



ASSESSMENT OF HEMATOLOGICAL PROFILE OF NEWBORNS BORN TO PREGNANCY INDUCED HYPERTENSION AND NORMOTENSIVE MOTHERS

Paediatrics

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ABSTRACT

Introduction: Hematological abnormalities in infants born to hypertensive mothers can lead to serious neonatal complications like sepsis, increased predisposition to infections and disseminated intravascular coagulation. This study was aimed to assess the hematological profile of newborns born to mother with pregnancy induced hypertension in comparison to normotensive mothers. **Material & Method:** This prospective comparative study was conducted among the inborn of PIH and normotensive mothers in AVMC hospital. Total of 360 patients fulfilling inclusion criteria were included with 180 neonates born to mother with PIH and normotensive mothers. Written informed consent was obtained from the mothers and cord blood sample was collected from newborn to measure the hematological parameters. Analysis of the data was done using the SPSS v21 with p-value <0.05 as statistically significant. **Results:** In present study, total of 360 patients fulfilling inclusion criteria are included with mean age of 25.86±2.68yrs. The mean level of hemoglobin, RBC and MCV were significantly higher in newborn of hypertensive mothers and significantly low leucocyte count and platelet count in newborn of hypertensive mothers (p<0.05) **Conclusion:** The babies born to pre-eclamptic mothers are more prone for development of prematurity, low birth weight, leukopenia, thrombocytopenia and elevated RBC count.

KEYWORDS

Birth weight, Hypertension, Hematological parameters, Cord blood.

INTRODUCTION

Hypertensive disorders of pregnancy complicate about 8% of all gestations. Hypertensive disorders are responsible for significant perinatal morbidity and mortality.^{1,2} Pregnancy induced Hypertension (PIH) is defined as hypertension (blood pressure $\geq 140/90$ mmHg) with or without proteinuria (≥ 300 mg/24hrs) emerging after 20 weeks gestation, but resolving up to 12 weeks postpartum. PIH also defined as new onset proteinuria (≥ 300 mg/24hrs) in hypertensive women who exhibit no proteinuria before 20 weeks of gestation.^{3,4} The classification of hypertensive disorders complicating pregnancy by the Working Group of the National high blood pressure education program [NHBPEP] (2015) is shown below. There are four types of Pregnancy induced hypertensive disease:

1. Gestational hypertension
2. Preeclampsia and Eclampsia syndrome
3. Preeclampsia superimposed on chronic hypertension.
4. Chronic hypertension.

Pre-eclampsia is currently believed to be a two stage disease⁵ with shallow cytotrophoblastic invasion of maternal spiral arterioles initially resulting in placental insufficiency. Acute or chronic uteroplacental insufficiency results in antepartum or intrapartum anoxia that may lead to fetal death, IUGR and /or preterm delivery. Prematurity is the most important factor responsible for increased perinatal morbidity and mortality. Neonatal complications occurring in babies of pre-eclamptic mothers closely relates to the severity of hypertension and proteinuria. Pre-eclampsia is known to be associated with adaptive changes in the fetal circulation and placentally derived factors implicated in the pathogenesis of the maternal manifestations of disease are known to contribute to the development of neonatal thrombocytopenia and growth restriction. Severe hypertension generates a significant imbalance in the neonate's haemostatic system. Somatic growth retardation, thrombocytopenia, leucopenia, neutropenia, low apgar scores, delayed adaption, patent ductus arteriosus, and gastrointestinal hypomotility are much more common in newborns of hypertensive mothers.⁶ Normotensive mothers are considered, if blood pressure is below 140/90 before delivery and

without having any other systemic illness. As a part of early neonatal haematological screening of babies born to mothers with PIH which helps in early detection and management of serious neonatal complications and morbidity rates of the neonates.

Hence, this study was aimed to assess the hematological profile of newborns born to mother with pregnancy induced hypertension in comparison to normotensive mothers.

MATERIAL AND METHODS

A prospective comparative study was conducted in the Department of Paediatrics in collaboration with the Department of Obstetrics and Gynaecology of a tertiary healthcare teaching centre over a period of 21 months (December 2020 – September 2022). This study was approved by Institutional Ethics Committee for Human Subjects (IECHS) - AVMC/IEC2020/178. Study population was Inborns of PIH and normotensive mothers. The study included two groups: Group A: Neonates born to mothers with PIH. Group B: Full term apparently healthy newborns born to normotensive mothers without maternal complications. The written informed consent was obtained from the mother. The patients with PIH and normotensive mothers were selected using convenient sampling technique. After the delivery 2ml of cord blood sample is collected in purple tube and was sent for central laboratory for evaluation of Hemoglobin (Hb), Total count (TC), Differential count (DC), Platelet count and Red cell indices like Mean corpuscular volume (MCV), Mean corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC). Hb, TC, DC, Platelet count was estimated using automated cell counter method using SYSMEX KX-21 Automated hematology analyser B2584 08/2007. Platelet count was confirmed by peripheral smear examination and REES ECKER method. All investigations were done at the clinical pathology and haematology laboratory at AVMCH, Puducherry. The consultant pathologists and laboratory technicians performing the tests were masked to the identity of the neonate. All the data were collected in proforma and entered in excel sheet. The summarised data were represented using tables, figures, bar diagram and pie charts. The mean difference between the continuous

data was analysed using t-test, for follow-up data paired t-test and for categorical data Chi-square test was used to determine the significance between the parameters observed in this study. Sensitivity, specificity, positive predictive value, negative predictive value of both the groups were assessed and compared using suitable statistical tests. P value <0.05 was accepted as significant. Statistical analysis was performed using SPSS version 22.0 (IBM SPSS, US) software operating on windows 10.

RESULTS

In present study, total of 360 patients fulfilling inclusion criteria were included with mean age of 25.86 ± 2.68 yrs.

Table 1: Comparison of blood pressure, gestational age, mode of delivery and gender of newborn between the group using unpaired t-test and chi-square test

	Normotensive		Hypertensive		p-value
	Mean	SD	Mean	SD	
SBP	113.2	7.1	144.2	6.9	0.01*
DBP	74.8	5.4	95.3	6.1	0.01*

		Normotensive		Hypertensive		Chi-square (p-value)
		Count	Column N %	Count	Column N %	
Gestational Age	Preterm	10	5.6%	40	22.2%	20.903 (0.01)*
	Term	170	94.4%	140	77.8%	
Mode of delivery	LSCS	82	45.6%	110	61.1%	8.750 (0.01)*
	NVD	98	54.4%	70	38.9%	
Sex	Female	79	43.9%	79	43.9%	0.0 (1.00)
	Male	101	56.1%	101	56.1%	

In the present study, the systolic and diastolic blood pressure were significantly higher among the hypertensive cases compared to normotensive pregnant women. There is significant higher incidence of preterm delivery among the hypertensive mothers 22.2% compared to normotensive group (5.6%). ($p < 0.05$) similarly study found significant higher incidence of LSCS among the hypertensive mothers (61.1%) compared to normotensive mothers (45.6%). ($p < 0.05$).

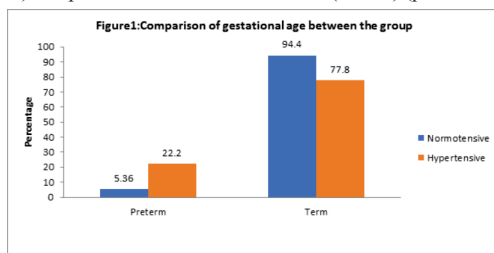


Table 2: Comparison of the mean weight and anthropometric parameters between the group using unpaired t-test.

	Normotensive		Hypertensive		p-value
	Mean	SD	Mean	SD	
Birth weight (kg)	2.88	.40	2.63	.41	0.01*
Head Circumference	33.3	1.0	33.0	1.2	0.01*
Chest circumference	31.3	1.0	31.0	1.2	0.01*
Length	44.6	8.3	48.6	1.2	0.01*

On assessment of the outcome on fetus with respect of development, we found there is significant lower mean of birth weight, head circumference and chest circumference among the newborns of hypertensive mothers compared to the newborns of normotensive mothers. ($p < 0.05$)

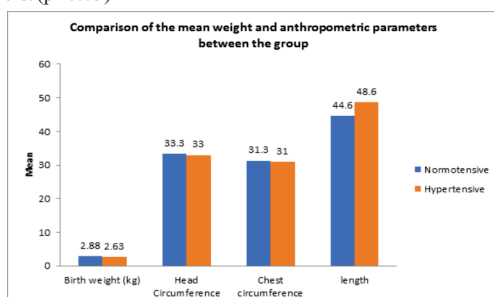
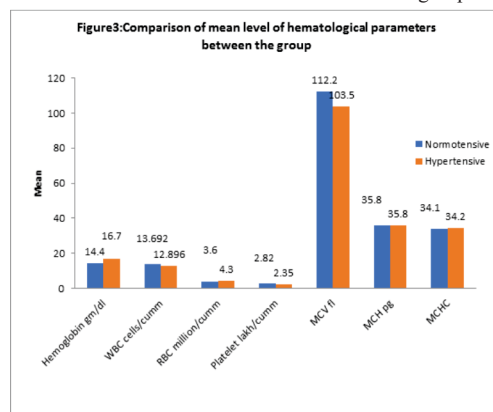


Figure 2: Comparison of the mean weight and anthropometric parameters between the group

Table 3: Comparison of mean level of hematological parameters between the group using unpaired t-test.

	Normotensive		Hypertensive		p-value
	Mean	SD	Mean	SD	
Hemoglobin gm/dl	14.4	1.9	16.7	2.2	0.01*
WBC cells/cumm	13692.3	2165.6	12896.4	2067.5	0.01*
RBC million/cumm	3.6	.8	4.3	.8	0.01*
Platelet lakh/cumm	2.82	.57	2.35	.72	0.01*
MCV fl	112.2	100.4	103.5	5.2	0.246
MCH pg	35.8	22.0	35.8	22.0	0.972
MCHC	34.1	1.4	34.2	1.4	0.649

In present study, there is significant higher mean hemoglobin levels among the newborn in hypertensive mothers (16.7 ± 2.2) compared to the normotensive mothers (14.4 ± 1.9). ($p < 0.01$) Similarly, in the newborn of hypertensive mothers the RBC count was significantly higher compared to the newborn of normotensive mothers. ($p < 0.01$) On comparison of the WBC and Platelet count, in the newborn to hypertensive mothers it was found to be significantly lower compared to newborn of normotensive mothers. ($p < 0.01$) There was no significant difference in MCH and MCHC between the groups



DISCUSSION

Hematological abnormalities in infants born to hypertensive mothers can lead to serious neonatal complications like sepsis, increased predisposition to infections and disseminated intravascular coagulation (higher in preterm than in term neonates). Bleeding manifestations including intracranial hemorrhage may result from platelet deficiency due to any cause.⁷ Therefore early hematological screening of these infants is recommended.

Acute or chronic uteroplacental insufficiency results in antepartum or intrapartum anoxia that may lead to fetal death, IUGR and/or preterm delivery. Prematurity is the most important factor responsible for increased perinatal morbidity and mortality. Neonatal complications occurring in babies of pre-eclamptic mothers closely relates to the severity of hypertension and proteinuria.

In present study, total of 360 patients fulfilling inclusion criteria are included with mean age of 25.86 ± 2.68 yrs. In the present study, on comparison of the mean age of patients between the group we found no significant difference in age distribution. The systolic and diastolic blood pressure was significantly higher among the hypertensive cases compared to normotensives pregnant women.

In present study there is significant higher incidence of preterm delivery among the hypertensive mothers (22.2%) compared to normotensive group (5.6%). ($p < 0.05$) similarly study found significant higher incidence of LSCS among the hypertensive mothers (61.1%) compared to normotensive mothers (45.6%). ($p < 0.05$)

In study by Al-Bahadily A et al., showed the significant difference between the two groups regarding mode of delivery, 94% of mothers in study group delivered by cesarean section while 60% of control group, delivered by cesarean section.

On assessment of the outcome on fetus with respect of development, we found there is significant lower mean birth weight, head circumference and chest circumference among the newborns of hypertensive mothers compared to the newborns of normotensive mothers. ($p < 0.05$) In the study it was detected that there is significant

influence of hypertension among the mother on the anthropometric parameters of newborn.

In study by Sunil et al., it was observed that mothers with gestational hypertension, preeclampsia and eclampsia syndrome had a higher number of premature and small for gestational age babies.^[7] Prakash et al., documented Mothers with gestational hypertension, preeclampsia and eclampsia syndrome had a higher number of premature and small for gestational age babies.

Mouna K et al., concluded that, the babies born to pre-eclamptic mothers are more prone for development of prematurity, low birth weight, Intrauterine Growth Retardation (IUGR), sepsis, neutropenia, leucopenia, thrombocytopenia, increased RBC count, nRBC and reticulocyte count. Early haematological screening helps to decrease morbidity, improve growth, development and survival of the baby. Mothers with gestational hypertension, preeclampsia and eclampsia syndrome had a higher number of premature and small for gestational age babies.

In present study, there is significant higher mean hemoglobin levels among the newborn in hypertensive mothers (16.7 ± 2.2) compared to the normotensive mothers (14.4 ± 1.9), ($p < 0.01$). Similarly, in the newborn of hypertensive mothers the RBC count was significantly higher compared to the newborn of normotensive mothers ($p < 0.01$). On comparison of the WBC and Platelet count, in the newborn to hypertensive mothers it was found to be significantly lower compared to newborn of normotensive mothers ($p < 0.01$). There was no significant difference in MCH and MCHC between the groups.

Singnarp E et al., Hemoglobin was found to be significantly higher in the study group as compared to the control group.^[8] Platelet counts were significantly decreased in these mothers and babies compared to controls. The platelet count in the baby was affected by the severity of hypertension in the mother. At higher levels of maternal systolic and diastolic blood pressure the number of babies in the case group presenting with thrombocytopenia increased. Al-Bahadily A et al., the PIH effects adversely over the growth parameter, well being and both WBC and platelet count of a newborn. There was the significant effect of gestational hypertension on gestational age, birth weight, need for resuscitation, APGAR score, mean WBC count and mean platelet count since ($P < 0.05$). There were no significant differences between two groups regarding another element of complete blood count.^[9] Neutropenia was present in 42% of neonates. The mean platelet count in neonates born to hypertensive mother was significantly lower than that of control babies in the study.^[10]

Meher P et al., documented in their study that there was significant decrease in TPC ($p < 0.01$) and absolute neutrophil count ($p < 0.01$), but significant rise in reticulocyte count ($p < 0.05$) in umbilical cord blood of babies born to hypertensive mothers compared to normotensive mothers. From this study, it was concluded that newborns of hypertensive mothers carry risks for infection and bleeding complications. So, these simple haematological tests can be done at early stage in neonates to reduce possible perinatal morbidities and mortality.^[11] There was a significantly higher mean corpuscular volume, while the red cell count and the mean corpuscular hemoglobin were only suggestive of statistical significance between the cases and the controls. Total leukocyte count, neutrophil count, absolute neutrophil count and platelet count were significantly decreased in these babies.^[12,13]

Bolat A et al., documented that the umbilical cord blood from newborns of healthy mothers and hypertensive mothers was collected. RBC, hemoglobin, reticulocyte count and normoblast count were higher in the newborns of hypertensive mothers compared to the control group, and total leukocytes, neutrophil, lymphocyte, monocyte, eosinophil, and thrombocyte counts were lower.^[14,15] Platelet count were significantly decreased in these mothers and babies compared to controls. The platelet count in the baby was affected by the severity of hypertension in the mother. At higher levels if maternal systolic and diastolic blood pressure the number of babies in the case group presenting the thrombocytopenia increased.^[16]

CONCLUSION

The anthropometric parameters of newborns born to PIH mothers were reduced significantly and higher incidence of preterm deliveries among the newborn of hypertensive mothers.^[17,18] The present study

detected significant changes in neonatal hematological profile. The changes include higher mean haemoglobin and red blood cell count and also significant reduction in total leucocyte count and platelet count. The babies born to pregnancy induced hypertensive mothers are more prone for development of prematurity, low birth weight, leukopenia, thrombocytopenia and elevated RBC count.^[19]

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