



RESEARCH ARTICLE

Morphological Changes in Placenta Associated with Maternal Hypertension at PMCH, Patna

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ABSTRACT

Background: Hypertensive disorders of pregnancy are important contributors to maternal and perinatal morbidity and mortality worldwide. Maternal hypertension leads to uteroplacental insufficiency resulting in significant gross placental alterations that adversely affect fetal growth and pregnancy outcome.

Objective: To evaluate gross morphological changes in placenta associated with maternal hypertension and correlate these findings with fetal outcome.

Materials and Methods: A hospital-based cross-sectional observational study was conducted in the Department of Anatomy in collaboration with the Department of Obstetrics and Gynecology at PMCH, Patna. A total of 100 placentae obtained from hypertensive pregnancies were examined. Gross morphological parameters including placental weight, diameter, thickness, placental infarction, calcification, retroplacental hematoma, and cord insertion abnormalities were evaluated. Statistical analysis was performed using SPSS version 25. Quantitative variables were expressed as mean $\pm$ standard deviation. Chi-square test and Student's t-test were applied, and p-value <0.05 was considered statistically significant.

Results: The majority of mothers belonged to the age group of 21–30 years (62%). Reduced placental weight was observed in 56% cases, placental infarction in 48%, calcification in 42%, retroplacental hematoma in 18%, and abnormal cord insertion in 12% cases. Mean placental weight progressively decreased with increasing severity of hypertension and was lowest in eclampsia cases (398 ± 42 g; $p < 0.001$). Placental infarction showed significant association with low birth weight ($p = 0.002$).

Conclusion: Maternal hypertension produces significant gross placental morphological alterations that reflect uteroplacental insufficiency and are associated with adverse fetal outcomes. Careful gross placental examination may provide important prognostic information regarding fetal wellbeing.

Keywords: Maternal hypertension; Placenta; Placental morphology; Placental infarction; Preeclampsia

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INTRODUCTION

Hypertensive disorders complicate approximately 5–10% of all pregnancies and remain among the leading causes of maternal and perinatal morbidity and mortality worldwide (1). These disorders include gestational hypertension, preeclampsia, eclampsia, and chronic hypertension complicating pregnancy. Among them, preeclampsia is considered the most clinically significant because of its association with maternal vascular dysfunction and fetal compromise (2).

The placenta plays a central role in fetal growth and development by maintaining adequate uteroplacental circulation and nutrient exchange. Maternal hypertension causes vasospasm and impaired uteroplacental blood flow, resulting in placental ischemia and reduced fetal oxygenation (3). These hemodynamic disturbances produce characteristic gross morphological changes in the placenta that can be assessed after delivery.

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Placental morphology provides valuable information regarding the intrauterine environment and severity of

maternal disease. Gross placental alterations commonly associated with hypertensive disorders include reduced placental weight, decreased placental diameter, placental infarction, calcification, retroplacental hematoma, and abnormalities of umbilical cord insertion (4). These changes are considered markers of uteroplacental insufficiency and chronic fetal hypoxia.

Placental weight is regarded as an important indicator of placental efficiency and fetal nutritional status. Several investigators have reported significantly lower placental weight in hypertensive pregnancies compared to normotensive pregnancies (5,6). Reduced placental growth may compromise fetal development and contribute to adverse neonatal outcomes such as low birth weight and prematurity.

Placental infarction is another commonly reported gross lesion in hypertensive pregnancies. Infarcts develop due to impaired maternal blood flow through spiral arteries, leading to ischemic necrosis of placental tissue (7). Extensive infarction reduces functional placental surface area and may adversely affect fetal oxygen supply.

Calcification of placenta is frequently observed in severe maternal hypertension and is considered a manifestation of accelerated placental aging (8). Retroplacental hematoma resulting from placental abruption is another important complication associated with maternal hypertension and contributes significantly to fetal morbidity and mortality (9).

Umbilical cord abnormalities such as eccentric or marginal insertion have also been associated with hypertensive pregnancies and may interfere with fetoplacental circulation (10). Gross examination of placenta therefore serves as a useful tool in assessing disease severity and fetal outcome.

In developing countries such as India, hypertensive disorders continue to pose major challenges due to delayed antenatal care and inadequate maternal health services (11). Bihar remains one of the states with relatively high maternal and neonatal morbidity rates. However, limited regional studies have focused specifically on gross placental morphology in hypertensive pregnancies.

A systematic morphological examination of placenta may improve understanding of disease mechanisms and help clinicians predict fetal outcome. Therefore, the present study was undertaken to evaluate gross morphological changes in placenta associated with maternal hypertension at PMCH, Patna.

MATERIALS AND METHODS

Study Design

Hospital-based cross-sectional observational study.

Study Setting

Department of Anatomy in collaboration with the Department of Obstetrics and Gynecology, PMCH, Patna.

Study Duration

The study was conducted over a period of one year.

Sample Size

A total of 100 placentae obtained from hypertensive pregnancies were included in the study.

Inclusion Criteria

- Pregnant women diagnosed with gestational hypertension, preeclampsia, or eclampsia
- Singleton pregnancies
- Gestational age more than 28 weeks
- Placentae collected immediately after delivery

Exclusion Criteria

- Diabetes mellitus
- Chronic renal disease
- Multiple pregnancies
- Congenital fetal anomalies
- Placentae with autolysis or inadequate preservation

METHODOLOGY

Placentae were collected immediately after delivery and washed under running water to remove blood clots. Membranes and umbilical cord were trimmed before examination.

The following gross morphological parameters were assessed:

- Placental weight
- Placental diameter
- Placental thickness
- Presence of placental infarction
- Calcification
- Retroplacental hematoma
- Umbilical cord insertion abnormalities

Placental weight was measured using a digital weighing machine. Diameter was measured using a measuring tape, and thickness was recorded at the center of the placenta. Gross lesions such as infarction and calcification were identified by visual examination.

Statistical Analysis

Data were analyzed using SPSS software version 25. Quantitative variables were expressed as mean $\pm$ standard deviation. Chi-square test and Student's t-test were applied. p-value <0.05 was considered statistically significant.

Ethical Clearance

The study was approved by the Institutional Ethics Committee of PMCH, Patna. Informed consent was obtained from all participants.

RESULTS

A total of 100 placentae obtained from hypertensive pregnancies were evaluated during the study period at PMCH, Patna. Detailed gross morphological examination of all placentae was performed, and the findings were analyzed statistically.

Demographic Characteristics of Study Participants

The majority of mothers belonged to the age group of 21–30 years, accounting for 62% of cases, followed by 31–40 years (24%). Only 8% of mothers were below 20 years of age, while 6% were above 40 years. The mean maternal age of the study population was 27.4 ± 4.8 years.

The age-wise distribution of study participants is presented in Table 1.

As shown in Table 1, hypertensive disorders of pregnancy were most commonly observed among women in the 21–30 years age group.

Distribution of Hypertensive Disorders

Among the hypertensive disorders, preeclampsia was the most common diagnosis observed in 54% of cases, followed by gestational hypertension in 28% and eclampsia in 18% cases.

The distribution of hypertensive disorders is summarized in Table 2 and illustrated in Figure 1.

As demonstrated in Table 2 and Figure 1, preeclampsia constituted the majority of hypertensive disorders encountered in the present study.

Table 1: Age Distribution of Study Participants (n = 100)

Age group (Years)	Number of cases	Percentage
<20	8	8%
21–30	62	62%
31–40	24	24%
>40	6	6%

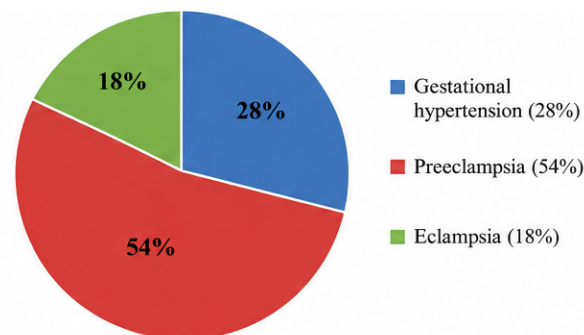


Figure 1: Distribution of Hypertensive Disorders

Table 2: Distribution of Hypertensive Disorders

Hypertensive disorder	Number of cases	Percentage
Gestational hypertension	28	28%
Preeclampsia	54	54%
Eclampsia	18	18%

Gross Morphological Changes in Placenta

Gross examination of placentae revealed multiple morphological abnormalities associated with maternal hypertension. Reduced placental weight was the most common finding and was observed in 56% cases. Placental infarction was present in 48% cases, while calcification was observed in 42% cases. Retroplacental hematoma and abnormal cord insertion were identified in 18% and 12% cases respectively.

The gross placental abnormalities observed are shown in Table 3 and Figure 2.

As shown in Table 3 and Figure 2, reduced placental weight and placental infarction were the predominant gross morphological abnormalities observed in hypertensive pregnancies.

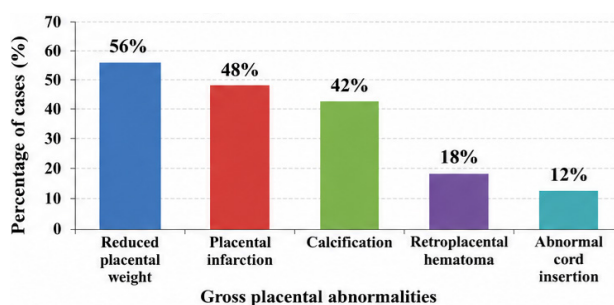


Figure 2: Gross placental abnormalities

Table 3: Gross Morphological Changes in Placenta

Gross morphological finding	Number of cases	Percentage
Reduced placental weight	56	56%
Placental infarction	48	48%
Calcification	42	42%
Retroplacental hematoma	18	18%
Abnormal cord insertion	12	12%

Comparison of Placental Parameters Among Hypertensive Disorders

Placental weight, diameter, and thickness progressively decreased with increasing severity of maternal hypertension. The lowest mean placental weight was observed among eclampsia cases.

The comparison of placental parameters among different hypertensive disorders is shown in Table 4 and Figure 3.

As demonstrated in Table 4 and Figure 3, placental dimensions showed a declining trend with increasing severity of hypertensive disease. The reduction in placental weight was statistically highly significant ($p < 0.001$).

Association Between Placental Infarction and Birth Weight

Low birth weight was observed more frequently among neonates delivered from placentae showing infarction. Placental infarction demonstrated a statistically significant association with low birth weight ($p = 0.002$).

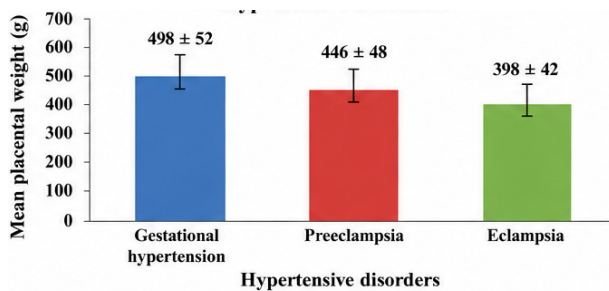


Figure 3: Mean Placental Weight in Different Hypertensive Disorders

Table 4: Mean Placental Parameters in Hypertensive Disorders

Parameter	Gestational Hypertension	Preeclampsia	Eclampsia	p-value
Mean placental weight (g)	498 ± 52	446 ± 48	398 ± 42	<0.001
Mean placental diameter (cm)	18.2 ± 1.6	16.9 ± 1.4	15.8 ± 1.2	0.003
Mean placental thickness (cm)	2.4 ± 0.3	2.1 ± 0.2	1.9 ± 0.2	0.011

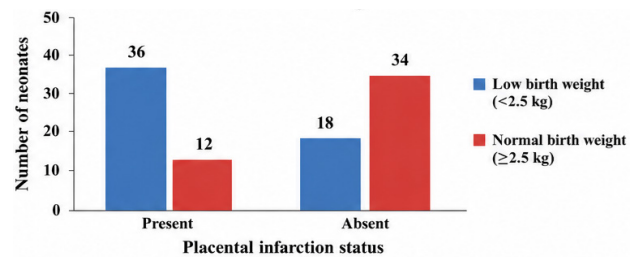


Figure 4: Association of Placental Infarction with Low Birth Weight

The association between placental infarction and fetal birth weight is shown in Table 5 and Figure 4.

As illustrated in Table 5 and Figure 4, placentae showing infarction were significantly associated with delivery of low birth weight neonates.

Statistical Analysis of Gross Placental Findings

Statistical analysis demonstrated significant associations between gross placental lesions and adverse fetal outcomes. Reduced placental weight showed strong association with severity of maternal hypertension, while placental infarction correlated significantly with low birth weight.

The statistical summary of major gross placental findings is presented in Table 6.

As shown in Table 6, statistically significant associations were observed between gross placental abnormalities and adverse fetal outcomes.

Overall Morphological Findings

The present study demonstrated significant gross placental morphological abnormalities in hypertensive pregnancies. Reduced placental weight, placental infarction, and calcification were the predominant findings. Placental dimensions progressively decreased with increasing severity of maternal hypertension. Gross placental lesions showed significant correlation with adverse fetal outcomes including low birth weight, fetal distress, and prematurity.

DISCUSSION

The placenta acts as an important indicator of maternal and fetal wellbeing. Maternal hypertension adversely affects

Table 5: Association Between Placental Infarction and Birth Weight

Placental infarction	Low birth weight	Normal birth weight	p-value
Present	36	12	0.002
Absent	18	34	

Table 6: Statistical Summary of Gross Placental Findings

Morphological parameter	Statistical value	p-value
Reduced placental weight and severity of hypertension	t = 5.62	<0.001
Placental infarction and low birth weight	$\chi^2 = 9.84$	0.002
Calcification and fetal distress	$\chi^2 = 4.91$	0.027
Retroplacental hematoma and prematurity	$\chi^2 = 5.16$	0.021

uteroplacental circulation, resulting in characteristic gross placental alterations. In the present study, several significant morphological abnormalities were observed in placenta obtained from hypertensive pregnancies.

The majority of patients belonged to the age group of 21–30 years, which is comparable to findings reported by Dutta et al. and Cunningham et al. (12,13). This age group represents the peak reproductive period and therefore contributes substantially to hypertensive pregnancies.

Reduced placental weight was the most common morphological finding in the present study. Similar observations have been reported by Majumdar et al. and Udania et al., who demonstrated significantly lower placental weight in hypertensive pregnancies compared to normotensive controls (14,15). Reduced placental growth may result from chronic uteroplacental insufficiency and impaired maternal blood flow.

The present study demonstrated a progressive reduction in placental weight with increasing severity of maternal hypertension. Eclampsia cases showed the lowest mean placental weight. Similar findings were reported by Kher et al. and Teasdale et al. (16,17). Reduced placental size may compromise fetal nutrient transfer and contribute to fetal growth restriction.

Placental infarction was observed in 48% of cases in the present study. Robertson et al. reported that placental infarcts occur due to inadequate remodeling of maternal spiral arteries and impaired placental perfusion (18). Infarction reduces the effective placental exchange area and contributes to chronic fetal hypoxia.

Calcification was identified in 42% of placenta in the present study. Increased placental calcification in hypertensive pregnancies has also been documented by Fox et al. and Benirschke et al. (19,20). Calcification may indicate accelerated placental aging secondary to vascular insufficiency.

Retroplacental hematoma was observed in 18% cases and showed significant association with prematurity. Similar findings were reported by Salafia et al., who emphasized the role of maternal vascular compromise in placental abruption and fetal morbidity (21).

Abnormal cord insertion was observed in 12% cases in the present study. Variations in cord insertion may affect fetoplacental circulation and fetal growth. Previous studies by Battaglia et al. also reported increased incidence of abnormal cord insertion in hypertensive pregnancies (22).

The statistically significant association between placental infarction and low birth weight observed in the present study supports findings reported by Naeye et al. and Redline et al. (23,24). Gross placental lesions therefore provide important prognostic information regarding fetal outcome.

One important strength of the present study is the systematic gross morphological assessment of placenta from hypertensive pregnancies. However, the study was limited by absence of a normotensive control group and relatively short study duration.

Overall, the findings indicate that maternal hypertension is associated with significant gross placental abnormalities that reflect uteroplacental insufficiency and adverse fetal outcome.

CONCLUSION

Maternal hypertension is associated with significant gross placental morphological changes including reduced placental weight, placental infarction, calcification, retroplacental hematoma, and abnormal cord insertion. These abnormalities reflect impaired uteroplacental circulation and are significantly associated with adverse fetal outcomes such as low birth weight and prematurity. Careful gross examination of placenta can therefore provide valuable information regarding disease severity and fetal prognosis.

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