

Research Article

Study of correlation between perinatal outcome, placental coefficient and feto-placental ratio

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ABSTRACT

Background: Pregnancy and birth are nature's finest marvel wherein perfect symbiosis between the two individuals protects the little and weak one and also allows the propagation of genetic prototype of the other individual generation after generation. Placenta acts as a mirror which reflects intrauterine status of fetus. Placenta has an undisputed role in foetal development but still is grossly neglected organ which is equal to liver, lung and kidney in function.

Methods: Placentae collected from labor rooms and operation theatres were studied for various parameters like weight, surface area, volume, area of calcification and infarction, number of cotyledons etc. Birth weight of babies was also noted, feto-placental weight ratio and placental coefficient was calculated.

Results: Average placental weight being 490.5 gm (range 295-660 gm). Placenta of male baby was found to be slightly heavier as compared to female babies. Birth weight of male babies was also more than female babies. Average placental surface area was found to be 225.5 sq. cm. Mean placental volume was recorded as 450.5 cu. cm. Foeto-placental weight ratio was found to be 5.41:1 irrespective of sex of the baby, 5.61:1 in case of male baby and 5.40:1 for female babies.

Conclusion: The placenta is a mirror which reflects intrauterine status of the fetus.

Keywords: Coefficient, Embryologists, Medicolegal, Infarction, Calcification

INTRODUCTION

Placenta always remained a matter of interest and curiosity since ages for many obstetricians, anatomists and embryologists because of its incomparable importance in the intrauterine development of human being.¹ Pregnancy and birth are nature's finest marvel wherein perfect symbiosis between the two individuals protects the little and weak one and also allows the propagation of genetic prototype of the other individual generation after generation. Placenta has an undisputed role in fetal development but still is grossly neglected organ which is equal to liver, lung and kidney in function.²

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.¹ Placenta has an undisputed role in fetal development but still is grossly neglected organ which is equal to liver, lung and kidney in function.¹

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. An adequate knowledge of the morphometry of placenta and its clinical relevance can prove to be valuable in the early

assessment of fetal well-being.³ The examination of placenta in utero as well as postpartum, gives valuable information about the state of fetal well-being.⁴ Retrospectively it can also give valuable information related to long term perinatal outcome.

We targeted to study this organ which has to witness so many antenatal and intranatal events and insults thrown in the way of "Life" to arrive on earth. This information will help us to enhance our knowledge about how to protect clinicians from medico-legal problems in the event of maternal and fetal adverse outcome.

METHODS

This study was carried out in the department of obstetrics and gynaecology and department of anatomy of our medical college. This project was approved by Institutional ethics committee. Total 112 placentae were collected immediately after delivery or cesarean section from labour rooms and operation theatres of Obstetrics department. All were full term deliveries (38-42 weeks of gestation) because placental weight approach term values at an earlier stage of gestation than do birth weight, it follows that the ratio of placental weight to birth weight increases with increasing degree of fetal immaturity.

After collection placentae were transferred to the Anatomy department for detail examination. Any gross abnormalities of the cords and membranes were noted. An accurate weighing of the placenta was done by trimming off all membranes and severing the umbilical cord 5 cm from site of its insertion on 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 calculated from diameter⁵.

Formula for Surface area of the placenta = πr^2 , where

π - 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

π - 3.14

r - Radius of the placenta

h - Mean thickness of the placenta

The maternal surface of the placenta was observed by placing the placenta in the white enamel tray and numbers of cotyledons were measured and whether any abnormality in the form of infarction and calcification were examined on the both surfaces of placenta by magnifying lens.

After the examination of placenta and umbilical cord, weight of newborn baby was obtained, foeto-placental weight ratio calculated. Placental coefficient was calculated by dividing placental weight by birth weight of the baby. Other parameters like areas of calcification, infarction and number of cotyledons were also measured.

Analysis and statistical aspect

Continuous variables were presented as mean \pm standard deviation. Categorical variables were expressed in percentages. P <0.05 was considered as statistically significant. Data was analyzed on statistical software Graph Pad Prism 5.01.

RESULTS

Out of 112 deliveries observed, 59 were primigravidae and remaining 53 were multiparae. The weight of the placenta ranged from 295 gm to 660 gm, average placental weight being 490.5 gm. Further we observed that in deliveries with male baby born average placental weight was 526 gm (range 320 to 645 gm) and 455 gm (295 to 660 gm) in case of deliveries where female baby was born.

Average placental surface area was found to be 225.5 sq. cm, ranging between 170.5 and 315.5 sq. cm. Mean placental volume was recorded as 450.5 cu. cm. The mean birth weight of the male babies was 2950 gm (range 2130 to 3915 gm) and 2455 gm (1965 to 4015 gm) in female babies.

The placental coefficient is calculated by dividing the placental weight (in grams) by birth weight of babies (in grams). Table I shows the placental coefficient calculated

male child, female child and irrespective of sex of the baby.

The ratio of fetal weight to the placental weight is known as the feto-placental ratio, which is normally 6:1.⁶ Feto-placental ratio in this study was observed as 5.41:1

irrespective of sex of the baby, 5.61:1 in case of male baby and 5.40:1 for female babies.

Only 9 out of 112 deliveries (8.04%) showed the presence of areas of calcification. Infracted area was observed in just 3 (2.68%) placentae.

Table 1: Shows the placental coefficient and feto-placental ratio for both sexes and irrespective of sex.

| | Average placental weight | Average birth weight | Placental coefficient | Feto-placental weight ratio |
|-----------------------------|---------------------------|------------------------------|-----------------------|-----------------------------|
| Male | 526 gm (320 to 660 gm) | 2950 (2130 to 3915 gm) | 0.18 | 5.61:1 |
| Female | 455 gm (295 to 660 gm) | 2455 gm (1965 to 4015 gm) | 0.19 | 5.40:1 |
| Irrespective of sex of baby | 490.5 gm | 2655 gm | 0.18 | 5.41:1 |

DISCUSSION

Some studies were conducted in the past on morphometry of placenta by various researchers but we tried to study the placentae of uncomplicated cases only. We compared the parameters according to the sex of baby.

We observed average placental weight being 490.5 gm in our study. Average placental weight was found to be 528.6 gm by Raghunath G et al. (2011).⁴ Majumdar et al. (2005)⁷ recorded the mean placental weight as 485.85 ± 47.31 gm. Udainia and Jain (2001)⁸ found mean weight as 495 ± 114.11 gm. Anjankar VP et al. (2014)¹ found mean placental weight as 408.14 ± 54.78 gm. Variations in the placental weight as observed by different authors may be attributed to nutritional status of the mother or variations in the antenatal care or follow up.⁴

In our study, average placental surface area was found to be 225.5 sq. cm (range 170.5 and 315.5 sq. cm). Anjankar VP et al. (2014)¹ found mean surface area of placenta as 221.99 ± 50.00 sq. cm. Udainia, Bhagwat and Mehta¹⁴ found the same as 242.56 ± 26.46 sq. cm. our findings are very much closer to the values as observed by other Indian authors. So this value can be used as reference range value for placental surface area.

The normal feto-placental weight ratio for western population is 6:1.⁴ Raghunath G et al. (2011)⁴ noted feto-placental weight ratio of 5.4:1 for male babies and 5.3:1 for female babies. Anjankar VP et al. (2014)¹ found feto-placental weight ratio 6.49 ± 0.55. In the present study, mean feto-placental weight ratio for male babies was recorded as 5.61:1 and 5.40:1 for female babies. Thus this ratio follows the similar trends alike found by Raghunath G et al. (2011).⁴ Sinclair JG (1948)⁹ had worked on placental and birth weight ratios. He studied 1517 placentae and concluded that placental weight increases

with increasing birth weight, the increase being linear for all full term births, while the placental birth weight ratio was found to be decreased linearly with birth weight. Again he noted that the ratio of placental to birth weight increases linearly with placental weight.

According to Fox¹⁰ (1986), placental-fetal weight ratios (placental coefficient) are more meaningful. This ratio should normally increase from 4 at 24th week to 7 at term. According to Indian studies, this ratio varies from 6.4:1 to 7.9:1 for full term normal infants [(Saigal and Shrivastava¹¹ (1970); Kher and Zawar¹² (1981)]. We found placental coefficient as 0.18 (0.18 in male babies and 0.19 in female babies). Raghunath G et al. noted placental coefficient of 0.19.

Little WA¹³ (1960) studied placental/fetal weight ratios (called as placental coefficient) in 956 consecutive third trimester deliveries. He determined the normal frequency distribution of the placental coefficient and defined the small and large placenta. Further he concluded that ‘perinatal adversity’ is caused only if ratio of placental to fetal weight is exceptionally smaller or larger.

CONCLUSION

The placenta is a mirror which reflects intrauterine status of the foetus.¹⁴ As newer investigative techniques like Colour Doppler Imaging or Gray scale ultrasound are emerging, an adequate knowledge of the morphometric analysis of placenta, and correlation between perinatal outcome, placental coefficient and feto-placental ratio proves very useful in early assessment of fetal insufficiency and status of fetal well-being.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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