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Original Research Article

PLACENTAL MORPHOLOGY AND FETAL OUTCOME IN PRE-ECLAMPTIC PREGNANCIES

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ABSTRACT

Introduction: Pre-eclampsia is one of the major obstetric problem affects 5-8% of all pregnancies leading to maternal and perinatal morbidity and mortality. Fetal outcome is badly affected by pathological changes developing in placenta.

Methods: A cross-sectional descriptive study was carried out in the department of Anatomy with Pathology, Yenepoya Medical College, Mangalore, Karnataka. A total of 32 freshly delivered placentae (24 from pre-eclamptic pregnancy and 8 from normal pregnancy) were collected from the Obstetrics and Gynaecology department of Yenepoya Medical College Hospital, Mangalore. Morphologic and morphometric parameters of placentae were noted and their means were calculated.

Results: The morphologic parameters of the placenta were showed significant difference in two groups (p=0.018). Fetal birth weight was lower in pre-eclamptic group and 33% of babies of pre-eclamptic mothers developed IUGR. The incidence of pre-eclamptic patients underwent caesarean section was 71% and 16% of pre-eclamptic mothers developed eclampsia and HELLP syndrome.

Discussion: Pre-eclampsia is associated with significant changes in placental morphology due to decreased uteroplacental blood flow. Prematurity, growth restriction and low birth weight are fetal complications expected to be linked with pre-eclampsia. Placental weight had relevant connection with the fetal birth weight. Hence, the knowledge of this will be extremely useful in the early diagnosis of placental insufficiency and to plan a safe pregnancy with healthy fetal outcome.

KEY WORDS: Fetal Outcome, Morphology, Placenta, Pre-Eclampsia.

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INTRODUCTION

Placenta is a vital organ which conserves pregnancy and helps in normal fetal development. Fetal outcome is unfavourably affected by pathological changes observed in placenta. Hence it is a reflection of the intrauterine status of the fetus. Pre-eclampsia is a relatively common pregnancy disorder that begins in the placenta and causes unpredictable maternal and fetal problems. It usually develops after 20 weeks of gestation and settles after delivery of placenta. The maternal mortality rate of pre-eclampsia in

India is diminished from 570 in 1990 to 230 in 2008, but still it persists high when compared to developed countries and is largely preventable [1].

Placenta represents the most precise record of prenatal experience of an infant. Placental morphological changes vary significantly in pre-eclampsia that influences the growth of fetus [2]. In pre-eclampsia there is increased resistance to utero-placental circulation which harms the growth of placenta regarding the weight, thickness, surface area and volume. These irregularities are affected macroscopically and microscopically in the placenta and results adverse pregnancy outcome with low birth weight babies [3].

The examination of placenta in utero as well as postpartum gives much acuity into the prenatal health of the baby and the mother .Those who have had no previous antenatal check up, a proper examination of placenta will be helpful in the early diagnosis of the fetal complications and can provide a safe delivery [4]. Hence, this study compares the morphological parameters of placenta in pre-eclamptic pregnancies with normal pregnancies and gives appropriate data about the state of fetal health.

MATERIALS AND METHODS

A cross-sectional descriptive study was conducted in the Department of Anatomy associated with Department of Pathology in Yenepoya Medical College, Mangalore, Karnataka, India, during the period from December 2016 to October 2017. A total of 32 placentae were collected from the Department of Obstetrics and Gynaecology. Before conducting the study permission was taken from the Institutional Ethics Committee and Head of the Department of Obstetrics and Gynaecology.

Inclusion criteria: Group 1(pre-eclamptic/study group) consists of placentae obtained from pre-eclamptic women (n=24) with a gestational age of 34-40 weeks. Women were diagnosed with pre-eclampsia if they had systolic BP $\geq$ 140 mm Hg and diastolic BP $\geq$ 90 mm Hg measured on two or more occasions at least 4 hrs apart after the 20th week of gestation with proteinuria in a previously normotensive and non proteinuric patient. Proteinuria was defined as there was a urine dipstick value of at least 1+ (> 30 mg/dl) on two separate occasions at least 6 hrs apart. Group 2 (control /normal group) consists of placentae obtained from normotensive pregnant women (n=8) with same gestational age.

Exclusion criteria: Patients with chronic hypertension, diabetes mellitus, jaundice, anaemia, multiple pregnancies, renal and cardiac disorders associated with pregnancy were excluded from this study

The Placentae were collected immediately after delivery, both from normal delivery and caesarean sections. The collected placenta was washed under running tap water. The cord and membranes were examined for any malformations. The placenta along with the cord were tagged with number and preserved in 10% neutral buffered formalin. All the morphological parameters of the placenta were recorded using standard procedures.

The following parameters were studied on gross examination of placenta

Weight: The placenta was washed in running tap water and dried by using blotting paper. The amnion and chorion were trimmed from the placenta and weighed in the electronic weighing machine .The weight of the placentae were noted in grams.

Type: According to the distribution of umbilical blood vessels on the fetal surface the placentae were categorised into dispersal and Magistral.

Attachment of umbilical cord: According to the variations in the site of insertion of umbilical cord placentae were divided as central/eccentric, marginal and velamentous.

Feto-placental ratio: The ratio of fetal weight to the placental weight is known as the feto-placental ratio which is normally 6:1.

Placental coefficient: The placental coefficient is calculated by dividing the placental weight in grams by birth weight of babies in grams.

Number of cotyledons: Each formalin fixed placenta was taken on both the hands. A gentle pressure was applied on the central part of the foetal surface to make the cotyledons on the maternal surface prominent .Then the placenta was placed on a flat tray with the maternal surface facing upwards. The counting was

started from the left side of one end of placenta towards right and turning back to the left in the form of a loop. The counting was repeated until the other end of placenta was reached and the total numbers of cotyledons were recorded.

Placental infarcts: Infarction is divided into four categories depending on gross examination of placenta. The categories are as follows,

Absent – When no foci of infarction is present on the placenta.

Mild- When a few scattered foci of infarcts are present on the placenta.

Moderate –When many scattered foci or large areas of infarction are present on the placenta of about 10- 25% of total surface area.

Severe- When more than 25% of total surface area of placenta is infracted with calcified patches.

The presence of Placental calcification and placental hematoma were also studied.

Data was analysed by calculating mean and standard deviation and the test of significance used was un paired t- test and chi-square test for categorical data. The significance of differences between parameters was interpreted significant if $p<0.05$.

RESULTS

The total placentae collected and examined for study was 32 .Out of which 24 belonged to the pre-eclamptic group with a gestational age between 34-40 weeks and remaining 8 belonged to the normal group with a same gestational age. The age of the mothers ranged between 18 -40 years with a mean age of 29 in pre-eclamptic group and 24 in normal/control group. In our study fetal birth weight of less than 2500 grams were found in 62.5% of pre-eclamptic cases and no cases in normal group. Mean fetal birth weight was 2167 grams in pre-eclamptic group and 3010 grams in control group, which indicates that fetal birth weight was significantly lower in pre-eclamptic group as compared to the normal group. The differences of fetal birth weight between two groups were statistically significant.

In the present study, the placental weight ranges between 260-580 grams in the pre-eclamptic group with a mean weight of 368 grams , whereas it ranges between 460-640 grams in normal group with a mean weight of 494 grams. This indicates that placental weight is significantly lower in pre-eclamptic group as compared to normal group . Average placental coefficient is 0.17 in pre-eclamptic group and 0.16 in normal group .Thus placental coefficient is higher in pre-eclamptic group since, mean feto-placental weight ratio was higher in normal group as compared to pre-eclamptic group.

Table 1: Gross features of placentae.

Variables	Pre-eclamptic group (n=24)	Control group (n=8)	P- value
Maternal age (y)	29.03 ± 1.14	24.5 ± 4.34	0.0321
Gestational age of delivery (wk)	36.2 ± 0.84	39 ± 0.53	0.0002
Fetal Birth Weight (g)	2167.54 ± 150.43	3010 ± 119.04	0.0003
Placental Weight (g)	391.58 ± 33.09	494 ± 33.67	0.0002
Feto- placental weight ratio	5.28 ± 0.86	6.09 ± 0.32	0.396
Placental coefficient	0.17 ± 0.03	0.16 ± 0.008	0.363
Number of cotyledons	12.12 ± 4.50	18.25 ± 1.03	0.0007

Results are expressed in mean ± standard deviation. P- value <0.05 – Statistically significant. Unpaired t- test for comparison between groups.

Table 2: Relation between insertion of umbilical cord, distribution of chorionic blood vessels and incidence of infarction in placentae of pre-eclamptic and normal subjects.

Variables		Pre-eclamptic group (n=24)	Control group (n=8)
1. Type of Insertion of umbilical cord	Central	01 (4.1%)	03 (37.5%)
	Eccentric	15 (62.5%)	05 (62.5%)
	Marginal	08 (33.3%)	nil
2. Type of distribution of chorionic blood vessels	Disperse	16 (66.6%)	08 (100%)
	Magistral	08 (33.3%)	nil
3. Incidence of Infarction	Absent	06 (25%)	07 (88%)
	Mild	12 (50%)	01 (12%)
	Moderate	05 (21%)	nil
	Severe	01 (4%)	nil

Results are expressed in number and percentage. 1. Chi-square (X^2) = 8, p =0.018, Significant

2. (X^2) = 3.44, p=0.312, Not significant.

3. (X^2) =9.8, p=0.019, Statistically significant.

In the present study, the mean number of cotyledons was 12 in the pre-eclamptic group and 18 in the normal group and is statistically significant. The infarcted and calcified areas had significantly higher in the study group than the control group. The observations of the infarction of the placentae are shown in Table2. Placental Infarction is present in 75% of cases in pre-eclamptic group and 12.5% of cases in

normal group. The incidence of marginal insertion of umbilical cord insertion was present in 33.3% of pre-eclamptic cases and was absent in normal placentae, which indicates that marginal cord insertion of umbilical cord represents the severity of disease. In both the pre-eclamptic and normal group majority of the placentae belonged to disperse type.

Table 3: Maternal and fetal outcome of study subjects.

Characterstic		Pre-eclamptic group (n=24)	Control group (n=8)
Maternal outcome	Caesarean section	17 (71%)	1 (12.5%)
	Eclampsia	4 (17%)	-
	Abruption	1 (4%)	-
	HELLP	4 (17%)	-
	Maternal mortality	-	-
Fetal outcome	APGAR < 7	5 (21%)	-
	IUGR	8 (33%)	-
	IUFD	-	-

Results are expressed in number or percentage.

Fetal birth weight was lower in 62.5% and IUGR was seen in 33% of pre-eclamptic cases. APGAR score less than seven was seen in 21% babies of pre-eclamptic mothers and there was no such complication in normal group (Table 3). Seventeen pre-eclamptic mothers underwent caesarean section and 16% developed eclampsia and HELLP syndrome, meanwhile only one patient in the normal group underwent caesarean section.

DISCUSSION

In the present study, morphological parameters of placenta like, placental weight and number of cotyledons are remarkably lower in pre- eclamptic group than the normal group. This study had resemblances to the study organized by Majumdar et al and Virupaxi R.D et al [5, 6]. In the present study, the mean placental weight is 368 grams in pre-eclamptic group and 494 grams in normal group .Garg et al stated that the size of placenta and its weight decreases with increase in severity of pregnancy induced hypertension [7].As the severity of hypertension increases, placental weight decreases and the incidence of intrauterine growth retardation increases.

In the present study, the mean fetal birth weight was 2167 grams in study group and in control group was 3010 grams .This indicates that the mean fetal birth weight is significantly lower ($p < .01$) in the pre-eclamptic group than the normal group [Table-1].This finding authenticates with the studies of Udania et al, Majumdar S. et al, Sing S et al and Salman D et al [8, 5, 9, 10].

The ratio of fetal weight to the placental weight is known as feto –placental weight ratio, which is normally 6:1. In the present study, the average feto- placental weight ratio in pre-eclamptic pregnancy is 5.82, where as in normal pregnancy it is 6.09 [Table-1]. In the present study, the mean feto-placental weight ratio is lower in pre-eclamptic group as compared to normal group, but it is not statistically significant. This study confirms with the studies of Goutam G et al and Singh S et al [11, 9]. In contradict to our findings, Majumdar S et al and Londhe P.S et al demonstrated a continuing increase in feto –placental weight ratio with increasing grades of hypertension [5, 1].

Another mode to compare the weight of the baby and placenta is by evaluating the placental coefficient. .In our study, the average placental coefficient is 0.17 in pre-eclamptic group and 0.16 in normal group which was contradicted to the findings of Singh s et al and Raghunath G et al [9, 12]. In the present study calcified areas were seen outstandingly on the placentae in hypertensive group than the normal group. This is similar to the study done by Londhe P S [1].Cotyledon numbers were found to be remarkably less in pre-eclamptic group than the normal group, which is similar to the observations noted by Sultan S et al [13].

The present study showed a marginal insertion of umbilical cord in 33% of pre-eclamptic cases, meanwhile, there are no cases in normal subjects. If the umbilical cord is inserted within 2cms from the placental edge, it is viewed as marginal insertion which is associated with IUGR, preterm labour and low birth weight .These findings have been implicated in the induction of pregnancy induced hypertension. Moreover, two types of vascular pattern were observed. Dispersal types of distribution of umbilical vessels were found in 66.6% of placentae of pre-eclamptic pregnancies and magistral type of distribution in 33.3% of placentae of pre- eclamptic cases. In control group, only dispersal type of distribution was found. A study

by Renjana et al., [14] observed an evident relationship between the vascular pattern and fetal birth weight. It is higher in magistral pattern than the dispersal pattern. Contrary to the above finding the present study revealed that fetal birth weight decreased significantly in the magistral pattern compared to dispersal pattern of umbilical vessels of placentae from pre-eclamptic pregnancies

Fox revealed that in pregnancies complicated by pre-eclamptic toxaemia, the occurrence of placental infarction was greatly raised [15] .The incidence of placental infarction was linked to the severity of disease and not to any other maternal factor. In the present study, placental infarction is present in 65% of pre-eclamptic cases and 12% cases in the normal group. This reveals that the severity of hypertension adversely influences the placental infarction.

CONCLUSION

The morphologic and morphometric parameters of placenta like placental weight, feto-placental weight ratio, number of cotyledons, type of distribution of umbilical vessels, umbilical cord attachment and degree of infarction are statistically significant in pre-eclamptic group. Placental weight is directly proportional to the birth weight of babies. Mean birth weight of babies and feto-placental weight ratio were lesser in pre-eclamptic group .Variations in the attachment of umbilical cord are associated with pregnancy complications. Besides to the advanced investigative techniques and other modern radio-imaging techniques, an adequate knowledge about the morphology and the various morphometric investigations of the placenta will be useful in the early detection of placental insufficiency and also the state of fetal well being .In such cases better management can be given during antenatal period and labor, and thereby avoiding unplanned caesarean sections.

Conflicts of Interests: None

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