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Anatomy

Gross Morphological Changes in Placenta of Hypertensive Pregnancy

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Original Research Article

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Abstract: The study was conducted at the Department of ANATOMY in collaboration with the Department of Obstetrics and Gynaecology in Gauhati medical collge and hospital, Guwahati from june 2009 to may 2012. Placentae expelled during normal vaginal delivery were included in the study. The study group comprised 103 placentae from pregnant women of 30 to 40 completed weeks, who had a blood pressure at or above 140/90 mmHg on at least two occasions 6 hours apart after 20 weeks of gestation, with or without oedema and/or proteinuria. The results were compared with those of 34 placentae of normotensive mothers those women between 18 to 35 years of age with a gestational age of the fetus between 37 to 42 weeks were examined. Both primigravida and multigravida of average height and weight upto 4th parity who were free from othersystemic illness were taken in the study. Morphological findings in both groups studied (normotensive and hypertensive mothers). The weight of placenta, thickness as well as diameter is found to be diminished in pregnancy induced hypertension. PIH significantly affects the placenta by reducing its weight and dimensions. These changes may cause placental insufficiency as a result of compromised utero-placental blood flow, thus producing an adverse affect on the neonatal birth weight. PIH has definite influence on morphology of placenta and therefore affects the growth of the fetus.
Keywords: Morphological, Placenta, Hypertensive & Pregnancy.

INTRODUCTION

The word placenta comes from the Latin for cake, from Greek plakóenta/plakoúnta, meaning “flat, slab-like", in reference to its round, flat appearance in humans. Prototherial (egg-laying) and metatherial (marsupial) mammals produce a choriovitelline placenta that, while connected to the uterine wall, provides nutrients mainly derived from the egg sac. The intrauterine existence of fetus is dependent on one vital organ “The Placenta”. Placenta is essential for maintenance of pregnancy and for promoting normal growth and development of fetus [1]. It is the most accurate record of the infant's prenatal experience [2]. It forms the morphological record of anatomical condition, intrauterine events and intrapartum events of gestation. Pregnancy-induced hypertension (PIH) is the leading cause of maternal mortality and is an important factor in fetal wastage. Pregnancy complications like hypertension are reflected in placenta in a significant way both macroscopically and microscopically. Several studies have shown that utero-placental blood flow is decreased in PIH due to maternal vasospasm [3]. This leads to constriction of fetal stem arteries and has been associated with the changes seen in the placenta of preeclamptic women [4] maternal vasospasm leads to fetal hypoxia and accordingly it may lead to fetal distress and fetal death [5]. Present study has been undertaken to record the data on the morphology and morphometry of placenta from mothers with PIH and correlate the findings with the birth weight of the new born babies. This study was done to find out the morbid changes of the placenta of hypertensive mothers in comparison to normotensive mothers. As placenta is the mirror of maternal and fetal status, it reflects the changes due to maternal hypertension.

MATERIALS & METHODS

The study was conducted at the Department of ANATOMY in collaboration with the Department of Obstetrics and Gynaecology in Gauhati medical collge and hospital, Guwahati from june 2009 to may 2012. Placentae expelled during normal vaginal delivery were included in the study. The study group comprised 103 placentae from pregnant women of 30 to 40 completed weeks, who had a blood pressure at or above 140/90 mmHg on at least two occasions 6 hours apart after 20 weeks of gestation, with or without

oedema and/or proteinuria. The results were compared with those of 34 placentae of normotensive mothers those women between 18 to 35 years of age with a gestational age of the fetus between 37 to 42 weeks were examined. Both primigravida and multigravida of average height and weight upto 4th parity who were free from othersystemic illness were taken in the study.

Collection and examination of placenta

The placenta with attached membranes and umbilical cord was collected soon after delivery, washed in running tap water, labeled, and then fixed with 10% formalin for 4-6 weeks. Gross examination of the placenta was carried out. The size, shape, weight, thickness at centre & diameter of placenta were noted down. The birth weights of newborn babies were documented and feto-placental ratio was calculated. The data collected from morphological and morphometric studies were recorded. Descriptive statistics was used to analyze the data. They were represented as Mean ± SD (standard deviation). The statistical significance between the means of the control group and study groups were analyzed by using Students unpaired "*t*" test. A *P* value of <0.05 was considered statistically significant. Statistical analysis was done by using Graph Pad Quick Calcs software.

OBSERVATIONS & RESULTS

Table-1: Number of cases in different type of pregnancy according to the weight of placenta

Weight in grams	Normotensive	Gestational hypertension	Preeclampsia	Eclampsia
Upto 250	0	0	2	7
251to 350	0	1	14	3
351to 450	3	20	13	0
451to 550	19	11	0	0
Above 550	10	0	0	0
Sum	32	32	29	10
Mean	6.400	6.400	5.800	2.000
S.D.	±8.142	±8.905	±7.085	±3.082
S.E.M.	±3.641	±3.982	±3.168	±1.378

The total number of placenta in normotensive and hypertensive mothers according to weight of placenta. The mean number of placenta found in normotensive pregnancy is 6.400 with a Standard Deviation of ±8.142 and Standard Error of Mean ±3.641. On the other hand the mean number of placenta in gestational hypertension is 6.4 with a Standard Deviation of ±8.905 and Standard Error of Mean ±3.982 , that in preeclampsia is 5.8 with a Standard Deviation of ±7.085 and Standard Error of Mean± 3.168 and in eclampsia it is 2.000 , ±3.082 and ±1.378 respectively.

In normotensive mother's weight of placenta is found to be 451 to 550 gms in highest number of cases, that in gestational hypertension is 351 to 450 gms, in preeclampsia is 251 to 350 gms and in eclampsia weight is not more than 250 gms.

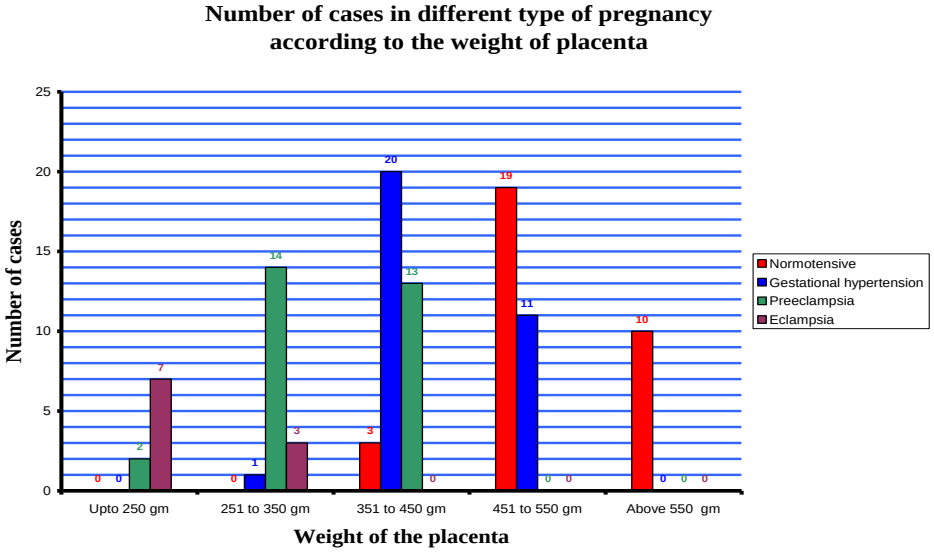

Fig-1: Showing distribution of weight of placenta in different type of pregnancy

Table-2: Table showing Distribution of average placental weight in different types of pregnancy

Type of pregnancy	Primigravida	Multigravida
Normotensive	519.43	530.68
Gestational Hypertension	431.05	442.30
Preeclampsia	340.51	342.25
Eclampsia	233.60	235.80

The above table shows the mean weight of placenta in normoptensive primigravida is 519.43, normotensive multigravida is 530.68; in gestational hypertension mean placental weight in primigravida is 431.05, that in multigravida is 442.30 gms. In preeclampsia and eclampsia it is seen that weight in primigravida is 340.51 gms and 233.60 gms and in multigravida is 342.25 gms and 235.80 gms respectively.

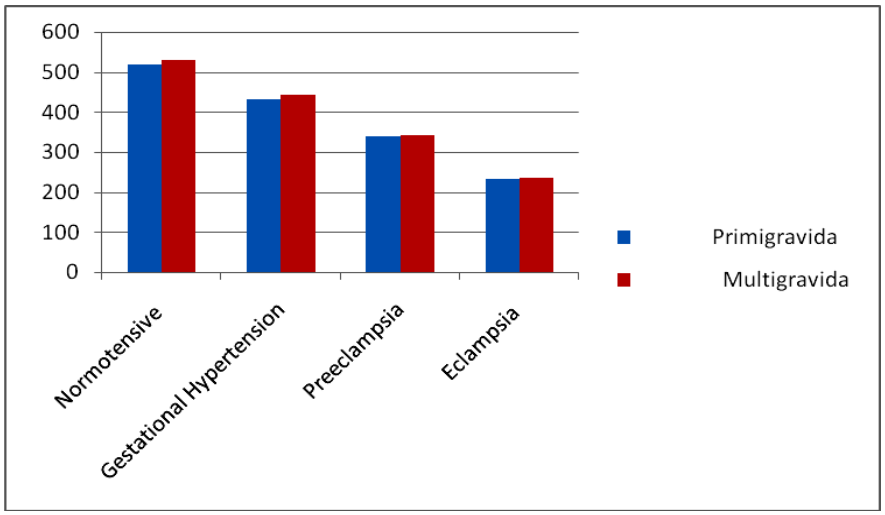

Fig-2: Showing distribution of average weight of placenta in gms in different types of pregnancy

Table-3: Table showing number of cases in different types of pregnancy according to thickness of placenta

Thickness of placenta in cm	Type of pregnancy			
	Normotensive	Gestational hypertension	Preeclampsia	Eclampsia
Upto 1.5	0	0	6	8
1.6 to 1.8	6	11	22	2
1.9 to 2.1	6	20	1	0
2.2 to 2.4	13	1	0	0
2.5 & above	7	0	0	0
Sum	32	32	29	10
Mean	6.4	6.4	5.8	2
S.D.	±4.615192	±8.905055	±8.532292	±3.464102
S.E.M.	±2.063	±3.982	±3.815	±1.549

From the above table it is observed that out of 32 case of normotensive pregnancy in 13 cases placental thickness is found to be in the range of 2.2 to 2.4 cm, that in gestational hypertension thickness ranges between 1.9 to 2.1 cm in 20 cases out of 32 cases, in preeclampsia thickness ranges between 1.6 to1.8 cm in 22 out of 29 cases and in eclampsia thickness of placenta is less than 1.5 cm in 8 out of 10 cases.

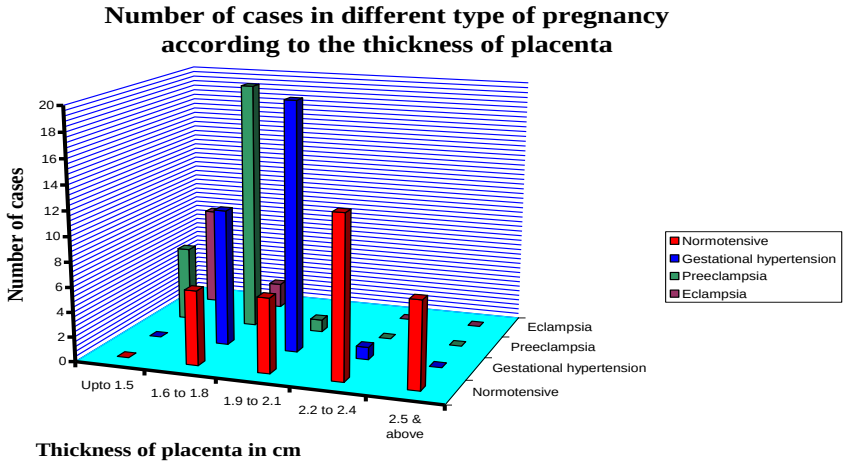

Fig-3: showing thickness of placenta in cm in different types of pregnancy

Table– 4: Table showing percentage of cases in different types of pregnancy according to the thickness of placenta

Thickness of placenta in cm	Type of pregnancy			
	Normotensive (%)	Gestational hypertension (%)	Preeclampsia (%)	Eclampsia (%)
Upto 1.5	0.00	0.00	20.68	80.00
1.6 to 1.8	18.75	34.37	75.87	20.00
1.9 to 2.1	18.75	62.50	3.45	0.00
2.2 to 2.4	40.62	3.13	0.00	0.00
2.5 & above	21.88	0.00	0.00	0.00
Sum	100	100	100	100
Mean	20	19.998	18.616	20
S.D.	±14.42085	±27.82841	±29.42023	±34.64102
S.E.M.	±6.448	±12.445	±13.157	±15.491

In normotensive pregnancy, 40.62% cases have placental thickness of 2.2 to 2.4 cm , in gestational hypertension in 62.50% cases have a thickness of 1.9 to 2.1 cm , in preeclampsia the thickness in 75.87% is 1.6 to 1.8 cm and in eclampsia the thickness is less than 1.5 cm in 80% cases.

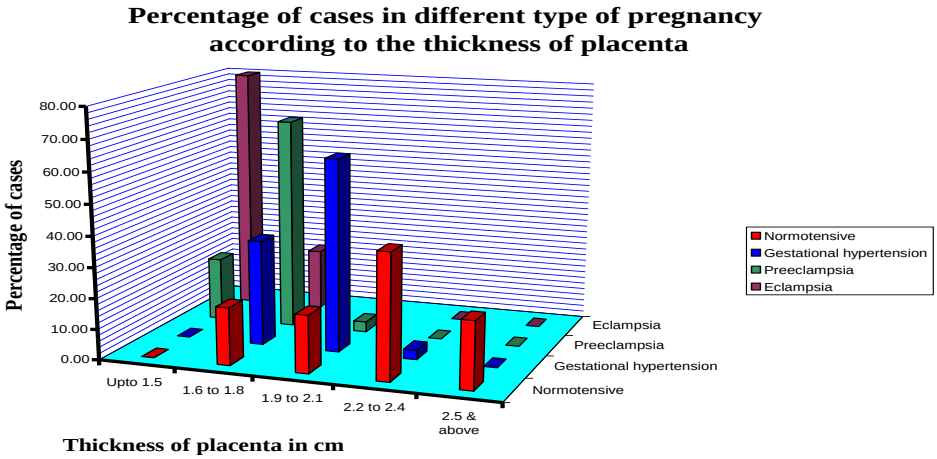

Fig-4: Showing thickness of placenta in different types of pregnancy

Table– 5: Table showing number of placenta with different diameters according to the type of pregnancy

Diameter of placenta	Type of pregnancy			
	Normotensive	Gestational hypertension	Preeclampsia	Eclampsia
≤ 18.5 cm	2	3	2	0
18.6 to 19 cm	2	6	8	1
19.1 to 20.5 cm	11	12	12	5
20.6 to 22 cm	16	10	6	4
> 22 cm	1	1	1	0
Sum	32	32	29	10
Mean	6.40	6.40	5.80	2.00
S.D.	±6.731	±4.615	±4.494	±2.345
S.E.M.	±3.010	±2.063	±2.009	±1.048

In the above table the diameter of placenta is 20.6 to 22 cm in 16 out of 32 normotensive cases, whereas diameter ranges between 19.1 to 20.5 cm in most of the cases of gestational hypertension, preeclampsia and eclampsia.

Number of cases in different diameter of placenta according to the type of placenta

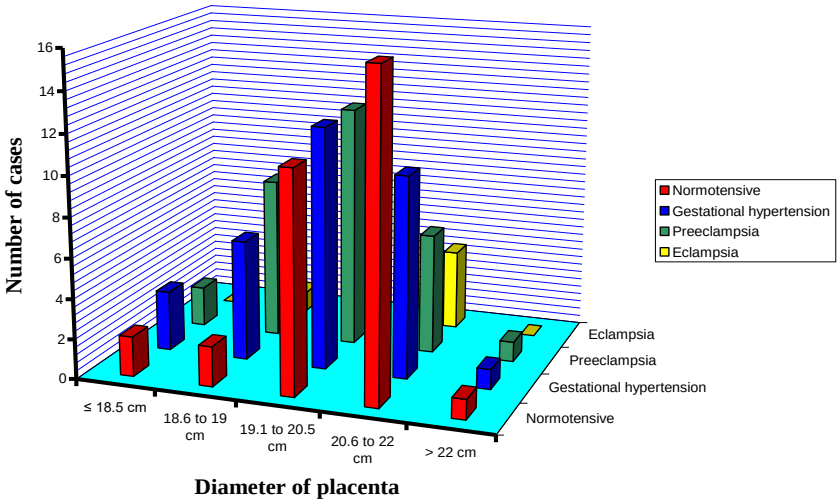

Fig-5: showing dimeter of placenta in different types of pregnancy

DISCUSSION

Weight of Placenta

The weight of placenta in normotensive mothers varied from 351 to above 550 gm. The highest weight was found to 612 gm in a primigravida mother of age 18 years. The maximum number of placentae had a weight of 451 to 550 gm in this group.

In gestational hypertension the weight of placenta was found to range between 351 to 450 gm in maximum cases. In preeclampsia highest number of cases had a weight of 251 to 350 gm whereas in eclampsia maximum cases had a weight less than 250 gm.

Statistical comparison between the normotensive and hypertensive groups using non parametric tests revealed a decrease in weight of placenta in hypertensive group. The weight in normotensive mother and eclamptic mother has a significant statistical difference with a t value of 2.645 and p value < 0.05. On the other hand when weight of placenta in normotensive mother is compared to that in gestational hypertension and preeclampsia shows a decrease in weight but it is not statistically significant i.e. p value> 0.05. However, the overall weight of placenta is seen to be decreased with increasing severity of pregnancy induced hypertension.

In the present study average placental weight in normotensive primigravida and multigravida was found to be 519.43 gms and 520.8 gms respectively. However, the average weight of placenta also decreases as the severity of hypertension increases during pregnancy.

Adair and Thelender [6] in their morphological study of normal placenta mentioned the

average weight as 473gms which is slightly lower than the average weight recorded in this study.

Hosemann [7] in his study of normal term pregnancy found the placental weight of 400 to 1000 gms whereas in 1962 Wigglesworth found placental weight to be 360 to 570 gms.

Garg *et al*. [8] mentioned that the size of placenta and its weight decreases with increase in severity of PIH which corresponds with the present study.

Dutta B. C. [9] in his study on placental changes in toxaemia of pregnancy recorded an average placental weight in control primigravida as 466.14 gms whereas eclamptic primigravida is 383.00 gms. On the other hand the placental weights in multigravida which are heavier than primigravida are 475.26 gms and 385.00 gms in control and test group respectively.

The following table shows normal average placental weight mention by various authors: Gray's Anatomy (40th edition) – 200 to 800 gms with an average weight of 470 gms

THICKNESS OF PLACENTA

The placental thickness in normotensive pregnancy ranges between 2.2 to 2.4 cm, whereas in gestational hypertension the thickness lies between 1.9 to 2.1 cm; in preeclampsia thickness is found to lie between 1.6 to 1.8 cm and in eclampsia thickness is less than 1.5 cm.

It is seen that 40.62% cases of normotensive pregnancy have a thickness of 2.2 to 2.4 cm whereas no cases seen to have a thickness less than 1.5 cm in this group. In gestational hypertension, 62.50% have a thickness in the range of 1.9 to 2.1 cm; in preeclampsia it is 1.6 to 1.8 cm in 68.96% and that in eclampsia is less than 1.5 cm in 80.00% cases and no case had thickness above 1.8 cm in this group [11].

Thus, analysis reveals that the thickness of placenta in hypertensive group gradually decreases. Zentler's finding of thickness gave 1.5 to 3.0 cm at the thickest portion and 4.0 to 6.0 mm at the margin of the placenta. Adair and Thelander [6] mentioned that the average thickness of toxaemic placenta was 1.15 cm which is almost similar to the present finding. He also mentioned that the thickest placenta seen in toxaemia of pregnancy had a dimension of 2.38 cm.

Sharma J. D. [10] who worked on placenta on the basis of maturity of pregnancy found the thickness in normal term pregnancy to range between 1.8 to 2.5 cm in most of the cases.

Various authors have stated the thickness of placenta as follows:

Gray's Anatomy (40th edition) – 25 mm
Boyd and Hamilton – 23 mm
T. W. Sadler – 30 mm
Williams Obstetrics – 23 mm

The above mentioned authors did not state whether they had taken the placental membranes into account or not.

Diameter of Placenta

From the present study it is observed that diameter of placenta in normotensive group ranges between 20.6 to 22.0 cm in 50% cases whereas only 3.12% cases have a diameter more than 22.0 cm. In gestational hypertension, preeclampsia and eclampsia the diameter was found to range between 19.1 to 20.5 cm in most of the cases.

Analysis and subsequent application of nonparametric test to find out if any relation exist between pregnancy induced hypertension and diameter of placenta reveals that there is no significant change in the diameter of placenta in gestational hypertension and preeclampsia i.e. p value > 0.05. On the other hand, diameter of placenta in normotensive mother and eclamptic mother shows a significant difference with $t=2.650$ and $p<0.05$.

Dutta B. C. [9] in his study of Placenta in Toxaemia of Pregnancy recorded an average diameter of 16.2 cm to 20.4 cm in the control group which is slightly lower than the present findings.

Sarma J. D. [10] in his study found the placental diameter in the range of 15.1 to 19.0 cm in normal term deliveries which is lower than the findings of present study. The diameter of placenta stated by Gray's Anatomy (40th edition) - 200 –220 mm.

CONCLUSION

- The placenta was collected immediately after delivery and was examined thoroughly. Morphological parameters such as shape, size, weight, thickness and diameter were recorded.
- Comparison of weight of placenta between normal and hypertensive mothers revealed that the weight of placenta in hypertensive mothers is less than that in normotensive mothers which is statistically significant ($p< 0.05$). The weight in normotensive group is 450 to 550 gm and that in eclamptic group is less than 250 gm.
- The thickness of placenta in the control group is 2.2 cm to 2.4 cm, in gestational hypertension is 1.9 cm to 2.1 cm, in preeclampsia is 1.6 to 1.8 cm and in eclampsia is less than 1.5 cm. Thus, there is

thinning of placenta with increasing severity of pregnancy induced hypertension.

- The diameter of placenta in the control group is 20.6 to 22.0 cm and in the hypertensive group the diameter ranges from 19.1 to 20.5 cm. The difference in the diameter of placenta of normotensive pregnancy and eclampsia showed a statistical significance with $p< 0.05$.

Thus there are widely differing morphological findings in both groups studied (normotensive and hypertensive mothers). The weight of placenta, thickness as well as diameter is found to be diminished in pregnancy induced hypertension. PIH significantly affects the placenta by reducing its weight and dimensions. These changes may cause placental insufficiency as a result of compromised utero-placental blood flow, thus producing an adverse affect on the neonatal birth weight. PIH has definite influence on morphology of placenta and therefore affects the growth of the fetus.

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