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A Study on Anatomical Variations of the Placenta of Low Birth Weight Babies

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ABSTRACT

Placenta is a functional unit between the mother and the fetus. It is the discoid, deciduate, haemochorial, chorioallantoic, endocrine gland which connects developing embryo by umbilical cord to the uterus. It develops from two sources. The fetal component which is the principal component develops from chorion frondosum and the maternal component from decidua basalis. If the decidual part of the placenta is healthy, which in turn depends upon maternal health the embryogenesis from germinal period up to the end of fetal period will be healthy. Otherwise it will lead to anomalies of the placenta, umbilical cord and of the fetus including low birth weight. For the study, 60 discarded placenta and umbilical cord were collected at random from deliveries (both vaginal and caesarian). Thirty out of the sixty placentae were from controls (birth weight $\geq$2500 gms) and thirty from low birth weight deliveries (birth weight <2500 gms). In the collected placenta the weight, volume, shape, diameter, site of attachment of umbilical cord, thickness of placenta and number of maternal cotyledons was noted. In conclusion, this study has provided evidence of a significant influence of both maternal factors and placental factors in determining fetal size and ultimately, birth weight. Because of the growing evidence of correlation of placental morphology with chronic diseases in later life, we suggest attention and correct examination of placenta and recording all of the observations in patient's files as an important evidence for future. With evaluation and follow up of placenta growth in early pregnancy, we can prevent the risks for fetal life and improves infant health.

INTRODUCTION

Placenta is a functional unit between the mother and the foetus. It is discoid, deciduate, haemochorial, chorioallantoic, labyrinthine and endocrine gland which connects developing embryo by umbilical cord to the endometrium of mother's uterus. It develops from two sources. The fetal component which is the principal component develops from chorion frondosum and the maternal component from decidua basalis. If the decidual part of the placenta is healthy, which in turn depends upon maternal health the embryogenesis from germinal period up to the end of fetal period will be healthy[1,2].

Otherwise it will lead to anomalies of the placenta, umbilical cord and of the foetus including low birth weight. The low birth weight babies are susceptible to hypoxia, fetal distress, long term handicap and fetal death and are at increased risk for perinatal morbidity and mortality[1]. There is a proven direct relationship between socioeconomic status, maternal health, placental growth, fetal well-being and finally fetal outcome, fetal outcome being the best predictor of health status of the society[3,4].

Despite the observed link between maternal health, placenta and newborn health, any kind of placental study is not routinely performed in hospitals. In country like India, it is also not economically viable. However a study focused at least on the placenta of low birth weight babies will shed light on the causative socioeconomic and maternal factors and will help in the better understanding of the etiology. Hence the present study is undertaken to analyze the spectrum of morphological changes in placenta of low birth weight babies.

MATERIALS AND METHODS

Source of data:

- Placenta of low birth weight deliveries and normal birth weight deliveries (both vaginal and caesarian) was collected
- Relevant data from the mothers (by history and case records) was collected
- Newborn data from newborn assessment record was collected

Inclusion criteria:

- Placenta of low birth weight deliveries and birth weight ≥2500 gm (both vaginal and caesarian) conducted at McGann teaching hospital, Shimoga Institute of Medical Sciences was collected
- For the purpose of study, low birth weight babies are considered whose birth weight is less than 2500 gms

Exclusion criteria:

- Deliveries before the period of viability are excluded
- Placentas of Intrauterine death of foetus before the period of viability are excluded
- Multiple pregnancies (twins, triplets) are excluded
- Mothers with type 1 diabetes mellitus, with combined diabetes and hypertension, positive VDRL were excluded from the study

Test: Independent sample t-test/unpaired t-test The cases were studied dividing into two experimental groups.

- **Group A:** 30 placentae from deliveries of birth weight ≥2500 gm
- **Group B:** 30 placentae from low birth weight deliveries (<2500 gm)

RESULTS

Majority of the placentae were round (Fig: 1) in shape, about 22 (73.33%) in group A and 18 (60%) in group B. About 8 (26.66%) placentae of group A and 12 (40%) placentae of group B were oval in shape. In group A, 23 (76.66%) placentae weighed between 400-500 gms and 7 (23.33%) placentae weighed more than 500 gms. About 17 (56.66%) placentae weighed less than 400 gms and 13 (43.33%) placentae weighed between 400- 500 gms in group B.

In group A, maternal lobes were between 15-20 in 4 (13.33%) placentae and more than 20 in 26 (86.66%) placentae. In group B, the maternal lobes were below 15 in 4 (13.33%) placentae, between 15-20 in 14 (46.66%) and more than 20 in 12 (40%) placentae. In group A, 9 (30%) placental volumes were ≤400 mL, 12 (40%) placental volumes was between 401-499 ml and 9 (30%) placental volumes was ≥500. The placental volume was ≤400 mL of 25 (83.33%) placentae, 4 (13.33%) placental volumes was between 401-499 mL and one (3.33%) placental volume was 500 mL in group B. In group A, the mode of cord insertion was central in 24 (80%) placentae and eccentric in 6 (20%) placentae. In group B, 20 (66.66%) placentae showed eccenteric attachment of umbilical cord and 10 (33.33%) placentae had central attachment.

DISCUSSIONS

In the present study, majority of the placentae were round in shape, about 22 (73.33%) in group A and 18 (60%) in group B. About 8 (26.66%) placentae of group A and 12 (40%) placentae of group B were oval in shape. Gunapriya Raghunath *et al*.[5] studied the morphology of 101 placentae and found that 94 placentae had a normal circular shape which mainly

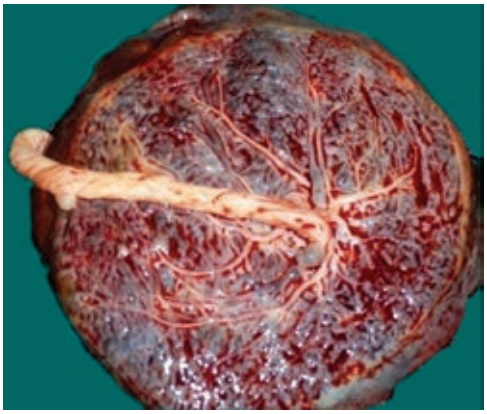

Fig 1: Round shaped placenta

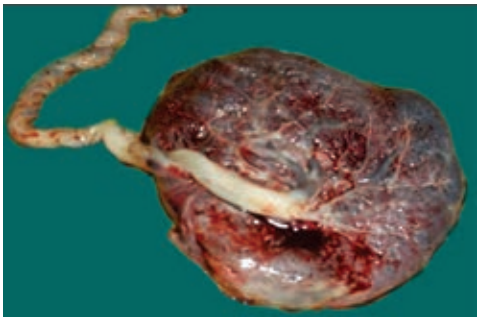

Fig 2: Oval shaped placenta

Fig 3: Eccenteric insertion of placenta

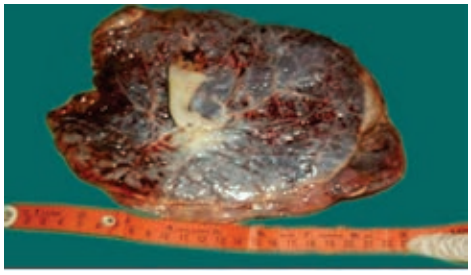

Fig 4: Central insertion of placenta

belonged to normal birth weight babies and 7 were oval in shape which belonged to low birth weight and preterm babies. In the present study the mean placental weight was 479.85±32.37gms in normal birth weight group and 385.10±59.86 gms in the low birth weight group and was found to be statistically significant. Placental weight and thickness has been taken as an indicator of placental function. Increase in placental weight in case of maternal anaemia have therefore, frequently been interpreted as evidence of compensatory hypertrophy for reduced oxygen supply. Braumann, 1993 observed that in hypoxic condition like anaemia, thickened placenta causes reduced birth weight due to blood flow and oxygen supply is happened in edematous thickened placenta[6].

Lao and Wong studied the morphology of the placenta and found out that the placental weight and thickness was higher in anaemic group as compared to the controls. Surya Babu *et al*.[7] studied 50 placentae of low birth weight babies and found that the placental parameters like weight and size of the placenta were significantly less than normal in low birth weight deliveries[8].

In a larger population size from Mexico (n: 300 live newborns) Sanin established a model to relate birth weight with placental weight. Placental weight was found to be significantly related to birth weight. For each gram increase of weight of placenta, the birth weight increased by 1.98 gms ($p<0.01$). The placenta however was shown to have a nonlinear relation to birth weight and could be used as a useful non-invasive predictor of birth weight. The authors concluded that along with age of gestation the maternal age and size, placental weight could explain 32% of the variability of birth weight and could thus be a “sentinel” indicator of nutritional and/or environmental problems.

Pradeep Londhe *et al.*[9] also found that placenta weight significantly lower in IUGR group as compared to normal group and statistically significant ($p<0.01$)[10]. The mean placental diameter in the present study was 18.88±0.95cm in normal birth weight group and 16.67±2.13cm in the low birth weight group. It was found to be statistically significant. The mean placental thickness in the present study was 1.82±0.25cm in normal birth weight group and 1.75±0.30cm in the low birth weight group. It was found to be statistically significant.

The mean thickness of term placenta reported by Gunapriya *et al*.[7] was 2.1cm, in other study by Hatti it was 2.21cm whereas, in the study of Rupa Balihallimath *et al*.[5] the mean placental thickness was 2.1 cm, 5th and 95th percentiles of placental thickness varied from 1.5-3.0 cm, with no significant relationship with birth weight. Lao and Wong found out that the placental weight and thickness was higher

Table 1: Shape of the placenta of the study groups

	Group A (placentas of normal birth weight)		Group B (placentas of low birth weight <2500g)		Total	
Parameters	No.	Percentage	No.	Percentage	No.	Percentage
Shape of the placenta						
Round	22	73.33	18	60	40	66.66
Oval	8	26.66	12	40	20	33.33

Table 2: Placental weight of the study groups

	Group A (placentas of normal birth weight)		Group B (placentas of low birth weight <2500g)		Total	
Parameters	No.	Percentage	No.	Percentage	No.	Percentage
Weight of placenta (gms)						
<400	0	0	17	56.66	17	28.33
400-500	23	76.66	13	43.33	36	60
>500	7	23.33	0	0	7	11.66

Table 3: Number of maternal lobes in each study group

	Group A (placentas of normal birth weight)		Group B (placentas of low birth weight <2500g)		Total	
Parameters	No.	Percentage	No.	Percentage	No.	Percentage
No. of maternal lobes						
<15	0	0	4	13.33	4	6.66
15-20	4	13.33	14	46.66	18	30
>20	26	86.66	12	40	38	63.33

Table 4: Placental volume of the study groups

	Group A (placentas of normal birth weight)		Group B (placentas of low birth weight <2500g)		Total	
Parameters	No.	Percentage	No.	Percentage	No.	Percentage
Volume of placenta (mL)						
≤400	9	30	25	83.33	34	56.66
401-499	12	40	4	13.33	16	26.66
≥500	9	30	1	3.33	10	16.66

Table 5: Mode of attachment of umbilical cord of the study groups

	Group A (placentas of normal birth weight)		Group B (placentas of low birth weight <2500g)		Total	
Parameters	No.	Percentage	No.	Percentage	No.	Percentage
Mode of attachment of umbilical cord						
Central	24	80	10	33.33	34	56.66
Eccentric	6	20	20	66.66	28	46.66

in anaemic group as compared to the controls. Braumann observed that in hypoxic condition like anaemia, thickened placenta causes reduced birth weight due to blood flow and oxygen supply is happened in edematous thickened placenta[6]. In the present study, the mean placental volume in the normal birth weight group was 448.50±41.21ml and in the low birth weight group it was 370±48.95 ml which was statistically significant.

In the study by Rupa Balihallimath *et al*.[11] the mean placental volume was 366.08±1.10 mL, with a significant positive correlation between the weight of the baby and the placental volume R = 0.662 mL, p<0.001). This result is consistent with the other study[10]. In a study by Virupaxi *et al*.[12] morphometric parameters of placenta like weight and volume were significantly lower in small for gestational age group babies as compared to full term normal group babies, these values were statistically significant (p<0.0001)[12].

The morphometric parameters of placenta like, weight, volume were found to be significantly lower in low birth weight group compared to normal group by Londhe *et al*.[10] Placental weight and placental volume had significant correlation with the birth weight of new born. In the present study, in the normal birth weight group, the mode of cord insertion was central in 80% placentae and eccentric in 20% placentae. In low birth weight group, 66.66% placentae showed eccenteric attachment of umbilical cord and 33.33% placentae had central attachment.

According to the study by Kowsalya *et al*.[13] 4.5% of umbilical cord insertions were in centre which associated with normal birth weights and 68% were

marginal which related to lower birth weights. The marginal umbilical cord insertion may be due to a primary implantation site having reduced vascular supply which makes the placenta migrate to a site of better nourishment. Foeto-placental ratio is the ratio of fetal weight to placental weight. The normal ratio is 1:7. The mean foeto-placental ratio in normal birth weight group was 6.19 whereas in low birth weight group, it was 5.17. The difference between two groups was statistically significant ($p<0.001$).

Placental coefficient is defined as the ratio of placental weight to fetal weight. Normally it is 0.10-0.18[14]. This correlated well with the present study. In the present study the placental co-efficient in normal birth weight group was 0.162±0.011 and in low birth weight group was 0.197±0.028. The placental co-efficient falls as the placental weight increases and high placental co-efficient in seen if the placental weight decreases. Placental coefficient outside the normal range is shown to be associated with perinatal adverse effects[14].

CONCLUSION

- The maternal lobes were significantly less in placentae of low birth weight newborns. ($p <0.001$)
- Eccentric mode of attachment of umbilical cord was seen more among the low birth weight placentae than normal birth weight placentae
- The difference between foeto-placental ratio and placental coefficient among the normal birth weight and low birth weight groups was statistically significant. ($p<0.001$)
- The shape of the placenta did not show significant variation

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