Chronic hypertension and risk of placental abruption: is the association modified by ischemic placental disease?

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OBJECTIVE: The purpose of this study was to evaluate whether the increased risk of placental abruption among women with chronic hypertension is modified by ischemic placental disease, specifically pregnancy-induced hypertension (PIH) and fetal growth restriction (FGR).

STUDY DESIGN: We used the US linked natality and fetal death data files (1995-2002) and restricted the analysis to women who had a singleton birth at ≥22 weeks of gestation and to fetuses who weighed ≥500 g (n = 30,189,949). *Fetal growth* was defined both on a continuum (<1, 1-2, 3-4, 5-9, 10-19,. . .,≥90) and as birthweight of <10th percentile for gestational age (FGR) or birthweight of >90th percentile (large for gestational age [LGA]). All analyses were adjusted for potential confounding factors through multivariable logistic regression.

RESULTS: Rates of abruption among women with and without chronic hypertension were 15.6 and 5.8 per 1000 pregnancies, respectively (relative risk [RR], 2.4; 95% CI, 2.3, 2.5). In comparison with normotensive women with appropriately grown babies (ie, 10th-90th percentile), the association between chronic hypertension and abruption was modified in the presence of FGR (RR, 3.8; 95% CI, 3.6, 4.1) and PIH (RR, 7.7; 95% CI, 6.6, 8.9). However, the highest risk was seen among women with chronic hypertension, PIH, and LGA (RR, 9.0; 95% CI, 7.2, 11.3). A dose-response relationship was observed between the risk of abruption and fetal growth (assessed on a continuum), with the risk being lowest among LGA babies.

CONCLUSION: The association between chronic hypertension and abruption is strong; ischemic placental disease (PIH and FGR) modified this relationship. These findings suggest an etiologic relationship between abruption and chronic placental disease. Chronic hypertension, if associated with LGA, is not associated with abruption; however, chronic hypertension with superimposed PIH accompanied by LGA is associated with significantly increased risk.

Key words: chronic hypertension, fetal growth, ischemic placental disease, placental abruption

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Chronic or preexisting hypertension complicates approximately 3-8 per 1000 pregnancies.[1,2] The condition confers increased risks for an array of reproductive and perinatal outcomes that include stillbirth,[3,4] preterm birth,[5-7] and restricted fetal growth.[3,5,8,9] The most common maternal risks that are associated with chronic hypertension include preeclampsia, pregnancy-induced hypertension (PIH), insulin resistance, and placental abruption.[10]

The causes of hypertensive diseases, fetal growth restriction (FGR), and placental abruption are heterogeneous, yet speculative. Nevertheless, hypoxia-induced changes in the maternal-fetal circulation,[11,12] uteroplacental vascular insufficiency,[13] and placental ischemia are believed to be the chief predisposing pathophysiologic mechanisms that are common to all these pregnancy complications.[14-16] Although women with chronic hypertension are at increased risk of placental abruption,[17-19] it remains unclear whether this is a direct association or whether the association is modified by complications that accompany chronic hypertension, namely, PIH and/or FGR. Such knowledge may provide important clues to understanding the pathophysiologic mechanisms to placental abruption. Because preterm PIH and preterm FGR represent more severe forms of the underlying disease states, we stratified the association between chronic hypertension and placental abruption by gestational age at delivery.

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Materials and Methods

Data source and cohort composition

We used the National Center for Health Statistics (linked birth and infant death)

TABLE 1
Maternal demographic characteristics in relation to chronic hypertension: US singleton births, 1995-2002

Characteristics	Total births (n)	Chronic hypertension	
		Cases (n)	Rate per 1000 pregnancies
Overall	30,189,949	221,404	7.3
Maternal age (y)			
<20	3,728,270	9557	2.6
20-24	7,553,149	32,830	4.3
25-29	8,178,160	53,649	6.6
30-34	6,891,465	62,796	9.1
35-39	3,196,547	46,636	14.6
≥40	642,358	15,936	25.1
Gravidity			
1	10,065,100	63,174	6.3
2	8,804,044	59,739	6.8
≥3	11,320,805	98,491	8.7
Maternal race			
White	23,879,305	15,567	6.4
Black	4,633,272	61,133	13.4
Other	1,677,372	8704	5.2
Maternal education (y)			
<12	6,590,795	29,884	4.5
12	9,690,753	77,696	8.0
13-15	6,511,350	58,639	9.0
≥16	6,981,470	51,801	7.4
Marital status			
Single	9,989,368	66,752	6.7
Married	20,200,581	154,679	7.7
Smoking during pregnancy			
Nonsmoker	22,005,904	176,439	8.0
1-10 cigarettes/d	2,047,370	14,598	7.1
11-20 cigarettes/d	792,315	6115	7.7
≥21 cigarettes/d	106,302	1135	10.7
Missing	5,238,058	23,117	4.4
Infant sex			
Male	15,463,653	114,278	7.4
Female	14,726,296	107,126	7.3

All comparisons are statistically significant ($P < .0001$).

data files for the years 1995-2002. The National Center for Health Statistics routinely links birth and infant death records that are provided by individual states under the Vital Statistics Cooperative Program.[20] The linked data include information on maternal characteristics, medical and obstetric history, complications of pregnancy, and fetal and infant outcomes. Natality and stillbirth data routinely are recorded on the live birth and fetal death certificates, respectively.

Gestational age on these data files was derived from the last menstrual period for >95% of the pregnancies. When the estimated gestational age that was based on menstrual dates was contradictory to the reported birthweight, a clinical estimate of gestational age was substituted. If the day of the menstrual period was missing (but month and year were available), the missing gestational age was input statistically.[21] The replacement of clinically estimated gestational age and the imputation were both performed by the National Center for Health Statistics consistently for all the years that were examined.[20,21]

Chronic hypertension was defined as hypertension diagnosed before conception or within the first 20 weeks in pregnancy. Because preeclampsia is not listed as a separate diagnosis, all analyses were restricted to PIH and eclampsia, either alone or together. These data were coded with the use of the check-box format on birth and fetal death certificates. Fetal growth was assessed on the basis of percentiles of birthweight for gestational age and corrected for infant sex and was defined as <1, 1-2, 3-4, 5-9, 10-19, 20-29, 30-39,. . .,≥90. *FGR* and *large for gestational age* (LGA) were defined as fetuses with sex-specific birthweight at <10th percentile and >90th percentile, respectively, for gestational age. For both the FGR and LGA analysis, fetuses with birthweight between the 10th and 90th percentile were used as the comparison group. We used all singleton births in the United States between 1995 and 2002 to derive the birthweight for gestational age cut-offs (internal standards). We restricted the analysis to women who delivered a singleton live birth or stillbirth at ≥22 weeks of gestation and to fetuses who weighed at least 500 g. These restrictions helped to avoid errors in these early gestational ages[22] and helped to minimize interstate differences in the reporting of births at the borderline of viability.

Statistical analysis

Multiple logistic regression models were fitted to evaluate the independent associa-