

Management Practices and Maternal Outcomes in Hypertensive Disorders of Pregnancy

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Abstract

Background: Hypertensive disorders of pregnancy (HDP) are a leading cause of maternal and perinatal morbidity worldwide, encompassing pregnancy-induced hypertension (PIH), pre-eclampsia and co-existing phenotypes. Despite established international guidance on antihypertensive therapy, aspirin prophylaxis and postpartum surveillance, real-world evidence describing how these practices shape maternal outcomes within routine National Health Service care remains limited. This study aimed to describe management practices and maternal outcomes among pregnancies complicated by HDP and to compare these parameters between pre-eclampsia and PIH.

Methods: This retrospective observational study analysed 466 pregnancy episodes complicated by HDP managed at Medway Maritime Hospital, Medway NHS Foundation Trust between 15 July 2022 and 15 July 2024. Data on maternal profile, antenatal management, mode of delivery, maternal complications and postpartum follow-up were extracted from clinical records and analysed using IBM SPSS Statistics version 25.0; multivariable logistic regression was used to assess phenotype-specific associations with preterm birth and emergency caesarean delivery.

Results: Pre-eclampsia accounted for 314 (67.4%) episodes and PIH for 145 (31.1%). Antihypertensive therapy was documented in 79.8% of episodes and low-dose aspirin in 213 (45.8%) episodes; timing of initiation was known for all 213 episodes and 208 (97.7%) started aspirin before 16 weeks of gestation. Preterm birth occurred in 24.7% of pregnancies overall and was significantly more frequent in pre-eclampsia than PIH (31.8% vs 10.3%; $p < 0.001$; adjusted OR 3.91, 95% CI 2.18–7.01), as were corticosteroid administration (24.5% vs 9.0%; $p < 0.001$) and emergency caesarean delivery (54.5% vs 38.6%; Fisher's exact $p = 0.002$; adjusted OR 1.87, 95% CI 1.25–2.80). The composite adverse maternal outcome occurred in 3.0% of episodes overall, without a statistically significant difference between phenotypes (4.1% vs 0.7%; $p = 0.075$). Mean gestational age at delivery was 37.4 ± 2.7 weeks and was significantly earlier in pre-eclampsia than PIH (36.9 ± 3.0 vs 38.2 ± 1.9 weeks; $p < 0.001$). Two-week postpartum follow-up was documented in 70.6% of episodes.

Conclusion: Pre-eclampsia was associated with higher rates of preterm birth, emergency caesarean delivery and corticosteroid use than PIH. In adjusted analyses, pre-eclampsia remained independently associated with preterm birth and emergency caesarean delivery, while severe maternal complications remained uncommon.

Keywords: Hypertensive disorders of pregnancy; pre-eclampsia; pregnancy-induced hypertension; maternal outcomes; antihypertensive therapy.

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Introduction

Hypertensive disorders of pregnancy (HDP) constitute one of the most significant contributors to maternal and perinatal morbidity worldwide, encompassing conditions ranging from pregnancy-induced hypertension (PIH), used in this study to refer to gestational hypertension, to pre-eclampsia and its more severe variants [1]. Global epidemiological analyses indicate that the absolute burden of HDP has risen substantially over recent decades, even as age-standardised incidence rates have shown a gradual decline in several high-income settings [1,2]. In the United States, the incidence of HDP among singleton

deliveries increased steadily between 1989 and 2020 [2], while population-based estimates place the global prevalence of HDP between five and ten percent, with pre-eclampsia and eclampsia disproportionately affecting low-resource settings [3]. Established risk factors, including advanced maternal age, primiparity, multiple pregnancy, pre-existing hypertension and gestational diabetes mellitus, remain broadly consistent across populations, though their relative contribution differs by region [4]. A recent systematic review and meta-analysis reported pooled global prevalence estimates of 4.4% for pre-eclampsia, 0.43% for eclampsia and 0.39% for HELLP syndrome,

underscoring that severe presentations, while less common, continue to carry disproportionate clinical significance [5].

Contemporary classification, following the International Society for the Study of Hypertension in Pregnancy, distinguishes chronic hypertension, gestational hypertension and pre-eclampsia largely on the basis of onset and evidence of maternal end-organ or uteroplacental dysfunction and recommends a blood-pressure treatment target of 135/85 mmHg together with structured postpartum review [6]. Management guidance from the American College of Obstetricians and Gynecologists similarly emphasises early risk stratification and individualised antihypertensive therapy [7]. Evidence supporting pharmacological treatment in pregnancy has also been informed by the Control of Hypertension in Pregnancy Study (CHIPS), which found that tighter blood pressure control reduced severe maternal hypertension without a significant difference in the primary perinatal outcome [8], while the Aspirin for Evidence-Based Preeclampsia Prevention (ASPREE) trial established that low-dose aspirin, initiated before 16 weeks of gestation, markedly reduces the incidence of preterm pre-eclampsia among high-risk women [9]. For established severe hypertension, oral nifedipine, labetalol and methyldopa have each shown comparable efficacy in randomised trials, supporting flexible first-line options even in resource-constrained settings [10]. Correspondingly, updated World Health Organization guidance recommends antenatal corticosteroids for women with a high likelihood of preterm birth within seven days, reflecting the close relationship between HDP and iatrogenic prematurity [11].

Beyond the index pregnancy, HDP carries substantial implications for delivery outcomes and long-term maternal health. Population-based cohort data demonstrate that pre-eclampsia, in particular, is associated with a markedly increased risk of caesarean delivery and preterm birth compared with other hypertensive phenotypes [12]. Importantly, the consequences of HDP extend well beyond delivery: women with a history of HDP face a two- to five-fold elevated long-term risk of cardiovascular disease [13], reinforcing the clinical importance of structured postpartum surveillance. Despite this recognised trajectory of risk, considerable variation persists in how antenatal management, delivery timing and postpartum follow-up are implemented across obstetric units. In the United Kingdom, National Institute for Health and Care Excellence guideline NG133 provides the national framework for diagnosis, antihypertensive treatment thresholds and postpartum review in HDP [14], while successive MBRRACE-UK confidential enquiries continue to identify

hypertensive disorders and their postpartum surveillance as an area where care can still be strengthened [15]; comparative data describing how these practices translate into maternal outcomes within contemporary United Kingdom-based cohorts nonetheless remain limited. This study was therefore undertaken to describe management practices and maternal outcomes among pregnancies complicated by HDP at a single NHS trust and to compare these parameters between pre-eclampsia and pregnancy-induced hypertension.

Materials and Methods

This was a retrospective observational study, registered as a service evaluation, conducted at Medway Maritime Hospital, Medway NHS Foundation Trust, United Kingdom, over a 24-month period from 15 July 2022 to 15 July 2024. The pregnancy episode, rather than the individual woman, was used as the unit of analysis. A total of 466 pregnancy episodes with documented HDP, corresponding to 464 unique hospital numbers, were included in the final analysis and evaluated according to their recorded clinical course, management, delivery characteristics, maternal complications and postpartum follow-up. Two women had two pregnancies each during the study period; this represented a very small proportion of the study population and was unlikely to materially influence the results.

Diagnostic Criteria and Definitions

Pre-eclampsia and PIH were diagnosed and classified using the definitions of the International Society for the Study of Hypertension in Pregnancy (ISSHP) and National Institute for Health and Care Excellence guideline NG133 [6,14]. Pre-eclampsia was defined as new-onset hypertension (systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg on two occasions) arising after 20 weeks of gestation in a previously normotensive woman, accompanied by one or more of: proteinuria, other evidence of maternal end-organ dysfunction (renal insufficiency, hepatic involvement, neurological or haematological features) or uteroplacental dysfunction. PIH was defined as new-onset hypertension after 20 weeks of gestation without proteinuria or other features of maternal end-organ dysfunction. Episodes in which both diagnoses were documented for the same pregnancy ($n=7$) were included in the overall descriptive statistics for the full cohort but excluded from the two-group phenotype comparison in Table 3. Severe-range blood pressure was defined, in accordance with NICE NG133 and ISSHP thresholds, as a documented systolic blood pressure ≥ 160 mmHg and/or diastolic blood pressure ≥ 110 mmHg [6,14]. The composite adverse maternal outcome was pre-specified as the occurrence of at least one of the following, explicitly documented in the

clinical record: eclampsia, HELLP syndrome, pulmonary oedema, renal failure or placental abruption. Consistent with the missing-data rule described below, an episode was classified as having the composite outcome only when an explicit 'yes' was documented for at least one component; episodes without an explicit positive component were classified as not having the composite outcome, irrespective of whether every individual component field carried a value for that episode. The composite outcome was therefore evaluable for all 466 episodes, whereas the individual components are reported over their own variable-specific denominators, reflecting differential completeness of documentation for each complication in the clinical record.

Selection Criteria

Inclusion criteria:

- Pregnancy episodes with a documented clinical diagnosis of pregnancy-induced hypertension, pre-eclampsia, or both, arising within the study period.
- Delivery recorded within the study institution, irrespective of gestational age at diagnosis.
- Availability of a retrievable hospital clinical record permitting extraction of demographic, antenatal, delivery and postpartum data.

Exclusion criteria:

- Chronic hypertension diagnosed before 20 weeks' gestation without documented superimposed pre-eclampsia.
- Incomplete or inaccessible clinical records precluding confirmation of the HDP diagnosis.
- Pregnancy episodes transferred from or to another institution for which complete antenatal or delivery data could not be retrieved.

Data Collection and Study Procedure

Data were retrospectively extracted from routinely maintained hospital clinical records, including antenatal booking documentation, inpatient delivery summaries, laboratory and blood-pressure charts and postpartum discharge and follow-up records. A structured data-extraction proforma was used to standardise the capture of maternal demographic characteristics, HDP phenotype, gestational age at diagnosis, number of fetuses, antihypertensive therapy, low-dose aspirin use and timing of initiation, corticosteroid administration, severe-range blood pressure, mode and gestational age at delivery, maternal complications (eclampsia, HELLP syndrome, pulmonary oedema, renal failure and placental abruption), gestational diabetes mellitus, cholestasis, stillbirth and postpartum management,

including two-week and three-month follow-up, whether an ACE inhibitor was offered as postpartum antihypertensive therapy and antihypertensive continuation at three months. To ensure accuracy, reliability and consistency, extraction was performed against pre-specified variable definitions and a random subset of records was independently cross-checked for concordance before analysis. Missing observations for any given variable were retained as missing rather than recoded as absence of the corresponding condition and the available-data denominator was used for all variable-specific analyses. Patient identifiers were removed at the point of extraction and all data were handled in a de-identified, password-protected format in accordance with institutional confidentiality and data-governance requirements for retrospective clinical research, with access restricted to the research team.

Continuous variables were summarised as means with standard deviations or medians with interquartile ranges or ranges, as appropriate, and categorical variables as frequencies and percentages. Comparative analyses between pre-eclampsia and PIH, excluding the 7 episodes with overlapping documentation, were performed using Pearson's chi-square test, with continuity correction applied only to 2×2 tables, or Fisher's exact test where expected cell counts were small, while continuous variables were compared using Welch's independent-samples t-test. To assess whether HDP phenotype was independently associated with preterm birth and emergency caesarean delivery, multivariable logistic regression models were constructed for each outcome, adjusting for maternal age, gestational diabetes mellitus and multifetal pregnancy. Because all four multifetal pregnancies in the cohort resulted in both preterm birth and emergency caesarean delivery, conventional maximum-likelihood logistic regression was subject to near-complete separation on this covariate; Firth's penalised-likelihood logistic regression was therefore used for both models to obtain stable, finite effect estimates. No formal sample size calculation was performed; all eligible episodes recorded during the 24-month study period were included. All conventional statistical analyses were performed using IBM SPSS Statistics version 25.0. Firth penalised-likelihood logistic regression was performed using R version 4.4.2 with the *logistf* package. P-value below 0.05 was considered statistically significant.

Ethical approval

This study was conducted as a retrospective observational study, registered as a service evaluation of routinely collected clinical data at Medway Maritime Hospital, Medway NHS Foundation Trust. It was registered with the Trust Clinical Audit and Effectiveness Department under registration number

2425.139. As the work used data already collected during routine care and no change was made to any patient's management, formal Research Ethics Committee approval was not required under the UK Health Research Authority decision tool. All patient identifiers were removed at the point of data extraction. Data were stored and handled in line with Trust information governance policy and the Caldicott principles. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Results

A total of 466 pregnancy episodes complicated by hypertensive disorders of pregnancy were analysed over the 24-month study period. Pre-eclampsia was the predominant HDP phenotype. Antihypertensive therapy was used in most episodes, whereas low-dose aspirin was documented in fewer than half; preterm birth, emergency caesarean delivery and corticosteroid administration were each significantly more common among women with pre-eclampsia than those with pregnancy-induced hypertension, while composite severe maternal complications were infrequent across both phenotypes. Detailed findings for each outcome domain are presented in Tables 1 to 7.

Table 1. Baseline and clinical characteristics of the study population

Category	Overall	Freq uenc y (n)	Perce ntage (%)
HDP phenotype (n=466)	Pre-eclampsia	314	67.4
	Pregnancy- induced hypertension	145	31.1
	Both PIH and pre-eclampsia documented	7	1.5
Maternal age, years (n=466)	Mean $\pm$ SD	30.8 $\pm$ 5.8	
	Median (IQR)	30.9 (26.8– 34.7)	
	Range	16.2–47.4	
Number of fetuses (n=466)	Singleton	462	99.1
	Twins	3	0.6
	Triplets	1	0.2
Mode of delivery (n=466)	Emergency caesarean	228	48.9
	Vaginal delivery	164	35.2
	Elective caesarean	74	15.9
Preterm birth <37 weeks (n=466)	Yes	115	24.7
	No	351	75.3

Gestational diabetes mellitus (n=464)	Yes	56	12.1
	No	408	87.9
Cholestasis (n=464)	Yes	16	3.4
	No	448	96.6
Stillbirth (n=466)	Yes	2	0.4
	No	464	99.6
Gestational age at delivery, weeks (n=466)	Mean $\pm$ SD	37.4 $\pm$ 2.7	
	Median (Range)	38 (26–42)	

Table 1 presents the baseline and clinical characteristics of the 466 pregnancy episodes included in the study. Pre-eclampsia was the predominant HDP phenotype, accounting for 314 (67.4%) episodes, followed by pregnancy-induced hypertension in 145 (31.1%) episodes; both conditions were documented concurrently in 7 (1.5%) episodes. The mean maternal age was 30.8 $\pm$ 5.8 years. Singleton pregnancies accounted for 462 (99.1%) episodes, with twin and triplet pregnancies recorded in 3 (0.6%) and 1 (0.2%) episodes, respectively. Emergency caesarean delivery was the most frequent mode of delivery (228, 48.9%), followed by vaginal delivery (164, 35.2%) and elective caesarean delivery (74, 15.9%). Preterm birth before 37 weeks occurred in 115 (24.7%) episodes. Gestational diabetes mellitus and cholestasis were documented in 56 (12.1%) and 16 (3.4%) episodes, respectively, and stillbirth occurred in 2 (0.4%) episodes. Mean gestational age at delivery was 37.4 $\pm$ 2.7 weeks (median 38 weeks; range 26–42 weeks).

Table 2. Antenatal management practices

Category	Ov era ll	Freq uenc y (n)	Perc entag e (%)
Antihypertensive therapy (n=461)	Ye s	368	79.8
	No	93	20.2
Low-dose aspirin (n=465)	Ye s	213	45.8
	No	252	54.2
Timing of aspirin initiation, among aspirin users with recorded timing (n=213)	<1 6 we eks	208	97.7
	$\geq$ 1 6 we eks	5	2.3
Corticosteroid administration (n=466)	Ye s	91	19.5
	No	375	80.5

Severe-range blood pressure (n=443)	Yes	144	32.5
	No	299	67.5

Table 2 describes antenatal management practices across the cohort. Antihypertensive therapy was documented in 368 (79.8%) of 461 episodes with available treatment information. Low-dose aspirin use was recorded in 213 (45.8%) of 465 episodes. Among the 213 episodes with recorded aspirin use and known timing, initiation before 16 weeks of gestation was documented in 208 (97.7%), indicating that, when used, aspirin was started within the recommended window in almost all treated episodes. Corticosteroids were administered in 91 (19.5%) episodes and severe-range blood pressure was identified in 144 (32.5%) of the 443 episodes with available blood-pressure data (299 pre-eclampsia, 139 PIH and 5 overlap episodes); Table 3 presents the phenotype comparison. Median gestational age at diagnosis was 36.6 weeks (IQR 35.1–38.6); diagnosis was made at or after 28 weeks of gestation in 442 (96.1%) of 460 episodes with a recorded gestational age at diagnosis.

Table 3. Comparison of clinical characteristics, management practices and pregnancy outcomes according to HDP phenotype

Variable	Pre-eclampsia, n (%)	PIH, n (%)	p-value
Pregnancies	314 (100.0)	145 (100.0)	—
Maternal age, mean $\pm$ SD, years	30.5 $\pm$ 5.9	31.2 $\pm$ 5.5	0.213
Severe-range BP	102/299 (34.1)	41/139 (29.5)	0.395
Antihypertensive therapy	245/312 (78.5)	117/142 (82.4)	0.409
Low-dose aspirin	151/314 (48.1)	61/144 (42.4)	0.298
Corticosteroid administration	77/314 (24.5)	13/145 (9.0)	<0.001
Mode of delivery (overall 3 $\times$ 2 comparison)			0.005
– Emergency caesarean	171 (54.5)	56 (38.6)	
– Vaginal delivery	102 (32.5)	59 (40.7)	
– Elective caesarean	41 (13.1)	30 (20.7)	
Preterm birth <37 weeks	100 (31.8)	15 (10.3)	<0.001

GDM	37/313 (11.8)	18/144 (12.5)	0.958
Cholestasis	10/313 (3.2)	5/144 (3.5)	p>0.9
Stillbirth	2 (0.6)	0 (0.0)	p>0.9
Gestational age at delivery, mean $\pm$ SD, weeks	36.9 $\pm$ 3.0	38.2 $\pm$ 1.9	<0.001

Table 3 compares clinical characteristics, management practices and pregnancy outcomes between the 314 exclusively classified pre-eclampsia episodes and the 145 PIH episodes, following exclusion of the 7 episodes with overlapping documentation. Maternal age, severe-range blood pressure, antihypertensive therapy and low-dose aspirin use did not differ significantly between groups. Corticosteroid administration was significantly more frequent in pre-eclampsia than PIH (24.5% vs 9.0%; p<0.001), as was preterm birth before 37 weeks (31.8% vs 10.3%; p<0.001). Mode of delivery differed significantly between phenotypes when all three categories were considered jointly (p=0.005); in a focused pairwise comparison, emergency caesarean delivery was significantly more frequent in pre-eclampsia than PIH (54.5% vs 38.6%; OR 1.90, 95% CI 1.27–2.84; Fisher's exact p=0.002). Gestational diabetes mellitus, cholestasis and stillbirth showed no significant between-group differences. Gestational age at delivery was significantly earlier in pre-eclampsia than PIH (mean 36.9 $\pm$ 3.0 vs 38.2 $\pm$ 1.9 weeks; Welch's t-test, p<0.001).

Table 4. Documented maternal complications

Maternal complication	Frequency (n)	Percentage (%)
Eclampsia (n=309)	4	1.3
HELLP syndrome (n=309)	8	2.6
Pulmonary oedema (n=313)	0	0
Renal failure (n=39)	0	0
Placental abruption (n=465)	3	0.6
Composite adverse maternal outcome (n=466)	14	3.0

Table 4 shows the frequency of documented maternal complications across the full cohort. HELLP syndrome was identified in 8 (2.6%) of 309 episodes with available data, eclampsia in 4 (1.3%) of the same denominator and placental abruption in 3 (0.6%) of 465 episodes. No pulmonary oedema was documented among the 313 episodes with available information. Renal function could not be reliably assessed in most episodes; among the 39 (8.4%) episodes for which this

variable was available, no renal failure was recorded, but this figure should be interpreted with caution given how few episodes had this information documented, rather than as evidence of a true 0% prevalence. The predefined composite adverse maternal outcome, evaluable across the full cohort using the definition given in the Methods, occurred in 14 (3.0%) of the 466 episodes. The individual complication counts sum to 15 rather than 14 because one episode had both eclampsia and HELLP syndrome documented concurrently; this episode contributes once, not twice, to the composite count.

Table 5. Composite adverse maternal outcome according to HDP phenotype

Outcome	Pre-eclampsia, n (%)	PIH, n (%)	p-value
Composite adverse maternal outcome	13 (4.1)	1 (0.7)	0.075

Table 5 presents the composite adverse maternal outcome according to HDP phenotype. The outcome occurred in 13 (4.1%) of pre-eclampsia episodes and 1 (0.7%) of PIH episodes; this difference did not reach statistical significance (Fisher's exact $p=0.075$).

Table 6. Postpartum management and follow-up

Category	Overall	Frequency (n)	Percentage (%)
Postpartum record linkage (n=466)	Successfully linked	456	97.9
	No reliable linkage	10	2.1
Two-week postpartum follow-up (n=446)	Documented	315	70.6
	Not documented	131	29.4
ACE inhibitor offered (n=354)	Yes	43	12.1
	No	311	87.9
Antihypertensive therapy at 3 months (n=443)	Yes	66	14.9
	No	377	85.1

Table 6 summarises postpartum management and follow-up. Postpartum records were successfully linked for 456 (97.9%) of 466 episodes. The two-week follow-up denominator (446) is ten fewer than the number of episodes with linked postpartum records: six had no documented follow-up outcome, two contact attempts were unsuccessful ('failed encounter') and two women declined follow-up contact; these ten episodes were excluded from the two-week follow-up

denominator. Two-week postpartum follow-up was documented in 315 (70.6%) of these 446 episodes with available data. An ACE inhibitor was offered in 43 (12.1%) of 354 episodes for which ACE inhibitor status was available, and continued antihypertensive therapy at three months postpartum was documented in 66 (14.9%) of 443 episodes.

Table 7. Firth penalised-likelihood logistic regression analysis of factors associated with preterm birth and emergency caesarean delivery

Predictor	Preterm birth, OR (95% CI)	p-value	Emergency caesarean, OR (95% CI)	p-value
Pre-eclampsia (vs PIH)	3.91 (2.18–7.01)	< 0.001	1.87 (1.25–2.80)	0.002
Maternal age (per year)	1.03 (0.99–1.07)	0.192	1.01 (0.98–1.05)	0.489
Gestational diabetes mellitus (yes vs no)	1.70 (0.90–3.21)	0.105	1.35 (0.75–2.43)	0.316
Multifetal pregnancy (yes vs no)	17.44 (0.65–469.35)	0.089	7.26 (0.27–194.16)	0.237

In multivariable analysis adjusting for maternal age, gestational diabetes mellitus and multifetal pregnancy, pre-eclampsia remained independently associated with both preterm birth (adjusted OR 3.91, 95% CI 2.18–7.01; $p<0.001$) and emergency caesarean delivery (adjusted OR 1.87, 95% CI 1.25–2.80; $p=0.002$) relative to PIH (Table 7). Maternal age and gestational diabetes mellitus were not independently associated with either outcome. Multifetal pregnancy showed a strong but imprecisely estimated association with both outcomes, reflecting the very small number of multifetal pregnancies ($n=4$) in the cohort, all of which were preterm and delivered by emergency caesarean. Firth's penalised-likelihood method was used to obtain stable estimates given this near-complete separation and this estimate should be interpreted cautiously given the wide confidence interval.

Discussion

Pre-eclampsia was the predominant HDP phenotype in this cohort, accounting for two-thirds of the 466 pregnancy episodes analysed. The mean maternal age was 30.8 years. The higher proportion of pre-eclampsia in this hospital-based cohort should not be interpreted as representative of the general population, where gestational hypertension may be as common or more common than pre-eclampsia [4]. Umesawa and

Kobashi reported HDP prevalence rates of 5.2 to 8.2%, with variation across populations and diagnostic criteria [4], while Vera-Ponce et al. reported a pooled global pre-eclampsia prevalence of 4.4% [5]. The maternal age observed in the present cohort is consistent with the age distribution reported in the meta-analysis by Sukmanee and Liabsuetrakul, whose included cohorts similarly clustered around the early thirties [16].

Antihypertensive therapy was documented in almost eighty percent of episodes with recorded treatment information, consistent with the emphasis on blood-pressure control in the Control of Hypertension in Pregnancy Study, in which tighter control reduced severe maternal hypertension without a significant difference in the primary perinatal outcome [8]. Aspirin use was documented in 45.8% of episodes, while 97.7% of those who received it were started before 16 weeks, in line with the aspirin-timing principle established in the ASPRE trial [9]. Thus, the main finding was lower overall documented aspirin use rather than delayed initiation among those treated. Risk factors determining aspirin eligibility were not consistently recorded, so the reasons for non-use could not be assessed. Aspirin initiated outside the hospital record may also not have been captured. Corticosteroid administration was significantly more frequent among women with pre-eclampsia than PIH (24.5% vs 9.0%; $p<0.001$), a pattern occurring alongside the higher preterm birth rate observed in the pre-eclampsia group (31.8% vs 10.3%; $p<0.001$) and consistent with updated WHO recommendations describing corticosteroid use in women with a high likelihood of preterm birth within seven days [11].

Emergency caesarean delivery was markedly more frequent among women with pre-eclampsia (54.5%) than PIH (38.6%), a difference that remained significant in a focused pairwise comparison (Fisher's exact $p=0.002$) and after adjustment for maternal age, gestational diabetes and multifetal pregnancy (adjusted OR 1.87, 95% CI 1.25–2.80). This is consistent with broader evidence linking pre-eclampsia with expedited delivery and adverse pregnancy outcomes, although comparator definitions differ across studies [12]. Preterm birth showed an even larger independent association with pre-eclampsia (adjusted OR 3.91, 95% CI 2.18–7.01). Maternal age and gestational diabetes were not independently associated with either outcome in this cohort, and the very small number of multifetal pregnancies ($n=4$, all preterm and delivered by emergency caesarean) limited the precision with which that association could be estimated despite the use of Firth's penalised-likelihood method.

The composite adverse maternal outcome occurred in 3.0% of the overall cohort and was numerically higher

in pre-eclampsia (4.1%) than PIH (0.7%), without reaching statistical significance ($p=0.075$). This is broadly compatible with the relatively low absolute rates of severe complications reported in the meta-analysis by Vera-Ponce et al., in which eclampsia and HELLP syndrome prevalence were each below one percent [5]. The absence of a statistically significant between-group difference may reflect the small number of composite events (14 in total) rather than genuine equivalence in underlying risk.

Two-week postpartum follow-up was documented in just over seventy percent of episodes, leaving 29.4% without a recorded review at this time point. Several service-level factors specific to this Trust plausibly contribute to this gap rather than reflecting a true absence of follow-up: postpartum contact after HDP is frequently delivered through community midwifery and general practice rather than solely through the hospital record from which these data were extracted, so follow-up that occurred outside the hospital system may not have been captured; discharge from hospital is also a recognised point of attrition in postpartum hypertensive surveillance pathways nationally, a pattern echoed in recent MBRRACE-UK reporting on the continuity of postpartum care after hypertensive disorders [15]. Khosla et al. emphasised that the two- to five-fold elevation in long-term cardiovascular risk following HDP makes structured postpartum surveillance essential rather than merely an administrative formality [13], while Emeruwa et al. demonstrated that a substantial minority of women develop clinically significant postpartum hypertension even after apparently uncomplicated deliveries, reinforcing the need for reliable follow-up pathways regardless of antenatal severity [17]. Sukmanee and Liabsuetrakul further showed that cardiovascular risk elevation persists for years after delivery, particularly among women with early-onset or severe-feature pre-eclampsia [16]. Taken together, these findings suggest that while antenatal management in this cohort was largely aligned with contemporary evidence, effective postpartum continuity of care depends on pathways that bridge hospital, community midwifery and primary care. Strengthening this pathway represents an important opportunity for improving the longer-term trajectory of women affected by hypertensive disorders of pregnancy.

Limitations and Recommendations

The retrospective, single-centre design limits generalisability and causal inference. The analysis included 466 pregnancy episodes from 464 women, with two women contributing two pregnancies each. Incomplete clinical documentation may have underestimated some complications, while the small number of adverse outcomes reduced statistical power. Risk factors used to determine aspirin eligibility were

not consistently recorded, limiting assessment of the reasons for non-use. Parity, BMI and ethnicity were not consistently available and could not be included in the baseline characteristics or multivariable regression models. Future prospective, multicentre studies should use standardised outcome assessment, more complete clinical documentation, systematic recording of aspirin eligibility factors and longer postpartum follow-up. Quality-improvement efforts should promote timely aspirin eligibility assessment and strengthen postpartum follow-up pathways.

Conclusion

This retrospective cohort of 466 pregnancy episodes complicated by hypertensive disorders found pre-eclampsia to be the predominant phenotype and to be associated with higher rates of corticosteroid use, emergency caesarean delivery and preterm birth than pregnancy-induced hypertension. In adjusted analyses, pre-eclampsia remained independently associated with preterm birth and emergency caesarean delivery, while severe maternal complications remained uncommon. The lower overall documented use of aspirin and incomplete postpartum follow-up highlight areas for further assessment and service improvement, particularly through strengthened pathways linking hospital and community care. We recommend checking aspirin eligibility at booking and having a clear plan for a blood pressure check two weeks after birth.

Author contributions

Pushpee Sinha: study design, data collection, analysis and part of the paper writing.

Ahamed Shammi Asif: writing the paper and reference search.

Periyasamy Krishnamoorthy: supervision (consultant).

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Data availability: The anonymised dataset is available from the corresponding author on reasonable request.

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