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# PREGNANCY-INDUCED HYPERTENSION AND ITS EFFECTS ON NEONATAL HEMOGRAM

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**Abstract**
Hypertensive disorders are the most prevalent pregnancy complications. Major pregnancy-related maternal morbidities are caused by preeclampsia toxemia. Preeclampsia increases neonatal morbidity and mortality. Hematological permutation is more common in neonates of hypertensive moms, especially those with preeclampsia, according to many studies.

**Objective:** To determine the frequency of hematological profile of neonates among women with pregnancy induced hypertension visiting to Liaquat National Hospital Karachi.

**Place and Duration:** This Cross-Sectional study was conducted at Department of Obstetrics and Gynecology, Liaquat National Hospital, Karachi, Pakistan from February 8, 2022 to August 7, 2022

**Methods:** All eligible patients who visited LNH, Karachi were studied. After discussing the study's process, drawbacks and benefits, informed consent was obtained. Our study took cord blood from all mothers soon after delivery by double-clamping and severing the cord in between the clamps, then putting the syringe at the placental end of the cord proximally and collecting 4 mL of cord blood. The newborns' blood was transferred to the hospital lab for hematological analysis. All obtained data were entered into the proforma at the end and used electronically for study.

**Results:** Mean maternal age was 28.4±5.5 years. Mean ± SD of neonatal age was 15.2±4.8 with C.I (14.30…….16.09) days. In distribution of gender of baby, 46 (40.4%) were male while 68 (59.6%) were female. Hematological profile of neonates showed neutropenia in 20 (17.5%) neonates, thrombocytopenia in 45 (39.5%) while polycythemia was noted in 9 (7.9%) neonates.

**Conclusion:** The most prevalent hematological profile was thrombocytopenia, followed by neutropenia and polycythemia. Since the sample originated from different parts of Pakistan, it can be generalized.

**Key words:** Hematological Profile, Neonates, Pregnancy Induced Hypertension, Prevalence

## INTRODUCTION

The definition of pregnancy-induced hypertension (PIH) is systolic blood pressure of 140 mm Hg and diastolic blood pressure of 90 mm Hg. Pregnant women with systolic or diastolic blood pressure increase of 30mm hg or 15mm hg, at least 6 hours apart. One of the leading causes of maternal and newborn death is PIH. PIH complicate 12–22% of pregnancies[1-2].

According to WHO, every year, about 3.4 million babies have died and about 4.3 million still births have been seen. This is usually seen during first week of life, accounting for 98% of cases in developing countries[3-4]. These mortalities are usually seen in initial few days and weeks of life commonly occurring secondary to events in utero and during childbirth, rather than outside factors. In United States, pregnancy related deaths are more common in blacks in comparison to white females out of which 16% of the deaths are secondary to PIH. Four categories of PIH, has been defined by American College of obstetrics and Gynae including PIH, Pre-eclampsia, eclampsia and HELLP syndrome. Mild PIH described as systolic blood pressure < 160 and diastolic is < 110 mm hg, it is severe when pressures are >160 and 110 respectively. PIH can give rise to many fetal and maternal complications, the maternal complications include thrombocytopenia, DIC, placental abruption, liver failure, intracranial haemorrhage and cardiovascular collapse[5-6].

Its adverse effects arise due to decrease utero-placental blood supply leading to poor oxygen concentration and acute or chronic utero- placental insufficiency. These complications include 12.6 times higher risk of polycythemia, neutropenia and thrombocytopenia occurring in as many as 22% of the population[7-8].

In addition, there is increased risk of thrombocytopenia especially in neonates born to hypertensive mothers who develop preeclampsia[9]. It is related with augmented risk of neonatal neutropenia and subsequent neonatal infections[10]. Despite of the fact that low birth weight and prematurity effect the neutrophil count, pregnancy induced hypertension may independently contribute to neutropenia in neonates. Studies done earlier showed that neonates born to mother with PIH, suffer longer duration of decrease neutrophil count and increase susceptibility to hospital acquired infection as compared to normotensive mothers. A study held in Obstetrics/Gynecology Department of National Cheng Kung Medical Centre suggested that pre-eclampsia may adversely affect the fetal hemogram leading to thrombocytopenia, neutropenia and increased red cell mass (polycythemia)[11-12]. A study reported polycythemia 8%, neutropenia 15% and thrombocytopenia 38% in neonates of females with PIH. In another study, mothers with preeclampsia had 50% of their babies with neutropenia and thrombocytopenia[13].

Hypertensive disorders, coupled with hemorrhage and infection, complicates 5–10% of pregnancies and contribute to maternal morbidity and mortality[14].

## METHODS

This Cross-Sectional study was conducted at Department of Obstetrics and Gynecology, Liaquat National Hospital, Karachi, Pakistan from February 8, 2022 to August 7, 2022.

Sample size was calculated through W.H.O sample size calculator by using frequency of polycythemia (8%) [6], margin of error (d)=5%, Confidence level (C.I) =95% then the estimated sample size came out to be n=114 and Non-Probability, Consecutive Sampling technique was used for patient selection.

## INCLUSION CRITERIA

- Subjects between age group 0 to 28 days.
- Either gender.
- All the neonates born to mother with pregnancy-induced hypertension in accordance with operational definition.

## EXCLUSION CRITERIA

- Women with multiple pregnancies.
- Women with diabetes mellitus.
- Women with renal or heart disease.
- History of chronic pulmonary disease.
- Smoking women.
- Neonates with other hematological disorder.
- Neonates with congenital malformations or birth asphyxia.

Data collection was started after approval of synopsis from Research Department of College of Physicians & Surgeons Pakistan and hospital ethical review committee. All the women who delivered the baby at department of Obstetrics and Gynecology, Liaquat National Hospital Karachi, fulfilling the inclusion criteria were included in the study after taken written informed consent. Our study took cord blood from all mothers soon after delivery by double-clamping and severing the cord in between the clamps, then putting the syringe at the placental end of the cord proximally and collecting 4 mL of cord blood. Blood sample of the neonates was also taken and sent to hospital laboratory for hematological profile in accordance with operational definition and results were finalized by consultant hematologists. The study was focused and employed suitable exclusion criteria to control bias and confounders.

Data was entered and analyzed using SPSS-26.0. Shapiro-Wilk tested continuous data normality. Mother's age, parity, gestational age at beginning of pregnancy-induced hypertension, gestational age at delivery, APGAR score, CBC, and birth weight were used to calculate mean ± SD/Median. Frequency and percentage were calculated for gender of baby, mode of delivery and hematological profile of neonates i.e., (i.e.: neutropenia, thrombocytopenia and polycythemia). Effect modifiers were controlled through stratification of age of mothers, parity, gestational age at onset of pregnancy induced hypertension, gestational age at delivery, APGAR score of fetuses, CBC (Hb, leukocytes, platelets), birth weight, gender of baby and mode of delivery to see the impact of these on hematological profile of neonates followed by appropriate Chi-Square / Fisher's Exact test consider two-sided P at level of significance $\alpha$=5% as significant.

## RESULTS

In this study 114 patients were included to assess the hematological profile of neonates among women with pregnancy induced hypertension visiting to Liaquat National Hospital Karachi and the results were analyzed as:

The distribution of continuous variables was tested by applying Shapiro-Wilk test for maternal age (P=0.129), neonatal age (P=0.117), parity (P=0.092), gestational age at onset of PIH (P=0.071), gestational age at delivery (P=0.109), APGAR score (P=0.355), HB level (P=0.258), leukocyte (P=0.085), platelets (P=0.711) and birth weight (P=0.628) respectively, as shown in TABLE 1.

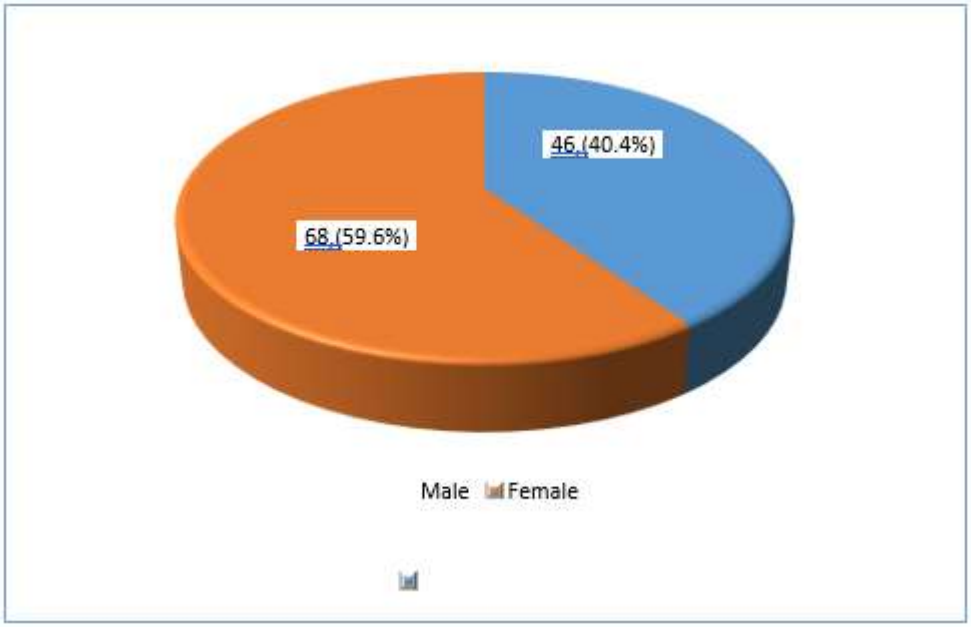
**TABLE # 1:** DESCRIPTIVE STATISTICS OF SHAPIRO-WILK TEST n=114

| VARIABLE | MEAN±SD | P-VALUE |
|---|---|---|
| **Maternal Age** (years) | 28.7±5.5 | 0.129 |
| **Neonatal Age** (days) | 15.2±4.8 | 0.117 |
| **Parity** | 2.2±0.7 | 0.092 |
| **Gestational Age at onset of PIH** (weeks) | 31.8±5.2 | 0.071 |
| **Gestational Age at delivery** (weeks) | 37.9±5.9 | 0.109 |
| **APGAR Score** | 6.7±2.4 | 0.355 |
| **HB level** (g/dl) | 11.8±1.2 | 0.258 |
| **Leukocytes** (cmm) | 5646.2±175.6 | 0.085 |
| **Platelets** (mcL) | 175485.4±618.7 | 0.711 |
| **Birth Weight** (kg) | 2.9±1.2 | 0.628 |

Mean ± SD of maternal age was 28.4±5.5, Mean ± SD of neonatal age was 15.2±4.8, Mean ± SD of parity was 2.2±0.7, Mean ± SD of gestational age at onset of PIH was 31.8±5.2, Mean ± SD of gestational age at delivery was 37.9±5.9, Mean ± SD of APGAR score was 6.7±2.4, Mean ± SD of HB level was 11.8±1.2, Mean ± SD of leukocytes was 5646.2±175.6, Mean ± SD of platelets was 175.485.4±618.7 and Mean ± SD of birth weight was 2.9±1.2 as shown in TABLE 1.

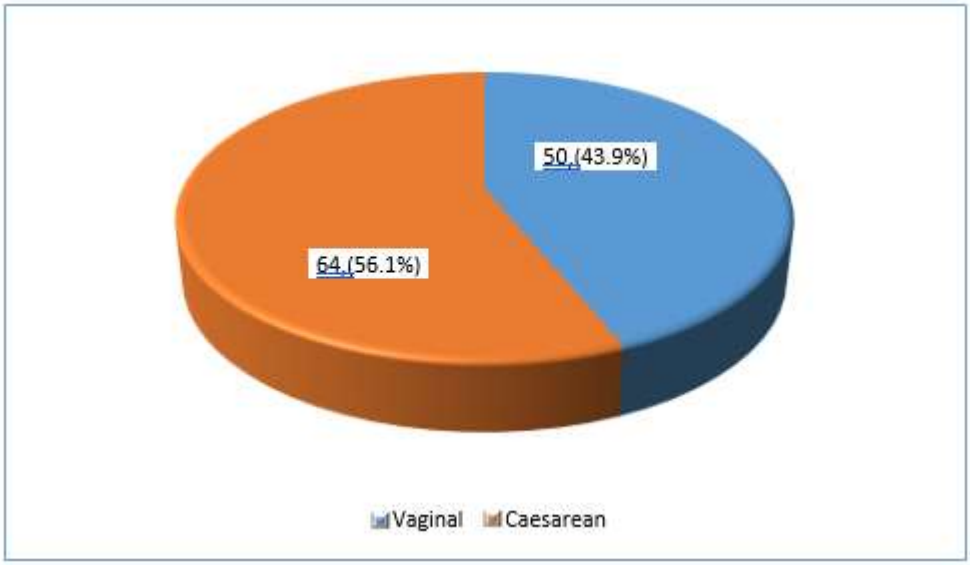
In distribution of gender of baby, 46 (40.4%) were male while 68 (59.6%) were female as shown in FIGURE 1.

**FIGURE # 1** FREQUENCY FOR GENDER OF BABY




Mode of delivery showed vaginal delivery in 50 (43.9%) women while caesarean section was noted in 64 (56.1%) women as shown in FIGURE 2.

**FIGURE # 2** FREQUENCY FOR MODE OF DELIVERY




Hematological profile of neonates showed neutropenia in 20 (17.5%) neonates, thrombocytopenia in 45 (39.5%) while polycythemia was noted in 9 (7.9%) neonates as shown in TABLE 3.

**TABLE # 2:** FREQUENCY FOR HEMATOLOGICAL PROFILE OF NEONATES n=114

| HEMATOLOGICAL PROFILE | | FREQUENCY | PERCENTAGE |
|---|---|---|---|
| Neutropenia | Yes | 20 | 17.5% |
| | No | 94 | 82.5% |
| | | | |
| Thrombocytopenia | Yes | 45 | 39.5% |
| | No | 69 | 60.5% |
| | | | |
| Polycythemia | Yes | 9 | 7.9% |
| | No | 105 | 92.1% |

Stratification of age of mothers, parity, gestational age at onset of pregnancy induced hypertension, gestational age at delivery, APGAR score of fetuses, CBC (Hb, Leukocytes, Platelets), birth weight, gender of baby and mode of delivery were done with respect to hematological profile of neonates in order to assess statistical difference from TABLE [13-23].

**TABLE # 3** STRATIFICATION OF MATERNAL AGE WITH HEMATOLOGICAL PROFILE OF NEONATES n=114

| HEMATOLOGICAL PROFILE | | AGE GROUP [In years] | | P-VALUE |
|---|---|---|---|---|
| | | 20 – 30 | >30 | |
| Neutropenia | Yes | 13 (11.4%) | 7 (6.1%) | 0.921 |
| | No | 60 (52.6%) | 34 (29.8%) | |
| | | | | |
| Thrombocytopenia | Yes | 31 (27.2%) | 14 (12.3%) | 0.383 |
| | No | 42 (36.8%) | 27 (23.7%) | |
| | | | | |
| Polycythemia | Yes | 5 (4.4%) | 4 (3.5%) | 0.414 |
| | No | 68 (59.6%) | 37 (32.5%) | |

**TABLE # 4** STRATIFICATION OF PARITY WITH HEMATOLOGICAL PROFILE OF NEONATES n=114

| HEMATOLOGICAL PROFILE | | PARITY | | P-VALUE |
|---|---|---|---|---|
| | | 1 – 2 | >2 | |
| Neutropenia | Yes | 11 (9.6%) | 9 (7.9%) | 0.269 |
| | No | 39 (34.2%) | 55 (48.2%) | |
| | | | | |
| Thrombocytopenia | Yes | 31 (27.2%) | 14 (12.3%) | 0.0001 |
| | No | 19 (16.7%) | 50 (43.9%) | |
| | | | | |
| Polycythemia | Yes | 3 (2.6%) | 6 (5.3%) | 0.383 |
| | No | 47 (41.2%) | 58 (50.9%) | |

**TABLE # 5** STRATIFICATION OF GESTATIONAL AGE AT ONSET OF PIH WITH HEMATOLOGICAL PROFILE OF NEONATES n=114

| **HEMATOLOGICAL PROFILE** | | **GESTATIONAL AGE** [In weeks] | | **P-VALUE** |
|---|---|---|---|---|
| | | 20 – 30 | >30 | |
| Neutropenia | Yes | 15 (13.2%) | 5 (4.4%) | 0.097 |
| | No | 53 (46.5%) | 41 (36.0%) | |
| | | | | |
| Thrombocytopenia | Yes | 30 (26.3%) | 15 (13.2%) | 0.217 |
| | No | 38 (33.3%) | 31 (27.2%) | |
| | | | | |
| Polycythemia | Yes | 7 (6.1%) | 2 (1.8%) | 0.215 |
| | No | 61 (53.5%) | 44 (38.6%) | |

**TABLE # 6:** STRATIFICATION OF GESTATIONAL AGE AT DELIVERY WITH HEMATOLOGICAL PROFILE OF NEONATES n=114

| **HEMATOLOGICAL PROFILE** | | **GESTATIONAL AGE** [In weeks] | | **P-VALUE** |
|---|---|---|---|---|
| | | 35 – 37 | >37 | |
| Neutropenia | Yes | 12 (10.5%) | 8 (7.0%) | 0.325 |
| | No | 45 (39.5%) | 49 (43.0%) | |
| | | | | |
| Thrombocytopenia | Yes | 25 (21.9%) | 20 (17.5%) | 0.338 |
| | No | 32 (28.1%) | 37 (32.5%) | |
| | | | | |
| Polycythemia | Yes | 5 (4.4%) | 4 (3.5%) | 0.500 |
| | No | 52 (45.6%) | 53 (46.5%) | |

**TABLE # 7:** STRATIFICATION OF APGAR SCORE WITH HEMATOLOGICAL PROFILE OF NEONATES n=114

| **HEMATOLOGICAL PROFILE** | | **APGAR SCORE** | | **P-VALUE** |
|---|---|---|---|---|
| | | 1 – 5 | >5 | |
| Neutropenia | Yes | 10 (8.8%) | 10 (8.8%) | 0.729 |
| | No | 43 (37.7%) | 51 (44.7%) | |
| | | | | |
| Thrombocytopenia | Yes | 19 (16.7%) | 26 (22.8%) | 0.461 |
| | No | 34 (29.8%) | 35 (30.7%) | |
| | | | | |
| Polycythemia | Yes | 3 (2.6%) | 6 (5.3%) | 0.320 |

**TABLE # 8** STRATIFICATION OF HB LEVEL WITH HEMATOLOGICAL PROFILE OF NEONATES n=114

| HEMATOLOGICAL PROFILE | | HB LEVEL [In g/dl] | | P-VALUE |
|---|---|---|---|---|
| | | 10 – 12 | >12 | |
| Neutropenia | Yes | 9 (7.9%) | 11 (9.6%) | 0.459 |
| | No | 34 (29.8%) | 60 (52.6%) | |
| | | | | |
| Thrombocytopenia | Yes | 14 (12.3%) | 31 (27.2%) | 0.240 |
| | No | 29 (25.4%) | 40 (35.1%) | |
| | | | | |
| Polycythemia | Yes | 4 (3.5%) | 5 (4.4%) | 0.460 |
| | No | 39 (34.2%) | 66 (57.9%) | |

**TABLE # 9:** STRATIFICATION OF LEUKOCYTE WITH HEMATOLOGICAL PROFILE OF NEONATES n=114

| HEMATOLOGICAL PROFILE | | LEUKOCYTE [In cmm] | | P-VALUE |
|---|---|---|---|---|
| | | 4400 – 6000 | >6000 | |
| Neutropenia | Yes | 14 (12.3%) | 6 (5.3%) | 0.867 |
| | No | 64 (56.1%) | 30 (26.3%) | |
| | | | | |
| Thrombocytopenia | Yes | 29 (25.4%) | 16 (14.0%) | 0.461 |
| | No | 49 (43.0%) | 20 (17.5%) | |
| | | | | |
| Polycythemia | Yes | 4 (3.5%) | 5 (4.4%) | 0.110 |
| | No | 74 (64.9%) | 31 (27.2%) | |

**TABLE # 10** STRATIFICATION OF PLATELETS WITH HEMATOLOGICAL PROFILE OF NEONATES n=114

| HEMATOLOGICAL PROFILE | | PLATELETS [In mcL] | | P-VALUE |
|---|---|---|---|---|
| | | 150,000 – 250,000 | >250,000 | |
| Neutropenia | Yes | 13 (11.4%) | 7 (6.1%) | 0.851 |
| | No | 59 (51.8%) | 35 (30.7%) | |
| | | | | |
| Thrombocytopenia | Yes | 26 (22.8%) | 19 (16.7%) | 0.031 |
| | No | 53 (46.5%) | 16 (14.0%) | |
| | | | | |
| Polycythemia | Yes | 6 (5.3%) | 3 (2.6%) | 0.561 |
| | No | 73 (64.0%) | 32 (28.1%) | |

**TABLE # 11** STRATIFICATION OF BIRTH WEIGHT WITH HEMATOLOGICAL PROFILE OF NEONATES n=114

| **HEMATOLOGICAL PROFILE** | | **BIRTH WEIGHT** [In kg] | | **P-VALUE** |
|---|---|---|---|---|
| | | 2.4 – 3.5 | >3.5 | |
| Neutropenia | Yes | 9 (7.9%) | 11 (9.6%) | 0.685 |
| | No | 47 (41.2%) | 47 (41.2%) | |
| | | | | |
| Thrombocytopenia | Yes | 32 (28.1%) | 13 (11.4%) | 0.0001 |
| | No | 24 (21.1%) | 45 (39.5%) | |
| | | | | |
| Polycythemia | Yes | 3 (2.6%) | 6 (5.3%) | 0.263 |
| | No | 53 (46.5%) | 52 (45.6%) | |

**TABLE # 12** STRATIFICATION FOR GENDER OF BABY WITH HEMATOLOGICAL PROFILE OF NEONATES n=114

| **HEMATOLOGICAL PROFILE** | | **GENDER OF BABY** | | **P-VALUE** |
|---|---|---|---|---|
| | | Male | Female | |
| Neutropenia | Yes | 16 (14.0%) | 4 (3.5%) | 0.0001 |
| | No | 30 (26.3%) | 64 (56.1%) | |
| | | | | |
| Thrombocytopenia | Yes | 17 (14.9%) | 28 (24.6%) | 0.651 |
| | No | 29 (25.4%) | 40 (35.1%) | |
| | | | | |
| Polycythemia | Yes | 4 (3.5%) | 5 (4.4%) | 0.529 |
| | No | 42 (36.8%) | 63 (55.3%) | |

**TABLE # 13** STRATIFICATION FOR MODE OF DELIVERY WITH HEMATOLOGICAL PROFILE OF NEONATES n=114

| **HEMATOLOGICAL PROFILE** | | **MODE OF DELIVERY** | | **P-VALUE** |
|---|---|---|---|---|
| | | Vaginal | Caesarean | |
| Neutropenia | Yes | 14 (12.3%) | 6 (5.3%) | 0.009 |
| | No | 36 (31.6%) | 58 (50.9%) | |
| | | | | |
| Thrombocytopenia | Yes | 21 (18.4%) | 24 (21.1%) | 0.626 |
| | No | 29 (25.4%) | 40 (35.1%) | |
| | | | | |
| Polycythemia | Yes | 2 (1.7%) | 7 (5.9%) | 0.180 |
| | No | 48 (40.7%) | 61 (51.7%) | |

Applied Chi-Square & Fisher's Exact test

## DISCUSSION

Hypertension during pregnancy is a leading cause of maternal and newborn morbidity. Hypertensive moms may deliver prematurely due to intrauterine growth limitation[15].

Hypertension in pregnancy (HIP) is a major cause of maternal and perinatal morbidity and mortality in the obstetric population. HIP is defined as diastolic blood pressure of at least 90 mmHg, systolic blood pressure of at least 140 mmHg, a 15-mmHg spike in diastolic blood pressure, or a 30-mmHg rise in systolic blood pressure in a pregnant woman on two occasions at least 6 hours apart. HIP problems complicate 12–22% of pregnancies. Blacks account for 16% of HIP pregnancy-related deaths in the US, 2 to 3 times more than white women. United Nations and American College of Obstetricians and Gynecologists recognize four HIP categories. Chronic, gestational, preeclampsia, and superimposed preeclampsia/eclampsia are examples. HELLP syndrome is a severe preeclampsia consequence[16].

Each pregnancy aims for a spontaneous, normal vaginal delivery. Hypertension can complicate pregnancy. Hypertensive pregnancies have a greater rate of newborn morbidity. Hypertensive pregnancies are more likely to result in premature deliveries and low birth weight (LBW)[17-18]. One of the leading causes of maternal and newborn morbidity is pregnancy-induced hypertension (PIH). Pregnancy hypertension reduces blood flow to the uteroplacental unit and causes placental malfunction, which can be deadly. Fatal consequences rise with hypertension severity. Hypertension during pregnancy increases newborn morbidity[19-20]. These children may be born early due to intra-uterine growth limitation. High-rate surgical deliveries and maternal medication side effects may also affect them. These newborns may have a variety of hematological abnormalities that increase morbidity[21-22]. Neutropenia in PIH moms' infants is well reported. Notably, it is the most prevalent congenital Neutropenia. Due to relative intrauterine hypoxia, these babies risk birth asphyxia and meconium aspiration. Drugs used to cure the mother harm the infant. Due to reduced blood supply in pregnant hypertensive disorders, it is lighter than usual[23].

Our findings are consistent with others. In this study, the average maternal age was 28.4±5.5 years. Another study reported a mother age of 31.7±4.1 years, while Al-bahadily AK, et al reported 30.86±6.02 years[24].

The baby gender distribution was 46 (40.4%) male and 68 (59.6%) female. Okoye HC, et al. found 53% male and 47% female newborns, while Al-bahadily AK, et al. found 42% male and 58% female[25].

The neonates had neutropenia in 20 (17.5%), thrombocytopenia in 45 (39.5%), and polycythemia in 9 (7.9%). A study found polycythemia 8%, neutropenia 15%, and thrombocytopenia 38% in neonates of pregnant women with hypertension. In another study, mothers with preeclampsia had 50% of their babies with neutropenia and thrombocytopenia[26].

Preeclampsia affects 3–10% of pregnancies and causes significant fetal and maternal mortality. Pre-eclampsia kills 60,000 mothers annually. During pregnancy, pregnant women develop hypertension and proteinuria de novo, along with edema, neurological issues, and intrauterine growth limitation. Pre-eclampsia is diagnosed with a systolic or diastolic BP of 140 or 90 mmHg and proteinuria of 0.3 g or greater in a 24-hour urine specimen. This begins after 20 weeks and can lead to premature delivery and increase mother and baby risk[27].

## CONCLUSION

The most prevalent hematological profile was thrombocytopenia, followed by neutropenia and polycythemia. The sample population represents one institutional experience, but it covers a wide range of Pakistani regions.

## REFERENCES


1. Dagar J, Au C. Study of hematological profil to mothers with hypertensive pregnancy as compared to n mothers. Int Med J. 2016;3(4):370-3.
2. Bolat A, Gursel O, Kurekci E, Atay A, Ozcan O. Blood parameters changes in cord blood of newborns of hypertensive mothers. Eur J Pediatr. 2013;172(11):1501-9.
3. Sharma G, Nesin M, Feuerstein M, Bussel JB. Maternal and neonatal characteristics associated with neonatal neutropenia in hypertensive pregnancies. Am J Perinatol. 2009;26(09):683-9.
4. Huang SC, Chang FM. The adverse effect on fetal hemogram by preeclampsia: marked anisocytosis with normocytic, normochromic erythrocythemia as well as thrombocytopenia. Early Human Develop. 1994;37(2):91-8.
5. Fraser SH, Tudehope DI. Neonatal neutropenia and thrombocytopenia following maternal hypertension. J Paediatr Child Health. 1996;32(1):31-4.
6. Okoye HC, Eweputanna LI, Korubo KI, Ejele OA. Effects of maternal hypertension on the neonatal haemogram in southern Nigeria: a case-control study. Malawi Med J. 2016;28 (4):174-8.
7. Al-bahadily AK, AL-Omrani A, Mohammed M. The effect of pregnancy induced hypertension on complete blood count of newborn. Int J Pediatr. 2017;5(9):5667-76.
8. Roberts I, Murray NA. Neonatal thrombocytopenia: causes and management. Arch Dis Childhood Fetal Neonat Ed. 2003;88(5):F359-64.
9. Fisher SC, Van Zutphen AR, Werler MM, Romitti PA, Cunniff C, Browne ML. Maternal antihypertensive medication use and selected birth defects in the National Birth Defects Prevention Study. Birth Defects Res. 2018;110(19):1433-42.
10. Spiro L, Scemons D. Management of chronic and gestational hypertension of pregnancy: a guide for primary care nurse practitioners. Open Nurs J. 2018;12:180-3.
11. Holm L, Stucke-Brander T, Wagner S, Sandager P, Schlütter J, Lindahl C, et al. Automated blood pressure self-measurement station compared to office blood pressure measurement for first trimester screening of pre-eclampsia. Health Informatics J. 2019; 25(4):1815-24.
12. Miller MJ, Butler P, Gilchriest J, Taylor A, Lutgendorf MA. Implementation of a standardized nurse initiated protocol to manage severe hypertension in pregnancy. J Matern Fetal Neonatal Med. 2020;33(6):1008-14.
13. Dymara-Konopka W, Laskowska M, Oleszczuk J. Preeclampsia - current management and future approach. Curr Pharm Biotechnol. 2018;19(10):786-96.
14. Gestational hypertension and preeclampsia: ACOG practice bulletin summary, number 222. Obstet Gynecol. 2020;135(6):1492-5.
15. Timpka S, Markovitz A, Schyman T, Mogren I, Fraser A, Franks PW, et al. Midlife development of type 2 diabetes and hypertension in women by history of hypertensive disorders of pregnancy. Cardiovasc Diabetol. 2018;17(1):124.
16. Catov JM, Countouris M, Hauspurg A. Hypertensive disorders of pregnancy and CVD prediction: accounting for risk accrual during the reproductive years. J Am Coll Cardiol. 2018;72(11):1264-6.
17. Yang YY, Fang YH, Wang X, Zhang Y, Liu XJ, Yin ZZ. A retrospective cohort study of risk factors and pregnancy outcomes in 14,014 Chinese pregnant women. Medicine (Baltimore). 2018;97(33):e11748.
18. Colussi G, Catena C, Driul L, Pezzutto F, Fagotto V, Darsiè D, et al. Secondary hyperparathyroidism is associated with postpartum blood pressure in preeclamptic women and normal pregnancies. J Hypertens. 2021;39(3):563-72.
19. American College of Obstetricians and Gynecologists' Committee on Practice Bulletins—Obstetrics. ACOG Practice Bulletin No. 203: chronic hypertension in pregnancy. Obstet Gynecol. 2019;133(1):e26-50.
20. Ishikawa T, Obara T, Nishigori H, Miyakoda K, Ishikuro M, Metoki H, et al. Antihypertensives prescribed for pregnant women in Japan: prevalence and timing determined from a database of health insurance claims. Pharmacoepidemiol Drug Saf. 2018;27(12):1325-34.

21. Gonzalez Suarez ML, Kattah A, Grande JP, Garovic V. Renal disorders in pregnancy: core curriculum 2019. Am J Kidney Dis. 2019;73(1):119-30.
22. Katigbak C, Fontenot HB. A primer on the new guideline for the prevention, detection, evaluation, and management of hypertension. Nurs Womens Health. 2018;22(4):346- 54.
23. ACOG Practice Bulletin No. 202: gestational hypertension and preeclampsia. Obstet Gynecol. 2019;133(1):1.
24. ACOG Committee Opinion No. 743: low-dose aspirin use during pregnancy. Obstet Gynecol. 2018;132(1):e44-52.
25. Smith GN, Pudwell J, Saade GR. Impact of the new American hypertension guidelines on the prevalence of postpartum hypertension. Am J Perinatol. 2019;36(4):440-2.
26. Hauspurg A, Sutton EF, Catov JM, Caritis SN. Aspirin effect on adverse pregnancy outcomes associated with stage 1 hypertension in a high-risk cohort. Hypertension. 2018;72(1):202-7.
27. Kam T, Alexander M. Drug-induced immune thrombocytopenia. J Pharm Pract. 2014;27 (5):430-9.