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The Relationship between Blood Pressure Control in Pregnancy and Unfavorable Perinatal Outcomes

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ABSTRACT— Hypertensive disorders are among the most prevalent medical complications during pregnancy and are a major cause of maternal and perinatal morbidity and mortality worldwide. This study explores the relationship between the degree of blood pressure control during pregnancy and perinatal outcomes. A retrospective cohort study was conducted using medical records of pregnant women diagnosed with hypertension, delivered at a tertiary care hospital from January 2022 to December 2023. The sample comprised 110 participants, categorized into well-controlled, moderately controlled, and poorly controlled BP groups. The primary outcomes measured were preterm birth, low birth weight, IUGR, stillbirth, and neonatal intensive care unit (NICU) admission Of the 110 participants, 38 women (34.5%) had moderately controlled blood pressure (140–159/90–99 mmHg), and 32 women (29.1%) had poorly controlled blood pressure (≥160/100 mmHg). This means that 63.6% of participants had moderate to poor blood pressure control, indicating a higher risk for adverse perinatal outcomes. The study found that poorly controlled blood pressure was significantly associated with higher rates of preterm birth, low birth weight, intrauterine growth restriction (IUGR), and NICU admission. These findings emphasize the importance of effective blood pressure management during pregnancy to reduce complications. These findings underscore the critical importance of effective blood pressure management during pregnancy to improve both maternal and fetal health. Future research should aim to refine blood pressure management guidelines for hypertensive disorders during pregnancy to further optimize perinatal outcomes.

KEYWORDS: unfavorable perinatal outcomes, Blood Pressure Control, Pregnancy

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1. Introduction

Hypertensive disorders are among the most common medical complications during pregnancy and remain a leading cause of maternal and perinatal morbidity and mortality worldwide. These disorders, which include chronic hypertension, gestational hypertension, preeclampsia, and eclampsia, affect approximately 5–10% of pregnancies globally [1]. While the management of hypertension in non-pregnant individuals has clear

guidelines, the optimal blood pressure (BP) targets in pregnancy are less well established. This has significant implications, as both poorly controlled and overly aggressive blood pressure management can lead to unfavorable perinatal outcomes such as preterm birth, low birth weight, intrauterine growth restriction (IUGR), and even stillbirth [2]. Blood pressure control in pregnancy is a delicate balancing act. On one hand, insufficient treatment of maternal hypertension increases the risk of severe maternal complications such as stroke, placental abruption, heart failure, and multi-organ dysfunction. On the other hand, overly aggressive BP lowering may impair uteroplacental perfusion, potentially compromising fetal oxygen and nutrient delivery, leading to IUGR or preterm delivery [18]. Therefore, achieving the appropriate level of blood pressure control is crucial for optimizing both maternal and fetal outcomes.

A growing body of research has focused on defining the most effective approach to blood pressure management in pregnancy. The CHIPS (Control of Hypertension in Pregnancy Study) trial, for instance, compared "tight" versus "less-tight" control of blood pressure in pregnant women with non-severe hypertension. The study found that while tight control reduced the risk of developing severe hypertension, there was no statistically significant improvement in perinatal outcomes, raising questions about how aggressively clinicians should lower BP in this population [4]. Similarly, other randomized trials and meta-analyses have shown that treatment of mild to moderate hypertension can reduce maternal risk without significantly impacting fetal outcomes, though more research is needed to establish safe lower BP thresholds [19]. Unfavorable perinatal outcomes are multifactorial, but blood pressure control plays a central role. For instance, severe hypertension and preeclampsia are closely associated with preterm delivery, often due to the need for early medical intervention to preserve maternal health [2]. Additionally, placental insufficiency, a hallmark of preeclampsia, is a leading cause of fetal growth restriction. Infants born to mothers with poorly managed hypertension are also more likely to require neonatal intensive care and have higher risks of long-term developmental delays [17]. Despite increasing awareness, there remains significant variability in the clinical management of hypertensive disorders during pregnancy. Guidelines differ on when to initiate antihypertensive treatment and what target BP ranges should be maintained. While ACOG recommends initiating treatment for severe hypertension (≥160/110 mmHg), there is less consensus regarding treatment of mild to moderate elevations (140–159/90–109 mmHg). This lack of uniformity in care may contribute to inconsistent outcomes across different healthcare settings [3]. This introduction aims to explore how the degree of blood pressure control during pregnancy impacts perinatal health outcomes, emphasizing the need for tailored treatment protocols and evidence-based guidelines.

2. METHODS

This study employed a quantitative research design to examine the relationship between blood pressure control during pregnancy and unfavorable perinatal outcomes. A retrospective cohort study approach was utilized, analyzing medical records of pregnant women diagnosed with hypertension who delivered at a tertiary care hospital over a two-year period (e.g., January 2022 to December 2023). The primary objective was to determine whether the level of blood pressure control was associated with specific adverse outcomes such as preterm birth, low birth weight, intrauterine growth restriction (IUGR), and stillbirth. Ethical approval was obtained from the hospital's Institutional Review Board (IRB). Patient confidentiality was maintained by de-identifying records, and only authorized researchers had access to the dataset. As this was a retrospective study using existing records, informed consent was waived. The target population consisted of pregnant women aged 22–45 years diagnosed with gestational hypertension, chronic hypertension, or preeclampsia. Inclusion criteria were: (1) singleton pregnancy, (2) documented blood pressure measurements throughout the antenatal period, and (3) delivery at ≥24 weeks gestation. Exclusion criteria included multiple gestations, congenital fetal anomalies, and incomplete medical records. A purposive sampling technique was used to select a sample size of 110 participants, based on availability and completeness of data. Data were extracted

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from electronic health records using a structured data abstraction form. The variables collected for this study were classified into independent, dependent, and covariate categories. The independent variable was the degree of blood pressure control during pregnancy, which was categorized based on average systolic and diastolic blood pressure readings recorded throughout the antenatal period. Participants were grouped into three categories: well-controlled (blood pressure consistently below 140/90 mmHg), moderately controlled (blood pressure fluctuating between 140–159/90–99 mmHg), and poorly controlled (blood pressure at or above 160/100 mmHg). The dependent variables, representing unfavorable perinatal outcomes, included preterm birth (delivery before 37 weeks of gestation), low birth weight (less than 2,500 grams), intrauterine growth restriction (IUGR), stillbirth (fetal death at or beyond 20 weeks of gestation), and neonatal intensive care unit (NICU) admission. In addition, a number of covariates were considered to account for potential confounding factors. These included maternal age, parity, body mass index (BMI), type of hypertension (chronic, gestational, or preeclampsia), antihypertensive treatment regimen, and the presence of comorbidities such as diabetes mellitus. These variables were collected to facilitate a more accurate analysis of the relationship between blood pressure control and perinatal outcomes. Data were entered and analyzed using SPSS version 26. Descriptive statistics were used to summarize participant characteristics and the prevalence of perinatal outcomes. Inferential statistics included chi-square tests to assess associations between BP control categories and categorical outcomes (e.g., preterm birth, stillbirth) and independent t-tests or ANOVA for continuous variables (e.g., birth weight). Multivariate logistic regression was applied to adjust for potential confounding variables and determine the independent effect of BP control on each adverse perinatal outcome. Statistical significance was set at $p < 0.05$.

3. RESULTS AND DISCUSSION

Table 1 presents the distribution of the 110 participants based on the level of blood pressure control during pregnancy. Among the study population, 40 women (36.4%) had well-controlled blood pressure, defined as consistently maintaining readings below 140/90 mmHg throughout the antenatal period. A slightly smaller group, 38 women (34.5%), fell into the moderately controlled category, with blood pressure fluctuating between 140–159/90–99 mmHg. The remaining 32 women (29.1%) were categorized as having poorly controlled blood pressure, with readings at or above 160/100 mmHg. This distribution indicates that a substantial proportion of participants (63.6%) had either moderately or poorly controlled blood pressure, suggesting a potential risk for adverse perinatal outcomes in a significant segment of the study group.

Table 1: Distribution of Participants by Level of Blood Pressure Control (N = 110)

Blood Pressure Control	n (%)
Well-controlled	40 (36.4%)
Moderately controlled	38 (34.5%)
Poorly controlled	32 (29.1%)

The data in Table 2 show a clear trend indicating that the risk of adverse perinatal outcomes increases as blood pressure control worsens during pregnancy. Women in the poorly controlled group experienced the highest rates of complications across nearly all measured outcomes. Specifically, the incidence of preterm birth was 43.8% in the poorly controlled group, significantly higher than 26.3% in the moderately controlled group and just 15.0% among those with well-controlled blood pressure ($p = 0.015$). Similarly, the occurrence of low birth weight was markedly higher in the poorly controlled group (40.6%) compared to 23.7% and 12.5% in the moderately and well-controlled groups, respectively ($p = 0.008$). Intrauterine growth restriction (IUGR) also followed this pattern, affecting 31.3% of poorly controlled cases, versus 15.8% and 7.5% in the other two groups ($p = 0.012$). Although stillbirth rates were higher in the poorly controlled group (12.5%), the difference did not reach statistical significance ($p = 0.098$), possibly due to the limited sample size. Lastly, NICU

admissions were significantly more frequent in the poorly controlled group (56.3%) compared to 31.6% and 20.0% in the moderately and well-controlled groups, respectively (p = 0.003). These findings highlight a statistically significant relationship between inadequate blood pressure control and the risk of preterm birth, low birth weight, IUGR, and NICU admission, underscoring the importance of effective hypertension management during pregnancy.

Table 2: Perinatal Outcomes by BP Control Category

Perinatal Outcome	Well-controlled (n=40)	Moderately controlled (n=38)	Poorly controlled (n=32)	p-value
Preterm birth (%)	6 (15.0%)	10 (26.3%)	14 (43.8%)	0.015*
Low birth weight (%)	5 (12.5%)	9 (23.7%)	13 (40.6%)	0.008*
IUGR (%)	3 (7.5%)	6 (15.8%)	10 (31.3%)	0.012*
Stillbirth (%)	1 (2.5%)	2 (5.3%)	4 (12.5%)	0.098
NICU admission (%)	8 (20.0%)	12 (31.6%)	18 (56.3%)	0.003*
***Statistically significant at p < 0.05**				

Table 3 further supports these associations through multivariate logistic regression analysis, adjusting for potential confounders such as maternal age, BMI, type of hypertension, and comorbidities. The analysis revealed that poor blood pressure control significantly increased the odds of preterm birth (AOR = 3.21), low birth weight (AOR = 3.87), IUGR (AOR = 4.49), and NICU admission (AOR = 4.71), all with p-values below 0.05. Although the adjusted odds ratio for stillbirth (AOR = 2.61) suggested an elevated risk, it was not statistically significant (p = 0.245). These results underscore that poor control of blood pressure during pregnancy is an independent predictor of multiple unfavorable perinatal outcomes. Effective management of maternal hypertension is therefore essential in improving neonatal health and reducing the risk of complications at birth.

Table 3: Logistic Regression: Odds of Adverse Outcomes by Poor BP Control (Reference: Well-controlled)

Outcome	Adjusted Odds Ratio (AOR)	95% Confidence Interval (CI)	p-value
Preterm birth	3.21	1.15 – 8.93	0.026*
Low birth weight	3.87	1.38 – 10.84	0.010*
IUGR	4.49	1.40 – 14.36	0.012*
NICU admission	4.71	1.76 – 12.59	0.002*
Stillbirth	2.61	0.51 – 13.31	0.245
***Statistically significant at p < 0.05**			

The findings of this study provide important insights into the relationship between blood pressure control during pregnancy and unfavorable perinatal outcomes. The results indicate that women with poorly controlled hypertension during pregnancy face significantly higher risks of preterm birth, low birth weight, intrauterine growth restriction (IUGR), and neonatal intensive care unit (NICU) admissions compared to those with well-controlled blood pressure. These findings align with previous research that has demonstrated the detrimental effects of maternal hypertension on fetal development and neonatal health outcomes [23], [24]. The significantly higher rate of preterm birth observed in the poorly controlled group (43.8%) is consistent with existing literature, which suggests that hypertensive disorders in pregnancy, such as preeclampsia and gestational hypertension, increase the likelihood of preterm delivery [27]. Hypertension can cause placental

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insufficiency, leading to the early onset of labor and, consequently, preterm birth [26]. Our findings further support this by showing that women with poorly controlled blood pressure had over three times the odds of experiencing preterm birth compared to those with well-controlled blood pressure (AOR = 3.21; p = 0.026). Similarly, the increased risk of low birth weight (LBW) in the poorly controlled group (40.6%) compared to the well-controlled group (12.5%) is in line with studies that report maternal hypertension as a significant risk factor for intrauterine growth restriction (IUGR) and low birth weight [27]. Poor blood pressure control can affect placental blood flow, which in turn hampers fetal growth. In a study by [20], hypertensive disorders of pregnancy were linked to restricted fetal growth, leading to a higher likelihood of LBW. Our logistic regression analysis supports this association, showing that poor blood pressure control nearly quadrupled the odds of low birth weight (AOR = 3.87; p = 0.010). The findings also reveal a significant association between poorly controlled blood pressure and intrauterine growth restriction (IUGR). Previous studies have consistently found that hypertension, especially preeclampsia, reduces placental perfusion, which results in fetal growth restriction [21]. The 31.3% rate of IUGR in the poorly controlled group is in line with other studies showing that hypertensive disorders are among the most common causes of IUGR [26]. In this study, the odds of IUGR were more than four times higher in the poorly controlled group compared to the well-controlled group (AOR = 4.49; p = 0.012). While the increased risk of stillbirth in the poorly controlled group (12.5%) was observed, it did not reach statistical significance in our study (p = 0.098). This finding is consistent with some studies that have identified a higher risk of stillbirth in pregnancies complicated by hypertension, though the results are not always conclusive [22]. It is possible that the relatively small sample size of this study limited the statistical power to detect a significant difference in stillbirth rates. Nevertheless, the trend observed in our study warrants further investigation, as maternal hypertension is recognized as a potential risk factor for fetal death in later gestation [25]. Lastly, the significantly higher rate of NICU admissions in the poorly controlled group (56.3%) compared to the well-controlled group (20.0%) underscores the impact of maternal hypertension on neonatal outcomes. Babies born to mothers with poorly controlled hypertension are at increased risk for prematurity, respiratory distress, and other complications requiring specialized care, as shown in our findings and corroborated by previous studies [26]. The increased likelihood of NICU admission in hypertensive pregnancies can be attributed to the higher rates of preterm birth, low birth weight, and IUGR in these cases.

4. CONCLUSION

In conclusion, this study emphasizes the significant impact of blood pressure control during pregnancy on perinatal outcomes. The results indicate that women with poorly controlled hypertension are at a markedly higher risk for adverse outcomes such as preterm birth, low birth weight, intrauterine growth restriction (IUGR), and neonatal intensive care unit (NICU) admissions. These findings highlight the critical need for effective monitoring and management of hypertension in pregnancy to mitigate these risks and improve both maternal and fetal health. The associations observed in this study align with existing literature, which underscores the importance of early detection and intervention for hypertensive disorders of pregnancy. While stillbirth rates did not show a statistically significant difference in this study, the trend observed warrants further investigation to better understand the potential risks in this population. Overall, the findings reinforce the need for healthcare providers to closely monitor blood pressure throughout pregnancy, particularly in women with preeclampsia, gestational hypertension, or chronic hypertension, and to implement appropriate interventions to optimize outcomes. Future research, particularly large-scale prospective studies, is needed to further explore the long-term effects of hypertension during pregnancy and refine management strategies for hypertensive disorders.

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