



Morphological Changes in Placenta in the Patients of Hypertension

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Abstract

Aim: Placenta is a vital organ for maintaining pregnancy and promoting normal foetal development. In this study, morphology of placenta and insertion of umbilical cord with placenta was studied in hypertensive and normotensive patients and correlated with the foetal outcome.

Material and Methods: One hundred fifty placentae of normotensive and hypertensive patients were collected from the department of obstetrics and gynaecology in a premier institute in North India. Placentae were grouped depending upon the degree of hypertension and morphology of placenta (size, weight and volume), umbilical cord insertion with placenta noted. Foetal outcome and birth weight was also recorded. The data was statistically analyzed and p value <0.05 was considered significant.

Results: The mean birth weight was 2752.5 ± 417.26 gm in normotensive and 2540 gm in hypertensive group. The marginal insertion of cord was 2% in normotensive group and 30% in severe hypertensive patients.

Conclusion: With progressive rise in hypertension in pregnancy, the birth weight of the foetus decreases.

Keywords: Placenta; hypertension; birth weight.

Introduction

Placenta is an important organ for the maintenance of pregnancy and promotion of normal fetal development. The placental functional activity takes place between maternal blood in the intervillous space and fetal blood in the capillaries and the sinusoids in the stroma of the chorionic villi.¹ The factors affecting the exchange are rate of circulation of blood in maternal and fetal vessels, pressure of blood in the intervillous space, volume of blood in the intervillous space,

structure and thickness of placental barrier and the surface area of villous.² Hypertensive disorders complicating pregnancy are common. There is voluminous literature, which is concerned with the effect of pre-eclampsia on placenta. However, few studies have correlated with the degree of hypertension with placental morphology and then to the foetal outcome in its entity, i.e. in respect of fetal weight, morbidity, mortality.³ Hypertension leads to the intrauterine growth retardation, which further leads to neonatal mortality.⁴ Some studies

reported that placental weight and size are directly proportional to the birth weight⁵ while some describe the relationship between birth weight, placental area and placental volume in normal infants.⁶ In the present study, morphology of placenta (size, weight and volume) and umbilical cord insertion with placenta has been studied in hypertensive and normotensive subjects and correlated with fetal outcome.

Material & Methods

One hundred and fifty placentae of hypertensive and normotensive mothers were obtained from the department of obstetrics and gynecology, IGMC, Shimla. The placentae were grouped depending on the degree of hypertension as described by Derek.⁷

Type of cases	Blood Pressure (mm Hg)
Normal	100/80 to 119/89
Mild hypertension	120/90 to 139/99
Moderate hypertension	140/100 to 169/ 119
Severe hypertension	>170/120

Detailed obstetric history (past & present) of the patients was taken and the following measurements were recorded to study the gross morphology of the placentae:-

Placenta with cord and membranes were collected immediately after delivery. Any abnormality of cord and membrane was noted. Amnion and chorion were trimmed from the placenta. Placentae were washed in running tap water, dried with the help of blotting paper.

Weight of the placenta was noted.

The minimum distance between the site of insertion and margin of placenta was measured.

The surface area of the maternal surface of placenta was calculated by taking its imprint on a graph paper and the number of squares on the graph paper were counted to find out the maternal surface area of placenta. (1 big square=1 cm² and 1 small square =1 mm²)

Assuming the placenta to be a circle, the mean radius 'r' was estimated from the diameter of placenta. Insertion percentage was calculated by the formula $D/r \times 100$ where 'D' is the minimum

distance of umbilical cord insertion from the margin of placenta and 'r' is the radius of placenta. Low insertion percentage implies marginal insertion while high insertion percentage indicate centrally attached umbilical cord. Each placenta was placed in one of the categories depending upon the insertion percentage i.e. central (insertion percentage of 76-100 percent), medial (51-75 percent), lateral (26-50 percent) and marginal (0-25 percent).

Volume of the placentae was recorded by assessment of the amount of water displaced by it. The dried up placenta was gradually immersed in a bowl full of water upto the brim and the water displaced by placenta was measured in a measuring cylinder.

The birth weight of infant in each case was noted.

The data was then analyzed by appropriate statistical methods and p value <0.05 was considered as statistically significant.

Observations

In the present study, a total of 150 placentae were subjected to gross examination. Out of these, 100 placentae were from normotensive subjects (mean age 25.6±4.0 years) and 50 belonged to hypertensive patients (mean age 25.12±3 years). In normotensive group, 52% patients were multiparous and 42% were primigravida whereas in the hypertensive group 54% were primigravida and 46% were multiparous. The hypertensive patients were further divided into three groups i.e. mild, moderate and severe hypertension. Mean birth weight, placental weight and placental area is tabulated in Table 1 as per the blood pressure status of the subject.

Table 1 Mean birth weight, placental weight and placental area in normotensive and hypertensive mothers

Category	Mean birth weight (gm)	Mean placental weight (gm)	Mean placental area (sq cm)	t	P value
Normotensive group(n=100)	2752 ± 417.26	441.35 ± 84.37	219.68 ± 46.47	2.462	0.000
Mild hypertensive (n=21)	2838.1 ± 295.76	428.57 ± 74.28	207.38 ± 31.93	3.792	0.000
Moderate hypertensive (n=19)	2386.84 ± 340.69	342.10 ± 56.55	168.68 ± 26.7	3.425	0.000
Severe hypertension (n=10)	2205.0 ± 225.4	315.45 ± 45.95	159.70 ± 30.73	7.897	0.000

Significant association was observed between the blood pressure status of the patient and mean birth weight, placental weight and placental area as is evident from table 1 and table 2.

Table 2 Relation between weight of placenta and birth weight

Group	Birth weight (gm)	Placental weight (gm)	Correlation Coefficient
Normotensive group (n=100)	2752.5 ± 417.26	441.35 ± 84.37	0.693*
Mild hypertensive (n=21)	2838.1 ± 295.76	428.57 ± 74.28	0.083*
Moderate hypertensive (n=19)	2386.84 ± 340.69	342.1 ± 56.55	0.845*
Severe hypertension (n=10)	2205.0 ± 225.40	315.45 ± 45.95	0.823*

Central insertion of umbilical cord was the most common pattern observed in both normotensive and hypertensive group (Table 3).

Table 3 Insertion of umbilical cord

Group	Central (76-100)	Medial (51-75)	Lateral (26-50)	Marginal (0-25)
Normotensive group(n=100)	56 (56%)	38 (38%)	4 (4%)	2 (2%)
Mild hypertensive (n=21)	16 (76%)	5 (24%)	0 (0%)	0 (0%)
Moderate hypertensive (n=19)	13 (68%)	4 (21%)	2 (11%)	0 (0%)
Severe hypertension (n=10)	3 (30%)	2 (20%)	2 (20%)	3 (30%)

In majority of normotensive and mild hypertensive group, surface area of the placenta was observed to be between 200-250 cm² (Table 4).

Table 4 Surface area of placenta

Group	100-150cm ²		150-200cm ²		200-250cm ²		250-300cm ²		>300cm	
	No.	%	No.	%	No.	%	No.	%	No.	%
Normotensive group(n=100)	04	4.0	20	20.0	50	50.0	21	21.0	5	5.0
Mild hypertensive (n=21)	01	4.8	07	33.3	11	52.4	02	9.5	00	00
Moderate hypertensive (n=19)	04	21.0	12	63.2	00	00	03	15.8	00	00
Severe hypertension (n=10)	04	40.0	04	40.0	00	00	02	20.0	00	00

The infarction was seen as greyish patches and was grouped in three categories as mild infarction (few foci), moderate infarction (10-25% involvement) and severe infarction (>25% placenta was infarcted). No infarction in placenta was observed in 88 subjects among normotensive group whereas only 10 placentae were devoid of infarction among hypertensive group (Table 5).

Table 5 Infarction in normotensive and hypertensive cases

Infarction grade	normotensive	Hypertensive		
		Mild	Moderate	Severe
Absent	88%	7 cases (33%)	3 cases (15.78%)	Nil (0%)
Mild infarction	12%	12 cases (57%)	5 cases (26.32%)	6 cases (60%)
Moderate infarction	-	2 cases (10%)	9 cases (47.37%)	2 cases (20%)
Severe infarction	-	-	2 cases (10.53%)	2 cases (20%)



FIG. 1 Shows marginal insertion of umbilical cord.



FIG 3 Placenta showing haemorrhage (marked with arrow).



FIG. 2 Showing central insertion of umbilical cord with infarction of placenta (marked with arrow).

Discussion

The mean birth weight in hypertensive cases was lower than in normotensive mothers in our study (Table 6) which is comparable to the observations by Rath et al.⁹ There was further decrease in mean birth weight in moderate and severe hypertension. Damania et al.² also observed that birth weight is less in hypertensive cases than in normotensive cases.

Table 6 Comparison of mean birth weight in gms

Group	Adair et al ⁸	Rath et al ⁹	Present study
Normotensive group	3368 gm	2718.297 ± 532.578	2752.5 ± 417.26
Mild hypertensive	-	2404.037 ± 360.311	2838.1 ± 295.76
Moderate hypertensive	-	2205.363 ± 424.692	2386.84 ± 340.69
Severe hypertension	-	2011.923 ± 459.688	2205.0 ± 225.40

In the present study, there was decrease in the placental weight in hypertensive group and there is progressive decrease in placental weight as the severity of hypertension increases which is

comparable to the study by Rath et al.⁹ (Table 7). Damania et al.² also observed that placental weight is less in hypertensive cases than in normotensive cases.

Table 7 Comparison of placental weight (gm)

Group	Adair et al ⁸	Rath et al ⁹	Present study
Normotensive group	473	382.142 ± 52.321	441.35 ± 84.37
Mild hypertensive	-	351.308 ± 64.047	428.57 ± 74.28
Moderate hypertensive	-	338.024 ± 57.807	342.10 ± 56.55
Severe hypertension	-	332.410 ± 60.037	315.45 ± 45.95

There was decrease in placental surface area in hypertensive patients. Similar observations have been reported by Rath et al.⁹ and Udaina et al.¹⁰

Table 8 Comparison of placental surface area in cm²

Group	Adair et al ⁸	Rath et al ⁹	Udaina et al ¹⁰	Present study
Normotensive group	248	254.63	242.56 ± 26.46	219.68 ± 46.47
Mild hypertensive	-	251.732	195.98 ± 38.18	207.38 ± 31.93
Moderate hypertensive	-	245.39	-	168.68 ± 26.70
Severe hypertension	-	209.36	179.14 ± 46.07	159.70 ± 30.73

In the current study the majority of the cases had central insertion of umbilical cord i.e. 56% in normotensive cases and 64% in the hypertensive

Table 9 Comparison of insertion of umbilical cord

Group	Central (76-100)		Medial (51-75)		Lateral (26-50)		Marginal (0-25)	
	Rath et al ⁹	Present Study	Rath et al ⁹	Present Study	Rath et al ⁹	Present Study	Rath et al ⁹	Present Study
Normotensive Group	25%	56%	22%	38%	27%	4%	27%	2%
Mild Hypertensive	22%	76%	22%	24%	30%	0	26%	0
Moderate Hypertensive	21%	68%	26%	21%	26%	11%	26%	0
Severe hypertension	23%	30%	15%	20%	20%	20%	42%	30%

The difference may be due to regional or genetic differences in the study population. Adair and Thelander⁸ in their study found marginal insertion of umbilical cord in 8% normotensive cases whereas we observed marginal insertion of cord in just 2% cases. The differences may be regional or genetic. These marginal insertions of the cord were associated with lower birth weights. Shanklin¹¹ also reported an increased incidence of term infants weighing less than 2500 gm when the cord insertion was marginal. Woods and Malan¹² observed no relation between birth weight and insertion of cord. Pretorius et al.¹³ and DiSalvo et al.¹⁴ observed that hypertensive mothers mostly have marginal insertion of cord but we observed equal incidence of central and marginal insertion of cord in severe hypertensive group.

Conclusion

Placenta should not be regarded as a wasteful byproduct as many important information can be derived from it. Birth weight, placental weight, placental surface area of mild, moderate and severe hypertensive mothers is less than those of the normal mothers. There is progressive decrease

(Table 8). In our study this could have been due to higher level of hypertension.

group while Rath et al.⁹ observed central insertion of cord in 25% normotensive patients (Table 9).

in the birth weight, placental weight and placental surface area in the mild hypertensive, moderate hypertensive and severe hypertensive subgroups. The marginal attachment of placenta is associated with lower birth weight.

Conflicts and Interest: Authors have none to declare.

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