Original Research

Morphological study of placental changes in anemia with its clinical significant

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Abstract

Background: The placenta acts like a sieve, moving oxygen and nutrients from the mother's body to baby and taking carbon dioxide and waste materials from the baby into mother's body for elimination. The placenta also plays an important role in hormone production and releases hormones into both the maternal and fetal circulations to affect pregnancy, metabolism, fetal growth, and parturition. Earlier in developing countries women often become anemic during pregnancy because the demand of iron and vitamins will increase. Fetuses are at risk of preterm deliveries, low birth weight due to impairment of oxygen delivery to placenta and fetus.

Objectives: To study the morphological changes in placenta in patients with anemia. And also to correlate between the degree of anemia with maternal and fetal complications.

Material and Methods: This study was conducted in the Department of Anatomy Government Medical College, Surat. The placentas were collected from labor room and gynecology operation theater. Total 130 cases were studied. Out of 130 cases 100 women having pregnancy with anemia and 30 cases belong to control group pregnant women without anemia.

Results: The weight of newborn baby in the present study is found to vary between 900 and 3400 g in the anemic group, where as it is between 2000 and 3500 g in the control group. Thus variation in the fetal weight is much more in the anemic group. Mean placenta weight is 500.30 g in mild anemic groups, 454.73 g group for moderate anemic group, and 405 g for severe anemic group. Majority of placenta in mild, moderate, and severe anemic groups are either round or oval in shape. There is no significant difference in the mean thickness of placenta in the control group and anemic group. The number of cotyledons in the present study is found to vary between 15 and 35 in the anemic group and it is between 17 and 29 in the control group. Surface area of placenta in the present study is found to vary between 133.10 cm^2 in the anemic groups, where as it is between 176.32 cm^2 in the control group. Mean placental coefficient is 0.203 for the anemic group and 0.0185 for control groups. The common site of insertion of umbilical cord in both the groups is eccentric.

Conclusions: It was concluded from the study that the weight of newborn baby is significantly low in anemia and it further decreased according to severity of anemia .Thickness of placenta is not much affected by anemia. Hence, it cannot be used as a reliable criterion for identification of anemia. Thus placenta acts as an effective index, by examination of which we can predicate the status of the fetus in neonatal life.

KEY WORDS: Placenta, morphology, anemia

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Introduction

The placenta is an extremely complex piece of biological structure. It is a little bit like an artificial kidney, it allows mother blood and baby blood to come into very close contact but without ever mixing. The placenta acts like a sieve, moving oxygen and nutrients from the mother's body to baby and taking carbon dioxide and waste materials from the baby

into mother's body for elimination. The blood vessels of the mother and baby are incredibly close together at the site where the placenta is attached to uterus. However, remarkably the blood flows always completely separate whilst facilitating vital exchange. The placenta can help to protect the fetus against certain xenobiotic molecule, infections and maternal diseases. Early placental development is characterized by the rapid proliferation of the trophoblast and development of chorionic sac and villi.[1] Placenta is classified into 2 types one is disperse and other is magistral.[2] Placental weight is around 500–600 g usually one-sixth of the fetal weight and thickness is 2.5 cm.[3] The umbilical cord is usually attached at the center. Anemia is an important public health problem worldwide and the most vulnerable group is pregnant women and children. In developing countries women often become anemic during pregnancy because the demand of iron and vitamins increased. Fetus are at risk of preterm deliveries, low birth weight due to impairment of oxygen delivery to placenta and fetus. Placenta being exchange organ its morphologic study may throw some light on the issue.

The objective of the present study was to study the morphology of placenta in anemic patients and to compare it with the placenta of pregnant woman with normal hemoglobin. Also to correlate between the degree of anemia and maternal and fetal complications.

Material and Methods

This study was conducted in the Department of Anatomy Government Medical College, Surat. Prior permission from Human Research Ethics Committee of the Institute was taken. The placentas were collected from labor room and gynecology operation theater. Total 130 cases were studied. Out of 130 cases 100 women having pregnancy with anemia and 30 cases belong to control group pregnant women without anemia. Study group included subjects having hemoglobin less than 10 g/100 ml during pregnancy. Subjects with anemia due to causes other than iron deficiency were excluded from the study. In control group subjects had Hb more than 10 g/100 ml. Maternal Hb was measured during the antenatal visit in the hospital. As soon as the placenta was delivered the cord was cut. The placenta was washed gently to remove the blood clots, blotted dry with filter paper, and weighed in the baby weight machine. Then the placenta was put on graph paper and its margins were drawn. Thickness at the umbilical cord insertion was measured with venire caliper.

Results

Morphological study of placenta in anemia with its clinical significance was done in 130 parturient, admitted in new civil hospital, surat.100 cases had pregnancy with anemia and 30 control group, had normal pregnancy. The weight of newborn baby in the present study was found to vary between 900 and 3400 g in the anemic group, where as it is between 2000 and 3500 g in the control group. Thus variation in the fetal weight is much more in the anemic group. Mean weight in the anemic group 2435 g, which is significantly low as compared to 2896 g in the control group. *P*-value observed was < 0.05; indicating that the difference is significant and not by chance. Thus anemia is significant factor to determine the weight of newborn baby. Mean weight of newborn baby is 2504 g for mild anemic group, 2547 g for moderate anemic group and 2187 g for severe anemic group. Thus mean weight is less in severe anemic group an also maximum weight is also low in severe anemic group. *P*-value observed was < 0.05; indicating that there is no significant difference seen in weight of newborn baby according to the severity of anemia.

As seen in Table 1, the mean placenta weight is 500.30 g in mild anemic group, 454.73 g group for moderate anemic group, and 405 g for severe anemic group. The mean weight of placenta in severe anemic group is 405 g which is low as compared to mild and moderate anemic groups. Minimum placenta weight is 318 g for severe anemic group and 300 g mild anemic group. Maximum placental weight is 680 g for mild anemic group, 720 g for moderate anemic group, and 508 g for severe anemic group. Thus maximum and minimum placental weight is less in severe anemic group.

Table 2 shows the shape of placenta in anemic cases. Majority of placenta in mild, moderate, and severe anemic groups are either round or oval in shape. Only 1% of placentas

Table 1: Weight of placenta in anemic cases

Weight (g)	Mild anemia		Moderate anemia		Severe anemia	
	No. of cases	%	No. of Cases	%	No. of cases	%
251–300	1	1.36	–	–	–	–
301–350	3	4.10	1	5.26	–	–
351–400	23	31.50	6	31.57	3	37.5
401–450	16	21.91	5	26.31	–	–
451–500	14	19.17	3	15.78	2	25
501–550	9	12.32	1	5.26	2	25
551–600	3	4.10	1	5.26	1	12.5
601–650	2	2.73	1	5.26	–	–
651–700	2	2.73	–	–	–	–
701–750	–	–	1	5.26	–	–

Table 2: Shape of placenta in anemic cases

Shape	Mild anemia		Moderate anemia		Severe anemia	
	No. of cases	%	No. of Cases	%	No. of cases	%
Round	22	30.13	8	42.10	2	25
Oval	46	63.01	10	52.63	4	50
Irregular	3	4.10	–	–	1	12.5
Triangular	1	1.36	–	–	–	–
Quadrangular	–	–	1	5.26	1	12.5

are quadrangular shape in moderate anemic group and severe anemic group. Briefly, 1% placenta is triangular in shape in mild anemic group. The thickness of placenta at the site of insertion if umbilical cord is found to vary between 0.5 and 2.4 cm in the anemic group, where as in the control group it varies between 1 and 2.5 cm. There is no significant difference in the mean thickness of placenta in the control group and anemic group. Maximum thickness of placenta also does not show a difference between the two groups. The number of cotyledons observed in the present study is found to vary between 15 and 35 in the anemic group and it is between 17 and 29 in control group. The mean number of cotyledons is same in both groups. In anemic group 37% of placenta have the number of cotyledons between 16 and 20 and 44% of placenta have the cotyledons between 21 and 25, in the control group 40% of placenta have the number of cotyledons between 16 and 20 and 56.66% of placenta have 21 cotyledons, and in the anemic group 25.6% of placentas have the cotyledons between 11 and 15 and 3% of placentas have the cotyledons between 31 and 35. Maximum number of cotyledons (35) found in both mild and moderate anemic groups. There is not much difference in mean number of cotyledons for mild, moderate, and severe anemic groups. Surface area of placenta in the present study is found to be 133.10 cm^2 in the anemic group, where as it is 176.32 cm^2 in the control group. The range is much wide in the anemic group. Mean surface area of placenta is 212.48 cm^2 in the anemic group and 244.74 cm^2 in the control group. Thus the surface area of placenta is less in the anemic group. The *P*-value observed was < 0.05; indicating that there is significant difference in surface area of anemic group and control group. So anemic is significant factor for decreasing the surface area. Mean placental coefficient is 0.203 for anemic group and 0.0185 for control group. There are 55% of cases with p/f value between 0.16 and 0.20 and 20% of cases from anemic group with low p/f value between 0.10 and 0.15. Maximum p/f value between 0.31 and 0.35 is found in 4% of cases in anemic group. For control group high p/f value is found between 0.26 and 0.33 in 3.33% cases.

The common site of insertion of umbilical cord in both the groups is eccentric. Central insertion is found in 28% placenta in the anemic group as compared to the only 19.66% in the control group. Eccentric insertion is found in 62% anemic cases and 76.66% in the control group. Marginal insertion is found in only 10% in both groups (Table 3). Thus eccentric insertion is more common in control group as well as anemic group.

Table 3: Insertion of umbilical cord

Type of insertion	Control group		Anemic group	
	No. of cases	%	No. of cases	%
Central	5	16.66	28	28
Eccentric	23	76.66	62	62
Marginal	3	10	10	10

Discussion

The placenta is highly specialized organ of pregnancy that supports the normal growth and development of the fetus. Growth and function of the placenta are precisely regulated and coordinated to ensure the exchange of nutrients and waste products between maternal and fetal circulatory systems. Placenta being the fetal organ shares same stress and strain to which the fetus is exposed. Thus, any disease process affecting mother and fetus also has great impact on placenta. Benirschke[4] and Agbola[5] studied 199 and 25 placenta from anemic mothers respectively and observed that maternal anemic was associated with placental hypertrophy. Agbola[5] also observed that mean placental weight in control group was lower than study group. Chung[6] studied 378 randomly collected placentas for study of biometrics of placenta. To the contrary they observed that placental weight of anemic mothers was lower than control group. Hosemann[7] reported that placental weight increases in anemia. Sinclair[8] in a study concluded that placental weight was lower in anemic mothers compared to healthy mothers. Dhall[9] observed that mean placental weight in anemic mothers was lower compared to healthy mothers though the difference was not significant statistically. Baptiste's[10] study of maternal risk factors for abnormal placental growth also observed increased placental weight in anemic mothers. In our study, we found that the mean placental weight was 484.09 ± 87.46 g in anemic mothers compared to 533.7 ± 85.57 gin healthy mothers. When anemic group was studied according to the severity of anemic, it was found that placental weight decreases as the severity of anemic increases, without being statistically significant. So our study correlates with the findings of previously mentioned study. This was believed to be because of small sample size and less severity of anemia, which in turn is due to awareness about anemic during pregnancy and its prevention by maternal healthy programmers, result could not reach statistical significance. Agbola[5] in his study on anemia observed fetal weight 3202.4 ± 437 g in control group and 3107.7 ± 381.3 g in anemic group. In his study, there was variability in fetal weight in anemic group. Dhall[9] in her study about morphology of placenta in anemic concluded that fetal weight was lower in anemic mothers. Agarwal[11] also stated that weight is low in anemic mothers. In our study, fetal weight is 2896 ± 417 g in control group and 2453 ±409 g in anemic group (*P* = 0.001), which correlates with above-mentioned studies. The decreased fetal weight found in our study is probably because of progressive reduction in the area of exchange surface in placenta. Historically reported placental coefficient or placental ratio which is calculated as ratio of placental weight to fetal weight. Hossman[7] described the significance of change of placental coefficient in maternal anemia. Lao[12] stated placental ratio is increased in anemic mothers. In the present study placental ratio for control group is 0.185 ± 0.024 and for anemic group is 0.203 ± 0.069. So, Placental ratio for anemic group is higher than the control group, but it did not reach statistical significance (*P* = 0.0559).

When we studied placental ratio according to the severity of anemia, results became statistically significant (P = 0.05). Soon Chung[6] observed average surface area of the placenta for normal cases was 264 cm^2. Dhall[9] concluded that surface area of chorionic villi and fetal vessels was decreases in anemics. In the present study, it was found that mean surface area of placenta for control group was 244.74 ± 41.23 and for anemic group it was 212.48 ± 45.38 cm^2. No studies were found to determine the range of surface area in anemic group but our findings of surface area is lower than the normal term placental surface area. The reason for decreased surface area is intervillous spaces. No studies are conducted to determine the exact number of cotyledons in severity of anemia. No studies are carried out for variation in shape of placenta, insertion of umbilical cord, thickness of placenta at the site of umbilical cord insertion in anemia.

Conclusion

The mean weight of newborn is 2896 g in control group, 2505 g in mild anemia, 2547 g in moderate anemia, and 2187 g in severe anemia. This indicates that weight of newborn baby is significantly low in anemia and it further decreased according to severity of anemia. Surface area is decreases in anemic group as compared to control group. Placental coefficient is higher in severe anemic group. Mean thickness of placenta at the site of insertion of umbilical cord does not show significant difference between the healthy and anemic groups. So thickness of placenta is not much affected by anemia. Hence, it cannot be used as a reliable criterion for identification of anemia. Eccentric insertion is common both in control and anemic groups. Round and oval shape is more common in control as well as anemic groups. Thus placenta acts as an effective index, by examination of which we can predicate the status of the fetus in neonatal life. A further study of placenta in more severely anemic mothers with hemoglobin < 5 g/dl giving birth to premature baby may throw some more light on the subject.

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