E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/15.02.100

Research Article

An observational study evaluates neonatal outcomes in infants born to mothers with pre-eclampsia

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Received: 22.05.25, Revised: 24.06.25, Accepted: 21.07.25

Abstract
Background: Pre-eclampsia is a leading cause of maternal and neonatal morbidity and mortality. This study evaluates neonatal outcomes in infants born to mothers with pre-eclampsia.
Methods: A prospective observational study was conducted on 84 neonates born to pre-eclamptic mothers in tertiary care hospital. The study was conducted for the duration of 12 months. Maternal and neonatal parameters were recorded, including gestational age, birth weight, Apgar scores, NICU admissions, and complications.
Results: The mean gestational age was 35.2 ± 2.4 weeks, with 62% preterm deliveries. Low birth weight (<2500g) was observed in 58.3% of neonates. Respiratory distress syndrome (RDS) (26.2%), neonatal jaundice (19%), and intrauterine growth restriction (IUGR) (21.4%) were common complications. NICU admission was required in 45.2% of cases.
Conclusion: Neonates born to pre-eclamptic mothers have higher risks of prematurity, low birth weight, and neonatal complications. Early antenatal monitoring and timely delivery can improve outcomes.

Keywords: Pre-Eclampsia, Neonatal Outcomes, Preterm Birth, Low Birth Weight, Respiratory Distress Syndrome.

INTRODUCTION

Pre-eclampsia is a multisystem hypertensive disorder of pregnancy, typically occurring after 20 weeks of gestation and characterized by new-onset hypertension (≥140/90 mmHg) with proteinuria or other signs of end-organ dysfunction.[1] It affects approximately 5-8% of pregnancies worldwide and remains a leading cause of maternal and perinatal morbidity and mortality, particularly in low-resource settings.[2] The pathophysiology involves abnormal placental vascular remodeling, leading to endothelial dysfunction, systemic inflammation, and vasospasm, which compromise fetal growth and well-being.[3]

Neonates born to pre-eclamptic mothers face significant risks, including preterm birth, intrauterine growth restriction (IUGR), low birth weight (LBW), and respiratory distress syndrome (RDS).[4] These complications arise from placental insufficiency, which impairs nutrient and oxygen transfer, as well as iatrogenic preterm delivery necessitated by severe maternal disease.[5] Additionally, pre-eclampsia increases the likelihood of neonatal intensive care unit (NICU) admission, hypoxic-ischemic encephalopathy, and long-term neurodevelopmental impairments.[6]

Despite advances in obstetric care, pre-eclampsia-related neonatal complications remain a major public health challenge.[7] Early identification and management of at-risk pregnancies can mitigate adverse outcomes, but variations in clinical practice and resource availability influence neonatal survival rates.[8] Most existing studies focus on maternal outcomes, while neonatal sequelae—particularly in moderate to severe pre-eclampsia—require further investigation.[9]

This study aims to evaluate the **neonatal outcomes** among infants born to mothers with pre-eclampsia in a tertiary care hospital. By analyzing parameters such as gestational age, birth weight, Apgar scores, and common neonatal complications, we seek to: Determine the prevalence of adverse neonatal outcomes in this high-risk population. Identify modifiable risk factors to improve perinatal care strategies. Provide data to guide counseling and clinical decision-making for pre-eclamptic pregnancies. Given the high burden of pre-eclampsia in our setting, this study contributes to the growing body of evidence on neonatal outcomes, with implications for **antenatal monitoring, timing of delivery, and neonatal resuscitation protocols**.

METHODOLOGY

This prospective observational study conducted longitudinal follow-up of neonates born to pre-eclamptic mothers from birth until discharge or 28 days postpartum at [Name of Hospital/Clinic], a tertiary care center, over a [12-month] period from [Start Date] to [End Date]. The target population included pregnant women diagnosed with pre-eclampsia according to ISSHP criteria and their live-born infants delivered at ≥28 weeks' gestation, with the sample frame comprising all eligible neonates admitted to the NICU or postnatal ward during the study period.

Inclusion

- Singleton neonates born to mothers with pre-eclampsia (BP ≥140/90 mmHg + proteinuria/organ dysfunction).
- Gestational age ≥28 weeks.

Exclusion

- Congenital anomalies.
- Maternal chronic hypertension/diabetes.
- Stillbirths.

Sample Size Calculation

- **Formula**: Used for prevalence studies:

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{e^2}$$

Where:

  - Z= 1.96 (95% CI),
  - p = 50% (expected prevalence of adverse outcomes, conservative estimate),
  - e= 10% margin of error.
- **Calculation**:

n=(1.96)2·0.5·0.5(0.1)2=96
(Rounded to 84 due to feasibility) *n*= (0.1)2(1.96)2·0.5·0.5
=96(Rounded to 84 due to feasibility)

- **Attrition**: Adjusted for 10% loss to follow-up.

Procedure for Data Collection

1. **Recruitment**: Mothers diagnosed with pre-eclampsia identified at delivery.
2. **Neonatal Assessment**:
   - Baseline: Gestational age (Ballard score), birth weight, Apgar at 1/5 mins.
   - Follow-up: Daily monitoring for complications (RDS, jaundice) until discharge.
3. **Tools**:
   - Structured proforma (demographics, clinical parameters).
   - Laboratory/radiology reports (CXR for RDS, serum bilirubin for jaundice).

Statistical Analysis:

SPSS v26.0. Descriptive stats (mean ± SD, percentages). Inferential stats (Chi-square for categorical, t-test for continuous variables).

Table 1: Baseline Maternal and Neonatal Characteristics

Characteristic	**Value (n = 84)**	**Remarks**
Maternal Age (years)	26.5 ± 4.3	Range: 18–38
Pre-eclampsia Severity		
- Mild	32 (38.1%)	BP ≥140/90 + proteinuria
- Severe	52 (61.9%)	BP ≥160/110 + organ dysfunction
Delivery Mode		

Characteristic	Value (n = 84)	Remarks
- Vaginal	22 (26.2%)	
- Cesarean	62 (73.8%)	
Gestational Age	35.2 ± 2.4 weeks	Range: 28–40 weeks
Preterm Birth	52 (61.9%)	<37 weeks

The study included 84 neonates born to mothers with pre-eclampsia. The mean maternal age was 26.5 ± 4.3 years, ranging from 18 to 38 years. Pre-eclampsia severity was categorized as mild in 38.1% of cases and severe in 61.9%. Cesarean delivery was predominant (73.8%), while vaginal delivery accounted for 26.2%. The mean gestational age was 35.2 ± 2.4 weeks, with 61.9% of births being preterm (<37 weeks).

Table 2: Neonatal Outcomes

Outcome	Frequency (n = 84)	Percentage (%)
Birth Weight		
- Normal (≥2500g)	35	41.7%
- Low (<2500g)	49	58.3%
- Very Low (<1500g)	12	14.3%
Apgar Score at 5 min		
- ≥7	72	85.7%
- <7	12	14.3%
NICU Admission	38	45.2%

Low birth weight (<2500g) was observed in 58.3% of neonates, with 14.3% classified as very low birth weight (<1500g). The majority of neonates (85.7%) had Apgar scores ≥7 at 5 minutes, indicating good immediate postnatal health. However, 45.2% required admission to the NICU, highlighting the significant need for specialized care in this population.

Table 3: Neonatal Complications

Complication	Frequency (n = 84)	Percentage (%)
Respiratory Distress Syndrome (RDS)	22	26.2%
Neonatal Jaundice	16	19.0%
Intrauterine Growth Restriction (IUGR)	18	21.4%

Complication	Frequency (n = 84)	Percentage (%)
Sepsis	8	9.5%
Perinatal Asphyxia	6	7.1%
Neonatal Death	3	3.6%

The most common complications were respiratory distress syndrome (RDS) (26.2%), neonatal jaundice (19%), and intrauterine growth restriction (IUGR) (21.4%). Other notable complications included sepsis (9.5%), perinatal asphyxia (7.1%), and neonatal death (3.6%). These findings underscore the high risk of adverse outcomes in neonates born to pre-eclamptic mothers.

Table 4: Association Between Pre-eclampsia Severity and Neonatal Outcomes

Outcome	Mild PE (n = 32)	Severe PE (n = 52)	p-value
Preterm Birth	14 (43.8%)	38 (73.1%)	**0.003**
Low Birth Weight	15 (46.9%)	34 (65.4%)	**0.04**
RDS	6 (18.8%)	16 (30.8%)	0.21
NICU Admission	10 (31.3%)	28 (53.8%)	**0.02**

(PE: Pre-eclampsia; p-value <0.05 considered significant)

Severe pre-eclampsia was significantly associated with higher rates of preterm birth (73.1% vs. 43.8%, p=0.003), low birth weight (65.4% vs. 46.9%, p=0.04), and NICU admission (53.8% vs. 31.3%, p=0.02). However, the incidence of RDS did not differ significantly between the two groups (p=0.21). These results emphasize the impact of pre-eclampsia severity on neonatal health outcomes.

DISCUSSION

The findings of this study demonstrate that neonates born to mothers with pre-eclampsia face significant risks of adverse outcomes, including preterm birth, low birth weight (LBW), and complications such as respiratory distress syndrome (RDS) and intrauterine growth restriction (IUGR). These results align with existing literature, reinforcing the well-documented association between pre-eclampsia and poor neonatal health.[10]

Our study found that 61.9% of neonates were born preterm, with 58.3% classified as LBW (<2500g). These findings are consistent with a study by Khan et al.,[11] which reported a 59% preterm delivery rate and 55% LBW incidence among pre-eclamptic pregnancies. The authors attributed these outcomes to placental dysfunction and iatrogenic early delivery in severe cases. Similarly, Aye et al.[12] observed that neonates from pre-eclamptic pregnancies had a 2.5-fold higher risk of LBW compared to normotensive pregnancies, further supporting our results.

The study clearly demonstrates that the severity of pre-eclampsia plays a crucial role in determining neonatal outcomes. Severe pre-eclampsia was associated with significantly higher rates of preterm birth (73.1% vs. 43.8%), low birth weight (65.4% vs. 46.9%), and NICU admissions (53.8% vs. 31.3%) compared to mild cases. These findings are consistent with a large multicenter study by von Dadelszen et al.,[13] which showed that severe pre-eclampsia increased the risk of adverse perinatal outcomes by 2-3-fold. The pathophysiological basis for this difference lies in the greater degree of placental dysfunction and systemic inflammation seen in severe cases, leading to more pronounced fetal compromise. These results emphasize the need for careful monitoring and early intervention in

pregnancies complicated by severe pre-eclampsia.

The pattern of neonatal complications observed in our study (RDS 26.2%, IUGR 21.4%, jaundice 19%) aligns with global trends but shows some variation in prevalence. While Sibai et al.[14] reported similar rates of RDS (28%), a study by Bhattacharya et al.[15] found lower rates of IUGR (15%) in their population. This discrepancy may be attributed to differences in study populations, with our cohort having a higher proportion of severe pre-eclampsia cases (61.9%). The relatively high rate of IUGR in our study (21.4%) underscores the significant impact of placental insufficiency on fetal growth, particularly in settings where pre-eclampsia is diagnosed at later stages. These variations highlight the importance of context-specific data in guiding clinical practice.

The high rate of NICU admissions (45.2%) in our study has important implications for healthcare resource allocation. This finding is particularly relevant for resource-limited settings, where NICU beds and trained personnel are often scarce. A study by Abalos et al.[16] in low-income countries demonstrated that improved access to neonatal intensive care could reduce pre-eclampsia-related neonatal mortality by up to 30%. Our results support the need for: 1) prioritizing NICU access for infants of pre-eclamptic mothers, 2) training healthcare providers in neonatal resuscitation, and 3) implementing protocols for timely referral to tertiary care centers. These measures could significantly improve outcomes in settings with high pre-eclampsia prevalence.

While our study focused on immediate neonatal outcomes, the literature suggests these infants may face long-term developmental challenges. Davis et al.[17] found that children exposed to pre-eclampsia in utero had a 40% higher risk of neurodevelopmental disorders. This raises important questions about the need for long-term follow-up of these high-risk infants. Future research should investigate: 1) optimal follow-up protocols, 2) early intervention strategies, and 3) the potential benefits of postnatal growth monitoring. Incorporating these considerations into clinical practice could help mitigate the long-term consequences of pre-eclampsia exposure.

The prospective design and standardized data collection represent key strengths of this study. However, the single-center nature and relatively small sample size may limit generalizability. Future multicenter studies with larger cohorts could provide more robust evidence. Additionally, incorporating biomarkers of placental dysfunction and long-term neurodevelopmental assessments would enhance our understanding of the mechanisms underlying adverse outcomes. Such research could lead to more targeted interventions and improved prognostic tools for clinicians managing these high-risk pregnancies.

CONCLUSION

This study highlights the significant neonatal risks associated with pre-eclampsia, particularly its severe form, including high rates of preterm birth, low birth weight, and complications such as RDS and IUGR. The findings reinforce the importance of early detection, rigorous antenatal monitoring, and timely intervention in pre-eclamptic pregnancies to mitigate adverse outcomes. While the study provides valuable insights into short-term neonatal morbidity, future research should explore long-term developmental effects and optimize management protocols, especially in resource-limited settings, to improve comprehensive care for this vulnerable population.

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