

Effect of Maternal Anemia on Placenta and its Correlation with Fetal Outcome

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Abstract

Introduction: The placenta being the bridge between maternal and fetal activity, is considered as a window through which understanding of various maternal disorders and their effect on fetal wellbeing can be obtained. Anemia in pregnancy constitutes a significant public health problem in developing countries. The *objective* was to assess the effect of maternal anemia on the morphometry of placenta and to correlate the analysis with fetal outcome. **Material and Methods:** The present study comprised of 151 cases admitted in obstetrics ward. Patients were divided into Control (101 cases) and Study groups as anemia group (50 cases). The placentas were studied in relation to its morphometric and macroscopic changes and their comparison with normal cases. The fetal parameters were also studied in the same cases and compared with normal cases. **Results:** The morphometric parameters of placenta like weight, diameter and placental coefficient were significantly increased in anemia group compared to control group. Rest of the parameters like number of cotyledons, thickness was significantly lower in study group. Birth weight and head circumference of the newborn was significantly reduced in study group as compared to control group. Placental weight had significant correlation with birth weight of newborn. **Discussion:** Examination of the placenta can yield information that may be important in the immediate and later management of mother and infant. This information may also be essential for protecting the attending physician in the event of an adverse maternal or fetal outcome.

Keywords: Placenta; Maternal Anemia; Fetal Outcome.

Introduction

Placenta is a focus of increasing interest in modern obstetrics because survival, growth and development of fetus is intricately linked with that of placenta, which is depend on both maternal nutritional status and transfer of nutrients as well as oxygen. The placenta – ‘the life of the fetus in utero’ is considered as a fountainhead of human existence.

The term placenta was introduced for the first time by ‘Realdus Columbus’ in 1559, who used this Latin word for a ‘flat cake or plate’. Placenta is the most accurate record of the infants’ prenatal experience

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K. Benirschke. After delivery if the placenta is examined minutely it provides much insight into the prenatal health of the baby and the mother [1].

Anemia in pregnancy [Haemoglobin < 10 gm/dl- WHO (1993)] is still a recognized obstetric hazard in lower socioeconomic group which is responsible for 20% of maternal deaths in third world countries [2]. It can have devastating effects on their babies. Placenta is most easily available of all human organs but not routinely subjected to detailed and critical scrutiny. Study of placenta in such cases is very helpful to scrutinize the exact etiopathogenesis in various disorders. Also it gives valuable information and answers to the questions concerned with the pregnancy management. The results are often helpful to plan safe pregnancy and healthy baby outcome [3].

With the above objective, present study has been undertaken to record the data on morphology and morphometry of placenta from mothers with maternal anemia and correlate the findings with the newborn parameters.

Materials and Methods

The study was conducted at the department of Anatomy in collaboration with department of obstetrics and gynecology at Government medical college and Hospital, Latur for the period of 2 years. Total 151 placentas, neonate constituted the material for the study. The study group comprised of 50 placentas from pregnancies with maternal anemia (Hemoglobin less than 10 gm %) [4].

The control group comprised 101 placentas from pregnancies without any maternal disorders who delivered at term at 36 to 40 weeks of gestation, registered cases whose present and past history was uneventful and who were attending antenatal clinics regularly.

Before the commencement of study, permission was taken from the institutional ethics committee. A detailed history of mothers was recorded on a pre-designed pro forma. Informed consent was taken from parents of the baby. All placentas were collected soon after their expulsion, both from normal deliveries and caesarean sections. The umbilical cord was cut leaving a length of 5 cm from its site of insertion. All the labeled specimens were washed and weighted. They were then transported in formalin (10%) filled glass jar to the Department of Anatomy for further study.

The following parameters of placenta were studied:

1. Weight of placenta in grams-recorded by weighing machine.
2. No. of cotyledons- by counting visually.
3. Thickness of placenta - by metal probe and permanent marker.

Thickness of placenta was measured at its centre, keeping its maternal surface in contact with the surface of the table. A sharp metal probe was then pierced at the centre of the fetal surface until it touches the surface of the table. Now, the point up to which the probe inserted was marked. Then the distance between the tip of the probe and the marked point was measured by using vernier calliper in millimeter.

4. Diameter of placenta- measured by metallic scale and tape.
 5. Feto-placental weight ratio= $\text{birth weight} \div \text{placental weight}$
 6. Placental coefficient= $\text{placental weight} \div \text{birth weight}$
- Newborn parameters studied were:

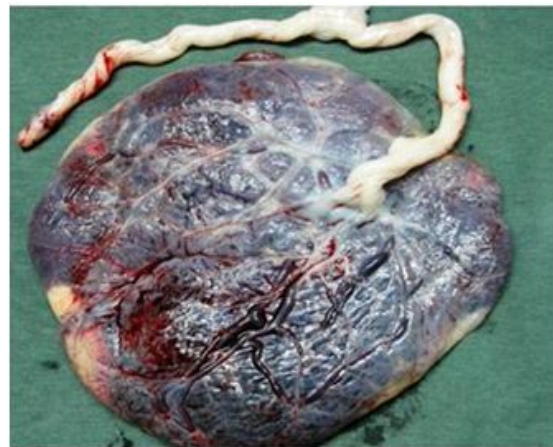
1. Weight of the newborn baby- recorded with a weighing machine.

2. Head circumference - measured from occipital protuberance to the supraorbital ridges on the forehead with measuring tape.

Fig. 1: Maternal surface of normal full term human placenta showing cotyledons



Fig. 2: showing enlarged placenta from anaemic mother



Statistical processing of data

The collected data was entered on the excel spreadsheet, processed and analyzed by using the SPSS 20.0 version. The tests of significance applied were Chi-square test (χ^2), unpaired 't' test and Pearson correlation coefficient for correlating birth weight with placental weight.

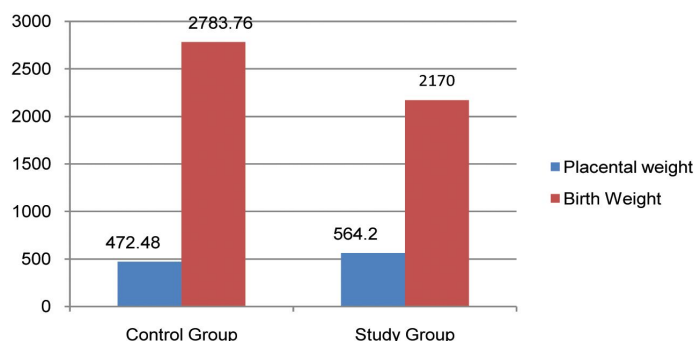
Observation and results

In present study, the placenta from anemic mothers showed higher frequency of calcification (52%) as compared to control group (23.76%) which was highly significant. The mean number of cotyledon was reduced significantly ($p < 0.001$) in study group (Table 1).

Table 1: Gross morphology of placenta in Normal and Anemic pregnancies

Sr.No.	Parameters	Control group	Anemia group	P value
1)	Presence of calcification (%)	23.76%	52%	<0.001 [#]
2)	Mean No. of cotyledons	16.22±1.88	13.06±1.38	<0.001*

#Chi-square test<0.001- Highly significant, * Unpaired t test <0.001-Highly significant

Graph 1: Comparison of mean placental weight and mean birth weight among two groups

All the morphometric parameters of placenta were measured and compared with the control groups. The mean (\pm SD) weight of placenta was 472.48 ± 77.06 gm in control group and 564.20 ± 58.71 gm in study group (Graph1).

The mean thickness of placenta in study group was 22.12 ± 3.94 mm which was significantly reduced than control group 30.84 ± 4.29 mm. The mean diameter of placenta in anemic group was

significantly increased than control group ($p < 0.001$). The ratio of birth weight to placental weight is known as fetoplacental ratio, which is normally 6:1. In the present study the ratio was reduced significantly in study group than in control group. The mean placental coefficient in study group was 0.26 as compared to control group was 0.16 and the difference was found to be statistically significant. (Table 2).

Table 2: Morphometric parameters of placenta from Normal and Anemic pregnancies

Sr. No	Parameters	Control group Mean \pm SD	Anemia group Mean \pm SD	Statistical significance P value
1)	Weight of placenta (gm)	472.48±77.0	564.20±58.71	<0.001*
2)	Thickness of placenta (mm)	30.84±4.29	22.12±3.94	<0.001*
3)	Diameter of placenta (mm)	154.5±23.9	168.7±31.29	<0.001*
5)	Feto-placental weight ratio	5.971±0.64	3.860±1.62	<0.0001*
6)	Placental coefficient	0.1693	0.2602	<0.0001*

SD- Standard deviation, *unpaired t test – Highly significant

The mean birth weight of newborn baby in study group was 2170 grams and in control group was 2783.76 grams. This indicates the mean birth weight of newborn baby was low in study group and the difference was statistically significant (Graph 1). In the

present study, it was seen that mean head circumference of newborn in control group was 33.50 cm while in anemia group was 32 cm. It was noted that, mean head circumference of babies was lower in anemia group than in control group ($P < 0.001$) (Table 3).

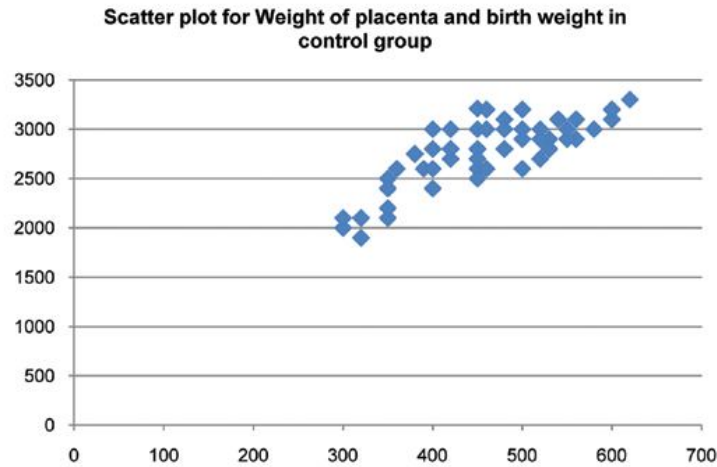
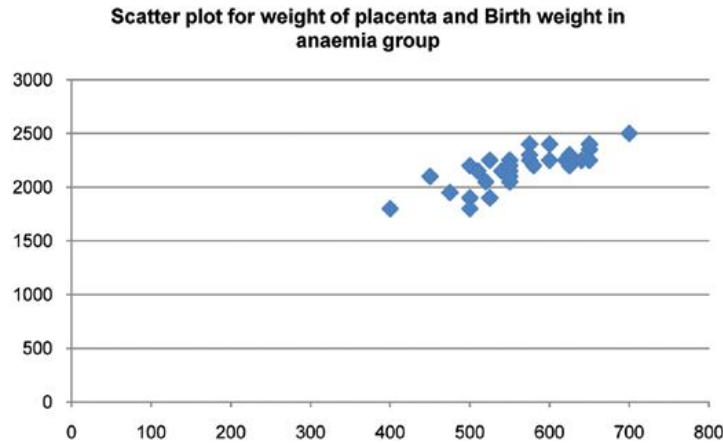
Table 3: Morphometric Parameters of newborn baby from Normal and Anemic pregnancies

Sr. No	Parameters	Control group Mean \pm SD	Anaemia group Mean \pm SD	Statistical significance P value
1)	Birth weight of baby (gm)	2783.7±300	2170±192	<0.001*
2)	Head Circumference (cm)	33.50±1.447	32±1.443	<0.001*
3)	Correlation coefficient (r)	0.779	0.790	<0.01*

SD- Standard deviation, *unpaired t test – Highly significant

In both the groups there was a significant positive correlation between birth weight and placental weight. In the study group, the Pearson correlation coefficient was $r = 0.790$ ($p < 0.001$, significant). It was

also noted that the birth weight in control group showed more clustering above 2500 grams (Graph No. 2) and in the study group showed more clustering below 2500 grams (Graph 3, Table 3).

Graph 2: Relation between placental weight and birth weight of newborn for control group**Graph 3:** Relation between Placental weight & birth weight of newborn for Anemia group

Discussion

The quantitative parameter of placenta like weight was significantly increased in anemic group than control group ($p < 0.001$). This had similarities to the study conducted by Agboola A. [5, 6] Levario-Carrillo M. et al [7], Lao TT, Tam KF (2000) [8].

The same parameter was found less in anemia group in the study conducted by Rangnekar AG et al [9] and Raghunath G. et al [10], Mongia SM et al [11]. Godfrey KM (1998) states that increase in placental weight in maternal anemia is indicative of inadequate oxygenation of the foeto-placental unit and in term invokes physiological response resulting in compensatory placental hypertrophy which is an adaptation to a physiological stress [12].

The mean diameter of placenta was found to be significantly increased in study group. Same was observed by Mahamuda Begum et al [13] in her study as "Big placenta and anemia in pregnancy".

In the present study, the mean thickness of placenta was significantly reduced in anemia group as also noted by others [9, 14]. Mahamuda Begum et al [13] observed that difference in mean thickness of placenta between normal and anemic group was not significant (Table 4).

A paucity of cotyledons was observed in this study group, which coincided with the findings of Singla PN et al [15], who attributed this reduced number of cotyledons in placenta of anemic mothers as an indication of lesser degree of septation and probably a greater proportion of functional parenchyma, which is an adaptation to physiological stress. Mongia SM et al [11] also recorded reduced number of cotyledon in anemia group [12] as compared to control group [18].

The mean birth weight of newborn baby was less in the study group [8, 10, 15]. Due to placental insufficiency, the fetal growth is affected. According to previous studies, for evaluation of fetus, the weight of placenta is not enough, but the foeto-placental ratio

Table 4: Showing comparison of results of present study with the studies conducted by various workers

Parameter Studies	Weight of Placenta (Grams)		Diameter (mm)		Thickness (mm)		Birth weight (Grams)	
	Gr A*	Gr B*	Gr A*	Gr B*	Gr A*	Gr B*	Gr A*	Gr B*
Agboola A(1975)	507.5	563	-	-	-	-	-	-
Agboola A (1979)	-	547.8 ± 75.7	-	-	-	-	-	3000
Rangnekar AG et al. (1993)	450.89	401.6	-	-	-	-	-	-
Singla PN et al. (1997)	-	-	-	-	-	-	2844	2393.3
Lao TT, Tam KF(2000)	594±108	609± 102	-	-	-	-	3220	3082
Levario-carrillo M et al. (2003)	527±107	558±105	-	-	-	-	-	-
Mahamuda Begum et al. (2009)	-	-	156	184.2	21.4	21.45	-	-
Raghunath G et al. (2011)	528.6	400	-	-	-	-	2800	2000
Priya G et al. (2012)	-	-	-	-	22	18.5	-	-
Present Study (2015)	472.48±77.0 6	564.20± 58.71	154.51	168.70	30.84	22.12	2783.76	2170

Gr A* - Group A (control Group)

Gr B* - Group B (study group)

is important [16]. Head circumference of newborn baby was significantly reduced in anemia cases. This is in similarity with the study conducted by Hadipour R et al [17].

Present study showed lower fetoplacental ratio in anaemic group which was also noted by Raghunath G et al [10].

High placental coefficient was also noted in other studies [7, 8, 10, 12].

Conclusion

The quantitative parameters of placenta like weight and diameter, placental coefficient showed significantly higher values in anemic group than in control group. Other parameters like no. of cotyledons, thickness, fetoplacental ratio was significantly lowered in anemic group. Our study concluded the strong correlation between birth weight and placental weight in study group and control group. So it would be logical to suggest that the postnatal examination of the placenta can yield information that may be important not only for immediate and late management of the mother and neonate but it may also help to prevent any adverse maternal or fetal outcome.

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