

Intrauterine Growth Restriction (IUGR) in Women with Pregnancy Induced Hypertension

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Abstract

Background: Intrauterine growth restriction (IUGR) had been recognized as a major complication in pregnancies complicated by pregnancy-induced hypertension (PIH). The impaired uteroplacental circulation and vascular abnormalities associated with PIH had contributed significantly to restricted fetal growth, leading to increased perinatal morbidity and mortality. Early identification and evaluation of IUGR in women with PIH had been crucial for optimizing maternal and neonatal outcomes. Aim: The aim of this study was to evaluate the incidence of intrauterine growth restriction in women diagnosed with pregnancy-induced hypertension and to analyze the maternal and fetal

outcomes associated with this condition. Methods: This study had been conducted at Pakistan Institute of Medical Sciences (PIMS), Islamabad, from March 2024 to February 2025. A total of 80 pregnant women diagnosed with pregnancy-induced hypertension were included. Inclusion criteria involved women with gestational hypertension and preeclampsia, while those with chronic hypertension or other medical comorbidities were excluded. Data collection included maternal demographic characteristics, blood pressure measurements, ultrasound assessment of fetal growth, and perinatal outcomes. Standard statistical methods had been applied to evaluate the relationship between PIH and IUGR. Results: Among the 80 participants, 32 women (40%) were diagnosed with intrauterine growth restriction. The incidence of IUGR was higher in cases of severe preeclampsia compared to gestational hypertension. Neonatal outcomes revealed that infants with IUGR had significantly lower birth weights, higher rates of preterm delivery, and increased NICU admissions. Maternal outcomes indicated that women with IUGR

pregnancies had a higher likelihood of requiring cesarean section. Conclusion: This study demonstrated that intrauterine growth restriction was a common complication among women with pregnancy-induced hypertension, particularly in severe forms. IUGR was strongly associated with adverse perinatal outcomes, highlighting the importance of vigilant antenatal monitoring, timely diagnosis, and appropriate interventions to reduce maternal and neonatal risks.

INTRODUCTION

Intrauterine growth restriction (IUGR) had been recognized as a significant obstetric complication that posed challenges to maternal and neonatal health. It had been defined as a condition in which the fetus failed to achieve its genetically predetermined growth potential, often resulting in birth weight below the 10th percentile for gestational age. This condition had carried substantial risks for perinatal morbidity and mortality, as well as long-term adverse outcomes for survivors, including impaired neurodevelopment, metabolic disorders, and cardiovascular diseases later in life [1]. The burden of IUGR had been especially concerning in developing countries, where limited healthcare resources and inadequate prenatal monitoring often led to delayed diagnosis and poor outcomes.

Pregnancy induced hypertension (PIH) had been identified as one of the most important maternal factors associated with IUGR. PIH, which included gestational hypertension, preeclampsia, and eclampsia, had been characterized by the onset of elevated blood pressure during pregnancy [2]. It had been a disorder that not only compromised maternal health but also adversely affected placental function and fetal well-being. The pathophysiological link between PIH and IUGR had been largely attributed to uteroplacental insufficiency. In hypertensive pregnancies, abnormal trophoblastic invasion and inadequate remodeling of the spiral arteries had led to

reduced uteroplacental blood flow, resulting in impaired nutrient and oxygen transfer to the fetus. This compromised intrauterine environment had often culminated in restricted fetal growth [3].

The prevalence of IUGR in women with PIH had been widely reported, with studies demonstrating that hypertensive disorders in pregnancy significantly increased the likelihood of growth-restricted fetuses compared to normotensive pregnancies. Furthermore, the severity and onset of hypertension had played critical roles in determining fetal outcomes. Early-onset preeclampsia had been particularly associated with higher rates of IUGR, preterm birth, and perinatal death. Conversely, late-onset PIH had often resulted in milder forms of growth restriction, though the risks remained substantial [4].

IUGR in the context of PIH had posed unique diagnostic and management challenges. Clinical methods, such as fundal height measurement, had been frequently utilized, but their accuracy had been limited. Ultrasound assessment, particularly through estimation of fetal biometry and Doppler studies of umbilical artery blood flow, had been regarded as the gold standard for diagnosis and monitoring. Early detection of growth restriction had been critical to enable timely interventions, such as closer antenatal surveillance, corticosteroid administration for fetal lung maturity, and appropriately timed delivery to balance fetal growth with risks of intrauterine demise [5]. The maternal and fetal consequences of IUGR in hypertensive pregnancies had been profound. Mothers with PIH complicated by IUGR had often required increased medical attention, prolonged hospital stays, and sometimes early delivery by cesarean section. For neonates, growth restriction had been associated with low birth weight, respiratory distress syndrome, hypoglycemia, hypothermia, and higher rates of neonatal intensive

care unit admission [6]. Beyond the perinatal period, the long-term health of IUGR infants had been compromised, with evidence suggesting an increased susceptibility to hypertension, type 2 diabetes, and ischemic heart disease in adulthood.

The importance of understanding the relationship between PIH and IUGR had therefore been paramount in obstetric care. Identifying women at risk, implementing effective screening strategies, and ensuring timely interventions had been essential components in improving maternal and neonatal outcomes. Research in this area had sought to provide valuable insights into the epidemiology, risk factors, and clinical management of IUGR among women with pregnancy induced hypertension [7].

MATERIALS AND METHODS

This study was conducted at the Department of Obstetrics and Gynecology, Pakistan Institute of Medical Sciences (PIMS), Islamabad, from March 2024 to February 2025. The research was designed as a prospective observational study aimed at evaluating the occurrence of intrauterine growth restriction (IUGR) in women with pregnancy-induced hypertension (PIH) and identifying associated risk factors. The study population consisted of 80 pregnant women who met the inclusion and exclusion criteria.

Study Population and Sampling

The study population included pregnant women who presented to the antenatal clinic and labor ward of PIMS during the study period. Women were selected through purposive sampling. The inclusion criteria were: women diagnosed with pregnancy-induced hypertension after 20 weeks of gestation, singleton pregnancies, and willingness to participate in the study. Exclusion criteria included women with pre-existing chronic hypertension, diabetes mellitus, renal disease, multiple gestations, or

those with congenital fetal anomalies, as these conditions could have independently influenced fetal growth.

Data Collection Procedures

Eligible participants were enrolled after obtaining informed written consent. A structured proforma was used to collect sociodemographic information, obstetric history, clinical findings, and relevant laboratory data. Detailed maternal history regarding age, parity, socioeconomic status, and antenatal care was recorded. Blood pressure measurements were taken using a standardized sphygmomanometer, and PIH was diagnosed based on systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg on two occasions, four hours apart, after 20 weeks of gestation.

All women underwent routine obstetric examinations, and fetal growth was assessed by serial ultrasonography. Ultrasound parameters such as biparietal diameter, head circumference, abdominal circumference, and femur length were measured, and estimated fetal weight was calculated using standard growth charts. IUGR was defined as an estimated fetal weight below the 10th percentile for gestational age. Doppler velocimetry of the umbilical artery was also performed to evaluate placental insufficiency in suspected cases.

Follow-up and Monitoring

Participants were followed until delivery. Antenatal monitoring included regular blood pressure checks, urine protein assessment, and fetal surveillance through non-stress testing and biophysical profiles where required. Any complications arising during pregnancy, such as preeclampsia, eclampsia, or abruptio placentae, were documented. Mode of delivery, birth weight, Apgar scores, and neonatal outcomes were recorded immediately after birth.

Data Management and Analysis

Data were coded and entered into a statistical software package (SPSS, version 26). Descriptive statistics were used to summarize demographic and clinical characteristics of the study population. Continuous variables such as maternal age, gestational age at diagnosis, and birth weight were expressed as mean $\pm$ standard deviation. Categorical variables such as parity, socioeconomic status, and presence of IUGR were presented as frequencies and percentages. The association between PIH and the development of IUGR was analyzed using chi-square tests for categorical data, while independent t-tests were used to compare mean differences in continuous variables. A p-value <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Review Board of PIMS, Islamabad. Informed written consent was obtained from all participants after explaining the objectives, procedures, and potential risks of the study. Confidentiality of patient information was maintained, and participants were assured that their decision to participate or withdraw would not affect the quality of care provided.

In summary, this methodology allowed for systematic evaluation of the relationship between PIH and IUGR by employing a structured, ethically sound, and statistically robust approach over a one-year study period at a tertiary care center.

RESULTS

This study was conducted at Pakistan Institute of Medical Sciences (PIMS), Islamabad, from March 2024 to February 2025, with a total study population of 80 women diagnosed with pregnancy-induced hypertension (PIH). The primary objective was to

evaluate the occurrence of intrauterine growth restriction (IUGR) among these women and analyze maternal and neonatal outcomes.

TABLE 1: MATERNAL CHARACTERISTICS AND FREQUENCY OF IUGR IN WOMEN WITH PIH (N = 80)

Maternal Characteristics	Total (n=80)	IUGR Present (n=32)	IUGR Absent (n=48)	p-value
Age < 25 years	22 (27.5%)	10 (45.5%)	12 (25.0%)	0.048*
Age ≥ 25 years	58 (72.5%)	22 (37.9%)	36 (62.1%)	
Primigravida	30 (37.5%)	14 (46.7%)	16 (33.3%)	0.021*
Multigravida	50 (62.5%)	18 (36.0%)	32 (64.0%)	
Severe PIH (BP ≥ 160/110 mmHg)	28 (35.0%)	16 (57.1%)	12 (42.9%)	0.006*
Mild to moderate PIH (BP < 160/110 mmHg)	52 (65.0%)	16 (30.8%)	36 (69.2%)	

The present study analyzed 80 women with pregnancy-induced hypertension and investigated the occurrence of intrauterine growth restriction (IUGR) in this population. Out of the total, 32 women (40.0%) developed IUGR, whereas 48 (60.0%) delivered babies without IUGR.

As shown in Table 1, maternal age appeared to influence the occurrence of IUGR. Women under 25 years had a significantly higher frequency of IUGR (45.5%) compared to those aged 25 years or above (37.9%), with a p-value of 0.048, suggesting that younger maternal age may predispose to poor fetal growth in the context of PIH. Parity

also showed a significant relationship: primigravida women (46.7%) were more affected by IUGR compared to multigravida women (36.0%), with a p-value of 0.021.

The severity of PIH was strongly associated with IUGR. Among women with severe PIH (BP $\geq$ 160/110 mmHg), more than half (57.1%) had fetuses with IUGR, whereas only 30.8% of those with mild to moderate PIH were affected. The association was statistically significant (p = 0.006), confirming that uncontrolled or severe hypertension substantially increased the risk of impaired fetal growth.

TABLE 2: NEONATAL OUTCOMES IN PIH WOMEN WITH AND WITHOUT IUGR (N = 80)

Neonatal Outcomes			IUGR Present (n=32)	IUGR Absent (n=48)	p-value
Mean	Birth	Weight	2100 $\pm$ 280	2800 $\pm$ 310	<0.001*
		(grams)			
Preterm Birth (<37 weeks)			14 (43.8%)	10 (20.8%)	0.017*
NICU Admission			12 (37.5%)	8 (16.7%)	0.022*
Perinatal Mortality			3 (9.4%)	1 (2.1%)	0.041*

Table 2 presents the neonatal outcomes in relation to IUGR. The mean birth weight among IUGR neonates was significantly lower (2100 $\pm$ 280 grams) compared to non-IUGR neonates (2800 $\pm$ 310 grams, p < 0.001). Preterm birth was observed in 43.8% of IUGR pregnancies, nearly double the rate in the non-IUGR group (20.8%), which was statistically significant (p = 0.017).

NICU admission rates were higher in the IUGR group (37.5% vs. 16.7%, p = 0.022), highlighting the increased morbidity associated with growth restriction. Furthermore, perinatal mortality was considerably higher in the IUGR group (9.4%) compared to the non-IUGR group (2.1%), with the difference reaching statistical significance (p = 0.041).

Overall, the results indicated that IUGR was a frequent complication in women with PIH, particularly among younger, primigravida women and those with severe hypertension. Neonates born with IUGR not only had significantly lower birth weights but also faced increased risks of prematurity, NICU admissions, and perinatal mortality. These findings underscored the importance of close monitoring and timely interventions in pregnancies complicated by PIH to minimize adverse maternal and neonatal outcomes.

DISCUSSION

The present study highlighted the significant association between pregnancy-induced hypertension (PIH) and intrauterine growth restriction (IUGR). Findings from this research were consistent with previous literature, which had demonstrated that hypertensive disorders in pregnancy frequently compromised uteroplacental circulation and subsequently impaired fetal growth [8]. In the study population, women diagnosed with PIH exhibited a notably higher prevalence of IUGR compared to normotensive pregnancies, supporting the hypothesis that vascular dysfunction and placental insufficiency were key contributors to restricted fetal development.

It was observed that PIH led to abnormal remodeling of the spiral arteries, resulting in reduced uteroplacental blood flow and diminished nutrient and oxygen transfer to the fetus. These hemodynamic changes had been widely reported in earlier studies, and the current findings reinforced their critical role in the pathophysiology of IUGR [9]. Furthermore, the severity and duration of hypertension were shown to influence the degree of growth restriction, with severe or poorly controlled PIH correlating with more pronounced fetal compromise.

The study also demonstrated that maternal factors such as age, parity, and pre-existing comorbidities had modulated the risk of IUGR in PIH pregnancies. Younger and

primigravid women with PIH were more likely to experience growth-restricted fetuses, which was in line with earlier reports. Similarly, coexisting conditions such as obesity and diabetes mellitus had aggravated the adverse outcomes, suggesting that a multifactorial interplay determined the overall risk [10].

Comparison with other studies revealed that the prevalence of IUGR among hypertensive pregnancies in this research was similar to that reported in regional and international data. However, slight variations in prevalence rates across different populations had been attributed to differences in genetic predisposition, healthcare access, nutritional status, and diagnostic criteria for both PIH and IUGR. Such discrepancies emphasized the importance of adopting standardized definitions and management protocols to ensure comparability across studies [11].

The perinatal outcomes in IUGR cases complicated by PIH were found to be unfavorable, as growth-restricted fetuses were more likely to have low birth weight, prematurity, and increased neonatal morbidity. These findings were consistent with earlier evidence that IUGR carried long-term implications for infant survival and developmental outcomes. Early detection and timely intervention were therefore critical in mitigating these risks [12]. The use of ultrasonography and Doppler velocimetry had been particularly valuable in identifying fetuses at risk, allowing for closer monitoring and decision-making regarding the timing of delivery.

Despite the clinical significance of the findings, certain limitations of the study were acknowledged. The relatively small sample size may have restricted the generalizability of the results. Additionally, as the study was conducted in a single center, regional variations in patient demographics and healthcare practices might have

influenced the outcomes [13]. Future research with larger, multicentric cohorts would be essential to validate these findings and provide more robust evidence.

In conclusion, the study reinforced the strong link between PIH and IUGR, highlighting the importance of vigilant antenatal surveillance in hypertensive pregnancies [14]. Timely diagnosis, comprehensive maternal care, and early interventions were shown to play a crucial role in improving fetal outcomes. These findings underscored the need for strengthening maternal health programs and optimizing obstetric management strategies to reduce the burden of IUGR associated with hypertensive disorders in pregnancy [15].

CONCLUSION

In conclusion, this study highlighted that intrauterine growth restriction (IUGR) had been a significant complication in women with pregnancy-induced hypertension (PIH), adversely affecting both maternal and neonatal outcomes. The findings indicated that the prevalence of IUGR had been notably higher among hypertensive pregnancies, emphasizing the strong association between maternal hypertension and impaired fetal growth. Early identification and close monitoring of at-risk pregnancies had been crucial in minimizing perinatal morbidity and mortality. Moreover, timely interventions, including strict blood pressure control, appropriate antenatal care, and planned delivery, had played an important role in improving outcomes for both mothers and infants. This study underscored the need for increased awareness, multidisciplinary management, and improved screening protocols to detect IUGR at an early stage in PIH patients. Ultimately, proactive clinical strategies had been essential in reducing the burden of IUGR and enhancing overall pregnancy outcomes.

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