Table 18: Comparison of NICU admission between study groups

NICU admission	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
No NICU admission	44 (69.84%)	17 (26.98%)	61 (48.41%)	<.0001*
NICU admission of the infant	19 (30.16%)	46 (73.02%)	65 (51.59%)	
Total	63 (100.00%)	63 (100.00%)	126 (100.00%)	

***-Chi square test**

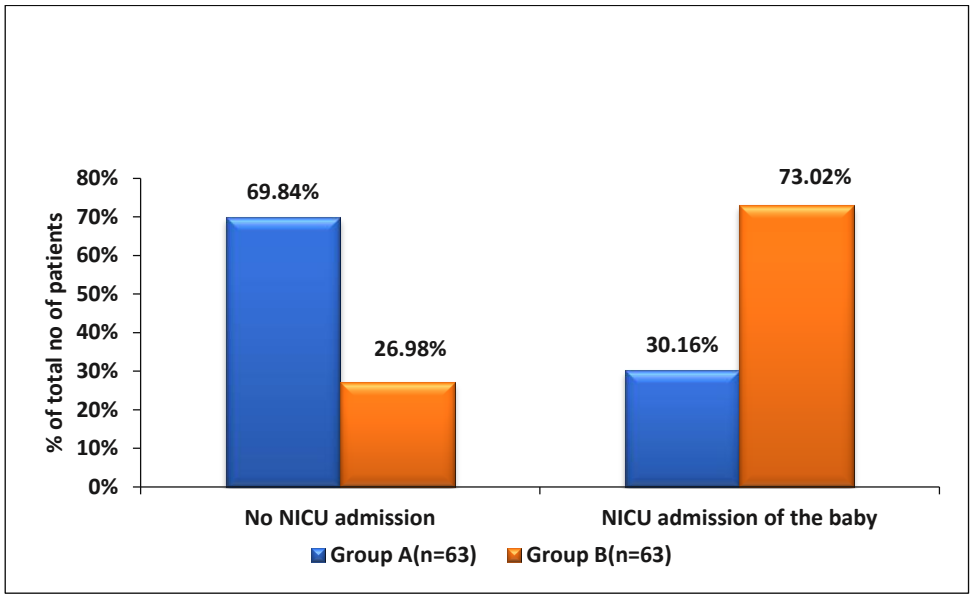


Figure 26: Comparison of NICU admission between study groups

In this study, 51.59% of the babies required NICU admission. Compared to Group B, Group A subjects had significantly lower number of NICU admissions of the infant (30.16% vs 73.02%, P<.0001).

It is shown in Table 18 and Figure 26.

Table 19: Comparison of perinatal morbidity between study groups

Perinatal morbidity	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
No perinatal morbidity	37 (58.73%)	16 (25.40%)	53 (42.06%)	0.0002*
Perinatal morbidity present	26 (41.27%)	47 (74.60%)	73 (57.94%)	
Total	63 (100.00%)	63 (100.00%)	126 (100.00%)	

***-Chi square test**

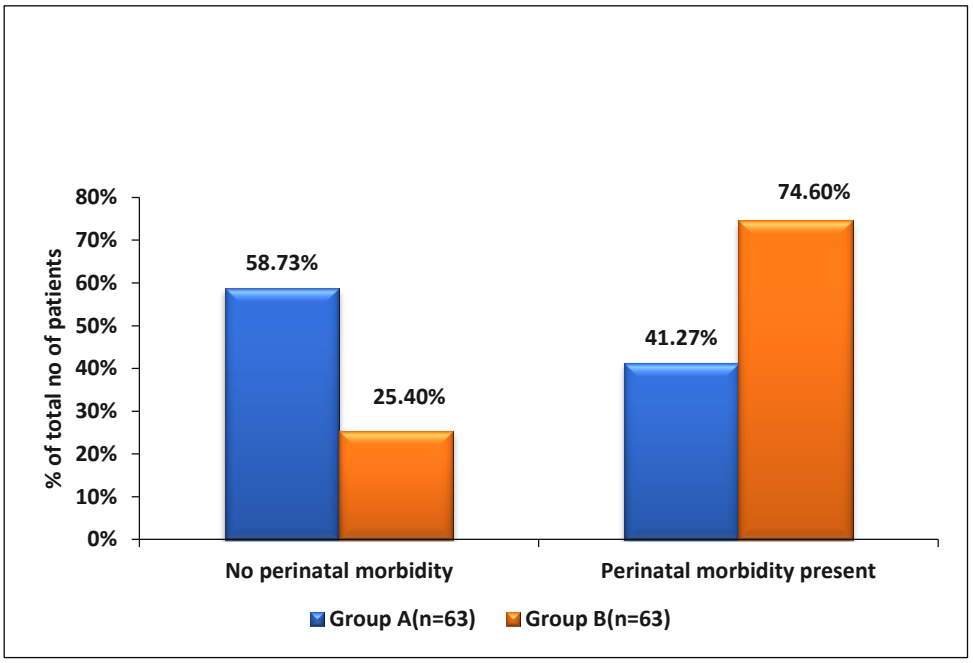


Figure 27: Comparison of perinatal morbidity between study groups

In this study, Perinatal morbidity was present in 57.94% babies. Compared to Group B, Group A patients had significantly lower Perinatal morbidity (41.27% vs 74.60%, P=0.0002).

It is shown in Table 19 and Figure 27.

Table 20: Comparison of perinatal mortality between study groups

Perinatal mortality	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
No perinatal mortality	58 (92.06%)	45 (71.43%)	103 (81.75%)	0.003*
Perinatal mortality present	5 (7.94%)	18 (28.57%)	23 (18.25%)	
Total	63 (100%)	63 (100%)	126 (100%)	

***-Chi square test**

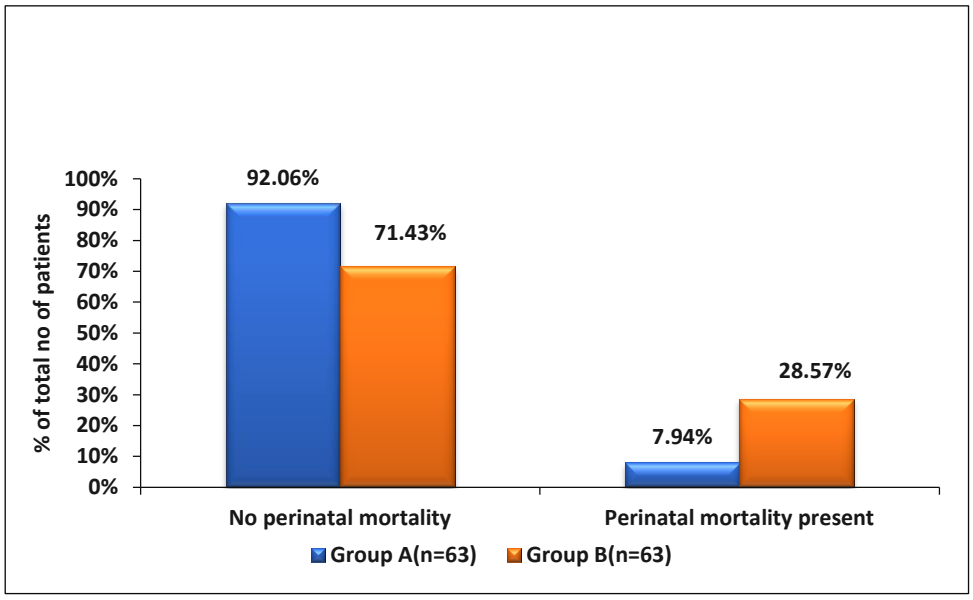


Figure 28: Comparison of perinatal mortality between study groups

In this study, perinatal mortality was present in 18.25% babies. Compared to Group B, Group A subjects had significantly lower perinatal mortality (7.94% vs 28.57%, P=0.003).

It is shown in Table 20 and Figure 28.

Table 21: Comparison of cause of perinatal morbidity/mortality between study groups

Cause of perinatal morbidity/mortality	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
Fetal distress	1 (1.59%)	2 (3.17%)	3 (2.38%)	1*
Small gestational age	0 (0.00%)	1 (1.59%)	1 (0.79%)	1*
Meconium with fetal distress	0 (0.00%)	1 (1.59%)	1 (0.79%)	1*
Secondary APNEA	0 (0.00%)	1 (1.59%)	1 (0.79%)	1*
Respiratory distress	4 (6.35%)	7 (11.11%)	11 (8.73%)	0.53
Anemia	1 (1.59%)	0 (0.00%)	1 (0.79%)	1*
Infant of diabetic mother	1 (1.59%)	0 (0.00%)	1 (0.79%)	1*
Intrauterine death	1 (1.59%)	2 (3.17%)	3 (2.38%)	1*
IUGR	15 (23.81%)	34 (53.97%)	49 (38.89%)	0.0005#
Pre term	11 (17.46%)	31 (49.21%)	42 (33.33%)	0.0002#
Low birth weight	10 (15.87%)	19 (30.16%)	29 (23.02%)	0.057#
Twins	2 (3.17%)	0 (0.00%)	2 (1.59%)	0.496*
Very low birth weight	1 (1.59%)	0 (0.00%)	1 (0.79%)	1*
Fetoplacental insufficiency	3 (4.76%)	0 (0.00%)	3 (2.38%)	0.244*

#-Chi square test

***-Fisher's Exact test**

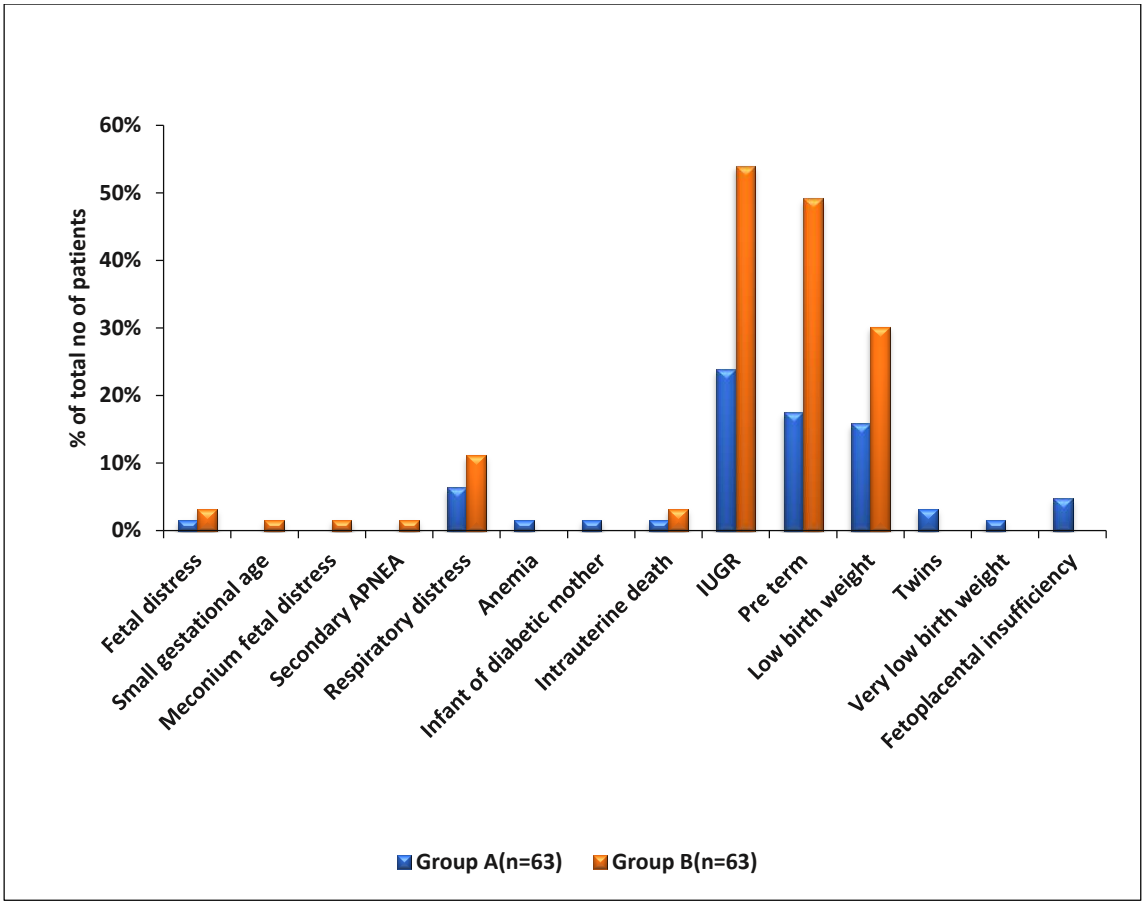


Figure 29: Comparison of cause of perinatal morbidity/mortality between study groups

Regarding cause of perinatal morbidity/mortality, compared to Group B, Group A subjects had significantly lesser IUGR (23.81% vs 53.97%, P=0.0005), and significantly lesser pre term babies (17.46% vs 49.21%, P=0.0002).

All other causes of perinatal morbidity/mortality were comparable in Group A and Group B which are shown in Table 21 and Figure 29.

Table 22: Comparison of maternal mortality between study groups

Maternal mortality	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
No	63 (100.00%)	60 (95.24%)	123 (97.62%)	0.244*
Yes	0 (0.00%)	3 (4.76%)	3 (2.38%)	
Total	63 (100%)	63 (100%)	126 (100%)	

***-Fisher's Exact test**

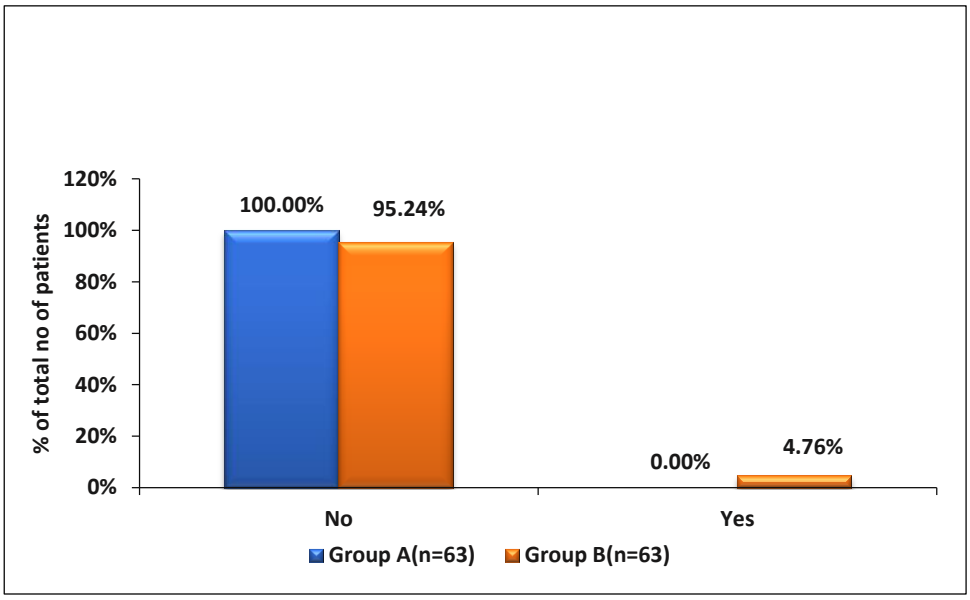


Figure 30: Comparison of maternal mortality between study groups

In this study, maternal mortality was present in 3 (2.38%) patients. Compared to Group B, Group A subjects had comparable maternal mortality (0.00% vs 4.76%%, P=0.244).

It is shown in Table 22 and Figure 30.

Table 23: Comparison of maternal complications between study groups

Maternal complications	Groups		Total	p value*
	Group A(n=63)	Group B(n=63)		
No	44 (69.84%)	26 (41.27%)	70 (55.56%)	
Yes	19 (30.16%)	37 (58.73%)	56 (44.44%)	0.001
Total	63 (100.00%)	63 (100.00%)	126 (100.00%)	

***-Chi square test**

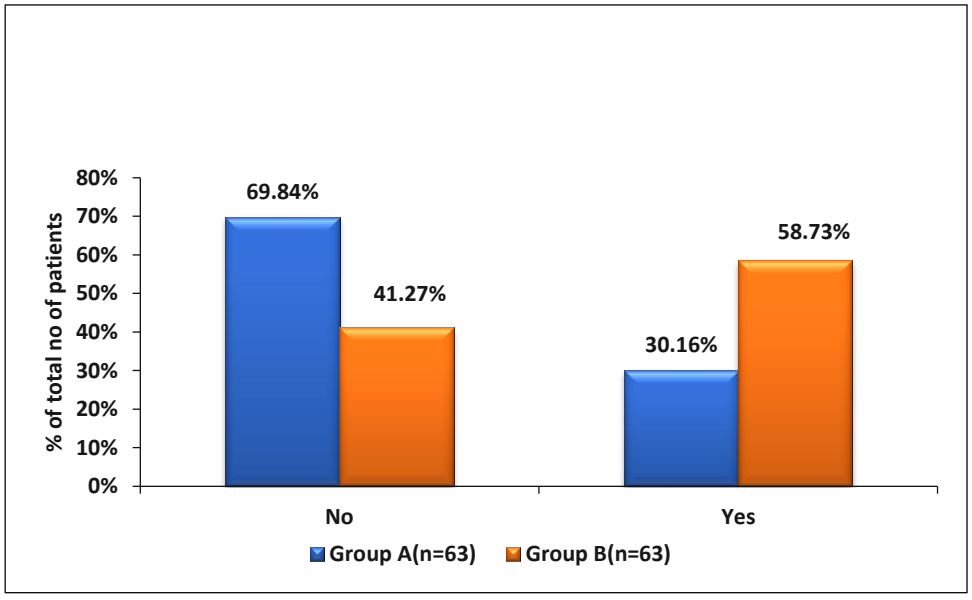


Figure 31: Comparison of maternal complications between study groups

In this study, maternal complications were present in 56 (44.44%) patients. Compared to Group B, Group A subjects had significantly lower maternal complications (30.16% vs 58.73%, P=0.001). It is shown in Table 23 and Figure 31.

Table 24: Comparison of cause for maternal morbidity/mortality between study groups

Maternal complications	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
Abruption	3 (4.76%)	1 (1.59%)	4 (3.17%)	0.619*
Inotropes support	0 (0.00%)	1 (1.59%)	1 (0.79%)	1.000*
DIC	0 (0.00%)	2 (3.17%)	2 (1.59%)	0.496*
Hepatorenal failure	0 (0.00%)	2 (3.17%)	2 (1.59%)	0.496*
ARDS	0 (0.00%)	1 (1.59%)	1 (0.79%)	1.000*
Anemia	13 (20.63%)	23 (36.51%)	36 (28.57%)	0.049#
Convulsions	1 (1.59%)	11 (17.46%)	12 (9.52%)	0.004*
ASCITIS	0 (0.00%)	2 (3.17%)	2 (1.59%)	0.496*
ICU Admission	0 (0.00%)	3 (4.76%)	3 (2.38%)	0.244*
Antepartum eclampsia	2 (3.17%)	1 (1.59%)	3 (2.38%)	1.000*

#-Chi square test

***-Fisher's Exact test**

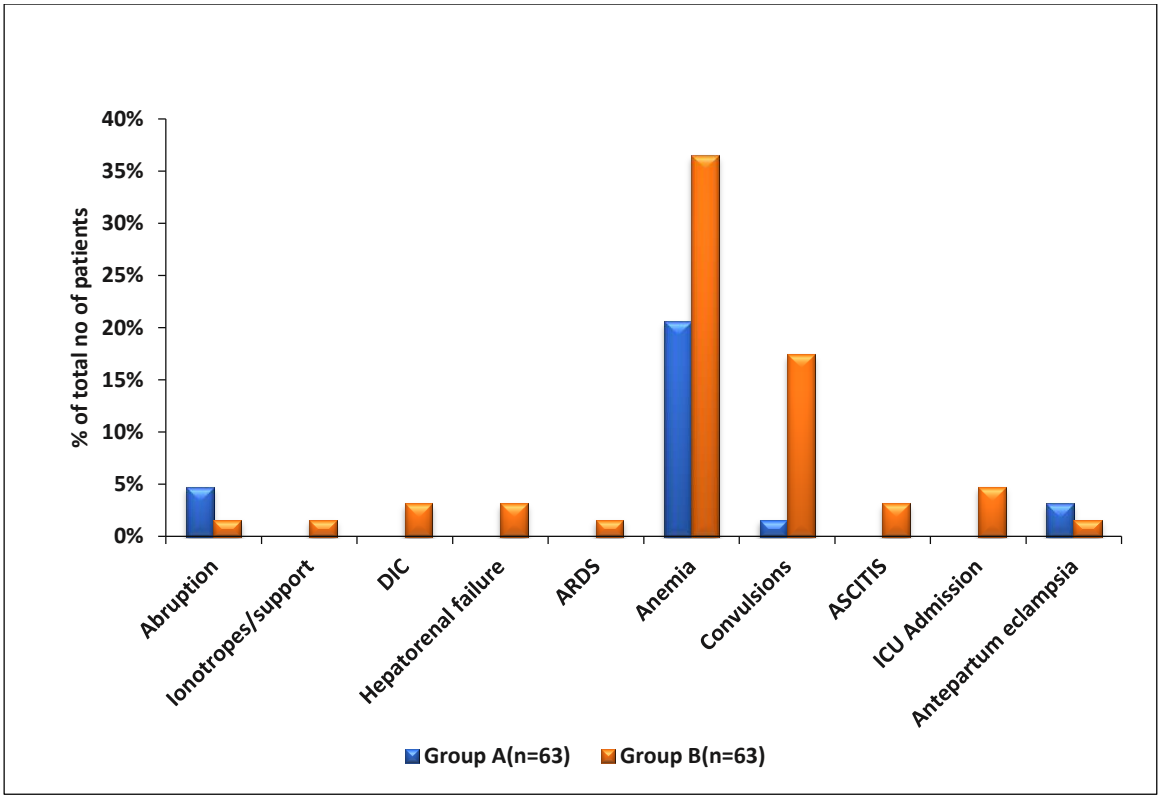


Figure 32: Comparison of cause for maternal morbidity and mortality between study groups

Regarding maternal complications, compared to Group B, Group A subjects had significantly lower occurrence of anemia (20.63% vs 36.51%, P=0.049), significantly lower occurrence of convulsions (1.59% vs 17.46%, P=0.004).

All other complications were comparable between Group A and Group B (P>0.05), which is shown in Table 24 and Figure 32.

Table 25: Comparison of blood/blood products transfusion between study groups

Blood transfusion	Groups		Total	P value
	Group A(n=63)	Group B(n=63)		
No	53 (84.13%)	35 (55.56%)	88 (69.84%)	0.0005*
Yes	10 (15.87%)	28 (44.44%)	38 (30.16%)	
Mean ± SD	1.5 ± 0.97	4.46 ± 3.85	3.68 ± 3.58	0.003#
Median(IQR)	1(1 - 2)	3(2 - 6.500)	2(1 - 5)	

***-Chi square test**

#-Mann Whitney test

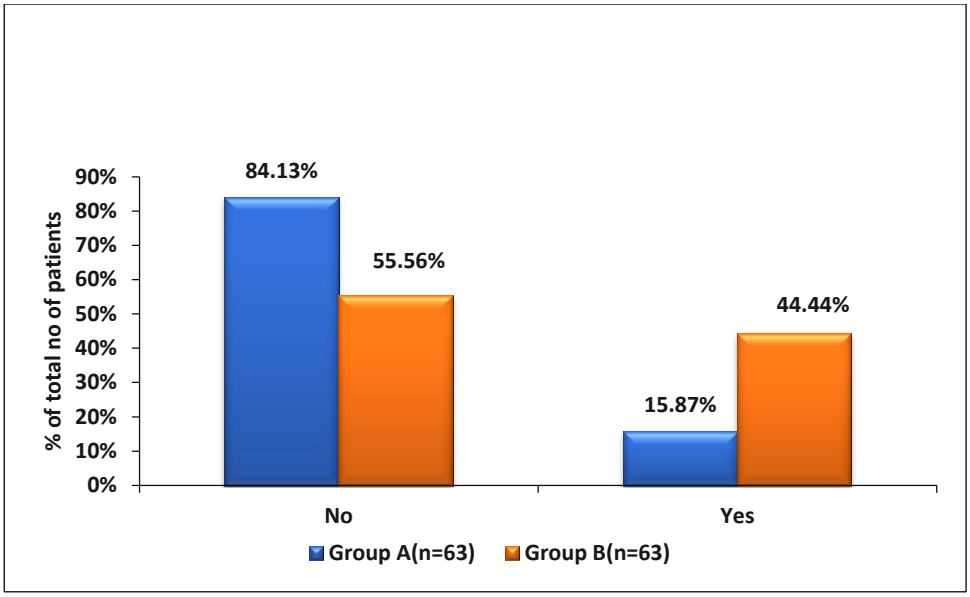


Figure 33: Comparison of blood/blood products transfusion between study groups

In this study, mean number of blood transfusion was 3.68 ± 3.58. Compared to Group B, Group A subjects had significantly lower number of median blood transfusion (1 vs 3, P=0.003)

It is shown in Table 25 and Figure 33.

Table 26: Comparison of haptoglobin between study groups

Haptoglobin(mg/dL)	Groups		Total	p value
	Group A(n=63)	Group B(n=63)		
Low	12 (19.05%)	50 (79.37%)	62 (49.21%)	<.0001*
Normal	44 (69.84%)	13 (20.63%)	57 (45.24%)	
High	7 (11.11%)	0 (0.00%)	7 (5.56%)	
Mean ± SD	107.49 ± 64.97	30.68 ± 28.06	69.08 ± 63.01	<.0001#
Median (IQR)	116.31(43.293 - 138.180)	16.2(15 - 31.555)	36.74(15 - 117.600)	

***-Chi square test**

#-Mann Whitney test

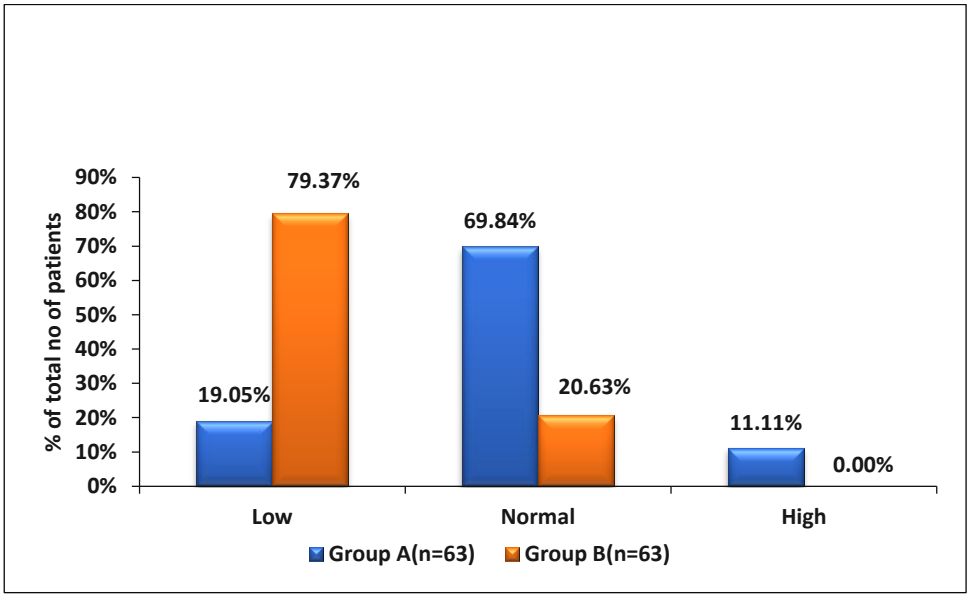


Figure 34: Comparison of haptoglobin between study groups

In this study, mean haptoglobin was 69.08 ± 63.01. Compared to Group B, Group A subjects had significantly higher median haptoglobin (116.31 vs 16.2, P<.0001)

It is shown in Table 26 and Figure 34.

Table 27: Association of haptoglobin with complete and partial HELLP.

Haptoglobin	Tennessee classification		Total	p value
	Complete(n=32)	Partial(n=31)		
Low	26 (81.25%)	24 (77.42%)	50 (79.37%)	0.707*
Normal	6 (18.75%)	7 (22.58%)	13 (20.63%)	
Total	32 (100.00%)	31 (100.00%)	63 (100.00%)	

*-Chi square test

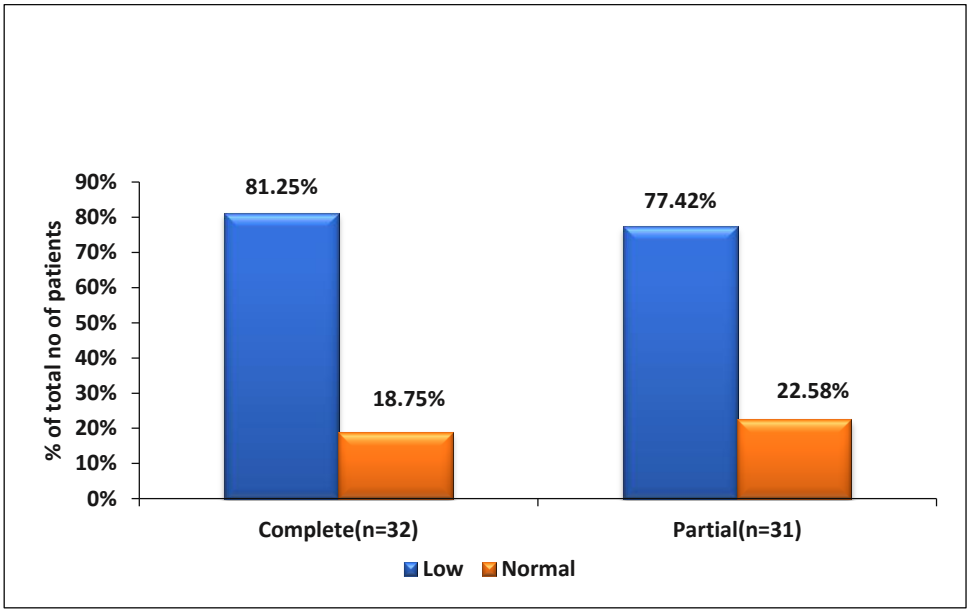


Figure 35: Association of haptoglobin with complete and partial HELLP.

There was no significant association of haptoglobin with complete and partial HELLP based on Tennessee classification (P=0.707). Low haptoglobin was comparable in complete and partial HELLP (81.25% vs 77.42%) and Normal haptoglobin was also comparable in complete and partial HELLP (18.75% vs 22.58%) (P=0.707).

It is shown in Table 27 and Figure 35.

Table 28: Association of perinatal morbidity with haptoglobin in Group A.

Perinatal morbidity	Haptoglobin(mg/dL)			Total	p value
	Low(n=12)	Normal(n=44)	High(n=7)		
No perinatal morbidity	8 (66.67%)	24 (54.55%)	5 (71.43%)	37 (58.73%)	0.578*
Perinatal morbidity present	4 (33.33%)	20 (45.45%)	2 (28.57%)	26 (41.27%)	
Total	12 (100.00%)	44 (100.00%)	7 (100.00%)	63 (100.00%)	

***-Chi square test**

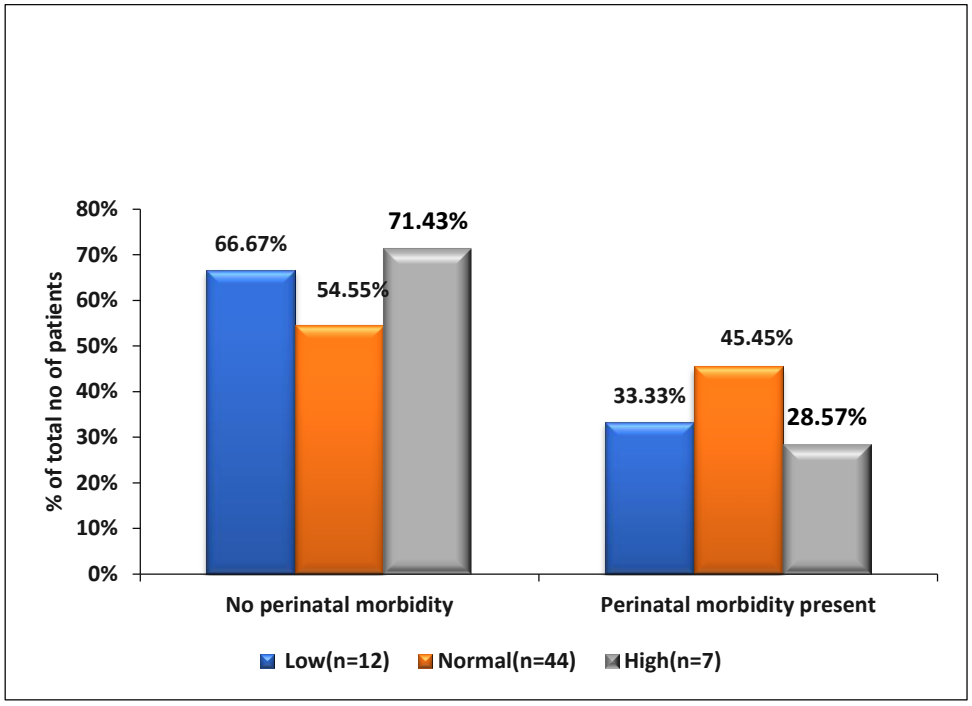


Figure 36: Association of perinatal morbidity with haptoglobin in Group A.

In this study, perinatal morbidity with haptoglobin in Group A was present in 41.27% subjects. Perinatal morbidity in Group A was comparable in subjects with low, normal, and high haptoglobin (33.33% vs 45.45% vs 28.57%, P=0.578).

It is shown in Table 28 and Figure 36.

Table 29: Association of perinatal mortality with haptoglobin in Group A.

Perinatal mortality	Haptoglobin			Total	P value
	Low(n=12)	Normal(n=44)	High(n=7)		
No perinatal mortality	12 (100.00%)	40 (90.91%)	6 (85.71%)	58 (92.06%)	0.472*
Perinatal mortality present	0 (0.00%)	4 (9.09%)	1 (14.29%)	5 (7.94%)	
Total	12 (100.00%)	44 (100.00%)	7 (100.00%)	63 (100.00%)	

***-Chi square test**

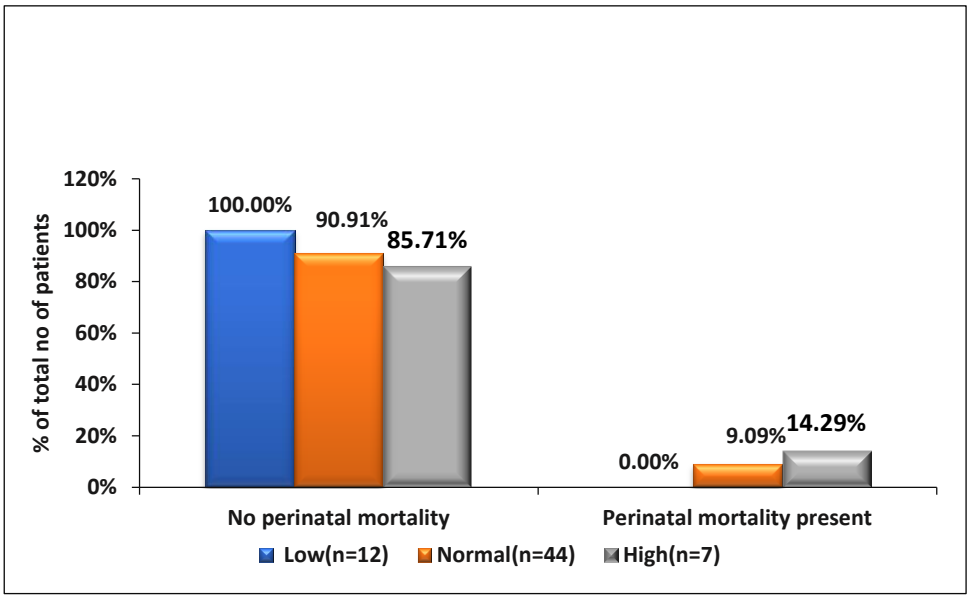


Figure 37: Association of perinatal mortality with haptoglobin in Group A.

In this study, perinatal mortality with haptoglobin in Group A was present in 7.94% subjects. Perinatal mortality in Group A was comparable in patients with low, normal, and high haptoglobin (0.00% vs 9.09% vs 14.29%, P=0.472).

It is shown in Table 29 and Figure 37.

Table 30: Association of maternal complications with haptoglobin in Group A.

Maternal complications	Haptoglobin			Total	P value
	Low(n=12)	Normal(n=44)	High(n=7)		
No	7 (58.33%)	31 (70.45%)	6 (85.71%)	44 (69.84%)	0.449*
Yes	5(41.67%)	13(29.55%)	1(14.29%)	19(30.16%)	
Total	12 (100.00%)	44 (100.00%)	7 (100.00%)	63 (100.00%)	

***-Chi square test**

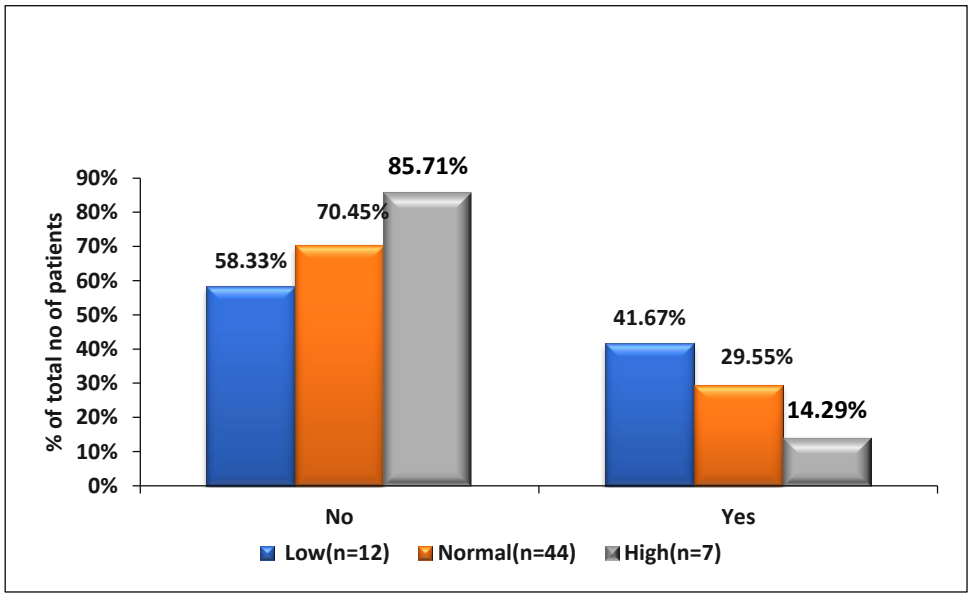


Figure 38: Association of maternal complications with haptoglobin in Group A.

There was no significant association of presence of maternal complications with haptoglobin in Group A (P=0.449).

It is shown in Table 30 and Figure 38.

Table 31: Association of perinatal morbidity with haptoglobin in Group B.

Perinatal morbidity	Haptoglobin		Total	P value
	Low(n=50)	Normal(n=13)		
No perinatal morbidity	12 (24.00%)	4 (30.77%)	16 (25.40%)	0.723*
Perinatal morbidity present	38 (76.00%)	9 (69.23%)	47 (74.60%)	
Total	50 (100.00%)	13 (100.00%)	63 (100.00%)	

***-Fisher's Exact test**

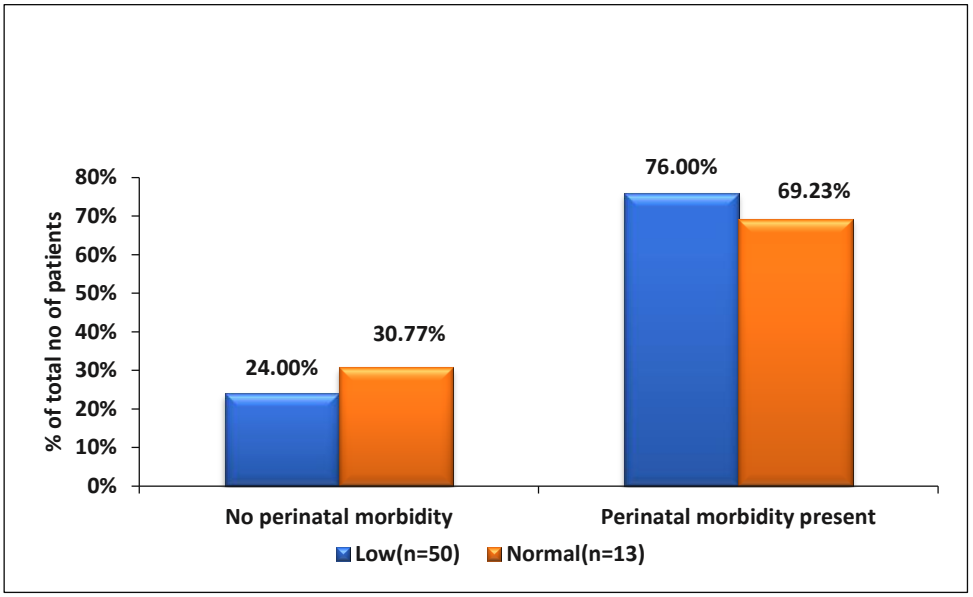


Figure 39: Association of perinatal morbidity with haptoglobin in Group B.

In this study, perinatal morbidity with haptoglobin in Group B was present in 74.60% subjects. Perinatal morbidity in Group B was comparable in subjects with low and normal haptoglobin (76.00% vs 69.23%, P=0.723).

It is shown in Table 31 and Figure 39.

Table 32: Association of perinatal mortality with haptoglobin in Group B.

Perinatal mortality	Haptoglobin		Total	P value
	Low(n=50)	Normal(n=13)		
No perinatal mortality	37 (74.00%)	8 (61.54%)	45 (71.43%)	0.376*
Perinatal mortality present	13 (26.00%)	5 (38.46%)	18 (28.57%)	
Total	50 (100.00%)	13 (100.00%)	63 (100.00%)	

***-Chi square test**

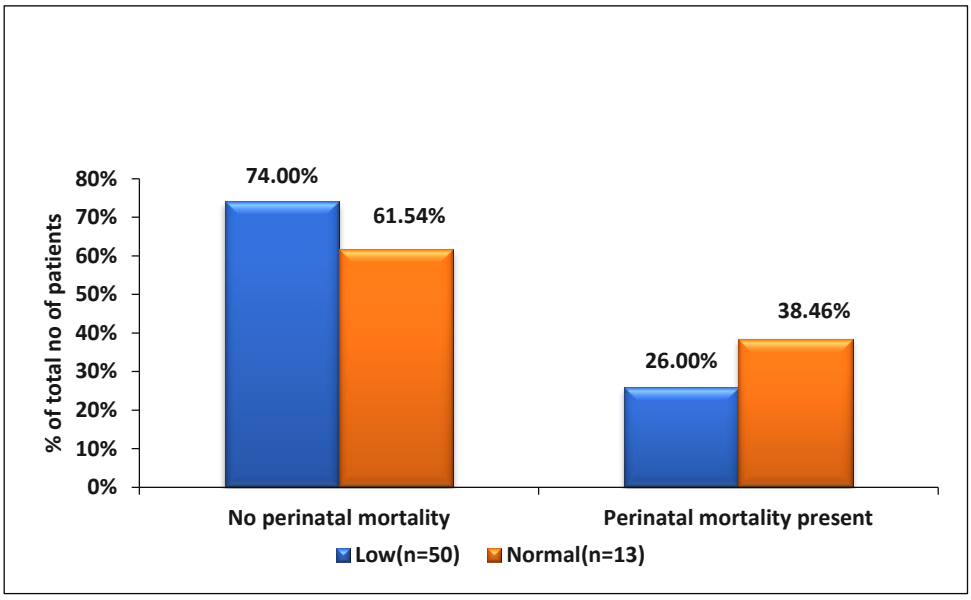


Figure 40: Association of perinatal mortality with haptoglobin in Group B.

In this study, perinatal mortality with haptoglobin in Group B was present in 28.57% subjects. Perinatal mortality in Group B was comparable in subjects with low and normal haptoglobin (26.00% vs 38.46%, P=0.376).

It is shown in Table 32 and Figure 40.

Table 33: Association of maternal mortality with haptoglobin in Group B.

Maternal mortality	Haptoglobin		Total	P value
	Low(n=50)	Normal(n=13)		
No	48 (96.00%)	12 (92.31%)	60 (95.24%)	0.506*
Yes	2 (4.00%)	1 (7.69%)	3 (4.76%)	
Total	50 (100.00%)	13 (100.00%)	63 (100.00%)	

***-Fisher's Exact test**

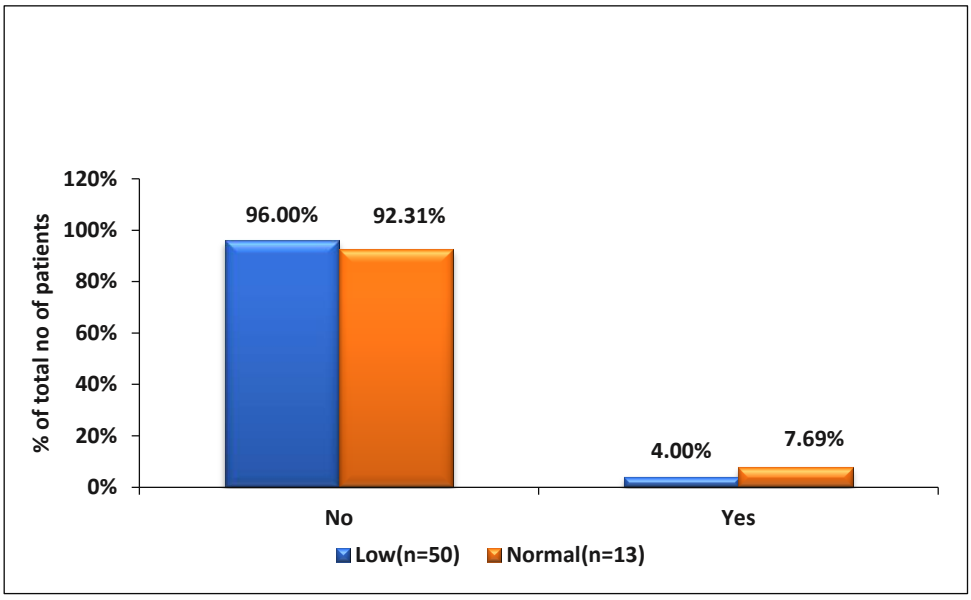


Figure 41: Association of maternal mortality with haptoglobin in Group B.

In this study, maternal mortality with haptoglobin in Group B was present in 3 subjects. There was no significant association of maternal mortality with haptoglobin in Group B (P=0.506).

It is shown in Table 33 and Figure 41.

Table 34: Association of maternal complications with haptoglobin in Group B.

Maternal complications	Haptoglobin		Total	P value
	Low(n=50)	Normal(n=13)		
No	23 (46.00%)	3 (23.08%)	26 (41.27%)	0.207*
Yes	27 (54.00%)	10 (76.92%)	37 (58.73%)	
Total	50 (100.00%)	13 (100.00%)	63 (100.00%)	

***-Fisher's Exact test**

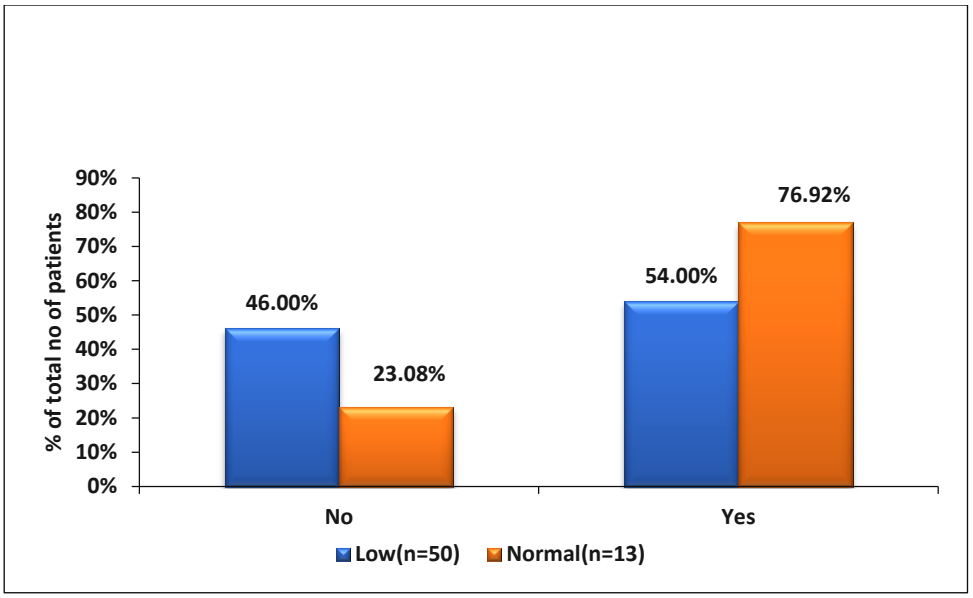


Figure 42: Association of maternal complications with haptoglobin in Group B.

There was no significant association of presence of maternal complications with haptoglobin in Group B (P=0.207).

It is shown in Table 34 and Figure 42.

Table 35(a): Receiver operating characteristic curve of haptoglobin for predicting HELLP.

	Area under the ROC curve (AUC)	Standard Error	95% Confidence interval	P value	Cut off
Haptoglobin	0.87	0.0316	0.798 to 0.923	<0.0001	≤74.19

Table 35(b): Diagnostic test to calculate sensitivity, specificity, NPV and PPV.

	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
Haptoglobin	92.06(82.4 - 97.4)	71.43(58.7 - 82.1)	76.3(65.2 - 85.3)	90(78.2 - 96.7)

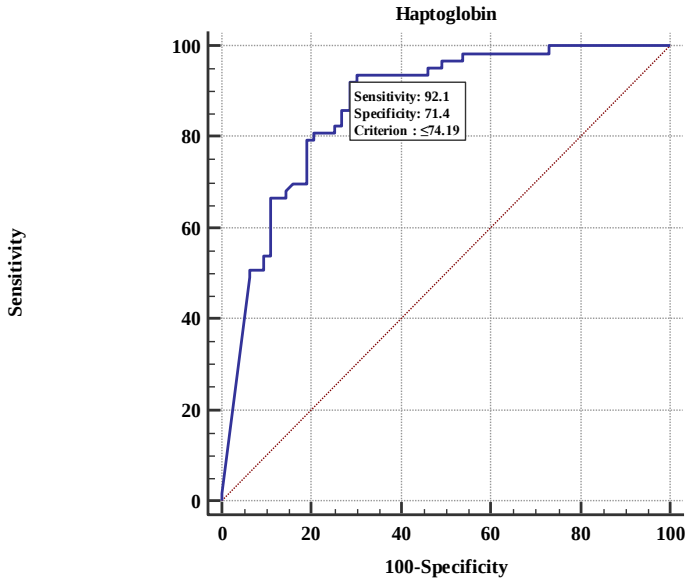


Figure 43(a): Receiver operating characteristic curve of haptoglobin for predicting HELLP.

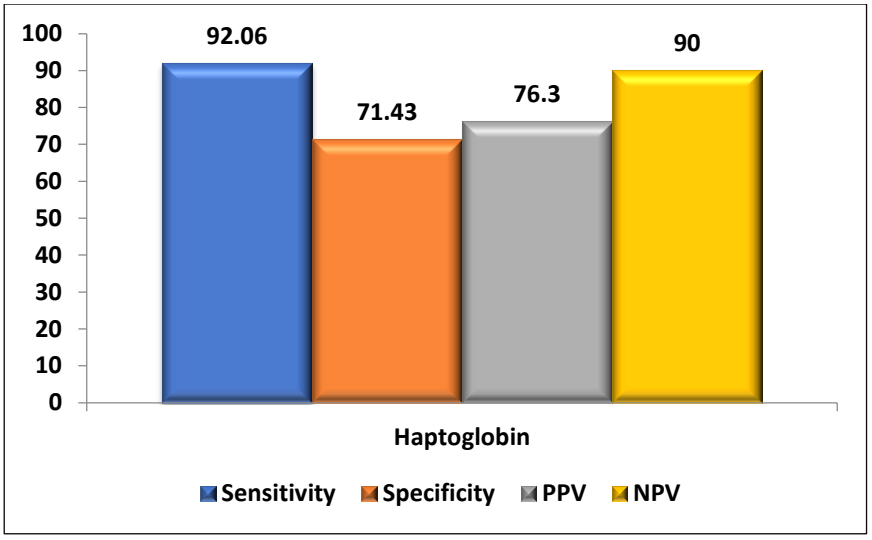


Figure 43(b): Diagnostic test to calculate sensitivity, specificity, NPV and PPV.

Area under curve of haptoglobin for predicting HELLP was good (0.87; 95% CI:0.798 to 0.923) at cut off point of ≤74.19. Sensitivity and specificity of haptoglobin was 92.06% and 71.43% respectively with PPV and NPV of 76.3% and 90% respectively. So we can say that, out of total HELLP subjects 92.06% of subjects were correctly diagnosed by haptoglobin and out of total non-HELLP subjects, 71.43% of patients were correctly diagnosed by haptoglobin. It is shown in Table 35(a), 35(b) and Figure 43(a), 43(b).

Table 36: Association of haptoglobin with HELLP syndrome

Association of HELLP and haptoglobin	Haptoglobin			Total	p value
	Low(n=62)	Normal(n=57)	High(n=7)		
Without HELLP to with HELLP	5(8.06%)	0(0.00%)	0(0.00%)	5(3.97%)	<.0001*
With HELLP to with HELLP	44(70.97%)	9(15.79%)	0(0.00%)	53(42.06%)	
Without HELLP to without HELLP	7(11.29%)	44(77.19%)	7(100.00%)	58(46.03%)	
With HELLP to without HELLP	6(9.68%)	4(7.02%)	0(0.00%)	10(7.94%)	
Total	62(100.00%)	57(100.00%)	7(100.00%)	126(100%)	

*-Chi square test

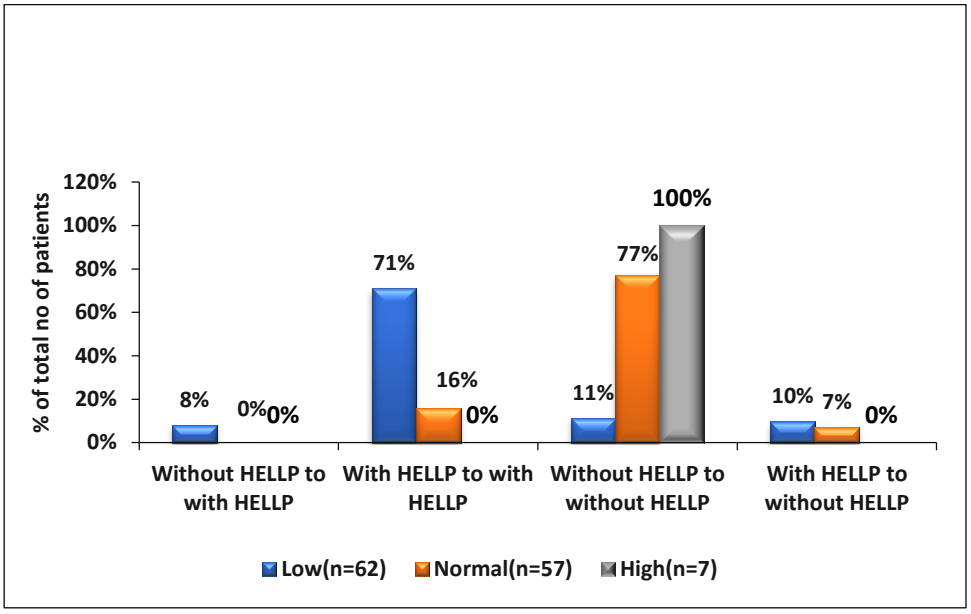


Figure 44: Association of haptoglobin with HELLP syndrome.

There was a significant association of low haptoglobin at presentation with the development of HELLP syndrome in the study population (P<.0001). All the patients who developed HELLP during the follow up had low serum haptoglobin levels. Even among the subjects whose HELLP persisted with time, most of them had low haptoglobin levels. It is shown in Table 36 and Figure 44.

DISCUSSION

DISCUSSION

HELLP syndrome has classically been described as a disease process that occurs more often in older, multigravida women than in younger nulliparous women with typical preeclampsia.[3]

HELLP Syndrome is considered a more severe form of preeclampsia. However, the relationship between the two disorders is controversial. HELLP syndrome is assumed to be a separate disorder by some authors due to the lack of hypertension or proteinuria in fifteen to twenty percent of women with HELLP syndrome.[11,67] Some studies have also shown that maternal morbidity risk is higher in HELLP syndrome cases than in severe preeclampsia.[38,68] In other studies, no significant difference was found for the maternal and perinatal outcomes between the two disorders.[11]

For the management of both severe preeclampsia and HELLP syndrome, it is important to predict the maternal and perinatal outcomes at early as well as late gestational age.[3] The purpose of expectant management is to reduce problems due to prematurity in severe preeclampsia. However, maternal risks and perinatal benefits of expectant management are unclear.[11]

Thus we conducted this study to assess maternal and fetal outcome in severe preeclampsia with HELLP syndrome and severe preeclampsia without HELLP syndrome. We also aimed to correlate Haptoglobin levels with the HELLP syndrome.

We found that the patients with severe eclampsia and HELLP syndrome had significantly higher preterm deliveries, higher normal vaginal deliveries, increased complaints of nausea, vomiting and headache (but less pain in abdomen), more maternal complications like anemia (microcytic hypochromic and dimorphic) and

convulsions; with their fetuses having increased NICU admissions, significantly increased perinatal mortality and morbidity due to IUGR and preterm. Due to anemia, the requirement of blood transfusion (BT) was also significantly higher among women with severe preeclampsia with HELLP. ($P<0.05$)

Haptoglobin, as an aid for the early diagnosis of HELLP syndrome was found to be significantly decreased in the women with HELLP syndrome as compared to those without HELLP syndrome. The occurrence of HELLP syndrome in patients of severe preeclampsia without HELLP syndrome, over the period of time was significantly high if the haptoglobin levels were lower. ($P<0.05$) This was consistent with various previous studies on HELLP syndrome and Haptoglobin. [10, 47,69,70,71,72,73]

Demography and clinical characteristics

Median age of the subjects in our study was 23 years. The mean age was comparable among the severe preeclampsia subjects with and without HELLP syndrome. ($P>0.05$).

However, subjects with HELLP syndrome (Group B) had significantly higher parity, and more unbooked pregnancies as compared to those without HELLP syndrome (Group A) Similar findings related to age were reported by Turgut et al,[45] mean age of the subjects in their study was 27.6 years. Mean age was comparable among the subjects in HELLP group and without HELLP group.

In contrast to findings of our study, Haddad et al[42] found that women with severe preeclampsia were younger as compared to women with HELLP syndrome cases. Yıldırım et al,[3] reported median age of subjects with severe preeclampsia as 27 years and that of HELLP subjects as 28 years. Finding related to maternal age is in contrary to that of our study.

Kinay et al,[11]also found that maternal age, gestational age, and parity were not statistically different in two groups.

In our study, Group B subjects had significantly higher number of primigravida (41.27% vs 65.08%) and lower number of multigravida (19.05% vs 11.11%, p=0.039).

Similar findings was reported in Isler CM et al (1999) was 61.5% and Ahmed et al (2007) was 62.5% of multipara women with HELLP syndrome.

In contrast to our study, Campos A et al found that most of the women with HELLP syndrome were nulliparous, without differences between the two groups (p = 0.60).

Maternal age and parity were higher in patients with HELLP syndrome than in those with severe preeclampsia with median of 34 (31.05-35.9) and 34.4 (31.7-36.7) respectively, p Value 0.0009 was reported by Yıldırım et al[3].

Compared to Group B in the present study, Group A subjects had significantly higher number of term pregnancies (76.19% vs 41.27%, P<.0001). Majority of the subjects (34.92%) were early term, followed by 23.81% late preterm.

The mean gestational age of the study group was 37.43 weeks. Similar findings to our study, Tandon A[74] et al reported mean gestational age of 36.4 weeks with severe preeclampsia and 35 weeks with HELLP syndrome.

Abramovici D et al[9], found lower gestational age at delivery in HELLP syndrome cases.

Various studies	Gestational age		Parity			
	Group A Mean±SD	Group B Mean±SD	Primigravida		Multigravida	
			Group A	Group B	Group A	Group B
Tandon A et al	36.4 ±2	35 ±3	66.55%	63.64%	33.45%	36.36%
Zuberi NF et al	34 ± 3.9	33.7± 3.7	34.0%	39.3%	65.8%	60.7%
Our study	37.2 ±2.9	35.4±3.4	41.27%	65.08%	19.05%	11.11%

LABORATORY PARAMETERS IN DIFFERENT STUDIES

Laboratory Parameters	**Martin et al.1998**		**Turgut et al 2000**		**Our study**	
	Severe PE Mean± SD	**Severe PE Mean± SD**	**Severe PE Mean±SD**	**HELLP Mean± SD**	**Group A Mean±SD & Median**	**Group B Mean±SD & Mean**
LDH	921±816	921±816	303.3±94.2	691.1±558.3	278.27±76.14 257(235-313)	1140.97±900.01 743(665-998)
SGOT	301±519	301±519	36.1 ±19.3	207.4 ±247.3	22.64±6.56 23(17.25-26.75)	123.8±186.3 267 (32-98.75)
SGPT	187±310	187±310	37±28.4	171.6 ±186.8	21.54±17 19 (15-25)	71.19±71.56 39 (24.25-89.5)
PLATELET	-	-	225154.4± 80336	102918.9 ±59266.3	252507±76606 243000 (200250-287500)	91126.98±5585 7.6882000(5825 0 – 104000)

In the present study, Group B subjects had significantly higher total bilirubin, raised SGOT and SGPT (liver enzymes) and lower platelet count. Owing to the hemolysis, LDH levels were also significantly elevated ($p<0.05$). Comparing the median value of liver enzymes, SGOT is better compared to SGOT in diagnosing HELLP.

Similarly, Kinay et al,[11] in their study found that liver enzymes were raised in subjects with HELLP syndrome. Peak serum aspartate aminotransferase (AST) level, and peak serum alanine aminotransferase (ALT) level were higher and mean platelet count was lower in the HELLP syndrome cases at all stages of gestation ($p<0.05$).

Turgut et al,[45] also found that LDH, AST (207.4 ±247.3) and ALT (171.6±186.8) level were higher and mean platelet count (102918.9±59266.3) was lower in the HELLP syndrome.

In our study significant number of subjects with HELLP syndrome had abnormal cells in peripheral smear (injured RBC like echinocytes, schizocytes, target cells) which shows hemolysis.

Maternal and Fetal outcomes

Studies by Anumba et al,[75] Bombrys AE et al,[76] and Guzel AI et al,[77] showed that HELLP syndrome and severe preeclampsia has increased perinatal morbidity and mortality.

However, it is unclear whether perinatal morbidity and mortality is dependent on the prematurity or nature of disease. Studies by Harms K et al,[78] and Raval DS et al,[79] reported that perinatal morbidity was higher in subjects with HELLP syndrome than in those with preeclampsia alone.

a. Maternal outcomes

In the present study, Group B subjects had significantly higher preterm deliveries, higher vaginal deliveries, more number of subjects with complaints of nausea, vomiting and headache (but less pain in abdomen) and maternal complications like anemia (microcytic hypochromic and dimorphic) and convulsions were high compared to Group A.

Due to more number of subjects with anemia in Group B, the requirement of blood transfusion (BT) was also significantly higher among those women. ($P<0.05$). However, the maternal mortality was comparable among the two groups. ($P>0.05$).

The only effective treatment for severe preeclampsia and HELLP syndrome is delivery, but no randomized trial has been conducted to determine the optimal method of delivery. The rate of cesarean delivery increases with increased occurrence of hypertensive disorders during pregnancy. Vaginal delivery is recommended for severe preeclamptic cases in the absence of obstetric indications for a cesarean section.[3]

There are other studies presenting similar and different findings in the literature. Kinay et al,[11] reported that placental abruption, cesarean delivery, and acute renal failure rates in subjects with and without HELLP syndrome were statistically similar. The requirement for blood products transfusion was more common in HELLP syndrome cases than in severe preeclampsia cases. DIC, pulmonary edema, or maternal death did not occur in any individuals.

Yıldırım et al,[3] reported that the rate of adverse maternal outcomes for women with HELLP syndrome were higher than those for women with severe preeclampsia. Acute renal failure and cesarean delivery were significantly more in subjects with HELLP. Other maternal outcomes such as ARDS, Abruptio placentae, Pulmonary edema, and ascites were comparable.

Turgut et al,[45]found that caesarean delivery was significantly higher and post-partum oliguria was significantly lower in the HELLP group. Rates of epigastric pain were also significantly higher in the women with HELLP syndrome. It was found that more blood transfusions were used for the HELLP group. There was a significant association between acute renal failure and HELLP syndrome. The need for the intensive care unit and mechanical ventilation was significantly higher in the HELLP group. The occurrence of at least one complication was significantly higher with the HELLP group than in the severe preeclamptic group.

The differences in the outcomes observed in these studies may be related to the earlier gestation in women with HELLP syndrome than in women with severe preeclampsia.

Maternal mortality associated with HELLP has been reported in different studies with ranges between 1.1% and 24.2%. This is due to differences in care provision and diagnostic criteria. Maternal mortality has been shown to be associated with low platelet counts (below 50 X 10^9/L) in circumstances where there was a delay in the diagnosis and when there has been hemorrhage in the hepatic or central nervous system or vascular insult to the cardiopulmonary or renal system.[48]

A significant complication of HELLP syndrome is acute renal failure. HELLP syndrome has been found to account for approximately 35% of pregnancy related acute renal failure. HELLP syndrome may deteriorate following delivery with low platelet counts, severe hypertension and proteinuria. Careful monitoring should be conducted for at least 48 hours after delivery, until an improvement is seen. Resolution normally occurs between 48 and 72 hours postpartum, with an improvement in the liver enzymes, usually prior to an improvement in platelet numbers. Mode of delivery has been shown to influence postnatal liver function tests, with AST and ALT rising more in those delivered by caesarean section rather than

vaginal delivery. Some of the changes, therefore, may be attributed to delivery rather than the underlying pathological process. Women with severe preeclampsia with HELLP may take longer to recover and in a few cases where there is no improvement; plasma exchange has been shown to be of benefit.[48]

There were three maternal mortalities in Group B (Severe preeclampsia with HELLP syndrome), all three mortalities were due to end organ failure.

b. Fetal outcomes

Fetuses of the Group B subjects had significantly more NICU admissions, significantly high perinatal mortality and morbidity due to IUGR and preterm.($P<0.05$).

Similar to our study, Abramovici et al[9] suggested that low birth weight, low Apgar scores and intrauterine death rates were higher in HELLP syndrome cases than severe preeclampsia at <36 weeks of gestation.

Yıldırım et al, [3] found that birth weight and gestational age at delivery were lower in infants of subjects with HELLP syndrome than in infants of those with severe preeclampsia. The percentage of oligohydramnios and of absent or reversed end diastolic flow, and the 5-min Apgar score, except FGR, were comparable among women with severe preeclampsia and HELLP syndrome. FGR was higher in subjects with severe preeclampsia than in those with HELLP syndrome.

Turgut et al,[19] found that HELLP syndrome cases had significantly lower gestational age and low birth weight. There were significant differences between the HELLP group and the severe preeclamptic group in neonatal mortality, NEC, requirement for mechanical ventilation and the intensive care unit, and the duration of stay in the newborn intensive care unit. In contrast to findings of our study, Kinay et al,[11] found that perinatal outcomes were similar in the patients with and without HELLP.

The HELLP syndrome is a variant of severe preeclampsia that is associated with significant maternal and perinatal morbidity and mortality. Perinatal outcome and perinatal mortality rates have been reported from 7.7% to 60%. HELLP may impose great impact on the fetus, including growth retardation, fetal death, stillbirth and premature birth due to insufficient placental blood and oxygen supplies, and decreased placental function. Perinatal mortality appears to be primarily related to the gestational age at delivery.[48] Studies involving prenatal management show increased perinatal mortality rates in cases of HELLP, mainly due to stillbirths.[80] But, it does not seems that HELLP syndrome enhances the neonatal mortality, regardless of gestational age, and data related to neonatal outcomes like intraventricular hemorrhage, respiratory distress syndrome (RDS), necrotizing enterocolitis, and sepsis are conflicting in nature.[26] Perinatal outcome improves with advancing gestational age at delivery.

When pregnancies with severe pre-eclampsia in the presence and absence of HELLP syndrome are compared, neonatal morbidity and mortality are related to gestational age and prematurity rather than the presence of HELLP syndrome.[48]

Expectant management with the antepartum use of steroids may allow delivery to be delayed and confer some benefit to the fetus in terms of gestational age, but this has to be weighed against the risks for the mother and risk of complications associated with HELLP syndrome. It might be that during expectant management, deterioration in the fetal condition occurs.[48]

Haptoglobin

Haptoglobin is an acute phase reactant that may aid in the early diagnosis of HELLP syndrome because it is decreased in women with HELLP syndrome. The mechanism behind lies in its function to bind degraded hemoglobin after hemolysis as seen in HELLP syndrome and thus the serum levels of Haptoglobin are decreased.

We found that Haptoglobin was significantly decreased in the women with HELLP syndrome (Group B) as compared to those without HELLP syndrome (Group A). The occurrence of HELLP syndrome in subjects with severe preeclampsia without HELLP syndrome over the period of time was significantly more if the haptoglobin levels were lower ($P<0.05$).

Area under curve of haptoglobin for predicting HELLP syndrome was good (0.87; 95% CI:0.798 to 0.923) at cut off point of $\leq$ 74.19. Sensitivity and specificity of haptoglobin was 92.06% and 71.43% respectively with PPV and NPV of 76.3% and 90% respectively. So we can say that, out of total HELLP syndrome subjects, 92.06% of patients were correctly diagnosed by haptoglobin and out of total severe preeclampsia without HELLP subjects, 71.43% of patients were correctly diagnosed by haptoglobin. This was consistent with various previous studies on HELLP syndrome and Haptoglobin. [10,47,70,71,72,73]

However, in our study, haptoglobin levels showed no significant association with feto-maternal outcome in either group except for increased fetoplacental insufficiency which was more in Group A with high Haptoglobin. This can be a chance effect or due to insufficiency in the circulation due to severe eclampsia per se.

Apart from that, no association of Haptoglobin was seen with maternal mortality, morbidity complications and perinatal mortality or morbidity. We also found no significant association of haptoglobin with complete and partial HELLP based on

Tennessee classification (P=0.707). To our knowledge, this is the first study that has evaluated the association of haptoglobin levels with feto-maternal outcome, maternal mortality, morbidity, complications and perinatal mortality or morbidity, as well as with complete and partial HELLP in women with and without HELLP.

To sum up, the present study promotes the idea that HELLP syndrome is associated with increased maternal and neonatal morbidity and mortality. Neonatal outcomes seems to be influenced mainly by gestational age at delivery. The maternal mortality rate in the pregnant women can be decreased by aggressive treatment.

These findings help the clinician to be more attentive to clinical as well as biological disturbances, particularly the simultaneous presence of HELLP syndrome and preeclampsia, in addition to ascites, oliguria, thrombocytopenia, as well as increased liver enzymes.

Association of Haptoglobin with HELLP syndrome in various studies

SI. NO	**Various Studies**	**HELLP syndrome**
1.	**Our study**	16.2 mg/dl (Group B)) vs 116.31 mg/dl (Group A) p<0.0001
2.	**Poldre et al**	0.6 gm/L
3.	**Wilke et al**	0.7 mg/ml
4.	**Gatzka C et al**	cut off: < 13 mg/dl
5.	**Deruelle et al**	<0.4 g/l
6.	**Roth et al**	Haptoglobin ↓ 95–97% [sensitive]

SUMMARY

SUMMARY

This was a cross-sectional observational study done at Department of Obstetrics and Gynaecology, R.L. Jalappa Hospital, Tamaka from January 2018 to May 2019. After applying inclusion/exclusion criteria and taking informed consent, 126 women with gestational age ≥20 weeks diagnosed with severe preeclampsia were enrolled. Two groups were created: Group A included women with severe preeclampsia without HELLP syndrome and Group B included women with severe preeclampsia with HELLP syndrome. Necessary lab investigations including serum haptoglobin level were done. Participants were observed for maternal mortality, morbidity, and fetal outcomes. Results related to the study are as follows:

- The median age of the patients in the study was 23 years. Most of them were in the age group of 21-25 years (60.32%). Age was comparable between Group A and Group B.
- Most of patients in the study belonged to lower middle socioeconomic status. Socioeconomic status was comparable.
- Group B women were significantly higher gravida, significantly higher unbooked, higher preterm deliveries, higher normal vaginal deliveries, more nausea, vomiting and headache (but less pain in abdomen), more maternal complications like anemia (microcytic hypochromic and dimorphic) and convulsions. Blood pressure, and AFI were comparable.
- Women with severe preeclampsia and HELLP had significantly higher total bilirubin, SGOT and SGPT (liver enzymes) and lower platelet count. LDH levels were also significantly increased. Blood transfusion was more required

in Group B. Alkaline phosphatase, APTT, uric acid level, haemoglobin, and urine albumin levels were comparable.

- Infants of mothers with severe preeclampsia and HELLP syndrome had significantly more NICU admissions, significantly more perinatal mortality and morbidity due to IUGR and preterm ($P<0.05$). Fetal distress, Small gestational age, Meconium fetal distress, Secondary APNEA, Preterm, Respiratory distress, Infant of diabetic mother, Intrauterine death, Low birth weight, occurrence of twins, and Fetoplacental insufficiency were similar in both groups.
- Group B had significantly more maternal complications, but type of maternal complication was comparable. The maternal mortality was comparable among the two groups.
- Group B had significantly more perinatal mortality and morbidity ($P<0.05$).
- Haptoglobin levels were low in Group B. There was a significant association of low haptoglobin at presentation with the development of HELLP syndrome in the study population ($P<.0001$). All the patients with severe preeclampsia without HELLP syndrome who developed HELLP during the follow up had low serum haptoglobin levels. Even among the patients whose HELLP persisted with time, most of them had low haptoglobin levels.
- Haptoglobin levels showed no significant association with fetomaternal outcome, maternal mortality, morbidity complications and perinatal mortality or morbidity, as well as with complete and partial HELLP in both Groups A and B.
- There was no significant association of haptoglobin with complete and partial HELLP based on Tennessee classification ($P=0.707$).

- Sensitivity and specificity of haptoglobin for predicting HELLP was 92.06% and 71.43% respectively with PPV and NPV of 76.3% and 90% respectively.

STRENGTHS OF OUR STUDY

Hypertensive disorders during pregnancy represent a significant public health problem throughout the world. Pregnancy complicated by severe preeclampsia with HELLP syndrome is associated with an increased risk of maternal and perinatal morbidity and mortality. This study will throw some light on this largely unrecognized category of hypertension in pregnancy.

1. There is a dearth of studies in India regarding evaluation of maternal and fetal outcome in severe preeclampsia with HELLP syndrome and severe preeclampsia without HELLP syndrome. Thus, our study can act as a stepping zone for further larger studies to find out maternal and fetal outcome in such Indian women.
2. Many of our results corroborated with other studies done at different times and in different places both in India as well as outside India. This study, thus, adds to the already existing literature about the fetomaternal outcomes in severe preeclampsia with and without HELLP syndrome.
3. A fairly reasonable number of cases were studied. So, it gives a fair idea of the fetomaternal outcomes of pregnant women with HELLP across various age groups encountered in a hospital setting.
4. We have also assessed the associations of haptoglobin levels with fetomaternal outcome, maternal mortality, morbidity complications and perinatal mortality or morbidity, as well as with complete and partial HELLP.

5. The results of this study show that, there is an urgent need to promote research and give greater importance in the medical curriculum to know the outcomes of HELLP and adopt preventive measures for the same.

LIMITATIONS OF THE STUDY

1. Our study was conducted in a setting which caters to patients belonging primarily to the lower or middle socio-economic strata and the data primarily reflects the situation in this cohort.
2. It was a single centre hospital based study with small sample size, and we recommend future multicentric studies to have more conclusive information about the associated risk factors.
3. Cause and effect relationship between some of the comorbid medical condition could not be drawn.

CONCLUSION

CONCLUSION

Preeclampsia and HELLP syndrome are the most common complications of pregnancy and posing a severe problem worldwide. This study demonstrates that pregnancies complicated by severe preeclampsia and HELLP syndrome have significantly higher maternal as well as perinatal mortality and morbidity Haptoglobin was significantly decreased in the women with HELLP syndrome. Serum Haptoglobin is statistically significant ($p<0.001$) between severe preeclampsia and HELLP syndrome in this study. There was no significant association of haptoglobin with fetomaternal outcome in women with and without HELLP. Though not a sole marker, it is usefull for early detection of the disease, to grade the severity of the disease, and to prevent severe preeclampsia progressing into HELLP syndrome. This in turn helps in proper management and would improve maternal and perinatal outcome.

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ANNEXURES

CASE PROFORMA

NAME: IP NO:

AGE: DOA:

OCCUPATION: DOD:

ADDRESS: EDUCATION:

HUSBANDS OCCUPATION: SOCIOECONOMIC STATUS: CHIEF COMPLAINTS:

HISTORY OF PRESENT ILLNESS:

OBSTETRIC HISTORY:

Marital life: Consanguinity:

Gravida: Para: living: Abortion: Dead:

Details of previous pregnancy:

Details of present pregnancy:

MENSTRUAL HISTORY:

Last menstrual period: Age of menarche: Expected delivery date:

Period of gestation:

Period of gestation according to early scan:

Past menstrual cycles:

PAST HISTORY:

HTN/DM/BA/TB/BLOOD DYSCRASIAS/EPILEPSY/THYROID DISORDER/CARDIAC DISEASE/ALLERGY

H/O blood transfusions:

H/O Surgeries or hospitalization:

PERSONAL HISTORY:

Sleep and appetite:

Diet:

Bowel and bladder:

FAMILY HISTORY:

DRUG HISTORY:

GENERAL EXAMINATION:

General condition: Fair/ moderate/ Poor Built: Nourishment:

Ht: cms Wt: kgs BMI:

Pallor: Icterus:

Cyanosis: Clubbing:

Lymphadenopathy: Edema:

VITALS:

Pulse rate: Respiratory rate: Blood pressure : Temperature:

SYSTEMIC EXAMINATION:

Cardiovascular system: Respiratory system: Central nervous system:

Per abdomen: Uterus size:

Relaxed / Irritable / Acting Presentation: cephalic/ Breech/ other

FHS:

LOCAL EXAMINATION:

Per vaginum: Effacement:

Dilatation: Station: Membranes: Pelvis:

PROVISIONAL DIAGNOSIS:

INVESTIGATIONS:

Blood group and Rh typing:

CBC: HB: HIV:

PCV: HbsAG:

RBC: VDRL:

WBC: PLT:

RBS:

Urine analysis: Albumin-

Sugar- Microscopy-

Liver Function tests- Renal function tests-

Uric acid-

LDH-

Coagulation Profile-

Serum Electrolytes-

Serum Haptoglobin-

Post Delivery :

Complete Blood Count-

Liver Function tests-

Renal function tests-

LDH-

OBSTETRICS SCAN:

DELIVERY DETAILS:

Mode of delivery: Vaginal delivery/ Caesarean section

CAESAREAN-

Indication:

DETAILS OF NEONATE:

Sex: Date: Time: Birth weight:

APGAR : 1″- 5″-

Admission to NICU:

MATERNAL COMPLICATIONS:

Hypertension Convulsions

Premature rupture of membranes

Ante partum hemorrhage Postpartum hemorrhage Uterine hyperstimulation

DIC

FETAL COMPLICATIONS:

Respiratory distress Admission to NICU

CONDITION AT DISCHARGE:

Mother: Baby:

PATIENT INFORMATION SHEET

Study title: Maternal and fetal outcome in women with severe preeclampsia with HELLP Syndrome

Study location: R L Jalappa Hospital and Research Centre attached to Sri Devaraj Urs Medical College, Tamaka, Kolar.

Patients who are of clinically proven severe preeclampsia without HELLP syndrome and severe preeclampsia with HELLP syndrome cases beyond 20 weeks of gestation admitted to OBG department of R L Jalappa hospital attached to Sri Devaraj Urs medical college are recruited in the study after obtaining patient information consent.

4 ml of venous blood is collected from the study subjects for serum haptoglobin levels estimation.

Details-

Please read the following information and discuss with your family members. You can ask any question regarding the study. If you agree to participate in the study we will collect information (as per proforma) from you or from a person responsible for you or both. Relevant history will be taken. This information collected will be used only for dissertation and publication.

All information collected from you will be kept confidential and will not be disclosed to any outsider. Your identity will not be revealed. This study has been reviewed by the Institutional Ethics Committee and you are free to contact the member of the Institutional Ethics Committee. There is no compulsion to agree to this study. The care you will get will not change if you don't wish to participate. You are required to sign/ provide thumb impression only if you voluntarily agree to participate in this study.

For further information

contact Dr. Nikitha S

Vasan

Post graduate, Department of Obstetrics and Gynaecology R L Jalappa hospital, Kolar .Phone no: 9845964429.

SRI DEVARAJ URS MEDICAL COLLEGE & RESEARCH CENTRE, TAMAKA, KOLAR

PATIENT CONSENT FORM

Case no:

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

"**MATERNAL AND FETAL OUTCOME IN WOMEN WITH SEVERE PREECLAMPSIA WITH HELLP SYNDROME**"

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:

4 ml venous blood sample taken for serum Haptoglobin levels estimation.

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_____

Signature of Researcher /person taking the consent_____

Date _____

Name and Address of Principal Investigator: Dr. Nikitha S Vasan

R.L Jalappa Hospital Tamaka, Kolar.

KEY TO MASTER CHART

- UHID : Unique Health Identification

- SES: Socio Economic Status

- Parity :
- G1- Primigravida
- G2- Gravida 2
- G3- Gravida 3
- G4- Gravida 4
- Booked/ Unbooked
- 0- Booked
- 1- Unbooked

- Study Group
- 0- Severe Preeclampsia without HELLP syndrome
- 1- Severe Preeclampsia with HELLP syndrome

- Nausea
- 0- No complaints of nausea
- 1- Complains of nausea

- Head ache
- 0- No complaints of headache
- 1- Complaints of headache
- Pain abdomen
- 0- No complaints of pain abdomen
- 1- Complaints of pain abdomen

- SBP- Systolic Blood Pressure
- DBP- Diastolic Blood Pressure

- AFI
- 0 AFI <5 cm
- 1- AFI >5 cm

- Fundoscopy
- 0- Normal
- 1- Abnormal
- Peripheral smear
- 0- Normocytic normochromic anemia
- 1- microcytic hypochromic
- 2- dimorphic anaemia

- RFT (Renal function test)
- 0- Normal
- 1- Abnormal

- Cause for perinatal morbidity/mortality
- 0 No perinatal morbidity/mortality
- 1 Preterm
- 2 IUGR
- 3 Low birth weight
- 4 Infant of diabetic mother
- 5 Respiratory distress
- 6 Meconium aspiration with fetal distress
- 7 Twins
- 8 Very low birth weight
- 9 Still Born
- 10 Secondary Apnea
- 11 Fetoplacental insufficiency
- 12 SGA

- 13 Intra uterine fetal demise

- Maternal Complications
- 0 No complications
- 1 Placenta previa
- 2 Overt Diabetes/GDM
- 3 Anemia
- 4 Antepartum hemorrhage
- 5 Convulsions
- 6 DIC
- 7 Hepatorenal failure
- 8 ICU admission
- 9 Inotropes
- 10 Abruption
- 11 Ascitis
- 12 Adult respiratory distress syndrome

- Blood/ blood products transfusion
- 0 Yes
- 1 No

MASTER CHART

Name	UHID	AGE	SES	PARITY	BOOKED/ UNBOOKED	REFERRED	Gestational Age	Study Group	NAUSEA/VOMITING	HEADACHE	PAIN ABDOMEN	SBP	DBP	PEDAL EDEMA	AFI	URINE ALBUMIN	FUNDOSCOPY	PS	TB	DB	SGOT	SGPT	ALP	LDH	URIC ACID	RFT	PT	APTT	INR	HB	PLATELET	MOD	B WT	APGAR	NICU	PERINATAL MORBIDITY	PERINATAL MORTALITY	CAUSE OF Perinatal mortality/morbidity	MATERNAL COMPLICATIONS	MATERNAL MORTALITY	Blood/bood products transfusin	Haptoglobin	Postpartum TB	Postpartum DB	Ppostpartum SGOT	Postpartum SGPT	Postpartum ALP	Postpartum LDH	Post Hb	Puroparturn PLT
Suguna	600709	19	III	G1	0	0	35+1	0	0	1	0	186	140	GRADE3	0	3+	0	0	0.1	0.2	38	29	34	414	7.5	0	12.9	22.4	1	13.5	135000	1	1.64	0	1	1	0	1,2,3	0	0	0	29.59	0.2	0.4	72	40	64	502	12	102500
Mallika	590557	21	IV	G1	0	0	39+6	0	0	0	0	164	110	GRADE2	1	2+	0	0	0.7	0.1	26	23	344	215	3.9	0	14.5	39.39	1.08	10.2	358000	1	3.6	0	0	0	0	0	0	0	0	120.86	0.6	0.2	29	22	340	216	10	358000
Shwetha	592579	22	III	G1	0	0	38	0	0	1	0	180	120	GRADE2	0	2+	0	0	0.7	0.4	24	15	15	331	5.5	0	33.1	13.44	1	9.5	353000	1	3.2	0	0	0	0	0	0	0	0	116.31	0.7	0.3	24	16	112	332	9.1	353000
Lavanya	592564	23	III	G1	0	0	30+5	0	0	0	0	166	110	GRADE1	0	3+	0	0	0.4	0.3	25	18	98	252	4.4	0	14.4	26.6	1.07	10.9	239000	1	1.26,1.32	0	0	1	1	0	1	0	0	75.74	0.4	0.3	26	20	101	250	10.3	235000
Sabiha Banu	593100	24	III	G3	0	0	36+6	0	0	0	1	160	110	GRADE2	0	2+	0	0	0.6	0.3	11	6	151	141	4.4	0	17.3	28.9	1.47	14.4	198000	1	3.64	0	0	1	0	4	2	0	0	100.97	0.5	0.4	12	10	148	140	13	197500
Shruthi	590991	23	II	G1	1	0	26	0	1	0	1	166	120	GRADE1	1	2+	0	1 WITH SCHIZOCYTES	0.6	0.1	28	16	99	337	7.1	0	15.7	31.7	1.2	8.3	236000	0	0.5	0	0	1	1	0	3,4	0	1	82.64	0.7	0.3	11	9	144	139	13.2	197500
Roja	592470	21	IV	G1	0	0	39	2	1	1	0	180	120	GRADE2	0	3+	0	0	0.2	0.02	99	76	253	992	5.2	0	13.5	35.2	1	6.2	82000	0	2.4	0	0	0	0	0	3	0	1	74.19	0.2	0.1	96	74	250	986	5.8	90000
Shobha	593577	24	II	G3	0	0	34+5	1	0	1	0	160	120	GRADE2	0	2+	0	0	1	0.7	139	69	137	1000	8.7	0	18.1	31.1	1.43	13.1	134000	0	1.21	1	1	1	1	1,2	0	0	0	<15	0.8	0.6	121	60	131	992	12.6	141000
Sabiha	597100	22	III	G1	0	1	39+2	0	0	0	0	160	120	GRADE1	0	3+	0	0	0.1	0.3	26	31	195	253	10.2	0	13.1	33.1	1	10.4	253000	0	2.5	0	0	0	0	0	0	0	0	304.7	0.1	0.2	23	30	196	252	10.2	253000
Divya	595260	23	II	G4	1	0	29+1	2	1	1	1	170	110	GRADE3	1	3+	GARDE1	1	4.5	2.4	495	122	179	2840	0.7	1	22.1	57.3	1.8	9.8	61000	0	1.19	1	1	1	1	1,2	5	0	1	105.12	3.2	1.1	392	96	136	1960	9.2	71000
Syeeda	594066	20	III	G2	0	0	37+1	1	1	0	0	166	120	GRADE	1	2+	0	1 WITH SCHIZOCYTES	0.3	0.2	23	22	192	623	1.2	0	21.1	33.2	1	10.5	98000	0	2.1	1	1	1	0	2,3	0	0	0	69.19	0.3	0.2	19	21	122	421	10.1	115000
Lavanya	592564	22	II	G1	0	0	30+5	0	0	0	0	160	110	GRADE2	0	2+	0	0	0.7	0.3	25	18	98	252	4.4	0	14.4	26.6	1.07	10.9	239000	1	1.26,1.32	1	0	1	1	0	1	0	0	215.35	0.4	0.2	22	18	89	223	9.9	238500
Divya	594428	24	III	G4	0	0	29+1	2	1	1	1	170	110	GRADE2	1	2+	1	0	4.9	1.8	1220	303	326	2465	9.8	0	22.1	57.3	1.8	9.8	41000	0	1.19	1	0	1	1	0	5	0	1	54.92	2.2	0.5	462	290	226	1253	9.7	69000
Munirathna	594102	21	IV	G1	0	0	38+6	0	0	0	1	160	110	GRADE1	1	2+	0	0	0.8	0.5	23	14	268	246	5.2	0	14.3	29.4	1.07	12	270000	1	3.3	0	0	0	0	0	0	0	0	170.66	0.6	0.4	20	11	192	202	11.8	269200
Asma	692144	28	II	G1	0	0	38+1	0	0	0	1	166	120	GRADE1	0	3+	0	0	0.2	0.1	16	7	186	375	7.2	0	15.4	29.1	1.1	10.4	195000	1	2.7	0	0	0	0	0	0	0	0	151.01	0.2	0.1	16	11	142	232	10.6	195000
Madhiha	566070	22	IV	G2	0	0	37+3	0	0	1	0	170	110	GRADE2	0	2+	0	0	0.1	0.02	21	31	165	258	6.4	0	12.3	33.1	1	12.1	243000	0	2.6	0	0	0	0	0	0	0	0	137.91	0.1	0.2	21	26	160	192	11.4	242000
Kalavathi	597060	25	III	G1	0	0	35+5	1	1	1	0	200	122	GRADE3	1	3+	0	1	0.2	0.01	86	72	223	655	5.6	0	11.2	29.5	0.8	9.6	115000	1	1.75	0	1	1	0	1,2,3	3	0	0	44.58	0.1	0.1	52	54	181	520	9.1	126000
Amrutha	598483	21	III	G3	0	0	37+5	0	0	1	0	180	120	GRADE2	0	2+	0	0	0.3	0.2	31	40	189	351	4.5	0	14.1	34.9	1	10.2	245000	0	2.8	0	0	0	0	0	0	0	0	105.75	0.3	0.2	30	26	156	220	10	246000
Shilpa	598154	22	II	G1	0	0	40	0	1	1	1	174	110	GRADE2	0	2+	0	0	0.7	0.3	29	18	215	440	8.4	0	13.6	49	1.01	9.4	288000	1	2.68	0	0	0	0	0	5	1	0	<15	0.4	0.3	36	21	223	602	9	251000
Nagaveni	597041	26	III	G1	0	0	39+6	1	0	0	0	166	120	GRADE2	0	3+	1	0	0.8	0.3	57	21	200	3140	5.8	0	13.6	25.2	1	7.3	40000	0	2.76	0	0	0	0	0	0	0	0	<15	0.4	0.2	26	16	116	1250	7.1	56000
Shwetha	581651	29	II	G1	0	0	38+1	0	0	0	0	180	120	GRADE1	0	3+	0	0	0.5	0.4	18	20	117	257	3.5	0	16	30.5	1.22	12.2	457000	0	3.13	0	0	0	0	0	0	0	0	181.48	0.2	0.1	18	19	94	119	11	442000
Lakshmi	465692	22	II	G3	0	1	35+6	0	0	0	1	170	120	GRADE2	0	3+	0	0	0.4	0.2	21	12	191	236	6.2	0	14.4	49.9	1.06	9.8	272000	1	2.6	0	0	0	0	0	0	0	0	25.2	0.6	0.4	41	27	194	522	8.1	190000
Shabana Taj	600108	20	III	G1	0	1	40+1	0	0	0	0	166	110	GRADE2	0	2+	0	0	0.1	0.01	32	29	157	452	7.9	0	13.2	33.3	1.01	11	166000	0	2.8	0	0	0	0	0	2	0	0	129.87	0.1	0.1	26	19	101	352	9.2	165000
Shamala	601391	26	II	G1	0	0	39+2	0	0	0	0	174	120	GRADE3	0	3+	0	0	0.3	0.1	22	27	165	325	4.5	0	11.5	32.6	1	10.9	326000	0	2.4	0	0	0	0	0	0	0	0	124.59	0.2	0.2	20	21	141	225	9.6	328000
Sahida	600699	22	IV	G2	0	0	36+6	2	1	1	0	184	120	GRADE2	1	2+	0	2	0.1	0.01	92	98	256	952	6.6	0	12.6	35.5	1.03	6.2	32000	0	1.5	1	1	1	0	1,2,3	3	0	1	119.87	0.1	0.1	66	52	198	722	6.9	59000
Rukmini	594528	27	III	G1	0	0	28+4	0	0	0	0	170	116	GRADE1	0	2+	0	2	0.2	0.01	34	25	156	236	7.8	0	14.4	50.8	1.07	8.2	165000	0	1.06	1	1	1	1	1,2	3	0	1	60.77	0.1	0.2	54	19	94	322	8	135000
HAJIRA	608050	22	IV	G1	0	0	39+3	0	0	0	1	180	120	GRADE3	0	3+	0	2	0.4	0.3	26	15	261	267	7.7	0	19.7	32.5	1.55	8.8	230000	0	2.98	0	0	0	0	0	0	0	0	<15	0.4	0.3	29	20	264	424	8.2	102500
Chowdamma	406691	28	IV	G2	1	0	37+2	2	1	1	0	200	116	GRADE2	0	2+	0	2	0.1	0.01	67	34	198	722	6.4	0	12.4	33.3	1	9.2	98000	0	2.1	0	1	1	0	2,3	0	0	0	<15	0.2	0.1	34	22	88	432	8.3	115000
Shwetha	581651	22	III	G1	0	0	38+5	1	0	0	1	160	110	GRADE1	0	2+	0	0	1.2	0.1	17	26	165	618	5.4	0	11.4	29.12	1.01	10.4	52000	0	2.12	0	1	1	0	3,5	0	0	0	19.24	0.9	0.2	19	18	84	522	10	98000
Lakshmi	609348	23	II	G1	0	0	32+1	0	0	1	0	180	110	GRADE1	0	3+	0	0	0.6	0.5	26	12	307	259	7.5	0	13.45	31.5	0.98	11.6	228000	0	1.3,1.32	1	1	1	0	1,3,5	0	0	0	45.46	0.2	0.3	19	20	115	221	10.6	228200
Shalini	609355	28	II	G2	0	0	34	1	1	0	1	160	110	GRADE3	1	3+	GRADEIII	1+echinocytes	4.3	1.3	511	286	218	635	8.8	1	17.1	13.5	1.31	12.4	69000	0	1.3	1	0	1	1	1,2	6,7	1	1	64.27	2.2	0.9	322	196	202	554	12	89000
Roopa	610190	29	III	G1	0	0	38+5	0	0	0	1	180	110	GRADE1	0	2+	0	0	0.3	0.3	29	23	150	208	7.2	0	11.4	28.4	0.87	13	235000	1	1.6	0	1	1	0	1,2	0	0	0	148.56	0.1	0.2	16	20	88	188	11.6	239000
Simran	610167	18	II	G1	0	0	35+6	0	0	0	1	160	114	GRADE1	0	3+	0	0	0.6	0.4	19	17	252	247	5.3	0	12.6	30.25	0.91	12.6	295000	1	1.88	0	1	1	0	1,2	0	0	0	132.63	0.2	0.1	12	22	166	220	12	295000
Tabassum	611138	22	IV	G2	0	0	36+4	0	0	0	1	160	110	GRADE1	0	2+	0	0	0.6	0.3	35	29	241	271	6.3	0	12.3	25.5	1	10	269000	1	2.38	0	0	0	0	0	0	0	0	120.3	0.4	0.1	29	30	240	225	10.2	270000
Shilpa	610912	25	III	G2	0	0	39+4	0	0	0	1	166	110	GRADE1	0	3+	0	0	1.1	0.3	16	21	269	261	7.6	0	17.1	33.5	1.31	9.4	212000	1	2.36	0	0	0	0	0	0	1	0	42.57	0.9	0.2	11	20	184	220	10	215000
Mubeena Taj	610158	30	III	G2	0	0	37	0	0	0	1	160	110	GRADE2	0	3+	0	0	0.4	0.4	14	15	185	211	4.6	0	14.6	34.05	1.09	9.6	490000	0	2.46	0	0	0	0	0	0	0	0	167.68	0.2	0.1	12	20	87	166	10.6	489500
Pavani	609742	25	II	G2	0	0	39+6	0	0	0	1	166	120	GRADE2	0	3+	0	0	0.6	0.4	33	26	336	294	7.1	0	12.6	30.1	1.1	10.6	127000	0	3.12	0	0	0	0	0	0	0	0	88.42	0.2	0.1	19	22	215	186	10	135000
Sumithra	610708	22	IV	G1	0	0	40	0	0	0	1	170	106	GRADE2	0	3+	0	0	0.5	0.3	24	24	348	255	5.2	0	11.7	30	1	12	126000	0	2.48	0	0	0	0	0	0	0	0	16.33	0.3	0.1	22	24	235	202	11.8	129000
Shamshad	614639	20	III	G1	0	0	30+5	1	0	0	0	180	120	GRADE2	0	4+	0	0	0.2	0.1	38	27	244	605	7.5	0	11.5	28.8	1.2	14	99000	1	1.37	1	1	1	0	1,2	5	0	0	<15	0.1	0.1	29	26	222	504	12.4	112000
Prema	614227	22	III	G1	0	0	39+4	2	1	0	1	166	110	GRADE2	0	3+	0	2 WITH SPHEROCYTES , SCHIZOCYTES	0.8	0.1	226	136	226	615	6.1	0	12.1	31.1	1.1	13.2	77000	0	2.06	0	1	1	0	6	0	0	0	<15	0.6	0.1	212	98	78	119	11.4	105000
Sudharani	613728	20	II	G1	0	0	41+1	0	0	0	1	160	116	GRADE1	0	3+	0	0	0.1	0.5	18	20	156	156	5.7	0	13	31	1	10.6	182000	0	1.88	0	1	1	0	2,3	0	0	0	96.2	0.1	0.2	18	19	111	124	11	183500
Sangeetha	612821	25	II	G1	0	0	39+3	0	1	0	1	166	120	GRADE1	0	2+	0	0	0.6	0.4	24	20	229	224	6.7	0	12.9	30	1.01	12.9	212000	1	2.36	0	0	0	0	0	0	0	0	138.27	0.3	0.2	22	16	219	220	13	220000
DEEPA	612698	32	III	G2	0	0	39+3	0	0	0	0	170	110	GRADE3	0	3+	0	1	0.6	0.6	21	21	222	292	6.6	0	13	29.3	1	8.1	359000	1	3.22	0	0	0	0	0	3	0	1	103.74	0.3	0.1	18	22	139	105	8	356000
Chowdamma	612862	21	IV	G1	1	0	35+4	2	0	0	0	170	110	GRADE1	0	2+	0	1	1.1	1.2	98	72	328	826	7.1	0	13.2	34.1	1.2	8	67000	1	1.2	1	1	1	0	1.3.5	3,5	0	1	<15	0.9	0.6	78	66	225	724	7.2	96000
Yashodha	614646	27	III	G5	0	0	38+5	2	0	0	0	166	120	GRADE1	0	2+	0	2+target cells	0.1	0.01	66	90	252	1905	9.6	0	13	30.2	1	6.3	37000	1	3.67	0	0	0	0	0	3	0	1	<15	0.1	0.1	26	66	194	674	7.1	49000
Suraiya Sulthana	652713	20	I	G1	0	1	36+1	0	0	0	0	166	110	GRADE2	0	2+	0	0	0.2	0.1	21	10	223	285	5.3	0	12.6	32.1	1.01	10.4	409000	1	1.64,1.8	0	1	1	0	1,2,3,6	0	0	0	127.27	0.2	0.1	11	15	171	163	11.4	409000
Swathi	495740	24	II	G1	0	1	34+6	1	0	0	1	166	120	GRADE1	0	3+	0	0	0.2	0.5	44	29	252	706	5.4	0	12.25	35.85	0.9	10.5	67000	1	1.76	0	1	1	0	1,3,5	0	0	0	106.07	0.2	0.3	35	21	164	659	10.2	61000
Ruksar	615063	18	III	G1	0	0	39+2	0	0	0	1	164	110	GRADE3	0	2+	0	1	0.1	0.1	18	30	232	244	6.8	0	13.2	33.9	0.98	8.1	313000	1	3.24	0	0	1	0	5	3	0	1	105.68	0.1	0.1	16	30	231	244	8.4	310000
Roja	613748	22	II	G2	0	0	37+3	1	0	0	0	160	110	GRADE1	0	1+	0	0	0.7	0.12	20	14	126	628	5.2	0	12.1	30.21	0.1	10	104000	0	2.4	0	0	0	0	0	0	0	0	<15	0.4	0.1	20	16	112	523	9.4	112000
Ummesalma	615068	19	II	G1	1	0	37+5	0	1	1	1	176	120	GRADE2	0	2+	0	0	0.1	0.2	16	24	221	222	4.5	0	12.3	30.1	0.92	9.2	252000	0	1.32	0	1	1	0	2,3	3	0	0	126.39	0.1	0.1	16	22	184	196	10	250000
Lakshinarasamma	615349	23	IV	G1	0	0	32	1	1	1	0	200	120	GRADE2	1	4+	0	1 WITH TARGET CELLS	0.2	2.3	141	90	184	2000	4.5	0	18.2	38.2	1.2	12.9	15000	0	1	1	1	1	1	1,2	8,9	0	1	<15	0.2	1.2	135	84	124	1850	12	22000
Fathima	615988	23	II	G1	0	0	33+3	2	1	1	0	220	140	GRADE1	0	3+	0	0	1.7	0.3	257	125	220	1000	7	0	12.1	33.8	0.89	14	124000	0	1.2	1	1	1	1	1	5	0	1	13.4	1.2	0.2	212	102	112	965	13.2	122200
Prema	619796	25	III	G1	0	0	32+1	1	1	1	0	200	120	GRADE2	0	3+	0	0	0.3	0.1	30	33	190	1120	7.6	0	12.3	31.2	1	14.1	40000	1	1.54	0	1	1	0	1,2,3	5	0	0	34.5	0.2	0.2	29	32	188	899	12.6	43000
Zamreen Taj	618798	23	III	G1	0	0	37+3	0	0	0	0	170	120	GRADE2	0	3+	0	0	0.2	2	18	19	164	235	6	0	12.1	30.6	0.9	10.5	206000	1	2.3,1.94	0	1	1	1	1,3,7	0	0	0	178.39	0.2	1.6	18	20	153	216	10.2	206500
Heena kouser	624792	25	II	G1	0	0	37+3	0	0	0	0	220	120	GRADE3	1	3+	0	0	0.4	0.1	26	140	213	280	6.8	0	12.5	3.2	1	12.4	129000	0	2.3	0	0	0	0	0	0	0	0	153	0.3	0.2	23	139	215	268	12.6	129000
Monika	625730	20	II	G2	0	0	38+2	1	0	1	1	160	120	GRADE3	0	3+	0	1+spherocytes	0.3	0.1	21	17	272	720	6.9	0	14.2	33.2	1	9.6	57000	1	1.96,2.92	0	0	0	0	0	3,5	0	1	<15	0.2	0.1	20	17	269	622	9.1	60000
Gayathri	626126	21	III	G1	0	0	37+3	0	0	0	0	160	114	GRADE1	0	2+	0	0	0.1	0.1	16	20	172	192	5.3	0	12.1	30.3	0.9	10.8	276000	0	2.92	0	0	0	0	0	0	0	0	165.96	0.1	0.1	16	21	163	190	10.2	276000
Swarna	626103	20	II	G2	0	0	34	2	1	1	0	190	110	GRADE1	1	3+	0	1 WITH TARGET CELLS	2	0.3	465	201	256	1720	7	0	13.2	29.7	1.03	12.6	58000	0	1.2	1	1	1	1	1,2	0	0	1	<15	1.2	0.2	360	191	220	1569	12.2	60000
Rajeshwari	765241	24	III	G2	0	0	38+4	0	0	1	1	160	110	GRADE1	0	2+	0	0	0.1	0.2	25	33	184	312	4.1	0	15.2	34.1	1.18	11.5	190000	1	3.88	0	1	1	0	5	0	0	0	<15	1.3	0.4	72	45	201	412	10	142000
Geetha	773103	20	IV	G1	0	0	31+4	2	1	1	0	160	110	GRADE3	0	2+	0	0	0.3	0.01	71	38	247	633	8.7	0	12.5	29.9	1.05	10.4	52000	0	1.1	1	1	1	0	1,2	5	0	0	<15	0.1	0.1	53	32	213	592	10.1	64000
Nazeema	636324	22	IV	G1	0	0	36.6	2	0	0	0	166	110	GRADE1	0	2+	0	1	0.1	0.2	76	23	231	698	5.2	0	11.4	31.4	1	9.2	96000	1	2.3	0	1	1	0	5	5	0	0	<15	0.1	0.2	70	22	219	602	9.4	98500
RADHA	636854	34	II	G3	1	0	28+5	2	1	1	0	170	110	GRADE2	1	3+	0	0	0.2	0.01	84	95	196	776	9.3	0	11.7	30.6	0.9	13.2	80000	0	1.1	1	1	1	1	5	0	0	0	26.25	0.2	1	80	89	165	769	13	83000

Name	UHID	AGE	SES	PARITY	BOOKED/ UNBOOKED	REFERRED	Gestational Age	Study Group	NAUSEA/VOMITING	HEADACHE	PAIN ABDOMEN	SBP	DBP	PEDAL EDEMA	AFI	URINE ALBUMIN	FUNDOSCOPY	PS	TB	DB	SGOT	SGPT	ALP	LDH	URIC ACID	RFT	PT	APTT	INR	HB	PLATELET	MOD	B WT	APGAR	NICU	PERINATAL MORBIDITY	PERINATAL MORTALITY	CAUSE OF Perinatal mortality/morbidity	MATERNAL COMPLICATIONS	MATERNAL MORTALITY	Blood/bood products transfusin	Haptoglobin	Postpartum TB	Postpartum DB	Ppostpartum SGOT	Postpartum SGPT	Postpartum ALP	Postpartum LDH	Post Hb	Puroprtum PLT
Nagaveni	638285	21	III	G1	0	0	35+4	2	1	1	0	160	110	GRADE1	1	3+	0	0	1.2	0.2	98	74	235	864	8.1	0	13.1	33.4	1.3	7.4	63000	0	1.02	1	1	1	0	2,3,5	3,5	0	1	<15	0.9	0.1	95	69	221	759	7.2	66000
Sumayya	764279	25	III	G1	0	0	34+5	0	0	0	0	166	110	GRADE1	0	2+	0	1	0.5	0.01	22	11	259	401	4.5	0	12.5	35.6	1	7.8	200000	1	2.02	0	1	1	0	1,2	3,10	0	1	116.76	0.4	0.1	22	12	246	399	8	201200
Sowmya	643712	22	II	G2	0	0	37+3	0	0	0	0	180	110	GRADE1	0	2+	0	0	0.5	0.1	26	27	202	560	5.4	0	14.6	30.25	1.18	8.7	200000	1	2.4	0	1	1	0	2	3	0	1	<15	0.4	0.2	28	26	223	606	8.1	147000
Dilshad	644585	20	IV	G1	0	0	39+1	1	0	0	1	170	110	GRADE3	0	3+	0	0	0.4	0.1	75	72	229	655	7.2	0	11.8	28.4	1	10.2	322000	0	2.72	0	0	0	0	0	3,5	0	1	135.06	0.2	2	69	70	213	589	10	321000
Rihana	769849	22	III	G1	0	1	38+2	0	0	0	1	160	110	GRADE2	0	2+	0	0	0.2	0.01	22	13	195	412	5.5	0	11.6	31.9	1	10.7	368000	1	2.9	0	0	0	0	0	0	0	0	36.28	0.1	0.01	22	16	192	396	10.4	367000
Malleshwari	666865	26	II	G3	0	0	36+6	2	0	0	0	166	110	GRADE1	0	2+	0	macrocytic hypochromic anemia + schizocytes	0.4	0.5	64	90	199	720	7.6	0	12.1	32.6	1.03	9.7	48000	0	1.9	0	1	1	0	1,2	3	0	1	<15	0.4	0.2	65	79	183	720	9.6	52000
Kavyashree	668028	23	II	G1	0	0	32	1	0	0	0	180	110	GRADE2	0	2+	0	2 WITH ECHINOCYTES	0.4	0.2	47	34	172	671	5.7	0	12.5	26.5	1	9.1	87000	1	1.68	0	1	1	0	1	3	0	0	<15	0.3	0.2	39	32	170	591	8.9	90000
Radha	668154	22	III	G1	0	0	31+4	0	1	1	0	160	112	NIL	0	3+	0	0	0.5	0.2	27	6	244	314	9.6	0	13.9	29.3	1.1	11.5	106000	0	1.06	0	0	1	0	1,2,8	5,10	0	0	124.18	0.3	0.2	30	11	234	296	11	112000
Vanitha	668172	25	II	G4	0	0	35+4	1	0	0	0	170	110	NIL	0	2+	0	0	0.2	0.1	15	13	206	674	7.4	0	10.2	22.4	0.78	8.9	27000	0	2.7	0	0	0	0	0	5	0	1	<15	0.2	0.1	16	19	178	592	8	36000
Jayanthi	667317	24	III	G2	0	0	37+4	1	0	0	0	166	110	NIL	0	2+	0	1	0.6	0.1	39	26	151	816	4.1	0	12	27.3	0.8	5.7	104000	0	2.75	0	0	0	0	0	5	0	1	<15	0.4	0.1	30	22	132	789	6	112000
Roja	683844	25	III	G4	0	0	37+1	1	0	0	1	170	110	GRADE2	1	2+	0	1 WITH SCHIZOCYTES	0.6	0.1	17	24	235	816	9	0	11.7	28.7	1	8.9	108000	0	1.39	1	1	1	1	1,2	5	0	1	78.59	0.3	0.2	20	19	191	793	8.1	108500
Ashwini	691768	22	II	G1	0	0	39+5	0	0	0	1	164	110	GRADE1	1	3+	0	0	0.2	0.02	12	19	194	254	6.9	0	12.5	35.75	1	8.9	309000	0	2.75	0	0	1	0	0	5	0	0	117.6	0.2	0.1	13	19	176	194	7.9	310000
Asma Rawat	692144	28	III	G1	0	0	38+1	0	0	0	1	166	110	GRADE1	1	2+	0	0	0.2	0.01	16	7	186	268	8.2	0	12.6	31.2	1	10.4	195000	1	2.7	0	0	0	0	0	0	0	0	26.4	0.2	0.1	16	11	161	178	10	195450
Radha	691371	24	IV	G2	0	0	34+3	1	0	0	1	160	110	GRAD21	0	2+	0	0	1.1	0.1	152	77	266	926	6.9	0	11.2	27.1	0.9	12.6	145000	1	1.84	0	1	1	0	1	5	0	0	16.9	0.8	0.1	132	56	215	916	12.1	145000
Roja	612839	21	IV	G2	0	0	32+2	1	0	0	0	160	120	GRADE2	1	3+	1	macrocytic hypocromic anemia + schizocytes	0.3	0.1	22	33	63	696	7.8	0	12.3	30.9	1	13.4	67000	0	1.37	1	1	1	1	9	0	0	1	19.8	0.2	0.1	22	30	57	602	12.9	84000
Srimathi	598929	24	II	G2	0	0	36+6	0	0	0	1	170	110	NIL	0	3+	0	0	0.2	0.01	27	17	253	283	7.2	0	15.1	41.8	1.13	9.2	228000	1	1.7	0	1	1	0	1,3,2	10	0	1	126.4	0.1	0.1	26	20	243	251	8.6	226500
Lakshmi	713091	25	IV	G1	0	0	39+3	0	0	0	1	164	112	GRADE2	0	3+	0	0	0.2	0.01	14	19	186	203	7.5	0	11.6	33.2	0.9	11.8	201000	1	2.7	0	0	0	0	0	0	0	0	231.8	0.1	0.1	14	20	174	199	10.9	201100
Roopavathi	750540	26	III	G2	0	0	35+4	2	1	1	1	200	120	GRADE3	0	3+	0	0	0.2	0.1	188	172	290	763	8.4	0	10.43	28.15	0.8	11.7	99000	1	1.92	0	1	1	0	1,2	0	0	0	31.6	0.2	0.2	176	165	253	699	10.4	102000
Shilpa	768367	25	II	G2	0	0	37+5	0	0	0	1	160	116	GRADE1	0	2+	0	2	0.5	0.01	28	13	228	312	5.1	0	13.1	30.6	1.12	7.9	226000	0	2.42	0	0	0	0	0	0	0	1	195.7	0.4	0.2	26	15	220	265	8	226000
Jabeen Taj	609009	36	III	G3	0	0	37+1	1	1	1	0	180	120	GRADE2	0	3+	0	0	0.8	0.6	92	64	347	654	9.9	0	12.5	33	0.9	13.3	189000	1	2.3	1	1	1	0	10	0	0	0	26.4	0.6	0.4	88	60	291	545	12.9	189000
Sandhya	703614	24	II	G3	0	1	40+1	0	0	0	1	170	110	GRADE2	1	2+	0	0	5.8	0.4	15	15	264	253	5.1	0	11.7	26.2	0.94	8.7	243000	1	3.4	0	0	0	0	0	3	0	1	87.1	3.9	0.2	18	15	235	199	8.1	243000
RAVALI	712198	25	III	G5	0	0	39+5	0	0	0	1	170	110	GRADE1	0	3+	0	0	0.4	0.01	31	34	193	366	6.3	0	11.4	31.2	1.04	13.3	286000	0	3.54	0	1	1	0	5	0	0	0	104.5	0.3	0.1	30	34	190	323	13.1	286000
CHANDRAMMA	704033	30	II	G2	0	0	38+6	0	0	0	0	166	124	GRADE2	0	2+	0	0	0.1	0.1	16	15	183	253	2.9	0	12.3	33.1	1.1	10.2	251000	1	2.34	0	0	1	0	2	0	0	0	121.01	0.1	0.1	15	15	182	242	9.8	251500
NAGAVENI	706901	24	IV	G3	0	0	37+2	0	0	0	0	160	110	GRADE2	0	3+	0	0	0.3	0.1	35	6	226	295	7.2	0	11.5	30.2	1	12.1	184000	1	1.8	0	1	1	0	1,3,11	0	0	0	24.1	0.3	0.2	52	23	293	400	11	182000
GAYATHRI	709479	23	III	G1	0	1	40+4	0	0	0	1	170	110	GRADE3	0	2+	0	0	0.6	0.2	13	6	298	331	6.5	0	14.05	26.55	1.44	9.1	363000	1	3.76	0	0	0	0	0	3	0	0	86.4	0.4	0.2	15	10	286	323	9	363000
Nethravathi	706157	28	IV	G3	0	0	40+1	0	0	0	1	160	110	GRADE2	0	3+	0	0	0.1	0.4	19	17	303	265	7.1	0	13.1	30.2	1.02	11.5	245000	0	4	0	0	0	0	0	0	0	0	18.04	0.1	0.2	19	17	296	266	10.9	245050
Kalyani	708415	19	II	G1	0	0	40+3	0	0	0	1	160	110	GRADE2	0	2+	0	0	0.1	0.2	13	17	196	196	2.8	0	13.1	29.6	1	12.2	261000	0	3.1	0	1	1	0	5	0	0	0	124.05	0.1	0.2	13	15	188	175	12.1	261000
DAYANA	705696	23	II	G2	0	0	38+2	0	0	1	0	160	114	GRADE1	0	2+	0	0	0.7	0.1	26	25	186	250	5.4	0	13.5	30.6	1.1	11.9	285000	1	3.7	0	0	0	0	0	0	0	0	233.2	0.5	0.1	25	26	177	219	10.9	284000
Anitha	633744	30	III	G3	1	0	38	0	0	0	0	166	110	GRADE2	0	3+	0	0	0.4	0.3	14	17	119	205	6.2	0	14.1	29	1.15	9.8	293000	0	2.88	0	0	0	0	0	3	0	0	29.32	0.7	0.4	37	29	232	604	9.2	284000
Afrina	694215	21	IV	G1	0	0	40	0	0	0	1	172	120	GRADE2	0	3+	0	0	0.1	0.2	11	19	124	223	5.2	0	11.4	32.3	1	12.7	335000	1	2.32	0	0	1	0	11	0	0	0	212.09	0.1	0.2	12	15	119	189	11.9	335000
Asfiya Banu	707919	21	IV	G2	0	0	35+2	0	0	0	0	160	110	GRADE1	1	2+	0	0	0.1	0.1	27	24	245	326	6.6	0	12.5	23.3	1	11.3	250000	1	1.16	0	1	1	0	11,1,3	0	0	0	198.05	0.1	0.1	25	24	223	305	11.1	249050
Nagma Sulthana	703163	26	III	G1	0	0	37+6	0	0	1	0	184	120	GRADE2	1	3+	0	0	0.2	0.1	20	17	162	223	5.2	0	11.2	33.1	1.03	10.4	363000	0	1.86	0	1	1	0	2,3	0	0	0	95.02	0.2	0.1	19	18	159	220	10.2	363000
Veena	702534	26	III	G1	0	1	39+6	0	0	0	0	172	120	GRADE1	0	2+	0	0	0.1	0.1	17	28	108	162	5	0	11.8	26.9	1	12.9	200000	0	2.67	0	0	0	0	0	0	0	0	39.48	0.1	0.2	18	28	93	121	11.6	201000
Sameena Taj	698287	21	IV	G1	0	0	38+6	0	0	0	1	190	110	GRADE3	0	4+	0	0	0.2	0.2	20	16	113	224	5.8	0	12.4	30.1	1.02	7.4	261000	0	2.31	0	0	0	0	0	3	0	0	16.23	0.2	0.1	19	17	89	212	7.2	260000
SIDDIQA	696416	21	IV	G1	1	0	37	1	1	1	1	166	120	GRADE2	0	3+	0	2 WITH ECHINOCYTES	0.3	0.1	16	16	222	652	6.2	0	15.8	31.1	1.33	13.2	107000	0	1.96	0	1	1	0	12	0	0	0	19.02	0.1	0.2	19	16	198	599	12.4	116000
Sadika	696444	28	III	G1	0	0	38+1	0	0	0	0	164	110	GRADE1	0	2+	0	1	0.2	0.1	25	16	406	237	4.3	0	11.92	28.1	1	6.6	241000	0	2.25	1	1	1	0	2	3	0	1	88.26	0.2	0.2	29	20	396	232	6.4	243000
Chaithra	695243	24	II	G1	0	0	40+6	0	0	0	0	160	110	GRADE2	1	3+	0	0	0.1	0.1	24	21	247	241	4.9	0	12.3	27	1	12.1	211000	1	2.56	0	0	0	0	0	0	0	0	130.25	0.1	0.2	26	20	224	236	11.5	212000
Veena	706652	35	III	G2	0	1	38+2	0	0	1	0	174	110	GRADE2	1	2+	0	0	0.2	0.1	31	34	273	388	4.2	0	13.1	29.2	1.1	12.9	225000	1	2.52	0	0	0	0	0	0	0	0	39.15	0.2	0.1	34	34	255	325	11.5	225000
Swathi	495740	24	III	G1	0	0	34+6	1	0	0	0	160	120	GRADE3	0	2+	0	0	0.5	0.2	44	29	252	722	6.1	0	12.2	35.8	0.9	10.5	67000	1	1.76	0	1	1	0	1,3,5	0	0	1	16.2	0.2	0.2	35	25	219	599	10.2	71000
ROJA	613748	21	IV	G2	0	0	32+2	2	1	1	0	180	120	GRADE2	1	3+	GRADE1	0	0.5	0.3	82	249	204	832	13.6	1	12.1	30.9	0.89	13.4	67000	0	1.37	1	1	1	1	1,2,13	11	0	0	23	0.2	0.1	72	119	199	652	12.4	70000
DILSHAD	705696	23	III	G2	0	0	38+2	1	1	0	0	160	116	GRADE3	0	3+	0	0	0.7	0.1	26	25	291	699	7.4	0	11.7	28.4	0.9	11.9	285000	1	3.7	0	0	0	0	0	0	0	0	37.2	0.4	0.2	23	24	288	623	10.8	289000
PAVITHRA	460643	22	II	G3	1	1	37+2	1	0	0	0	166	110	GRADE1	0	2+	0	0+target cells	0.2	0.02	19	20	192	663	6.2	0	12.4	26.3	1	11.7	37000	0	2.5	0	0	0	0	0	0	0	0	29.7	0.1	0.01	22	20	178	569	11.1	45000
PADMAVATHI	651795	25	III	G2	0	0	30+4	1	1	1	0	170	110	GRADE1	0	2+	0	2 WITH ECHINOCYTES	0.2	1.5	28	22	216	721	5.2	0	17.5	32.4	1.44	8.6	105000	0	1.1	1	1	1	1	1,2	3	0	0	66.3	0.2	1.2	25	22	197	667	8.1	107000
Jayanthi	667317	24	II	G2	0	0	37+4	1	0	0	0	166	110	GRADE2	0	2+	0	1	0.6	0.1	39	26	151	816	4.1	0	12	27.3	0.8	5.7	254000	0	2.75	0	0	0	0	0	3	0	1	<15	0.4	0.2	35	25	142	722	6.1	255000
Eshwari	761465	23	IV	G1	0	0	30+3	2	1	0	0	160	116	GRADE1	1	3+	0	1	1.2	0.1	66	25	114	1977	5.8	0	13	31.4	0.9	6.8	52000	1	1.17	1	1	1	1	1,2	6,8,12	0	1	<15	0.6	0.2	56	26	99	1722	7.1	59000
SHOBHA	703611	22	III	G1	0	0	41	2	0	0	1	160	110	GRADE2	1	2+	0	0	0.9	0.4	61	62	245	625	4.4	0	13.1	33.2	1	13.3	173000	0	3.5	1	1	1	1	5	0	0	0	29.7	0.6	0.3	59	52	194	425	12.9	175000
Amrutha	598483	19	III	G1	0	0	38+5	2	0	0	1	170	112	GRADE1	0	3+	0	2 WITH SPHEROCYTES , SCHIZOCYTES	0.6	0.2	250	96.4	189	766	3.9	0	12.7	30.1	0.8	10.2	97000	0	3.4	0	0	0	0	0	0	0	0	<15	0.4	0.2	233	90.4	170	653	9.6	102000
Manjula	754500	28	II	G2	1	0	28+2	2	1	1	1	200	110	GRADE3	1	3+	0	0	0.9	0.1	295	162	194	1540	4.7	0	14.3	41	1.09	15	65000	0	1.1	1	1	1	1	1,2	0	0	0	23.03	0.6	0.2	222	150	188	1120	13.6	71000
Nagaveni	756651	22	III	G1	0	0	34+4	1	1	1	0	180	116	GRADE1	0	3+	0	0	0.4	0.1	28	21	164	720	3.6	0	11.3	30.2	1	10.4	94000	0	1.3	0	1	1	0	1,2	0	0	0	17.56	0.2	0.1	29	20	155	623	10.1	99000
Shashikala	756082	23	IV	G2	0	0	38+2	1	1	0	1	170	112	GRADE1	0	2+	0	0	0.6	0.1	90	64	225	622	4.2	0	12.1	33.1	1.02	11.2	104000	0	2.5	0	0	1	0	2	0	0	0	33.4	0.4	0.2	88	60	189	599	11.1	111000
Usha	686265	20	II	G2	0	1	37+2	1	0	0	1	160	112	GRADE2	0	1+	0	2	0.4	0.2	27	22	195	698	5.7	0	11.7	32	1	6.8	96000	0	2.4	0	0	0	0	0	3	0	1	<15	0.2	0.2	22	20	176	625	7	99000
Usha	763089	23	II	G1	0	0	35+2	1	1	0	0	174	112	GRADE2	1	2+	0	0	0.2	0.01	64	53	253	702	4.3	0	12.1	33.8	1.06	10.5	115000	0	1.6	0	1	1	0	1,2	0	0	0	20.9	0.2	0.02	52	49	222	695	10.2	115000
Shashikala	770140	32	III	G3	0	0	29+6	2	0	0	0	200	110	GRADE3	0	3+	0	0+echinocytes	0.8	0.3	70	55	109	691	4	0	14.3	37.9	1	10.3	33000	0	1	1	1	1	1	1,2	6,10	0	1	18.59	0.5	0.2	66	50	84	569	9.6	45000
Ragini	795082	25	III	G1	1	0	39	2	0	0	0	160	110	GRADE2	0	3+	0	1 WITH TARGET CELLS	2.47	0.6	74	17	134	4914	8.6	0	12.1	33.4	1	8	86000	1	2.9	1	1	1	0	1,2	3,5,11	0	1	<15	1.96	0.6	66	22	122	2568	8.4	92000

Name	UHID	AGE	SES	PARITY	BOOKED/ UNBOOKED	REFERRED	Gestational Age	Study Group	NAUSEA/VOMITING	HEADACHE	PAIN ABDOMEN	SBP	DBP	PEDAL EDEMA	AFI	URINE ALBUMIN	FUNDOSCOPY	PS	TB	DB	SGOT	SGPT	ALP	LDH	URIC ACID	RFT	PT	APTT	INR	HB	PLATELET	MOD	B WT	APGAR	NICU	PERINATAL MORBIDITY	PERINATAL MORTALITY	CAUSE OF Perinatal mortality/morbidity	MATERNAL COMPLICATIONS	MATERNAL MORTALITY	Blood/bood products transfusin	Haptoglobin	Postpartum TB	Postpartum DB	Ppostpartum SGOT	Postpartum SGPT	Postpartum ALP	Postpartum LDH	Post Hb	Puropartum PLT
RATHNAMMA	535548	26	III	G2	1	0	38	2	1	1	1	170	110	GRADE2	0	2+	0	0	0.6	0.4	216	74	118	886	9.2	1	11.1	33.6	1.06	4.8	89000	1	2	1	1	1	0	2,3	6,7	0	0	<15	0.4	0.2	198	62	96	652	5.2	90000
Veena	795087	19	II	G1	1	0	38+5	2	0	1	0	160	110	GRADE3	0	3+	0	2	1.93	0.8	48.4	20.4	222	3982	10.4	0	12.3	31.1	1.09	4.6	77000	0	2.4	0	0	1	0	2,3	3	0	1	<15	0.8	0.6	35.2	20	182	2115	4.6	79000
Gayathri	766288	21	III	G2	0	0	36+6	1	0	0	0	170	116	GRADE1	0	2+	0	0	0.1	0.2	27	21	253	624	5.4	0	13.1	32.2	0.8	11.2	116000	1	2	1	1	1	0	1,2	6	0	0	20.19	0.2	0.1	29	19	175	522	10.9	119000
Shaila	795090	28	I	G2	1	0	36	2	0	0	0	160	116	GRADE2	0	3+	0	0	0.8	0.2	147	88	133	743	9.3	0	11.2	31.1	1.02	6.9	59000	0	1.7	0	1	0	1	1,2,3	3,10	0	1	<15	0.4	0.2	122	65	115	685	6.2	63000
Vandana	766721	20	II	G3	0	0	34+4	1	0	0	0	176	114	GRADE1	0	2+	GRADE II	0	0.5	0.6	27	30	198	663	5.9	0	12.1	29.1	1	10.4	132000	0	1.2	0	1	1	0	1,2,3	0	0	0	56.9	0.2	0.2	26	25	156	498	9.8	135000
Ananthalakshmi	795088	30	III	G2	0	1	32	2	0	0	0	200	120	GRADE3	0	3+	GRADE III	0+spherocytes	0.64	0.2	552	329	370	2225	8.9	0	11.6	30.2	1.01	10	80000	0	1.54	1	1	1	0	1,3,5	5	1	1	<15	0.4	0.2	322	256	235	1988	9.7	83000
Bhavya	795086	28	III	G2	1	0	34	1	0	0	1	200	120	GRADE1	0	3+	0	0	0.5	0.2	44	39	175	3598	9.6	0	12.6	33.4	1.06	9.6	89000	0	1.59	1	1	1	0	1,2	0	0	0	<15	0.3	0.2	42	35	166	2853	9.1	90000
Nagaveni	760896	27	III	G1	0	0	37+2	1	0	0	0	160	110	GRADE1	0	2+	0	0	1.5	0.3	38	14	180	950	7.1	0	13.5	28.2	1.1	11.7	52000	1	2.82	1	1	0	1	13	3,8,10	0	1	<15	0.9	0.4	38	16	152	321	11	59000
Asma	769741	20	IV	G3	0	0	35+6	2	0	0	0	160	110	GRADE2	0	2+	0	0	0.6	0.12	97	76	223	821	7.2	0	12.5	33.2	1.04	10.6	92000	0	1.5	1	1	1	0	1,2	0	0	0	31.42	0.4	0.1	88	65	220	722	10.2	101200
Arunamma	773008	32	II	G2	1	1	39	2	0	0	1	160	114	GRADE1	0	2+	0	1+schizocytes	1.2	0.6	72	31	256	2180	6.9	0	11.4	31.1	0.8	6.6	64000	0	2,2.1	0	1	1	0	3	3	0	1	<15	1	0.3	56	28	223	1952	6.2	67000