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Association of maternal hypertensive disorders of pregnancy with neonatal morbidity and NICU admission: A two-year retrospective observational study from a tertiary care Centre in Eastern India.

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Abstract

Background:
Hypertensive disorders of pregnancy (HDP), particularly pre-eclampsia and eclampsia, are major contributors to maternal and neonatal morbidity and are associated with adverse neonatal outcomes, including prematurity, low birth weight, and neonatal intensive care unit (NICU) admission.

Objective:
To determine the incidence of pre-eclampsia/eclampsia among deliveries at a tertiary care teaching hospital and evaluate its association with neonatal morbidity and NICU admission compared with normotensive pregnancies.

Methods:
This retrospective observational cohort study was conducted in the Department of Obstetrics and Gynaecology, Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, using departmental records from January 2024 to December 2025. Women diagnosed with pre-eclampsia/eclampsia after 20 weeks of gestation and delivering at ≥28 weeks were included. Neonatal outcomes were compared with those of normotensive pregnancies using the chi-square test and relative risk (RR), with $p<0.05$ considered statistically significant.

Results:
Among 1,378 deliveries, 83 (6.02%) were complicated by pre-eclampsia/eclampsia. Compared with normotensive pregnancies, neonates of mothers with hypertensive disorders had significantly higher rates of NICU admission (71.1% vs. 7.6%; RR=9.39, $p<0.001$), preterm birth (31.3% vs. 17.1%; RR=1.84, $p=0.002$), low birth weight (55.4% vs. 29.7%; RR=1.87, $p<0.001$), stillbirth/intrauterine death (9.6% vs. 1.7%; RR=5.67, $p<0.001$), respiratory distress (28.9% vs. 3.7%; RR=7.80, $p<0.001$), and meconium aspiration (14.5% vs. 2.0%; RR=7.20, $p<0.001$).

Conclusion:
Maternal hypertensive disorders of pregnancy are significantly associated with adverse neonatal outcomes and substantially increased NICU admission.

Recommendation:
Early antenatal detection, close maternal–fetal surveillance, and timely referral of high-risk pregnancies to tertiary centres with NICU facilities are recommended to improve neonatal outcomes.

Keywords: *Hypertensive disorders of pregnancy; Pre-eclampsia; Neonatal morbidity; Neonatal intensive care unit; Pregnancy outcomes.*
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Introduction
Hypertensive disorders of pregnancy (HDP) encompass a spectrum of conditions including gestational hypertension, chronic hypertension, and pre-eclampsia/eclampsia, and together they represent one of the most common medical complications encountered in obstetric practice, affecting approximately 8-10% of pregnancies worldwide [1,2]. Pre-eclampsia is defined as new-onset hypertension after 20 weeks of gestation accompanied by proteinuria or other evidence of maternal end-organ dysfunction, and its progression to eclampsia is characterised by the onset of generalised tonic-clonic seizures [3]. In India, hypertensive

disorders of pregnancy constitute the third most important cause of maternal mortality, following haemorrhage and sepsis [4].

The pathophysiology of pre-eclampsia centres on abnormal trophoblastic invasion of the maternal spiral arteries, leading to placental hypoperfusion, endothelial dysfunction, and release of anti-angiogenic factors into the maternal circulation [3]. This uteroplacental insufficiency not only threatens maternal health but also compromises fetal growth and well-being, frequently necessitating iatrogenic preterm delivery to safeguard both mother and baby [5]. As a direct consequence, infants born to hypertensive mothers are recognised to be at substantially higher risk of prematurity, low birth weight, respiratory distress, birth asphyxia, and other morbidities requiring intensive neonatal care [2,5].

Several observational studies from India and elsewhere have documented a strong association between maternal hypertensive disorders and adverse neonatal outcomes, including markedly higher rates of NICU admission compared with normotensive pregnancies [6,7]. However, the burden of this association varies with disease severity, gestational age at diagnosis, timing of delivery, and the level of care available at the treating institution [8]. Given that IGIMS, Patna, functions as a tertiary referral centre for high-risk obstetric cases in the region, a large proportion of the pre-eclampsia/eclampsia caseload managed here is likely to reflect more severe or advanced disease at presentation.

This study was therefore undertaken to determine the incidence of pre-eclampsia/eclampsia among deliveries over two years at our institution and to systematically compare neonatal morbidity and NICU admission rates between hypertensive and normotensive pregnancies, to highlight the magnitude of risk and inform strategies for early detection, referral, and neonatal preparedness.

Materials and Methods

Study Design and Setting

This retrospective observational cohort study was conducted in the Department of Obstetrics and Gynaecology, Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar, India, a tertiary care teaching hospital and referral centre for high-risk obstetric cases. The study utilized departmental delivery registers and medical records collected over two years from January 2024 to December 2025.

Study Population

The study included pregnant women diagnosed with pre-eclampsia or eclampsia after 20 weeks of gestation whose neonates were delivered at a gestational age of ≥28 weeks.

Inclusion criteria

- Pregnant women with pre-eclampsia or eclampsia diagnosed after 20 weeks of gestation.
- Delivery at a gestational age of ≥28 weeks.

Exclusion criteria

- Women with chronic hypertension.
- Women with a known seizure disorder.
- Women with systemic diseases unrelated to pregnancy (e.g., chronic renal disease).
- Cases with incomplete or missing medical records.

A normotensive comparison group comprising all other eligible deliveries during the same study period was included for comparison of neonatal outcomes.

Data Collection

Maternal demographic characteristics, gestational age at diagnosis and delivery, and neonatal outcome variables were extracted from departmental delivery registers and individual medical records using a standardized data collection format. The primary neonatal outcomes assessed were neonatal intensive care unit (NICU) admission, preterm birth (<37 weeks), low birth weight (<2.5 kg), stillbirth/intrauterine death, respiratory distress, and meconium aspiration.

Bias

To minimize selection bias, all eligible cases of pre-eclampsia/eclampsia that met the predefined inclusion and exclusion criteria during the study period were included. A contemporaneous normotensive control group from the same institution and study period was used to reduce temporal bias. Information bias was minimized by extracting data from standardized hospital records and delivery registers using uniform eligibility criteria. Records with incomplete or missing information were excluded to improve data accuracy and reliability.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Categorical variables were summarized as frequencies and percentages. Comparisons between the hypertensive and normotensive groups were performed using the Chi-square test, and relative risks (RRs) were calculated for each neonatal outcome. A two-sided *p*-value <0.05 was considered statistically significant.

Ethical Considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical approval was obtained from the **Institutional Ethics Committee, Indira Gandhi Institute of Medical Sciences (IGIMS), Patna**, before commencement of the study. The approval number was [Approval Number], and the approval was

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granted on [Approval Date]. As this was a retrospective record-based study, patient confidentiality was strictly maintained by anonymizing all collected data, and no personally identifiable information was recorded.

Results

During the two-year study period (January 2024 to December 2025), a total of 1378 deliveries were recorded at the department, of which 83 (6.02%) were complicated by pre-eclampsia/eclampsia (Table 1). Of these 83 cases, 57 (68.7%) delivered at term (≥37 weeks) and 26 (31.3%) delivered preterm (<37 weeks).

Table 1. Incidence of pre-eclampsia/eclampsia among total deliveries

Parameter	Value
Total deliveries during study period (Jan 2024–Dec 2025)	1378
Cases of pre-eclampsia/eclampsia detected	83
Incidence of pre-eclampsia/eclampsia	6.02%
Normotensive comparison group	1295
Delivered at term (≥37 weeks) among PE/E cases	57 (68.7%)
Delivered preterm (<37 weeks) among PE/E cases	26 (31.3%)

Neonatal outcomes were compared between the 83 pre-eclampsia/eclampsia cases and 1295 normotensive controls (Table 2, Figure 1). NICU admission was required in 59 of 83 (71.1%) neonates born to mothers with pre-eclampsia/eclampsia compared with 98 of 1295 (7.6%) neonates of normotensive mothers (RR 9.39, χ^2=305.46, p<0.001). Preterm birth occurred in 31.3% versus 17.1% (RR 1.84, p=0.002), low birth weight (<2.5 kg) in 55.4% versus 29.7% (RR 1.87, p<0.001), stillbirth/IUD in 9.6% versus 1.7% (RR 5.67, p<0.001), respiratory distress in 28.9% versus 3.7% (RR 7.80, p<0.001), and meconium aspiration in 14.5% versus 2.0% (RR 7.20, p<0.001). All differences were statistically significant
.

Table 2. Comparison of neonatal outcomes between pre-eclampsia/eclampsia cases and normotensive controls

Neonatal outcome	Pre-eclampsia/ Eclampsia (n = 83)	Normotensive controls (n = 1295)	Relative Risk	χ^2	p-value
NICU admission	59 (71.1%)	98 (7.6%)	9.39	305.46	<0.001
Preterm birth (<37 weeks)	26 (31.3%)	221 (17.1%)	1.84	9.83	0.002
Low birth weight (<2.5 kg)	46 (55.4%)	384 (29.7%)	1.87	22.94	<0.001
Stillbirth / IUD	8 (9.6%)	22 (1.7%)	5.67	19.51	<0.001
Respiratory distress	24 (28.9%)	48 (3.7%)	7.80	95.07	<0.001
Meconium aspiration	12 (14.5%)	26 (2.0%)	7.20	40.56	<0.001

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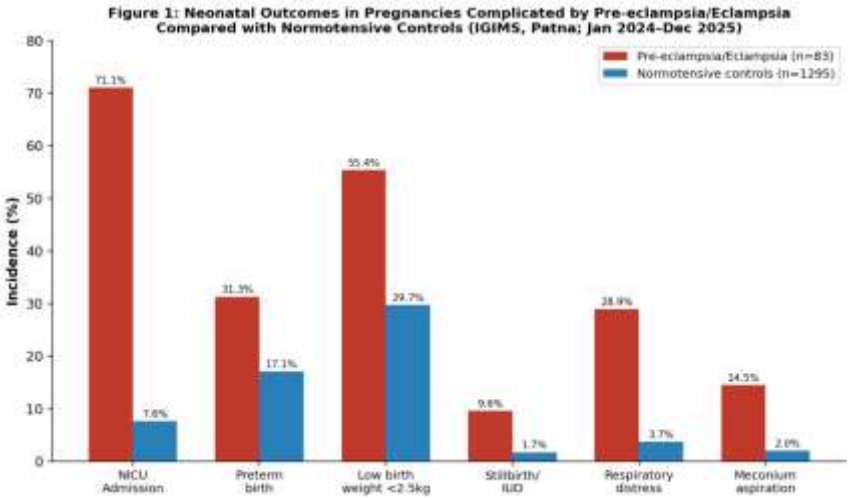

Figure 1. Comparison of neonatal outcomes (%) between pregnancies complicated by pre-eclampsia/eclampsia and normotensive controls.

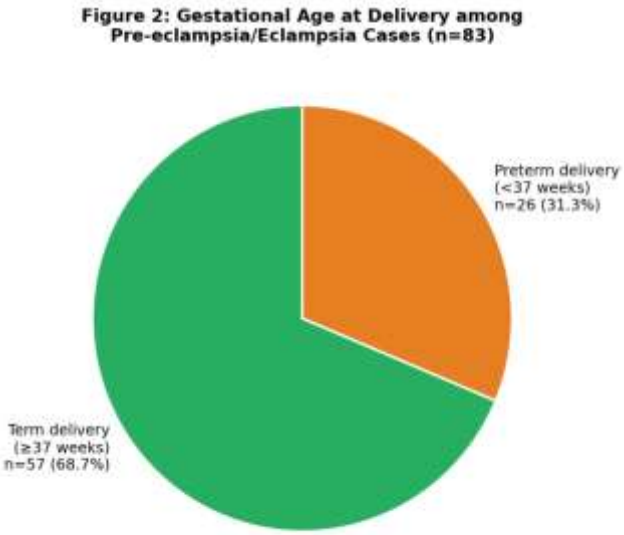

Figure 2. Gestational age at delivery among pre-eclampsia/eclampsia cases (n=83).

Discussion

The present study, conducted over two years at a tertiary referral centre in Eastern India, found an incidence of pre-eclampsia/eclampsia of 6.02% among total deliveries, which is consistent with the widely reported global range of 6-10% for hypertensive disorders of pregnancy [1,2]. This confirms that HDP continues to represent a substantial proportion of the high-risk obstetric caseload at tertiary centres in this region.

The NICU admission rate of 71.1% observed among neonates of mothers with pre-eclampsia/eclampsia in our study closely mirrors the 70.83% reported by a retrospective study of 120 cases of severe pre-eclampsia and eclampsia from a tertiary centre in Western India [7], suggesting that referral hospitals managing predominantly severe or late-presenting disease encounter comparably high rates of neonatal intensive care requirement. In contrast, other Indian cohorts have reported somewhat lower NICU admission rates - 40% in a prospective study from Andhra

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Pradesh [9] and 46.4% in a retrospective cohort from a South Indian teaching hospital [8] - a difference that may reflect variation in disease severity, gestational age at diagnosis, and institutional referral patterns. A prospective observational study from a tertiary hospital similarly reported NICU admission in 35.1% of newborns of hypertensive mothers [6], while a cross-sectional analysis restricted specifically to preeclampsia/eclampsia (as opposed to milder gestational or chronic hypertension) found a NICU admission rate of 22.7% [10], considerably lower than in our cohort; this again underscores that the risk of NICU admission rises sharply with increasing disease severity and lower gestational age at delivery, both of which are more common in patients referred to a tertiary high-risk centre such as ours.

The preterm birth rate of 31.3% among our pre-eclampsia/eclampsia cases is comparable to rates reported in similar Indian studies of severe hypertensive disease [8,11], and reflects the frequent need for iatrogenic early delivery to prevent progression of maternal disease and its complications [5]. Likewise, the low birth weight rate of 55.4% in our cohort is broadly consistent with other reports linking hypertensive disorders to fetal growth restriction secondary to chronic uteroplacental insufficiency [11,12]. A large retrospective claims-based analysis similarly found that preterm delivery, low birth weight, and NICU admission were most strongly associated with preeclampsia and superimposed preeclampsia, compared with milder forms of hypertension such as gestational or chronic hypertension [5], reinforcing the observation that disease subtype and severity are key determinants of neonatal risk.

The stillbirth/intrauterine death rate of 9.6% in our study was higher than the 6.8% reported in a tertiary hospital cohort of HDP pregnancies [6], and considerably higher than the 1.7% observed in our normotensive comparison group, again highlighting the disproportionate perinatal risk borne by pregnancies complicated by severe hypertensive disease. Respiratory distress (28.9%) and meconium aspiration (14.5%) rates in our cohort were also markedly elevated compared with normotensive controls, consistent with findings from a case-control study of women requiring intensive care for hypertensive disorders, which similarly reported significantly higher rates of respiratory distress syndrome and related neonatal morbidity in the more severe disease groups [13].

Taken together, these findings are in agreement with a growing body of literature - spanning South Asian tertiary centres [7,8,9], claims-based cohorts [5], and multicentre neonatal network data [14] - confirming that hypertensive disorders of pregnancy, and particularly pre-eclampsia and eclampsia, are consistently and strongly associated with adverse neonatal outcomes, chief among them NICU admission, prematurity, and low birth weight. The consistency of this association across diverse settings and study designs, including systematic reviews extending the finding even to twin gestations [15], underscores the biological plausibility of uteroplacental insufficiency as the common underlying mechanism, and reinforces the clinical importance of early antenatal detection, timely referral to centres with neonatal intensive care facilities, and close fetomaternal surveillance in all pregnancies complicated by hypertensive disease.

This study has certain limitations. Being a retrospective, single-centre study, it is subject to the inherent limitations of record-based data collection, including possible under-documentation of milder or borderline cases and the referral bias associated with a tertiary high-risk centre, which may have contributed to the relatively high NICU admission rate observed. Disease subtypes (gestational hypertension, pre-eclampsia, severe pre-eclampsia, eclampsia) were not separately sub-analysed, and long-term neonatal follow-up beyond the NICU stay was not assessed. Prospective, multicentric studies with sub-classification by disease severity are recommended to further characterise this association.

Generalizability

Although this study was conducted at a single tertiary care referral centre, the findings are likely to apply to similar tertiary healthcare settings that manage high-risk pregnancies. The observed association between hypertensive disorders of pregnancy and adverse neonatal outcomes is consistent with previous studies, supporting the external validity of the results. However, differences in patient demographics, referral patterns, healthcare resources, and clinical practices may limit the generalizability of these findings to primary and secondary healthcare facilities. Therefore, multicentre prospective studies involving more diverse populations are recommended to further validate these findings.

Conclusion

Maternal hypertensive disorders of pregnancy, particularly pre-eclampsia and eclampsia, are strongly and significantly associated with adverse neonatal outcomes, including a nearly ten-fold higher risk of NICU admission compared with normotensive pregnancies, along with significantly increased rates of preterm birth, low birth weight, stillbirth, respiratory distress, and meconium aspiration. These findings emphasise the need for early antenatal screening for hypertensive disorders, close maternal-fetal surveillance once diagnosed, and timely referral to tertiary centres equipped with neonatal intensive care facilities, to reduce the substantial burden of neonatal morbidity associated with this common obstetric complication.

Recommendation

Routine antenatal screening for hypertensive disorders of pregnancy should be strengthened to facilitate early diagnosis and timely intervention. Pregnant women diagnosed with pre-eclampsia or eclampsia should receive close maternal and fetal surveillance and, where appropriate, early referral to tertiary care centres equipped with neonatal intensive care facilities. Further multicentre prospective studies are recommended to validate these findings and guide evidence-based clinical practice.

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Author Contributions

Supriya Kumari: Conceptualization, study design, data collection, data analysis, interpretation of results, manuscript drafting, and final approval of the manuscript.
Amrita Bharti: Methodology, literature review, data interpretation, critical revision of the manuscript, and final approval.
Archana Singh: Study supervision, validation of results, critical review and editing of the manuscript, and final approval.
All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

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Data Availability
The datasets generated and/or analysed during the current study are available from the corresponding author upon reasonable request.

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