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COMPARISON BETWEEN COAGULATION PROFILE IN NEWBORNS OF NORMAL PREGNANCY, PREECLAMPSIA AND ECLAMPSIA PATIENTS. A CROSS-SECTIONAL STUDY.

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ABSTRACT

Introduction

Preeclampsia involves endothelial dysfunction, poor placentation, vasospasm, and hematological changes. These lead to a hypercoagulable state, exacerbated in preeclampsia-eclampsia. Neonates born to hypertensive mother face risks including growth retardation, thrombocytopenia, and other complications, potentially resulting in severe neonatal issues like DIC and serious hemorrhage.

Aim

The aim of this study was to assess and compare the coagulation parameters between newborns born to women who had pre-eclampsia and eclampsia, and those born to normotensive mothers who were healthy and did not have any medical conditions.

Material and method

Present study was a cross-sectional study undertaken from June 2023 to May, 2024. 100 neonates were included in both the study and control group were on Day 1 of birth. Neonates born to mothers with eclampsia, pre-eclamptic toxemia, and gestational hypertension were further classified into the test category.

Results

A noteworthy association was noted between reductions in fetal age and modifications in every coagulation parameter. As PIH severity increased, there was a significant lengthening in partial thromboplastin time with kaolin (PTTK) and thrombin time (TT) values, as well as an increased risk of prematurity and hyperbilirubinemia. Preterm infants had a greater incidence of dissemination of intravascular coagulation (DIC) than mature neonates.

Conclusion

Pregnancy-related hypertension directly affects the unborn child of the affected woman, changing the coagulation parameters and increasing the neonate's risk of bleeding from a decreased platelet count and a compromised coagulation profile. It has been discovered that preterm babies are more affected than term babies. Because of all these findings, this neonate group needs excellent prenatal care, resuscitation facilities, and regular monitoring of their clotting status.

Keywords: *Hypercoagulation, Eclampsia, Hypertensive Mother*
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INTRODUCTION

Pregnancy-induced hypertension (PIH) is defined as newly diagnosed hypertension that starts after 20 weeks of gestation and disappears after childbirth. It is a severe health issue that must be addressed, especially in poor countries, because it is widely recognized as a leading cause of maternal and perinatal disease and mortality. Fetal death and suffering are among the most common complications of PIH-induced intrauterine growth restriction (IUGR). Preeclampsia caused 7.8% of hypertension problems during pregnancy in India, compared to 5.4% in the study Population. PIH's most serious side effects are eclampsia and HELLP syndrome (hemolysis, increased liver enzymes, and low platelet count) [1].

The most common hematological abnormality among PIH patients is thrombocytopenia, which worsens as the illness progresses [2]. A hypercoagulable state results from changes in the coagulation and fibrinolytic system that occur during a regular pregnancy. Pregnancy-related

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hypercoagulable states may become more common in PIH, raising the risk of bleeding problems, particularly after surgical delivery or the insertion of an epidural catheter for regional anesthesia [3].

Coagulation irregularities associated with PIH require close monitoring, especially for symptoms of Disseminated Intravascular Coagulation (DIC) and HELLP Syndrome. Clotting profile assays and platelet counts are critical for pregnant patients with hypertensive diseases [4]. The two tests most commonly used in coagulation profiles to detect coagulation disorders are prothrombin time (PT) and activated partial thromboplastin time (APTT). Because PT and APTT evaluate enzyme activity that causes clot formation, they are also considered functional tests.

During pregnancy, the hemostatic system changes to a more procoagulant state, with lower amounts of naturally occurring anticoagulants like protein C and S and higher levels of fibrinogen, D-dimer, and coagulation factors V, VII, VIII, IX, and XII. Hemostatic changes progressively revert to normal following delivery [5]. Based on these insights, it is critical to comprehend patient care before they develop life-threatening problems. It is also crucial to assess the severity of coagulation changes in PIH cases using a quick and cost-effective technique. These findings suggest that better understanding and control of coagulation alterations can improve outcomes for both mothers and their infants.

Aim of this study: The present study aims to determine and compare the coagulation parameters (platelet count, prothrombin time, activated partial thromboplastin time, thrombin time, fibrinogen level, and fibrin degradation products) in neonates born to mothers with pre-eclampsia and eclampsia and neonates born to normotensive mothers without any maternal complications or medical illness.

METHODS AND MATERIALS

Study site

Comparison between Coagulation Profile in Newborns of Normal Pregnancy, Preeclampsia and Eclampsia Patients was conducted in the Department of Pathology in Maharshi Devraha Baba autonomous state medical college, Deoria, UP.

Study duration

June 2023 to May 2024

Study setting

The study comprised pregnant women with proven hypertension caused by pregnancy, normotensive women, and pre-eclamptic cases reported at our medical college with gestational ages more than 20 weeks. A total of 100 PIH and pre-eclampsia patients were evaluated for platelet parameters and coagulation profiles. Three study groups were established: Neonates born with mild preeclampsia from 47 cases, neonates born with severe preeclampsia from 42 cases, and Eclampsia mothers from 11 cases, and the classification of mild pre-eclampsia, severe pre-eclampsia, and eclampsia were treated following the most recent ACOG recommendations.

Inclusion criteria

1) Neonates born to mothers with preeclampsia and eclampsia after receiving a vitamin K injection.

2) Neonates born to normotensive mothers without any maternal complication or medical illness after receiving vitamin K injection.

3) All of the neonates included both in study and control group were on Day 1 of birth.

Exclusion criteria

1. Babies born to mothers when pregnancy is complicated by any other risk factors for increase in maternal or fetal morbidity and mortality such as:

a. Rh incompatibility

b. Diabetes Mellitus

c. Any other medical illness such as severe anemia, chronic hypertension, renal disease, connective tissue damage, and those who received drugs like aspirin which are likely to cause change in the hematological profile.

2. Babies born to mothers with hypertension diagnosed before 20 weeks of gestation.

3. Babies born with congenital malformations.

Procedure

The blood coagulation study and platelet count parameters of each study group which include Activated Partial Thrombin Time (APTT), Prothrombin Time (PT),

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Thrombin Time (TT), Fibrinogen & FDP (Fibrin Degradation Product) were examined. Neonates were assessed for birth weight, sex, time and mode of delivery, and APGAR score. A single proforma was utilized to collect relevant information from case files, which included the patients' sociodemographic characteristics, obstetric history, signs and symptoms at presentation, lab results, and maternal and perinatal outcomes.

Statistical analyses

The method of data collection was followed by data analysis. A statistical review was carried out, and the results were compared to other publicly available research. A P-value of less than 0.05 indicated a significant difference. The Chi square test was used to compare the data. The statistical analyses were conducted on Windows with SPSS version 22.

RESULTS

The study encompassed a cohort of 100 patients, who were classified according to their age and parity. The patients' age distribution was as follows: 14% of the individuals were below the age of 20, 44% were between the ages of 20 and 24, 28% were between the ages of 25 and 29, and 14% were above the age of 30. In terms of parity, 65% of the patients were primigravida, indicating that they were experiencing their first pregnancy, while 35% were multigravida, indicating that they had been pregnant more than once.

Table 1: Characteristics of patients (N=100):

Characteristics	**Cases (n=100)**	**Percentage**
Age		
< 20 Years	14	14%
20 – 24 Years	44	44%
25 – 29 Years	28	28%
>30 Years	14	14%
Parity		
Primigravida	65	65%
Multigravida	35	35%

The study examined a sample of 100 mothers who had varying degrees of pre-eclampsia (moderate, severe) and eclampsia. The mothers were classified based on their age. The majority of occurrences of mild pre-eclampsia occurred in women between the ages of 20 and 29. The incidence of severe pre-eclampsia was highest among moms between the ages of 20 and 24. The incidence of eclampsia was equally prevalent among individuals aged 20-24 and 25-29. The age distribution was as follows: 14% of the population was under 20 years old, 44% was between 20 and 24 years old, 28% was between 25 and 29 years old, and 14% was over 30 years old.

Table 2: Portion of Mothers with Mild Pre-Eclampsia, Severe Pre-Eclampsia, and Epileptic Syndrome by Age

	<20 yrs	**20-24 yrs**	**25-29 yrs**	**>30 yrs**	**Total**
Mild pre-eclampsia	9(19.15%)	16 (34.04%)	17 (36.17%)	5 (10.63%)	47 (100%)
Severe pre-eclampsia	5(11.90%)	23 (54.76 %)	6(14.28%)	8(19.04%)	42 (100%)
Eclampsia	0 (0%)	5(45.45%)	5 (45.45%)	1(9.09%)	11 (100%)
Total	**14**	**44**	**28**	**14**	**100**

The patient cohort consisting of pre-eclampsia and eclampsia mothers were analysed to comprehend their systolic and diastolic blood pressure at the time of admission. Regarding systolic blood pressure (SBP), 43% of the cases had an SBP ranging from 140 to 159 mmHg, 33% had an

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SBP ranging from 160 to 179 mmHg, 17% had an SBP ranging from 180 to 199 mmHg, and 7% had an SBP beyond 200 mmHg. In relation to diastolic blood pressure (DBP), 1% of individuals had a DBP ranging from 80 to 89 mmHg, 29% had a DBP ranging from 90 to 99 mmHg, 17% had a DBP ranging from 100 to 109 mmHg, and 53% had a DBP exceeding 110 mmHg.

Table 3: Patient distribution based on the systolic and diastolic blood pressure of preeclampsia and eclampsia mothers during the time of admission

SBP on admission	**No. Of cases**	**Percentage**
140-159mmHg	43	43%
160-179mmHg	33	33%
180-199mmHg	17	17%
>200mmHg	7	7%
DBP on admission	**No. Of cases**	**Percentage**
80-89mmHg	1	1%
90-99mmHg	29	29%
100-109mmHg	17	17%
>110mmHg	53	53%

The distribution of proteinuria levels among mothers with pre-eclampsia and eclampsia, based on the disease severity were also analyzed as shown in Table 4. Out of the individuals with mild pre-eclampsia, 41 had a proteinuria level of 1+, 6 had a level of 2+, and none had levels of 3+ or 4+. In cases with severe pre-eclampsia, none had a proteinuria level of 1+, whereas 23 cases had a level of 2+, 17 cases had a level of 3+, and 2 cases had a level of 4+. None of the patients with eclampsia had proteinuria levels of 1+ or 2+. Eight patients had proteinuria levels of 3+, while three patients had proteinuria levels of 4+. In all, 41% of the patients exhibited a proteinuria level of 1+, 29% had a level of 2+, 25% had a level of 3+, and 5% had a level of 4+.

In relation to edema, none of the 3 moms with mild pre-eclampsia exhibited any signs of edema, whereas 43 mothers had mild edema (rated as 1+), and just one woman had moderate edema (rated as 2+), with none of the mothers experiencing severe edema (rated as 3+). Regarding severe pre-eclampsia, none of the individuals had edema, whereas 18 individuals had a 1+ level, 20 individuals had a 2+ level, and 4 individuals had a 3+ level. In cases of eclampsia, none of the patients exhibited any edema or 1+ edema. Eleven patients had 2+ edema, while none had 3+ edema. Out of the total, 3 moms did not have edema, while 61 had a 1+ level, 32 had a 2+ level, and 4 had a 3+ level.

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Table 4: Table displaying the distribution of proteinuria levels based on disease severity in mothers with pre-eclampsia and eclampsia.

Proteinuria	Mild pre-eclampsia	Severe Pre-eclampsia	Eclampsia	Total
1+	41	0	0	41 (41%)
2+	6	23	0	29 (29%)
3+	0	17	8	25 (25%)
4+	0	2	3	5 (5%)
Edema	Mild pre-eclampsia	Severe Pre-eclampsia	Eclampsia	Total
NIL	3	0	0	3
1+	43	18	0	61
2+	1	20	11	32
3+	0	4	0	4

The platelet count (in units of 100,000 per cubic millimetre) has been examined for both the control group and various severity levels of pre-eclampsia in patients with pregnancy-induced hypertension (PIH). The mean platelet count for Group A, which represents the control group, is 2.04 ± 0.54 lakh/cumm. Group B consists of cases of PIH, where patients are classified into three categories: mild pre-eclampsia, severe pre-eclampsia, and eclampsia. The average platelet count for all instances of pregnancy-induced hypertension (PIH) is 1.69 ± 0.34 lakh/cumm. Specifically, the platelet counts for mild pre-eclampsia are 1.69 ± 0.34 lakh/cumm, severe pre-eclampsia are 1.22 ± 0.41 lakh/cumm, and eclampsia are 0.94 ± 0.26 lakh/cumm. Furthermore, the table displays the distribution of platelet counts categorized as either within the normal range or below the normal range. The platelet counts for mild pre-eclampsia fall within the range of 1.82 ± 0.26 lakh/cumm, while for severe pre-eclampsia, the range is 1.70 ± 0.22 lakh/cumm. No platelet counts were observed for eclampsia. The counts for mild pre-eclampsia fall below the normal range of 1.25 ± 0.07 lakh/cumm, whereas severe pre-eclampsia falls below the normal range of 1.01 ± 0.31 lakh/cumm, and eclampsia falls below the normal range of 0.94 ± 0.26 lakh/cumm. The statistics demonstrate a gradual decline in platelet count as the severity of pre-eclampsia increases (Table 5).

Table 5: Platelet Count Distribution by Severity of Pre-Eclampsia

Group	**Platelet count lakh/cumm (mean ± sd)**		
Group A - Control	2.04 ± 0.54		
Group B - Cases	**Patients with mild pre-eclampsia (mean ± sd)**	**Patients with severe pre-eclampsia (mean ± sd)**	**Patients with eclampsia (mean ± sd)**
Overall	47 (1.69±0.34)	42 (1.22±0.41)	11 (0.94±0.26)
Within normal range	34 (1.82±0.26)	13 (1.70±0.22)	0
Below normal range	13 (1.25±0.07)	29 (1.01±0.31)	11 (0.94±0.26)

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Table 6 provides information on the distribution of Prothrombin Time (PT), International Normalised Ratio (INR), and Activated Partial Thromboplastin Time (APTT) among both control subjects and cases with different levels of pre-eclampsia severity. The control group, also known as Group A, exhibits a prothrombin time (PT) of 14.07±1.21, international normalised ratio (INR) of 1.10±0.11, and activated partial thromboplastin time (APTT) of 37.796±1.72. The average prothrombin time (PT) and international normalised ratio (INR) for mild pre-eclampsia in Group B are 14.99±1.38 and 1.19±0.13, respectively. For severe pre-eclampsia, the average PT and INR are 19.29±1.24 and 1.69±0.13, respectively. Lastly, for eclampsia, the average PT and INR are 23.05±1.31 and 1.89±0.05, respectively. The APTT readings for mild pre-eclampsia are 39.04±1.97, for severe pre-eclampsia are 50.45±6.09, and for eclampsia are 57.15±3.35. Furthermore, this report provides a comprehensive analysis of the distribution of these parameters, both within and above the normal range. It specifically emphasizes notable variations that occur as the severity of pre-eclampsia escalates.

Table 6: Prothrombin Time (PT), International Normalized Ratio (INR), and Activated Partial Thromboplastin Time (APTT) Distribution by Severity of Pre-Eclampsia

	PT with INR (mean ± sd)					
Group A – Control	14.07±1.21; INR = 1.10±0.11					
Group B – Cases	**Patients with mild pre-eclampsia (mean ± sd)**		**Patients with severe pre-eclampsia (mean ± sd)**		**Patients with eclampsia (mean ± sd)**	
Overall	n	INR	n	INR	N	INR
	47 (14.99±1.38)	1.19±0.13	42 (19.29±1.24)	1.69±0.13	11 (23.05±1.31)	1.89±0.05
Within normal range	34 (13.76±1.01)	1.13±0.08	1 (15.9±0.00)	1.26±0.00	0	0
Above normal range	13 (16.46± 0.52)	1.35±0.08	41 (19.38±1.11)	1.69±0.13	11 23.05±1.31)	INR=1.89±0.05
APTT (mean ± sd)						
Group A – Control	37.796±1.72					
Group B – Cases	**Patients with mild pre-eclampsia (mean ± sd)**		**Patients with severe pre-eclampsia (mean ± sd)**		**Patients with clampsia (mean ± sd)**	
Overall	47 (39.04±1.97)		42 (50.45±6.09)		11 (57.15±3.35)	
Within normal range	31 (37.41±1.38)		5 (38.3±0.44)		0	
Above normal range	16 (40.87±1.14)		37 (51.51±4.58)		11 (57.15±3.35)	

The changes in the Thrombin Time (TT) and Fibrinogen levels in both control subjects and cases, as per the severity of pre-eclampsia was noted. The control subjects in Group A have an average TT (thrombin time) of 11.07±0.90 and a Fibrinogen level of 287.77±26.66 mg/dl. Within Group B, the TT values demonstrate a progressive increase in severity: 11.13±0.84 for moderate pre-eclampsia, 13.96±0.90 for severe pre-eclampsia, and 15.23±0.56 for eclampsia. The majority of patients' thyroid hormone levels (TT) stayed within the normal range, while a significant increase was found in more severe cases. The severity of the condition is directly proportional to the drop in fibrinogen levels. Specifically, the levels are 281.3±15.84 mg/dl in mild pre-eclampsia, 202.33±17.84 mg/dl in severe instances, and 182.18±20.83 mg/dl in eclampsia. Although the majority of cases originally displayed normal levels of Fibrinogen, a notable proportion of severe and eclampsia cases demonstrated decreased levels, suggesting a connection between the severity of the condition and the depletion of fibrinogen (Table 7).

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Table 7: Thrombin time and Fibrinogen levels of controls and cases according to severity of pre-eclampsia:

TT (mean ± sd)			
Group A – Control	11.07±0.90		
Group B – Cases	**Patients with mild pre-eclampsia (mean ± sd)**	**Patients with severe pre-eclampsia (mean ± sd)**	**Patients with clampsia (mean ± sd)**
Overall	47 (11.13±0.84)	42 (13.96±0.90)	11 (15.23±0.56)
Within normal range	43 (11.02±0.79)	3 (11.8±0.1)	0
Above normal range	4 (12.32±0.20)	39 (14.13±0.69)	11 (15.23±0.56)
Fibrinogen level in mg/dl (mean ± sd)			
Group A – Control	287.77±26.66		
Group B – Cases	**Patients with mild pre-eclampsia (mean ± sd)**	**Patients with severe pre-eclampsia (mean ± sd)**	**Patients with clampsia (mean ± sd)**
Overall	47 (281.3±15.84)	42 (202.33±17.84)	11 (182.18±20.83)
Within normal range	47) (281.3±15.84)	22 (216.63±9.32)	2 (217±7)
Above normal range	0	20 (186.6±10.01)	9 (174.44±13.79)

The study further examined the coagulation profiles of individuals without pre-eclampsia (PE) or eclampsia, as well as those with different levels of severity of these conditions. The control group had an average platelet count of 2.04 ± 0.54 lakh/cumm. The counts exhibited a decrease in severity as follows: 1.69 ± 0.34 (mild PE), 1.22 ± 0.41 (severe PE), and 0.94 ± 0.26 (eclampsia). The Prothrombin time (PT) and international normalized ratio (INR) showed a rise in severity. For mild pre-eclampsia (PE), the PT was 14.99 ± 1.38 seconds with an INR of 1.19 ± 0.13. For severe PE, the PT was 19.29 ± 1.24 seconds with an INR of 1.69 ± 0.13. For eclampsia, the PT was 23.05 ± 1.31 seconds with an INR of 1.89 ± 0.05. The activated partial thromboplastin time (APTT) was shown to be enhanced in different conditions: 39.04 ± 1.97 seconds in cases of mild pre-eclampsia (PE), 50.45 ± 6.09 seconds in cases of severe PE, and 57.15 ± 3.35 seconds in cases of eclampsia. The thrombin time (TT) for mild pre-eclampsia (PE) was 11.13 ± 0.84 seconds, for severe PE it was 13.96 ± 0.90 seconds, and for eclampsia it was 15.23 ± 0.56 seconds. The levels of fibrinogen dropped in accordance with the severity of the conditions: 281.3 ± 15.84 mg/dl for moderate pulmonary embolism (PE), 202.33 ± 17.84 mg/dl for severe PE, and 182.18 ± 20.83 mg/dl for eclampsia.

Table 8: Platelet count, PT, APTT, TT, and Fibrinogen comparison between neonates born to eclampsia, control group, severe preeclampsia, mild preeclampsia and control group

Test	**Control**	**Mild PE**	**Severe PE**	**Eclampsia**
Platelet count count	2.04±0.54	1.69±0.34 (P-value <0.001)	1.22±0.41 (P-value <0.001)	0.94±0.26 (P-value<0.001)
Prothrombin time (PT)	14.07±1.21	14.99±1.38 (P-value <0.001)	19.29±1.24 (P-value <0.001)	23.05±1.31 (P-value<0.001)
Activated Partial Thromboplastin Time (APTT)	37.796±1.72	39.04±1.97 (P-value= 0.01)	50.45±6.09 (P-value <0.001)	57.15±3.35 (P-value<0.001)
Thrombin time	11.07±0.90	11.13± 0.84 (P-value= 0.71)	13.96± 0.90 (P-value <0.05)	15.23± 0.56 (P-value<0.001)
Fibrinogen	287.77±26.66	281.3±15.84 (P-value= 0.29)	202.33±17.84 (P-value <0.05)	182.18± 20.83 (P-value<0.001)

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Table 9 presents a comparison between preterm and term neonates born to moms with moderate preeclampsia, severe preeclampsia, eclampsia, and a control group in terms of the presence or absence of fibrin degradation product (FDP). Among premature newborns, 10% of cases had moderate preeclampsia, 75% had severe preeclampsia, and 100% had eclampsia. All of these cases tested positive for FDP, while none of the cases in the control group were FDP positive. Among term neonates, there were no cases of FDP positivity in mild preeclampsia, 16 cases (53.33%) in severe preeclampsia, and 5 cases (83.33%) in eclampsia. The control group had no cases of FDP positivity. Out of a total of 47 cases of mild preeclampsia, only 1 (2.12%) tested positive for FDP. Among the 42 cases of severe preeclampsia, 25 (59.52%) were FDP positive. Additionally, out of the 11 cases of eclampsia, 10 (90.90%) were FDP positive. On the other hand, all 100 control cases tested negative for FDP.

Table 9: Comparison of FDP among Preterm and Term Neonates with Preeclampsia and Eclampsia Compared to Controls

FDP		Mild PE	Severe PE	Eclampsia	Control
Preterm	**FDP Positive**	1	9	5	0
	FDP Negative	9	3	0	14
Term	**FDP Positive**	0	16	5	0
	FDP Negative	37	30	1	86
Total	**FDP Positive**	1 (2.12%)	25 (59.52%)	10 (90.90%)	0 (0 %)
	FDP Negative	46 (97.87%)	17 (40.47%)	1 (9.09%)	100 (100%)

The study conducted a comparative analysis of the coagulation profiles of neonates born to mothers with eclampsia, severe pre-eclampsia (PE), mild PE, and a control group. Platelet counts and fibrinogen levels shown a notable decrease in all cases of pre-eclampsia (PE) and eclampsia, in contrast to the control group. Conversely, prothrombin time (PT) and activated partial thromboplastin time (APTT) demonstrated a considerable increase. The thrombin time (TT) was markedly increased in cases of severe mild pre-eclampsia (PE) and eclampsia, but not in cases of mild PE. In the comparative examination of coagulation profiles, neonates born to mothers with eclampsia have the greatest FDP positivity (90.90%), followed by severe (59.52%) and mild (2.12%). The control group has no FDP positivity. FDP positive increases significantly with maternal disease severity. In general, the seriousness of mild pre-eclampsia (PE) and eclampsia was linked to more significant irregularities in these blood clotting parameters.

DISCUSSION

The present investigation reveals a significant decrease in platelet count among newborns with mild, severe, and eclamptic preeclampsia in comparison to the control group ($p < 0.001$). Agarwal K et al. [6] estimated the average platelet levels in cases of mild preeclampsia, severe preeclampsia, and eclampsia to be 1.34 lakhs/cumm, 1.37 lakhs/cumm, and 0.79 lakhs/cumm, respectively. In newborns born to mothers with pre-eclampsia, Madiha Abdalla El Sayed et al. [7] found a mean platelet count of 1.86±0.91 lakhs/cumm. In preterm infants, they observed a mean platelet count of 1.33±0.58 lakhs/cumm.

HC Okoye et al. [8] reported that the average platelet counts for neonates born to mothers with preeclampsia was 1.46 ±0.96 lakhs/cumm, whereas for infants of mothers with eclampsia, it was 1.78±1.46 lakhs/cumm. According to K. Mouna et al. [9], infants born to mothers with preeclampsia had an average platelet count of 0.94± 0.10 lakhs/cumm. The present study found that infants born with mild preeclampsia, severe preeclampsia, and eclampsia had significantly lower platelet counts compared to the control group ($p < 0.05$).

Agarwal K et al. [6] obtained comparable findings to those of the present investigation. The researchers observed that the average PT value among infants born to mothers with mild preeclampsia, severe preeclampsia, and eclampsia was

22.83 seconds, 22.56 seconds, and 23.50 seconds, respectively. The average prothrombin time (PT) in full-term neonates with preeclampsia and eclampsia was 20.74±2.82 seconds, while the average PT in preterm neonates with preeclampsia and eclampsia was 24.0±4.58 seconds. A significant increase in the length of PT ($p<0.05$) was observed in both full-term and preterm infants born to women with pregnancy-induced hypertension, when compared to infants born to mothers with normal blood pressure.

The investigation conducted by S. Narayan et al. [10] found that babies born to mothers with PIH experienced a significant prolongation of PT ($p<0.05$). The study revealed that the average PT value for infants in the study group was 27.26 (±13.96) seconds, whereas the control group had an average of 20.0 (±5.19) seconds. The present study demonstrates a substantial increase ($p<0.05$) in Prothrombin Time (PT) among neonates born to mothers with mild, severe, or eclamptic preeclampsia, when compared to newborns of normal pregnant women.

The work conducted by Agarwal K et al., which was published in [6], yielded findings that are comparable to the present study. The researchers found that the average APTT (Activated Partial Thromboplastin Time) in babies with mild pre-eclampsia, severe pre-eclampsia, and eclampsia was 66, 77.56, and 105 seconds, respectively. In comparison, the control group had an average APTT of 50.10 seconds. In their analysis, it was found that both term and preterm neonates had noticeably extended APTTs ($p<0.05$). The average APTT values for the full-term and pre-term babies of a pregnant woman with hypertension were 63.00±18.08 seconds and 79.45±30.21 seconds, respectively. In comparison, the control group had values of 49.32±9.08 seconds and 54.0±4.42 seconds. The present study indicates that neonates born to mothers with severe pre-eclampsia and eclampsia exhibit significantly elevated levels of APTT (Activated Partial Thromboplastin Time) compared to neonates from uncomplicated pregnancies ($p<0.05$). However, there is no statistically significant increase in APTT observed in neonates with mild pre-eclampsia ($p>0.05$).

The findings of the present study align with the research conducted by Agarwal K et al. [6]. The neonatal individuals with mild preeclampsia, severe preeclampsia, and eclampsia had average TT values of 18.25, 21.11, and 31 seconds, respectively, in comparison to the control group's average TT value of 15.83 seconds. The findings revealed that both term and preterm babies exhibited extended TT. The duration of the study group's preterm infants' TT was significantly longer ($p <0.05$) compared to the control groups. Regrettably, the disparity in length between the neonates in the study group and the control group was not statistically significant ($p>0.05$). The average TT values for term and preterm infants born to a pregnant woman with hypertension were 16.95±3.01 seconds and 23.45±7.33 seconds, respectively. In comparison, the control group had values of 15.92±2.25 seconds and 15.40±0.55 seconds. Research conducted by Neilson et al. [11], Kleckner HB [12] et al., and Lox et al. [13] in 1985 found that neonates born to mothers with pregnancy-induced hypertension had low levels of fibrinogen. Conversely, Lox et al. [13] discovered that newborns whose mothers had preeclampsia had elevated fibrinogen levels in their cord blood. However, Spencer et al. [14] and Sibai et al. [15] reported in 1986 that there were no abnormalities in the fibrinogen levels in the umbilical cord blood. The increased thrombin time (TT) observed in term and preterm neonates with pre-eclampsia and eclampsia may be attributed to hypofibrogenemia.

Additionally, in this study, 1 (2.12%) of 47 mild preeclampsia neonates were FDP positive and 46 (97.87%) were negative. FDP positivity is found in 25 (59.52%) of 42 newborns in severe preeclampsia and 10 (90.90%) in eclampsia. Neonatal FDP positive is low in moderate preeclampsia ($p>0.05$) compared to controls, but substantial in severe and eclampsia ($p<0.05$). Similarly in the study by Agarwal K et al. (1991-1992), neonates born to mothers with mild, severe preeclampsia, and eclampsia had greater FDP levels than controls [6]. They also found higher FDP levels in term and preterm neonates of pregnancy-induced hypertensive mothers than normotensive mothers. S. Narayan et al. (1994) found FDP positive in 60% of neonates born to hypertensive mothers, supporting maternal hypertension-related FDP levels [10].

CONCLUSION

Neonates born to women with preeclampsia and eclampsia exhibited thrombocytopenia, prolonged prothrombin time (PT) and international normalised ratio (INR), activated partial thromboplastin time (APTT), thrombin time (TT), increased fibrin degradation products (FDP), and decreased fibrinogen levels, when compared to neonates delivered to mothers without hypertension. These findings are substantially associated with maternal preeclampsia and eclampsia. Coagulation investigations are readily available and affordably priced tools for promptly identifying coagulation problems in neonates with preeclampsia or eclampsia. Pregnancy-induced hypertension has a direct impact on the foetus of the affected woman, altering the blood clotting process and elevating the baby's vulnerability to bleeding due to reduced platelet count and impaired blood clotting ability. Research has revealed that preterm infants are more susceptible to adverse effects compared to full-term infants. Due to these discoveries, it is imperative that

this infant group receives exceptional prenatal care, access to resuscitation facilities, and consistent monitoring of their coagulation status.

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