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Research Article

Maternal and Perinatal Outcomes in Pregnancies Complicated by Chronic Hypertension: A Prospective Observational Study from a Tertiary Care Centre in Kashmir

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ABSTRACT

Background: Chronic hypertension in pregnancy is associated with substantial maternal and perinatal morbidity. Prospective regional data remain limited, particularly from tertiary referral settings in low- and middle-income regions. We assessed maternal and perinatal outcomes among pregnant women fulfilling a chronic hypertension definition based on hypertension present before pregnancy or diagnosed at or before 20 weeks of gestation. **Methods:** This prospective observational study was conducted over 18 months at Lalla Ded Hospital, Srinagar, a tertiary care referral centre. A total of 280 women with singleton pregnancies and chronic hypertension were enrolled after written informed consent and followed until delivery. Maternal outcomes included superimposed preeclampsia, preterm delivery, placental abruption, postpartum haemorrhage, eclampsia, HELLP syndrome, acute kidney injury, ICU admission, maternal death, and mode of delivery. Fetal and neonatal outcomes included fetal growth restriction, fetoplacental insufficiency, oligohydramnios, low birth weight, low Apgar score, neonatal resuscitation, NICU admission, intrauterine death, and neonatal mortality. A secondary analysis compared women with known pre-pregnancy chronic hypertension with those diagnosed before 20 weeks during the index pregnancy. **Results:** Of the 280 participants, 149 (53.3%) had known chronic hypertension before pregnancy and 131 (46.7%) were diagnosed before 20 weeks during the index pregnancy. Preterm delivery occurred in 110 (39.3%) women and superimposed preeclampsia in 71 (25.3%). Caesarean delivery was performed in 202 (72.0%). Abruptio placentae occurred in 28 (10.0%), postpartum haemorrhage in 19 (6.8%), eclampsia in 11 (3.9%), ICU admission in 9 (3.2%), HELLP syndrome in 6 (2.1%), acute kidney injury in 4 (1.4%), and maternal death in 2 (0.7%). Among newborns, 86 (30.6%) required resuscitation and 77 (27.3%) required NICU admission; fetal growth restriction was observed in 56 (20.0%), low birth weight in 43 (15.3%), intrauterine

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death in 13 (4.6%), and neonatal mortality in 15 (5.4%). In the secondary analysis, known pre-pregnancy chronic hypertension was associated with superimposed preeclampsia (adjusted OR 5.82, 95% CI 3.11-10.88; $p < 0.001$) and fetal growth restriction (adjusted OR 1.91, 95% CI 1.04-3.50; $p = 0.03$), while associations with preterm delivery and ICU admission were not statistically significant. Conclusion: Chronic hypertension in pregnancy was associated with a high burden of maternal and neonatal complications in this tertiary-care cohort. Pre-existing chronic hypertension before pregnancy was particularly associated with superimposed preeclampsia and fetal growth restriction. Early identification, close maternal and fetal surveillance, and management in appropriately equipped centres are important for risk reduction.

INTRODUCTION

Chronic hypertension is an important medical complication of pregnancy and is associated with increased risks of superimposed preeclampsia, placental dysfunction, preterm birth, fetal growth restriction, operative delivery, and perinatal death.¹⁻⁴ The condition complicates approximately 1-5% of pregnancies, although estimates vary according to population characteristics and case definitions.^{3,4} Women with chronic hypertension enter pregnancy with established vascular and endothelial abnormalities that may impair adaptation of the maternal circulation and uteroplacental perfusion. These changes increase susceptibility to superimposed preeclampsia and fetal growth restriction.⁴⁻⁷ The magnitude of risk varies with baseline blood pressure, disease severity, comorbidities, and the development of superimposed preeclampsia.^{4,8} Pregnancies complicated by chronic hypertension also have increased rates of preterm delivery, low birth weight, neonatal unit admission, caesarean delivery, and perinatal death compared with the general obstetric population.^{4,9-11} Optimisation of blood-pressure control and close antenatal surveillance are therefore central to management. Contemporary evidence further supports treatment strategies aimed at preventing severe maternal

hypertension while balancing fetal considerations.¹⁰ Despite extensive literature, prospective data describing the complete maternal and perinatal outcome profile of chronic hypertension remain limited in many low- and middle-income settings. The present study was undertaken at a tertiary referral hospital in Kashmir to prospectively document maternal, fetal, and neonatal outcomes among women meeting the study definition of chronic hypertension. The study also examined whether previously known chronic hypertension differed from chronic hypertension first recognised before 20 weeks of gestation with respect to selected adverse outcomes.

MATERIALS AND METHODS

Study design and setting This was a prospective observational study conducted in the Postgraduate Department of Obstetrics and Gynaecology, Lalla Ded Hospital, Srinagar, Kashmir, India. The study was conducted over a total period of 18 months and included recruitment, antenatal follow-up, delivery, and postnatal assessment. The institution functions as a tertiary care referral centre serving pregnant women from urban and rural areas of the Kashmir valley.

Study population and definition The study included 280 pregnant women with singleton pregnancies fulfilling the study definition of chronic hypertension: hypertension present before pregnancy or diagnosed at or before 20 weeks of gestation. Of these, 149 women were documented as known cases of chronic hypertension prior to pregnancy, while 131 were newly diagnosed during the index pregnancy before 20 weeks. Thus, both groups formed part of the chronic-hypertension cohort; the 149/131 distinction was used for subgroup analysis.



Exclusion criteria were multifetal gestation; congenital fetal anomalies or aneuploidies; pregnancy ending in miscarriage before 16 weeks; type 2 diabetes mellitus with retinopathy, nephropathy, or neuropathy; refusal to participate; and loss to follow-up.

Data collection and follow-up After obtaining written informed consent, participants were enrolled using a predesigned and pretested proforma. Demographic and clinical variables included age, parity, gestational age, booking status, previous obstetric history, medical and surgical history, duration and severity of hypertension, and antihypertensive treatment.

Baseline investigations included complete blood count, kidney function tests, liver function tests, coagulation profile, and assessment of proteinuria using spot urine protein, 24-hour urinary protein, or urine protein- creatinine ratio as clinically indicated. Renal ultrasonography, fundoscopy in women with long-standing or poorly controlled hypertension, obstetric ultrasonography, and electrocardiography were performed according to the study protocol.

Participants were reviewed monthly until the seventh month of gestation and fortnightly thereafter. Visits were intensified when blood pressure was uncontrolled or when fetal growth restriction, abnormal Doppler velocimetry, suspected superimposed preeclampsia, or impending eclampsia was present. At each visit, blood pressure was measured using a standardised technique and maternal and obstetric examinations were performed.

Urine was tested for protein and treatment was reviewed. Participants were followed until delivery, after which maternal and neonatal outcomes were documented up to hospital discharge.

Outcomes Maternal outcomes were preterm delivery, superimposed preeclampsia, gestational diabetes mellitus, abruptio placentae, postpartum haemorrhage, eclampsia, HELLP syndrome, acute kidney injury, ICU admission, maternal death, and mode of delivery. Fetal and neonatal outcomes were fetoplacental insufficiency, fetal growth restriction, oligohydramnios, low birth weight, low Apgar score, need for resuscitation, NICU admission, intrauterine death, and neonatal mortality.

Statistical analysis Data were entered in Microsoft Excel and analysed using SPSS version 23. Continuous variables were summarised as mean and standard deviation and categorical variables as frequencies and percentages. For the secondary comparison of known pre-pregnancy chronic hypertension versus chronic hypertension newly diagnosed before 20 weeks, logistic regression was used for selected outcomes. Associations were expressed as crude and adjusted odds ratios with 95% confidence intervals. A p value <0.05 was considered statistically significant.

The original thesis contains a subgroup analysis labelled as an association of chronic hypertension with selected outcomes. Because all 280 women fulfilled the chronic-hypertension eligibility definition, this manuscript explicitly describes that analysis as comparing previously known chronic hypertension with newly diagnosed chronic hypertension. The adjusted model is reported exactly as provided in the thesis, without extending the inference to comparisons with normotensive pregnancies.

Ethical considerations The study protocol entitled “Foetomaternal Outcome of Chronic Hypertension in Pregnancy” received approval from the Institutional Review Board, Government Medical College Srinagar; the decision was



recorded on 10 July 2024. Written informed consent was obtained from all participants.

RESULTS

Participant characteristics A total of 280 women were included in the final cohort. Most participants were 21-30 years old (165, 58.9%), followed by 31-40 years (105, 37.5%); 10 women (3.6%) were aged >40 years. There were 181 multiparous women (64.6%) and 99 primiparous women (35.4%). Known chronic hypertension was present in 149 women (53.3%), while 131 (46.7%) were diagnosed before 20 weeks during the index pregnancy.

Table 1. Baseline characteristics of the study population (n=280)

Characteristic n (%) Age 21-30 years 165 (58.9) Age 31-40 years 105 (37.5) Age >40 years 10 (3.6) Primiparous 99 (35.4) Multiparous 181 (64.6) Known chronic hypertension before pregnancy 149 (53.3) Diagnosed during pregnancy before 20 weeks 131 (46.7) Single antihypertensive drug 101 (36.1) Multiple antihypertensive drugs 147 (52.5) Erratic/irregular antihypertensive treatment 32 (11.4) Required antenatal hospitalisation 58 (20.7) Maternal outcomes Preterm delivery was the most frequently reported adverse maternal outcome, occurring in 110 women (39.3%), followed by superimposed preeclampsia in 71 (25.3%). Gestational diabetes mellitus occurred in 60 (21.5%), abruptio placentae in 28 (10.0%), and postpartum haemorrhage in 19 (6.8%). Eclampsia occurred in 11 women (3.9%), HELLP syndrome in 6 (2.1%), acute kidney injury in 4 (1.4%), ICU admission in 9 (3.2%), and maternal death in 2 (0.7%).

Table 2. Maternal outcomes

Outcome n (%) Preterm delivery 110 (39.3) Superimposed preeclampsia 71 (25.3) Gestational diabetes mellitus 60 (21.5) Abruptio placentae 28 (10.0) Postpartum haemorrhage 19 (6.8) Eclampsia 11 (3.9) ICU admission 9 (3.2) HELLP syndrome 6 (2.1) Acute kidney injury 4 (1.4) Maternal death 2 (0.7) Caesarean delivery 202 (72.0) Vaginal delivery 78 (28.0) Gestational age and neonatal outcomes Term delivery occurred in 170 women (60.7%), late preterm delivery in 92 (32.9%), and early preterm delivery in 18 (6.4%). Caesarean delivery was the predominant mode of delivery, accounting for 202 deliveries (72.0%).

Table 3. Gestational age at delivery

Gestational age n (%) Term (≥ 37 weeks) 170 (60.7) Late preterm (34-36 weeks) 92 (32.9) Early preterm (≤ 33 weeks) 18 (6.4) Percentages in this table were recalculated from the reported category counts (n=280) to ensure internal consistency.

Neonatal resuscitation was required in 86 newborns (30.6%) and NICU admission occurred in 77 (27.3%).

Fetoplacental insufficiency was observed in 58 pregnancies (20.6%), fetal growth restriction in 56 (20.0%), and oligohydramnios in 45 (16.0%). Low birth weight occurred in 43 newborns (15.3%) and low Apgar scores in 35 (12.6%). There were 13 intrauterine deaths (4.6%) and 15 neonatal deaths (5.4%).

Table 4. Fetal and neonatal outcomes

Outcome n (%) Need for resuscitation 86 (30.6) NICU admission 77 (27.3) Fetoplacental insufficiency 58 (20.6) Fetal growth restriction 56 (20.0) Oligohydramnios 45 (16.0) Low birth weight 43 (15.3) Low Apgar score 35 (12.6) Neonatal mortality 15 (5.4) Intrauterine death 13 (4.6) Secondary comparison: known versus newly



diagnosed chronic hypertension Among the 149 women with known pre-pregnancy chronic hypertension, fetal growth restriction occurred in 36 (24.2%), preterm delivery in 78 (52.3%), and postpartum haemorrhage in 14 (9.4%). The reported unadjusted associations were statistically significant for fetal growth restriction ($p=0.041$), preterm delivery ($p<0.001$), and postpartum haemorrhage ($p=0.040$).

Table 5. Secondary subgroup analysis reported in the thesis

Outcome	Total cohort n (%)	Known pre-pregnancy chronic HTN n (%)	p value
Fetal growth restriction	56 (20.0)	36 (24.2)	0.041
Preterm delivery	110 (39.3)	78 (52.3)	<0.001
Postpartum haemorrhage	19 (6.8)	14 (9.4)	0.040

The comparison group for these analyses was the 131 women whose chronic hypertension was first diagnosed before 20 weeks during the index pregnancy.

Multivariable analysis In the multivariable analysis reported in the thesis, known pre-pregnancy chronic hypertension was strongly associated with superimposed preeclampsia (adjusted OR 5.82, 95% CI 3.11-10.88; $p<0.001$) and fetal growth restriction (adjusted OR 1.91, 95% CI 1.04-3.50; $p=0.03$). The association with preterm delivery was not statistically significant after adjustment (adjusted OR 1.36, 95% CI 0.82-2.14; $p=0.18$), nor was the association with ICU admission (adjusted OR 3.21, 95% CI 0.88-11.72; $p=0.07$).

Table 6. Multivariable logistic regression analysis

Outcome	Crude OR (95% CI)	Adjusted OR (95% CI)	p value
Superimposed preeclampsia	6.17 (3.45-11.02)	5.82 (3.11-10.88)	<0.001
Preterm delivery	1.42 (0.89-2.25)	1.36 (0.82-2.14)	0.18

Outcome	Crude OR (95% CI)	Adjusted OR (95% CI)	p value
Fetal growth restriction	2.04 (1.16-3.60)	1.91 (1.04-3.50)	0.03
ICU admission	3.78 (1.05-13.55)	3.21 (0.88-11.72)	0.07

DISCUSSION

This prospective study describes a substantial burden of adverse maternal and perinatal outcomes among 280 pregnant women fulfilling the study definition of chronic hypertension. The most prominent maternal outcomes were preterm delivery, superimposed preeclampsia, caesarean delivery, placental abruption, and postpartum haemorrhage. Neonatal morbidity was also considerable, with frequent requirements for resuscitation and NICU admission and appreciable rates of fetal growth restriction, low birth weight, intrauterine death, and neonatal mortality.

The 25.3% frequency of superimposed preeclampsia in the cohort is close to the pooled incidence of 25.9% reported in a large systematic review and meta-analysis of chronic hypertension in pregnancy.⁴ The same review reported pooled incidences of caesarean delivery, preterm birth, low birth weight, neonatal unit admission, and perinatal death that underscore the consistency of the overall pattern seen in the present cohort.⁴ The adjusted analysis in this study provides an important additional observation. Women with known chronic hypertension before pregnancy had substantially higher odds of superimposed preeclampsia than women whose chronic hypertension was first diagnosed before 20 weeks. This finding is biologically plausible and consistent with the established relationship between chronic vascular disease and superimposed preeclampsia.^{3,8} The magnitude of the association in this tertiary-care cohort may also reflect disease duration, referral patterns, and the concentration of complicated cases.



Fetal growth restriction occurred in 20.0% of the cohort and remained independently associated with known chronic hypertension after adjustment. Chronic uteroplacental insufficiency is a recognised mechanism linking maternal vascular disease with impaired fetal growth.^{4,5} The present finding is therefore consistent with the pathophysiology and with previous observations that chronic hypertension is associated with increased fetal growth restriction and small-for-gestational-age birth.

Preterm delivery occurred in 39.3% of the cohort and in 52.3% of women with known chronic hypertension.

The unadjusted subgroup analysis suggested an association, but this was not statistically significant after adjustment. This distinction is important: prematurity is common in chronic hypertensive pregnancies, but part of the excess risk may be explained by superimposed preeclampsia, fetal growth restriction, or medically indicated early delivery rather than by chronic hypertension status alone. Similar clinical pathways have been described in earlier cohorts.^{4,9} The caesarean section rate of 72.0% was higher than pooled estimates from broader chronic-hypertension populations.⁴ This may reflect the referral nature of the study centre, the severity of the included pregnancies, and a lower threshold for operative delivery when maternal or fetal compromise is present. Comparable variation between cohorts has been reported in the literature and is partly driven by case-mix and disease severity.

The neonatal findings also indicate clinically important perinatal morbidity. Nearly one-third of newborns required resuscitation and more than one-quarter required NICU admission. The observed 20.0% rate of fetal growth restriction, 15.3% low birth weight, and 5.4% neonatal

mortality emphasise the importance of placental function, growth surveillance, and timely neonatal support in these pregnancies.

The present study should be interpreted as a prospective cohort of women with chronic hypertension rather than as a comparison between hypertensive and normotensive pregnancies. Accordingly, the study provides estimates of outcome burden within a chronic-hypertension population and a secondary comparison between women with known pre-pregnancy disease and those diagnosed before 20 weeks. It cannot establish the excess risk attributable to chronic hypertension relative to normotension because no normotensive control group was included.

STRENGTHS AND LIMITATIONS

The prospective design, systematic antenatal follow-up, and documentation of maternal and neonatal outcomes through hospital discharge are important strengths. The study also provides regional data from a tertiary referral centre in Kashmir and specifically focuses on chronic hypertension according to a prespecified early-pregnancy definition.

Several limitations should be considered. The study was conducted at a single tertiary care referral hospital, limiting generalisability and potentially enriching the cohort for severe disease. There was no normotensive control group. In addition, the study did not fully stratify chronic hypertension by duration, severity, or degree of blood-pressure control. Antihypertensive treatment and obstetric decisions were influenced by clinical judgement and therefore may have introduced confounding. Follow-up was limited to immediate maternal and neonatal outcomes up to hospital discharge, and long-term maternal cardiovascular and offspring neurodevelopmental outcomes were not evaluated.



A further analytical limitation is that the multivariable comparison was between women with known chronic hypertension before pregnancy and women whose chronic hypertension was diagnosed before 20 weeks, rather than between chronic hypertension and normotension. The adjusted findings should therefore be interpreted as differences according to timing of recognition of chronic hypertension within the cohort.

CONCLUSION

In this prospective tertiary-care cohort, chronic hypertension in pregnancy was associated with substantial maternal and perinatal morbidity. Superimposed preeclampsia, preterm delivery, operative delivery, fetal growth restriction, neonatal resuscitation, NICU admission, and perinatal mortality were prominent outcomes. Known pre-pregnancy chronic hypertension was independently associated with superimposed preeclampsia and fetal growth restriction when compared with women diagnosed before 20 weeks during the index pregnancy. These findings support early identification of chronic hypertension, close maternal and fetal surveillance, and delivery in centres capable of managing severe maternal and neonatal complications.

DECLARATIONS

Ethics approval and consent to participate: The institutional review documentation for the study protocol was approved by the Institutional Review Board, Government Medical College Srinagar, with the decision recorded on 10 July 2024. Written informed consent was obtained from all participants.

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Authors' contributions: Anjum Ara - study conception, data acquisition, interpretation, and manuscript revision; Ambreen Qureshi - study supervision, interpretation, and critical revision; Shabhat Shabir - study conduct, data acquisition, analysis, and initial manuscript preparation. All authors reviewed and approved the final manuscript.

Data availability: The dataset is available from the corresponding author on reasonable request, subject to institutional and ethical restrictions.

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