



MORPHOLOGICAL AND HISTOPATHOLOGICAL CHANGES IN CHORIONIC VASCULAR PATTERNS IN PLACENTAS OF HYPERTENSIVE AND NON-HYPERTENSIVE MOTHERS OF CENTRAL INDIA.

Clinical Anatomy

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ABSTRACT

Introduction: The study likely investigates how high hypertension in mothers from central India affects the morphology and histopathology of vascular patterns within the finger-like projections of placentas. These villi are crucial for exchange of nutrients and oxygen between mother and fetus. The research likely compares placentas from mothers with hypertension to those from healthy mothers (non-hypertensive) to identify changes in the villi's blood vessel patterns caused by high blood pressure. This could help understand how hypertension might disrupt vital exchanges within the placenta and potentially impact fetal health. **Materials and Methods:** Obstetrics and Gynecology Department, Department of Anatomy, Ram Krishna Medical Hospital and Research Centre, Bhopal, Madhya Pradesh. Study Population: 46 Placentas from both hypertensive (e.g., gestational hypertension, preeclampsia) and non-hypertensive mothers. **Methods:** The study likely involved collecting and analyzing placental tissue samples from two groups: mothers with hypertension and mothers with normal blood pressure during pregnancy. Researchers would have examined the placentas for: Macroscopic morphology, histopathology Measuring size, weight, and shape of the placenta, Examining tissue samples under a microscope to identify changes in blood vessel structure, presence of abnormal cells, or deposits within the chorionic villi (finger-like projections responsible for nutrient and oxygen exchange). **Objective:** To investigate the morphological (shape and size) and histopathological (microscopic tissue structure) alterations in the chorionic vascular patterns of placentas delivered by mothers with hypertension compared to those from normotensive (healthy blood pressure) mothers in Central India. **Expected Results:** The study likely expects to identify differences in the morphology and histopathology of the chorionic vascular patterns between the hypertensive and non-hypertensive groups. These differences might include: Reduced size or weight of placentas in the hypertensive group, Changes in blood vessel size or distribution within the villi, Evidence of cell damage

KEYWORDS

Placenta, Chorionic, Vascular, Hypertensive, Histopathology.

INTRODUCTION

Complications associated with high blood pressure during pregnancy are common. The exact mechanism by which pregnancy leads to or exacerbates hypertension is still unknown despite decades of research efforts ^[1] Pre-eclampsia syndrome, characterized by the sudden onset of hypertension and the presence of protein in the urine during pregnancy, is the main cause of most adverse outcomes such as maternal and neonatal mortality and morbidity ^[2]. According to the recommendations of the National High Blood Pressure Education Program's Working Group on Hypertension in Pregnancy, hypertensive disorders in pregnancy can be divided into four categories ^[1,3]. There are four possible conditions that can occur during pregnancy: ¹⁾ chronic hypertension, which is high blood pressure that persists throughout pregnancy; ²⁾ preeclampsia-eclampsia, which is a condition characterized by high blood pressure and organ damage; ³⁾ preeclampsia in addition to chronic hypertension, i.e. when a woman with pre-existing hypertension develops pre-eclampsia; and ⁴⁾ gestational hypertension, i.e. either transient hypertension during pregnancy or the onset of chronic hypertension in the later stages of pregnancy. A normotensive pregnancy is characterized by blood pressure below 140/90 mmHg throughout the pregnancy.

The placenta is an important organ that is necessary for the survival of the fetus in the uterus. A thorough examination of the placenta can provide valuable information about the prenatal health of mother and child ^[4]. The uterus is a vital organ for supporting the pregnancy and promoting optimal fetal development. The placenta serves as a reflective surface that mirrors the intrauterine state of the fetus. Preeclampsia has been shown to lead to a reduction in blood flow between the mother and the placenta as a result of constriction of the maternal blood vessels. Fetal hypoxia is a consequence of maternal vasospasm. In the short term, fetal hypoxia is a common occurrence that can lead to both fetal distress and death ^[5,6].

The placenta of women with preeclampsia has been associated with changes in decreased blood flow between the mother and the placenta, which can indirectly lead to constriction of the arteries that supply blood to the fetus ^[6,7]. The placenta of pregnancies complicated by preeclampsia had a significantly smaller total tissue volume and a smaller surface area of the villi compared to normal pregnancies of the same gestational length. Approximately 25% of placentas from pregnancies without complications have modest areas of infarction. Placentas from

mothers with pre-eclampsia usually have a significant placental infarct ^[7,8]. The placenta of mothers with pre-eclampsia is often smaller than the placenta of uncomplicated pregnancies. In addition, these mothers are more likely to have larger infarcts, which occur more frequently and are often located in the central region of the placenta.

The placenta of women with hypertension showed increased histopathologic features, including increased cytotrophoblastic cell proliferation, the development of syncytial nodules, and the formation of fibrin plaques.

Aim and Objectives

Aim: To investigate and compare the morphological and histopathological changes in chorionic vascular patterns between placentas from hypertensive and non-hypertensive mothers.

Objectives:

- To assess morphological variations in chorionic vascular patterns in placentas of hypertensive and non-hypertensive mothers.
- Determine histopathological differences in chorionic vascular structures between the two groups.
- To analyze any correlations between maternal hypertension and specific morphological or histopathological alterations in the placental vasculature.
- To explore potential implications of these changes for maternal and fetal health outcomes.
- To provide insights into the underlying mechanisms contributing to vascular alterations in placentas associated with maternal hypertension.

MATERIALS AND METHODS:

Our study included 46 third-trimester pregnant patients admitted to the Ram Krishna Medical Hospital and Research Centre, of Obstetrics and Gynecology Department, Bhopal, in the last three years. I collected a total of 46 placentas soon after delivery.

Study Population: 46 Placentas from both hypertensive (e.g., gestational hypertension, preeclampsia) and non-hypertensive mothers.

$n=Z^2 P(1-P)/d^2$
Where,

- n = sample size,
- Z = Z statistic for a level of confidence
- P = expected prevalence or proportion
- d = precision

Inclusion criteria:

- Placentas from both hypertensive (e.g., gestational hypertension, preeclampsia) and non-hypertensive mothers.
- Placentas with complete medical records available for review.

Group I: Hypertensive pregnant mothers attend their delivery during data collection period aged 20-35 years, and diagnosed clinically

Group II: Non- hypertensive pregnant mothers aged 20-35 years having no signs and symptoms of hypertensive.

Exclusion criteria:

- Placentas with evidence of other significant placental pathologies (e.g., placental abruption, placenta previa).
- Placentas from mothers with pre-existing medical conditions that may affect placental morphology.

Data Collection:

Placental samples will be obtained as part of the regular pathological evaluation that occurs after childbirth. The medical records will be used to gather important clinical information such as the mother's medical history, the stage of pregnancy, the results of the birth, and any difficulties experienced by both the mother and the fetus.

The placenta, together with the connected membranes and umbilical cord, will be taken shortly after birth. It will be rinsed under a stream of running tap water, labeled, and then preserved in a solution of 10% formalin for a period of 4-6 weeks. An analysis of both the macroscopic and microscopic features of the placenta will be conducted. Observations will be made on the dimensions, configuration, mass, central thickness, cotyledon count, and umbilical cord insertion point. The birth weights of newborn infants will be recorded and the ratio of feto-placental weight will be computed. A histopathological examination of the placenta will be conducted, and the slides will be analyzed using a light microscope. The data obtained from studies on the form and measurement of organisms will be documented.¹⁶

Morphological Assessment:

Macroscopic examination

The placenta will be visually inspected and its physical characteristics will be noticed and documented. Microscopic examination: Placental tissue will be processed and stained using conventional histopathological methods (such as hematoxylin and eosin staining) to create histological sections.

The chorionic vascular patterns will be examined using light microscopy to evaluate any qualitative and quantitative morphological alterations.

Histopathological Analysis:

The chorionic vascular structures will be investigated for changes in tissue structure such as fibrinoid necrosis, thrombosis, inflammation, and abnormalities in blood vessel development. Histopathological grading systems will be used to evaluate the degree of vascular alterations in a semi-quantitative manner.

Review of Literature:

Thakur et al. (2018) did a study to see if there are any discernible distinctions between the placenta of individuals with hypertension and the placenta of individuals in the control group with uncomplicated pregnancies. The study was conducted on a sample of sixty women who had normal pregnancies and another sixty moms who had pregnancies complicated by hypertension. Hypertensive pregnancies are linked to alterations in the size and shape of the placenta, including a decrease in placental weight, diameter, thickness, surface area, volume, and number of cotyledons. The fetoplacental ratio is higher in individuals with hypertension. Hypertensive disorders of pregnancy have a negative impact on the structure of the placenta and also affect the result of childbirth.⁹

Chhatwal et al. (2018) did a study to examine the structural and tissue-related alterations in the placenta during hypertensive pregnancies.

The study included 42 pregnant women who had hypertension disease and were between 28 and 42 weeks gestational age with a singleton pregnancy.¹⁰

Vişan et al. (2020) did a study to examine the macroscopic and microscopic pathogenic characteristics of placentas in pregnancies complicated by intrauterine growth restriction (IUGR). Immediately following delivery, we collected and studied a total of 42 placentas. Out of these, 32 placentas were obtained from instances that had previously been diagnosed with an impact on intrauterine growth restriction (IUGR) and were therefore included in our study group.¹¹

Gebremeskel et al. (2020) examined the histological alterations in the placenta that are linked to maternal anaemia. A comparative cross-sectional study was done at Dessie Referral Hospital between May and June 2018. After delivery, a total of 66 placentas were retrieved, with 33 placentas from anaemic individuals and 33 placentas from non-anaemic individuals. In pregnancies where the mother has anaemia, 75.7% of placentas with anaemia showed an increase in the number of terminal villi vessels, compared to just 15.1% in pregnancies without anaemia ($p=0.001$). The percentage of placental calcification was 72.7% in the anaemic groups, whereas it was 54% in the non-anaemic groups. Nevertheless, it was deemed statistically insignificant with a p -value of 0.12. The width of the intervillous space was greater in the anaemic group compared to the non-anaemic group ($p<0.001$). The number of chorionic villi capillaries was higher and dilated in anaemic placenta compared to non-anaemic placenta. The width of the intervillous gap was noticeably greater in placenta affected by anaemia.¹²

Furaha et al. (2022) examined and compared the physical and cellular characteristics of the placenta in pregnant women with hypertension and those without hypertension who were treated at Muhimbili National Hospital. A total of 80 placentas were examined both morphologically and histologically.¹³

Panday et al. (2023) examined the histology of placental abnormalities in hypertensive diseases of pregnancy and investigated the relationship between these changes and fetal outcome. A cross-sectional study was conducted between December 2021 and November 2022 at the Department of Obstetrics and Gynecology, Sardar Patel Medical College, Bikaner. The study included 100 pregnant women with singletons who were admitted to the labor room and had gestational ages greater than 30 weeks and less than 35 weeks. These women were diagnosed with hypertensive disorders of pregnancy. The examination encompassed the assessment of the placenta's shape, weight (in grams), size, diameter (in centimeters), and deposition. The outcome for both the fetus and the mother was also observed. Out of the total, 80% of the individuals belonged to the age range of 21-30 years, with an average age of 25.01 ± 4.56 (ranging from 18 to 44 years). Out of all the females, only 35% were booked, whereas the majority of cases, 63%, belonged to G1. The majority of cases (42%) were attributed to pregnancy-induced hypertension, followed by eclampsia (36%) and pre-eclampsia (16%).¹⁴

Lai et al. (2024) conducted a study to assess the occurrence of placental histopathological lesions in pregnancies affected by gestational diabetes mellitus (GDM) in comparison to a control group with similar gestational age. They also examined the relationship between these lesions and any difficulties experienced by the mother and fetus. A total of 54 singleton pregnancies with gestational diabetes mellitus (GDM) complications were included in the study and compared to 33 successive pregnancies without any complications. Two pathologists, who were unaware of any clinical information, examined and assessed all histology samples of the placentas based on the Amsterdam criteria. Data pertaining to demographics, clinical characteristics, and primary birth outcomes were meticulously documented. Several histomorphological abnormalities were more commonly observed in the placentas of individuals with gestational diabetes mellitus (GDM) compared to the control group. These abnormalities included chronic inflammation ($n = 9/54$, $p = 0.031$), histological chorioamnionitis ($n = 23/54$, $p < 0.001$), umbilical/chorionic vasculitis ($n = 9/54$, $p = 0.031$), changes related to maternal vascular malperfusion ($n = 22/54$, $p = 0.003$), chorangiosis ($n = 10/54$, $p = 0.046$), and villous dysmaturity ($n = 9/54$, $p = 0.012$). In addition, GDM substantially raised the likelihood of fetal problems, such as macrosomia/fetal development limitation ($n = 13/54$, $p = 0.004$). Placentas of fetuses with gestational diabetes mellitus (GDM) exhibited a higher frequency of histoarchitectural

abnormalities compared to the control group. The results of our study confirm the theory that harm to placental function caused by diabetes may be linked to an increase in fetal growth problems in pregnancies complicated by gestational diabetes mellitus (GDM).¹⁵

RESULTS:

The study likely expects to identify differences in the morphology and histopathology of the chorionic vascular patterns between the hypertensive and normotensive groups. These differences might include:

- Reduced size or weight of placentas in the hypertensive group.
- Changes in blood vessel size or distribution within the villi.
- Evidence of cell damage or abnormal deposits due to high blood pressure.

Significance:

Understanding how hypertension affects placental blood vessel structure could provide insights into potential risks for fetal growth and development. This knowledge might contribute to improved monitoring and management of pregnancies with high blood pressure.

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