

## **Research Article**

### **Placental Morphometry in Toxaemia of Pregnancy**

**Dr. Vaibhav P. Anjankar<sup>1</sup>, Dr. M. P. Parchand<sup>2</sup>, Dr. Ashish P. Anjankar<sup>3</sup>, Dr. N. Y. Kamdi<sup>4</sup>, Dr. Mrs. M. M. Meshram**

<sup>1</sup>Assistant Professor, Department of Anatomy, L. N. Medical College & Research Centre, Bhopal- 462042, Madhya Pradesh, India

<sup>2</sup>Professor and Head, Department of Anatomy, I. G. Government Medical College, Nagpur, Maharashtra, India

<sup>3</sup>Assistant Professor, Department of Biochemistry, Government Medical College, Latur, Maharashtra, India

<sup>4</sup>Associate Professor, Department of Anatomy, Government Medical College, Nagpur, Maharashtra, India

<sup>5</sup>Professor and Head, Department of Anatomy Government Medical College, Nagpur, Maharashtra, India

#### **\*Corresponding author**

Dr. Vaibhav Anjankar

**Email:** [vaibhav\\_anjankar@yahoo.co.in](mailto:vaibhav_anjankar@yahoo.co.in)

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**Abstract:** Placenta acts as a mirror which reflects intrauterine status of fetus. It is the most accurate record of infant's prenatal experiences, so study of placenta gives valuable clues in cases of adverse fetal outcome. The study of placenta is a combined team work of an obstetrician, a pediatrician, a pathologist, an anatomist, a biochemist and an endocrinologist. A complete picture of placental function emerges through this team work. Objective of this study is to study and correlate morphometric changes occurring in the placenta of normal and hypertensive pregnancies that help in the assessment of the state of the well being of the foetus in utero. Total 510 placentae (220 from normal and 290 from hypertensive pregnancies) were collected. The parameters studied were mean birth weight of babies, mean placental weight, mean placental surface area, mean placental volume and mean foeto-placental weight ratio. Results reveal that there is significant decrease in mean birth weight, mean placental weight, mean surface area and mean volume of the placenta in toxaemia of pregnancy group as compared with control group. Mean foeto-placental weight ratio is higher in toxaemic group than in control group. Alterations in various parameters may be attributed to the effect of ischaemia produced by hypertension on the placenta, subsequently affecting the foetus in the womb of mother. Appropriate precautions if instituted during pregnancy, complications of PIH can be reduced.

**Keywords:** Placenta, Hypertensive pregnancies, Morphometric changes, Foeto-placental weight ratio, Ischaemia

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#### **INTRODUCTION**

Placenta, no doubt is a matter of interest and curiosity for ages for many anatomists, embryologists and obstetricians because of its incomparable importance in the intrauterine development of human being. Placenta acts as a mirror which reflects intrauterine status of fetus. It is the most accurate record of infant's prenatal experiences, so study of placenta and umbilical cord gives valuable clues in cases of adverse fetal outcome.

The study of placenta is a combined team work of an obstetrician, a pediatrician, a pathologist, an anatomist, a biochemist and an endocrinologist. A complete picture of placental function emerges through this team work.

Now a day, hypertensive disorders complicating pregnancies (Toxaemia of Pregnancy) are common and such hypertensive pregnancies are one of the commonest causes of maternal and foetal morbidity and mortality [1]. These disorders occur as a direct result of gravid state and there is no antecedent history or any

documentation that the woman has hypertension prior to pregnancy.

Since the substances required for the foetal metabolism come from the mother's blood and foetal catabolites are passed back into the mother's circulation, through the placenta and umbilical cord, examination of the placenta gives a clear idea of what had happened with it, when it was in the mother womb and what is going to happen with the foetus in the future [2].

This study correlate and compare morphometric changes that occur in placentae of normal and hypertensive pregnancies in the respect of various parameters.

#### **MATERIALS AND METHODS**

The material for the present study comprised of normal pregnant cases and cases of Preeclampsia-Eclampsia syndrome admitted, diagnosed and delivered

in the department of Obstetrics and Gynecology, Govt. Medical College, Nagpur.

Overall 510 patients and their placentae were included in the study, all from the full term deliveries (38-42 weeks of gestation).

All cases were divided into two main groups.

### Group I or Control Group

This group comprises pregnant women without preeclampsia; women had normal blood pressure, no proteinuria and no edema and their respective placentae. This group included 220 cases.

### Group II or Study Group

This group comprises hypertensive pregnancies (PIH) which were diagnosed as preeclampsia, eclampsia or gestational hypertension and their respective placentae. This group included 290 cases. None of these cases had hypertension prior to the pregnancy.

Criteria for selection of cases for Study group (Group II) were as Chesley [3]. Examination of placenta was done, as per methodology of Joseph Yetter [4].

The placentae with cords and membranes were collected immediately after delivery from labour rooms or operation theatres. An accurate weighing of the placentae was done by trimming off all membranes and severing the umbilical cord from the placental surface. Superficial vessels were drained of all blood. Adherent blood clots were removed from the maternal surface. Then, the placenta was washed in running tap water, dried with the help of blotting paper, weighed in the weighing machine. The weights of the placentae were noted in grams (gm).

For calculating surface area of the placenta, diameter of the placenta was measured with the measuring scale. At first, the maximum diameter was measured with a metallic scale graduated in centimeters (cm). Then a second maximum diameter was taken at right angles to the first one. The mean of two measurements was considered as the diameter of the placenta expressed in centimeters. The radius is obtained from diameter [5].

Formula for Surface area of the placenta =  $\pi r^2$ , where  $\pi=3.14$ , r- Radius of the placenta.

With a long needle placental thickness was measured at five points of each placenta. Each placenta was placed on fetal surface. The placenta was divided arbitrarily into three zones of equal parts by drawing two circles on the maternal surface. These circles cut the radius of the placenta into three equal parts. One thickness was measured from the centre of the central zone, two from middle and two from peripheral zone.

The peripheral points were taken within the outer zone on a line perpendicular to the previous imaginary line. Finally the mean of all five measurements was calculated and considered as mean thickness of the placenta and volume of placenta was calculated in cubic cm [5].

Formula for Volume of placenta =  $\pi r^2 h$ , where  $\pi=3.14$ , r- Radius of the placenta, h- Mean thickness of the placenta

After the examination of placenta and umbilical cord, weight of newborn baby was obtained, foeto-placental weight ratio calculated.

All these values were noted in the control group as well as in the study group and the comparison between the two groups was done.

## RESULTS

Table I shows that mean birth weight of babies in control group is  $2651.18 \pm 392.00$  gm while in study group is  $2279.14 \pm 418.08$  gm. It is noted that, mean birth weight of babies is lower in hypertensive pregnancies than in control group and the difference is highly significant (as  $P < 0.0001$ ).

Mean placental weight in control and study group are  $408.14 \pm 54.78$  gm and  $306.45 \pm 78.74$  gm respectively. Mean birth weight of babies between two groups differs and the difference is statistically significant (as  $P < 0.0001$ ).

Mean placental surface area in control group and study group are found to be  $221.99 \pm 50.00$  and  $182.84 \pm 56.71$  sq. cm respectively, and difference is highly significant (as  $P < 0.0001$ ).

Similarly, the mean placental volume in control and study group is  $473.03 \pm 112.98$  and  $385.89 \pm 142.70$  cu. cm respectively and the difference is highly significant (as  $P < 0.0001$ ).

Thus, the above data suggest that there is significant decrease in mean birth weight, mean placental weight, mean surface area and mean volume of the placenta in hypertensive group as compared with control group and the difference is statistically significant ( as  $P < 0.05$  ).

As per table II, on calculation of mean foeto-placental weight ratio, the mean foeto-placental weight ratio in control group is  $6.49 \pm 0.55$  and in hypertensive group is  $7.75 \pm 1.89$ .

Difference in the mean foeto-placental weight ratio in the two groups is found to be statistically significant. (as  $P < 0.0001$ ).

**Table I : showing Placental Morphometric Changes**

|  | Normal Pregnancies<br>(n=220) | PIH Group<br>(n=290) | P-value<br>and significance               |
|--|-------------------------------|----------------------|---|
| Mean birth weight of babies in Gm.     | 2651.18 ± 392.00              | 2279.14 ± 418.08     | P < 0.0001<br>Significant<br>( P < 0.05 ) |
| Mean placental weight in Gm.           | 408.14 ± 54.78                | 306.45 ± 78.74       | P < 0.0001<br>Significant<br>( P < 0.05 ) |
| Mean placental surface area in Sq. cm. | 221.99 ± 50.00                | 182.84 ± 56.71       | P < 0.0001<br>Significant<br>( P < 0.05 ) |
| Mean placental volume in Cu. Cm        | 473.03 ± 112.98               | 385.89 ± 142.70      | P < 0.0001<br>Significant<br>( P < 0.05 ) |

**Table II: Showing Mean foeto-placental weight ratio in both the groups**

| Normal Pregnancies<br>(n = 220) | PIH Group<br>(n = 290) | P value and significance                  |
|---------------------------------|------------------------|---|
| 6.49 ± 0.55                     | 7.75 ± 1.89            | P < 0.0001<br>Significant<br>( P < 0.05 ) |

**DISCUSSION**

Many studies have been undertaken on examination of placenta and umbilical cord and foetal outcome in hypertensive pregnancies but a very few studies have used parameters which are comparable with each other, thus making discussion an exhaustive and difficult.

**Birth weight of babies**

In our study, mean birth weight of babies in normal pregnancies is 2651.18 ± 392.00 gm and in hypertensive group is 2279.14 ± 418.08 gm. The mean foetal weight is significantly reduced in pregnancy induced hypertensive group as compared to normal pregnancies. Our findings correlate with the findings of Damania *et al.* [6], Mohan H *et al.* [7], Das *et al.* [8], Udainia & Jain [9] and Majumdar *et al.* [10], but Shah, Jagiwalla and Vyas [11] recorded higher birth weight in hypertensive group than in normal pregnancies.

**Placental weight**

In the present study, mean placental weight in normal pregnancies is 408.14 ± 54.78 gm and in hypertensive group is 306.45 ± 78.74 gm. It is clear that mean placental weight is significantly reduced in case of placenta of pregnancy induced hypertensive group as compared to control group. Similar findings were noted by Damania *et al.* [6], Mohan H *et al.* [7], Das *et al.* [8], Rath *et al.* [12], Udainia & Jain [9] and Majumdar *et al.* [10]. The reduced placental weight in hypertensive group may be attributed to reduced blood flow due to ischaemic changes in the vessels.

**Placental surface area**

There is significant reduction in placental surface area in PIH group as compared to normal pregnancies

similar to Rath *et al.* [12], Udainia *et al.* [13] and Majumdar *et al.* [10].

**Placental volume**

In present study, mean placental volume is 473.03 ± 112.98 cu. cm in normal pregnancies and 385.89 ± 142.70 cu. cm in pregnancy induced hypertensive group. Thus the mean placental volume is lower in PIH group than in normal pregnancy group similar to the findings of Majumdar *et al.* [10].

**Foeto- placental weight ratio**

The foeto-placental weight ratio in our study is significantly higher in PIH group as compared to control group. Majumdar *et al.* [10] also recorded the same findings. But the findings of our study contradict with the findings of Damania *et al.* [6], Mohan H *et al.* [7], Das *et al.* [8] and Rath *et al.* [12], who recorded decrease in foeto-placental weight ratio in PIH group than in normal pregnancies.

**CONCLUSION**

At last, we can conclude that the birth weight of babies and placental weight in pregnancy induced hypertension are less than that of the normal pregnancies. The mean surface area and volume of the placenta is also decreased in PIH group than normal pregnancies. The foeto-placental weight ratio is increased in PIH group. So it can be concluded that the placental weight is more severely affected than that of the foetal weight.

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