

Morphological Variations of Human Placenta in Pre-Eclampsia Pregnancy and to Compare the Same with The Uncomplicated or Normal Pregnancy

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Abstract:

Background: Placental insufficiency is a concern in pregnancy brought on by preeclampsia. There is an increase in maternal and fetal mortality as a result. The aim of the study was to study the morphological variations of human placenta in complicated pregnancy and to compare the same with the uncomplicated or normal pregnancy. **Materials & Methods:** This research makes use of an observational methodology. After obtaining permission from Institutional Ethics Committee studied at the Department of Anatomy at Indore Medical College & Hospital, Indore. There was a total of 220 human placentas used in this study; 110 were from healthy pregnancies serving as controls, and the remaining 110 were from pregnancies complicated by preeclampsia. The morphology of every sample was analyzed. **Results:** Variation in placental shape was observed, with both groups producing organs with extra lobes. Significant decreases ($p < 0.001$) were seen in pre-eclampsia for both placental shape, thickness and maternal surface cotyledons. While pre-eclampsia group did have a thinner placenta, the difference was not statistically significant. The cotyledon count in pre-eclampsia group was drastically higher than in uncomplicated group. ($p < 0.05$). **Conclusion:** In this investigation, we found that preeclamptic placentae exhibit distinctive morphological alterations. Placental insufficiency, a condition associated with preeclampsia, appears to be the cause of these alterations. However, more extensive placental research using histological and morphometric methods with bigger sample sizes are needed before any conclusion can be drawn.

Keywords: Pregnancy, Placenta; Pre-eclampsia; Cotyledons

Introduction:

India reduced its maternal mortality ratio the number of deaths per 100,000 live births from 103 deaths in 2017-2019 to 97 deaths per lakh in 2018-2020. The placenta is one of the main reasons why mothers and babies die, as well as why babies do not grow as quickly as they should. This is referred to as placental insufficiency [1].

During a normal pregnancy, trophoblastic cells invade the spiral artery walls and transform them into large, winding blood vessels that carry a large amount of blood to the intervillous space and are unaffected by vasomotor agents [2]. The trophoblastic invasion begins between 16 and 20 weeks of pregnancy and destroys the spiral artery's muscularis layer. This is completed in 24 weeks [3-7]. These changes in how the body functions are limited in preeclampsia⁴. The main sign of an abnormal placenta is that the trophoblast cells do not penetrate the mother's spiral arteries sufficiently [8]. This causes the muscles and elastic tissues in the middle of the spiral arteries to remain in place. As a result, the blood vessels do not dilate and remain sensitive to vasomotor influences [1]. As a result, choriodecidual circulation with high resistance and low flow occurs [4]. The metabolic needs of the fetus and placenta increase as the pregnancy progresses, but the spiral arteries cannot widen enough to accommodate the increased blood flow [6]. This results in placental dysfunction, which manifests as preeclampsia [5]. We don't know what causes preeclampsia, but we do know that it is characterized by abnormal trophoblast invasion of uterine blood vessels and immunological intolerance between fetoplacental and maternal tissues [6]. Babies born with an abnormally large placenta are more likely to develop high blood pressure later in life [8]. When the placenta is examined carefully, it can provide important information about how to care for the mother and baby both immediately and in the future [7].

The aim of the study was to study the morphological variations of human placenta in complicated pregnancy and to compare the same with the uncomplicated or normal pregnancy.

Materials & Methods:

This research makes use of an observational methodology. After obtaining permission from Institutional Ethics Committee studied at the Department of Anatomy at Indore Medical College & Hospital, Indore. There was a total of 220 human placentas used in this study; 110 were from healthy pregnancies serving as controls, and the remaining 110 were from pregnancies complicated by preeclampsia. After a proper inspection, notes were made about the shape of the placenta and whether or not it had an extra lobe. Each placenta was put into one of three groups: oval, round, or irregular.

Five spots on each placenta were poked with a long needle to measure how thick the placenta was. Each placenta was put on the surface of the fetus. By drawing two circles on the surface of the mother, the placenta was randomly split into three equal parts. The placenta's radius is divided into three equal parts by these circles. One thickness was measured from the middle of the middle zone, two thicknesses from the middle zone, and two thicknesses from the edges. The points on the edges were found in the outer zone on a line that was perpendicular to the first line. The final step was to take the average of all five measurements to figure out how thick the placenta was [9].

Each placenta that had been set in formalin was taken with both hands. Then, with the thumbs of both hands, gentle pressure was put on the center of the fetal surface while the other fingers were used to hold the placenta. So, when the two parts are separated, the cotyledons on the maternal side stand out. The placenta was then put on a flat tray with the side facing the mother facing up. A block of paraffin was put on the side facing the baby. Then, counting began on the left side of one end of the placenta, went to the right, and then looped back to the left. This process of counting was done again and again until the other end of the placenta was reached. A total of 10 cotyledons were counted [10].

Statistical analysis:

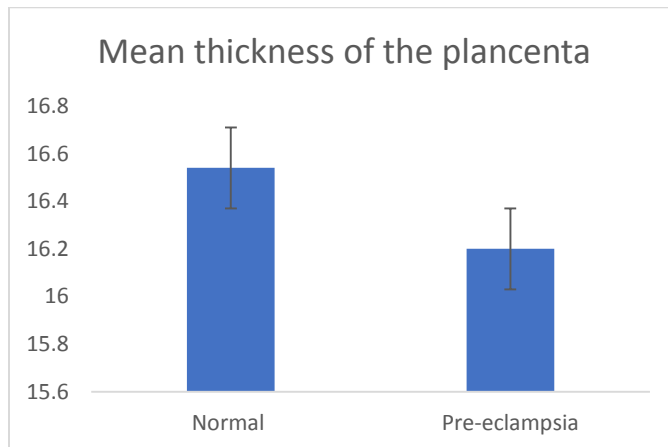
The raw data was analyzed with IBM SPSS. T-tests for samples were used to examine the differences in mean differences between parameters. Percentages were also calculated. There was a < 0.05 p-value threshold for statistical significance in this study.

Results:

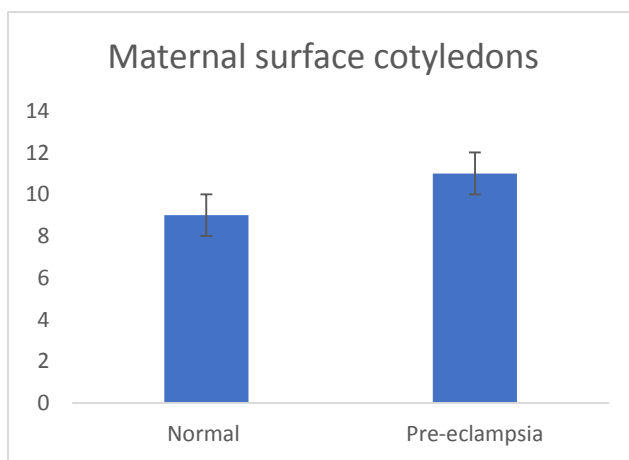
The current investigation required the collection of 220 human placental specimens, 110 of which originated from pregnancies that were unaffected by eclampsia and 110 of the specimens originated from pregnancies that were straightforward (Table 1). There were a total of 110 placenta specimens, all of which originated from healthy pregnancies that did not present any complications. Of those, 61.8% had the form of a circle, 27.3% had the shape of an oval, 7.3% had the shape of a triangle, and 0% had the shape of a heart. The shapes known as the succenturiate, the kidney, and the irregular were also discovered. 50.1% of the placenta specimens obtained from pre-eclamptic pregnancies had a circular form, 40% had an oval shape, 0% had a triangular shape, 3.7% had a heart shape, and 0% had a succenturiate, kidney, or irregular shape.

Table 1: Shape of the placenta of present study specimen collected

| SHAPE | Normal | Pre-eclampsia | Total |
|---------------|---------------|----------------------|--------------|
| Circular | 68 | 56 | |
| Oval | 30 | 44 | 176 |
| Triangular | 8 | 0 | 12 |
| Heart shape | 0 | 4 | 4 |
| Succenturiata | 4 | 0 | 4 |
| Kidney shape | 0 | 0 | 3 |
| Irregular | 0 | 6 | 15 |
| Total | 110 | 110 | 220 |

Figure 1: Mean thickness of the placenta of the present study specimen

The present observed in 110 specimens in each group, the mean number of maternal cotyledons in normal group was observed to be 9 ± 3.15 , range being (5 - 17). The mean number of maternal cotyledons in pre-eclampsia complicating pregnancies was 11, range being (6-18). The difference between the normal group and the pre-eclampsia group in terms of the mean number of cotyledons was statistically significant ($P = 0.003$, which is less than 0.05).

Figure 2: Maternal surface cotyledons of the placenta in the present study:

The present observed in 110 specimens in each group, the average thickness of the placenta in normal group was observed to be 1.9 ± 0.3 cm, range being (0.8-2.5) cm. The average thickness in Pre-eclampsia complicating pregnancies was 1.3 ± 0.3 cm, range being (0.6-2.0) cm. It was determined by statistical analysis that there was statistically significant difference in diameter between the normal and pre-eclampsia groups ($P = 0.001$, which is greater than 0.05).

Discussion:

The aim of the study was to study the morphological variations of human placenta in complicated pregnancy and to compare the same with the uncomplicated or normal pregnancy.

Vrijens et al., 2020 [11]; found in a study of 100 placentae, that the average number of cotyledons to be 18 with a range 3 - 24. Hong et al., 2021 [12]; in their study of 70 placenta (50 Hypothyroid and 20 euthyroid patients), the mean number of cotyledons in hypothyroid group was 23.86 ± 5.26 and in normal group was 19.70 ± 2.00 ($p < 0.001$). Prathinidhi et al., 2021 [13]; studied in 150 normotensive and 150 preeclampsia placenta and stated that there was a significant positive correlation between birth weight and number of cotyledons [$r = 0.647$, $p = 0.0001$]. Comparatively, Pearson correlation test showed that birth weight was moderately correlated with number of cotyledons ($r = 0.566$, $p = 0.0001$). In pre-eclampsia, birth weight and number of cotyledon. Thakur et al., 2022 [14]; stated that in her study of 100 placentae, the number of cotyledons in the maternal surface varies from 12 to 24. The average being 18 in number. Arora et al., 2022 [15]; They reported that the mean number of cotyledons in normal (60) and hypertensive (60) group were 16.4 ± 1.81 and 12.3 ± 1.6 ($p < 0.001$). The present observed in 110 specimens in each group, the mean number of maternal cotyledons in normal group was observed to be 9 ± 3.15 , range being (5 - 17). The mean number of maternal cotyledons in pre-eclampsia complicating pregnancies was 11, range being (6-18). The difference between the normal group and the pre-eclampsia group in terms of the mean number of cotyledons was statistically significant ($P = 0.003$, which is less than 0.05). Augustine et al., 2016 [16]; in their study of 58 placentas, discovered that the mean diameter of the placenta in the control group was 15.4 ± 1.49 cm, whereas the mean diameter of the placenta in the GDM group was 16.66 ± 1.18 cm. Kumari et al., 2016 [17]; reported in their study of 70 placentas (50 from patients with disorder and 20 from patients with euthyroidism), discovered that the mean placental diameter in the normal group was 14.712.07 cm, while the mean placental diameter in the hypothyroid group was 16.641.70 cm ($p < 0.001$). Puthuraj et al., 2018 [18]; observed that the average diameter of the placentae was 17.8cms in uncomplicated pregnancies and that the diameter was in the range of 15.1- 17 cm in pregnancy induced hypertension patients. In his study, the 292 placentae were divided into four categories: Normal patients ($n = 147$), patients with pregnancy-induced hypertension ($n = 15$), patients with gestational diabetes mellitus ($n = 30$), patients with anemia ($n = 65$), and noted that having gestational diabetes mellitus increased the diameter of the placenta. Thakur et al., 2022 [14]; In their study of 100 placenta, 50 uncomplicated pregnancy (control group) and 50 with pregnancy induced hypertension (PIH), the observed mean placental diameter was 18.94 ± 3.25 cm & 16.32 ± 3.19 cm respectively. The present observed in 110 specimens in each group, the average thickness of the placenta in normal group was observed to be 1.9 ± 0.3 cm, range being (0.8-2.5) cm. The average thickness in Pre-eclampsia complicating pregnancies was 1.3 ± 0.3 cm, range being (0.6-2.0) cm. It was determined by statistical analysis that there was statistically significant difference in diameter between the normal and pre-eclampsia groups ($P = 0.001$, which is greater than 0.05).

Conclusion:

In this investigation, we found that preeclamptic placentae exhibit distinctive morphological alterations. Placental insufficiency, a condition associated with preeclampsia, appears to be the cause of these alterations. However, more extensive placental research using histological and morphometric methods with bigger sample sizes are needed before any conclusion can be drawn.

Conflict of interest:

The present authors do not carry any conflict of interest among themselves.

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