



ORIGINAL RESEARCH PAPER

CORRELATIONAL STUDY OF MORPHOLOGICAL AND HISTOPATHOLOGICAL CHANGES OF THE PLACENTA IN NORMAL AND ANAEMIC PREGNANT WOMEN AND EFFECT ON THE PREGNANCY OUTCOME

Pathology

KEY WORDS: : Placenta, control, anaemia, fetal and maternal outcome

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ABSTRACT

BACKGROUND: The foetus, placenta and mother constitute triad of contributors to pregnancy outcome. Thus, any insult in the growth of the placenta affects the fetal development and outcome. Anaemia in pregnancy is also very common, but severe anaemia in pregnancy may have adverse effects on pregnancy, delivery and neonatal infants. Maternal anaemia is an independent risk factor for pre-term delivery and low birth weight. The placental examination will help in understanding of the specific etiologies of adverse outcome which will lead to specific treatment and preventive measures for those with risk for recurrence in subsequent pregnancies. **OBJECTIVES:** Study of the histomorphology of placenta in cases of anaemia and control group, Findings that help to explain adverse pregnancy outcome, Findings predictive of possible recurrence that could guide care in subsequent pregnancies. **MATERIALS AND METHODS:** Evaluation of 50 placentas of patients with anaemia and 50 of healthy control received at tertiary care hospital over a period of 4 months. **RESULT:** In present study mean weight of the newborn baby born to anaemic group was significantly lower than the control group. Percentage of asphyxia and death of the newborn baby as well as percentage of shock and death in pregnant women were also more in anaemic cases. In gross features of placenta; irregular shape of the placenta and marginal insertion of umbilical cord, calcification and paranchymal fibrosis were more observed in anaemia cases. In Histopathological examination percentage of Syncytial knots, Fibrinoid necrosis, Placental infarct, Calcification, Fibrosis, Villous hypovascularity, Cytotrophoblastic proliferation and basement membrane thickening were more significant in anaemia cases as compared to control group. **CONCLUSION:** Present study supports the view that there is a very strong relationship between the placental histomorphology in anaemia with adverse fetal and maternal outcome.

INTRODUCTION

Placenta is the unique organ having maternal and fetal origin, upon which developing fetus is totally dependent for the nutritional requirements, metabolic and immunological need. Thus, any insult in the growth of the placenta affects the fetal development and outcome. Indications for examination are essentially any disease of the mother, the infant or any clinically accepted placental abnormality.¹ Placental examination is an integral part of fetal or perinatal autopsy and adds conclusive or important information.²

Morphological and histopathological examination of the placenta is helpful in accessing the time and nature of the insult in the intrauterine environment. Among the high risk pregnancies, anaemia is one of the commonest causes. Placental examination has been proved to be of clinical value in cases selected because of gestational complications, unusual disorders of mother or infant, perinatal death, problems in perinatal diagnosis, and multiple pregnancies.³ Placental evaluation requires thoughtful gross examination, careful sectioning, and an understanding of the basic microscopic changes in a variety of pathologic processes.⁴ Anaemia in pregnancy is very common, but severe anaemia in pregnancy may have adverse effects on pregnancy, delivery and neonatal infants. Maternal anaemia is an independent risk factor for pre-term delivery and low birth weight.⁵

ANAEMIA IN PREGNANCY:

Anaemia is said to have occurred in pregnant women when the hemoglobin level is less than 11 g/dl and is divided into three degrees mild (10.9-9.0 gm %), moderate (8.9-7.0 gm %) and severe degree (<7.0 gm %).⁶ Anaemia is a condition of low circulating haemoglobin (Hb) in which concentration has fallen below a threshold lying at two standard deviations below the median of a healthy population of the same.^{7,8}

Maternal effects of anaemia^{8,9}:

Mild anaemia may not have any effect on pregnancy and

labour except that the mother will have low iron stores and may become moderately to severely anaemic in subsequent pregnancies. Moderate anaemia may cause increased weakness, lack of energy, fatigue and poor work performance. Severe anaemia, however, is associated with poor outcome. The woman may have palpitations, tachycardia, breathlessness, increased cardiac output leading on to cardiac stress which can cause de-compensation and cardiac failure which may be fatal. Increased incidence of pre-term labour (28.2%), pre-eclampsia (31.2%) and sepsis have been associated with anaemia.

Fetal effects of anaemia⁸:

Irrespective of maternal iron stores, the fetus still obtains iron from maternal transferrin, which is trapped in the placenta and which, in turn, removes, and actively transports iron to the fetus. Gradually, however, such fetuses tend to have decreased iron stores due to depletion of maternal stores. Adverse perinatal outcome in the form of pre-term and small-for-gestational-age babies and increased perinatal mortality rates have been observed in the neonates of anaemic mothers.

Gross And Histopathological Changes In Placenta In Anaemia:

Researchers like Barker et al. (1990), Godfrey et al. (1991), Lao and Tam (2000) have all concluded that maternal anaemia was associated with larger placental weights, reduced fetal birth weights, and higher ratios of placental weight: fetal weight.^{10,11,12} According to Agarwal (1991), placental histology in maternal anaemia showed decreased villous vascularity and increased villous fibrosis.¹³ Joshi et al. (1996) reported villous hypovascularity, increased syncytial knots and fibrinoid necrosis in maternal anaemia.¹⁴ It was observed by C.H. Burton et al that fetal vasculature of human placenta adapt in a uniform manner in different form of hypoxic stress like high altitude and maternal iron deficiency anaemia and

the factors responsible for the formation of stromal fibrosis are normal ageing process and reduced uteroplacental blood flow along with fibrin deposition causes reduction in the villous surface area.¹⁵ Low oxygen causes cytotrophoblastic proliferation and leading to increase in syncytium thickness.¹⁵ Placental weight which is known to be increased in anaemia, and the histological feature of villous fibrosis which has been found to be the earmark of the placenta in anaemia, are both independent of the type or duration of existing anemia.¹⁶ The umbilical cord insertion was more towards the margin with the increase in severity of anaemia.¹⁷

AIMS AND OBJECTIVES:

- 1) Study of the histomorphology of placenta in cases of anaemia and control group.
- 2) Findings that help to explain adverse pregnancy outcome.
- 3) Findings predictive of possible recurrence that could guide care in subsequent pregnancies.

MATERIALS AND METHODS :

Source of data: Evaluation of 50 placentas of pregnant women with anaemia and 50 of healthy control received at tertiary care hospital

Study period: 4 months.

Study type: Observational Study.

Post surgical specimen:

Specimens were fixed by 10% neutral buffered formalin & processed preferably within 24 hrs of collection of specimen. Tissue sections were taken from membrane, proximal and distal umbilical cord 3 cm away from the insertion and end respectively, parenchyma and any abnormal looking areas. After routine paraffine processing, 3-5micron thick sections were cut and stained by Hematoxylin –Eosin method (H & E Method) and studied under low and high power and observations were recorded.

OBSERVATIONS AND RESULTS

The present study was conducted on the 100 placentas received at Histopathological section. Out of which 50 were control and 50 were anaemic cases.

Clinicopathological correlation

In present study mean age of pregnant women was 26.92yrs and 23.4yrs in control group and anaemic cases respectively, suggesting women with lower age group have higher chances of development of anaemia during pregnancy (Table 1).

Table 1 Correlation between age wise distribution of control group and anaemic cases

Age group (yrs)	No. and percentage of control	No. and percentage of anaemic cases
19-23	9 (18%)	23 (46%)
24-28	24 (48%)	09(18%)
29-33	15 (30%)	12(24%)
34-38	2 (4%)	06(12%)

64% women of second gravida in control group while 46% women of third gravida in anaemic group, suggesting that multiple pregnancy increase the risk of anaemia (Table 2).

Table 2 Correlation between gravida of women in control group and anaemic cases

Gravida of the women	Control group	Anaemic cases
Primigravida	26%	34%
Second gravida	64%	12%
Third gravida	10%	46%
Fourth gravida	0%	8%

Table 3 Grading of anaemia

Grading of anaemia	No. of the cases	Percentage (%)
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Mild (10-9gm%)	13	26%
Moderate (8.9-7gm%)	11	22%
Severe (<7gm%)	26	52%

Table 4 Correlation between weight of new born baby of control group and anaemic cases

Weight (kg)	No. and percentage of control	No. and percentage of anaemic cases
1-1.5	3 (6%)	23 (46%)
1.6-2	15 (30%)	12 (24%)
2.1-2.5	23 (46%)	08 (16%)
2.6-3	7 (14%)	04 (8%)
>3	2 (4%)	03 (6%)

Table 5 Correlation between physical condition of new born baby of control group and anaemic cases

Physical condition	No. and percentage of control	No. and percentage of anaemic cases
Normal	46 (92%)	11 (22%)
Asphyxia	3 (6%)	36(72%)
Death	1 (2%)	03 (6%)

Table 6 Correlation between physical condition of mother of control group and anaemic cases

Physical condition	No. and percentage of control	No. and percentage of anaemic cases
Normal	49 (98%)	18 (36%)
Shock	01(2%)	31 (62%)
Death	0 (0%)	01 (2%)

Mean weight of the newborn baby born to control group was 2.22kg; while that of anaemic 1.86kg, suggesting that anaemia during pregnancy has great impact on low birth weight baby (Table 4). Percentage of asphyxia and death of the newborn baby (Table 5) as well as shock and death of pregnant women (Table 6) is more in anaemic cases compared to control group, suggesting that maternal anaemia has worrisome effect on fetal and maternal wellbeing.

Histomorphological Correlation

Table 7 Correlation between gross features of the placenta in control group and anaemic cases

Gross features of the placenta	Control group	Anaemic cases
Average weight of placenta	425gm	480gm
Shape of placenta		
Circular	39(78%)	35(70%)
Oval	11(22%)	9(18%)
Irregular	0	6(12%)
Foetal surface	Normal	Normal
Membranes	Normal	Normal
Umbilical cord insertion		
Central	35(70%)	12(24%)
Eccentric	15(30%)	10(20%)
Marginal	0	28(56%)
Single umbilical artery	Nil	Nil
Mean umbilical cord length in centimetres	24.56	24.98
Knots in umbilical cord	Nil	Nil
Maternal surface		
Calcification	8(16%)	36(72%)
Paranchymal fibrosis	10(20%)	32(64%)
Retro placental hematoma	Nil	Nil

In present study irregular shape of the placenta, marginal insertion of umbilical cord (Fig. 1), calcification (Fig. 3, 5) and paranchymal fibrosis (Fig.2) were more in anaemic cases.



Figure 1: Marginal insertion of umbilical cord

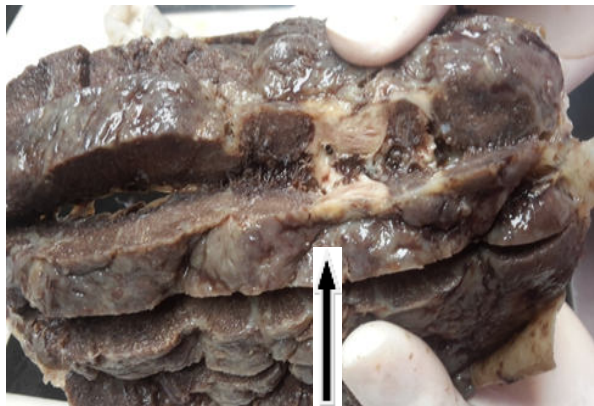


Figure 2: Paranchymal Fibrosis

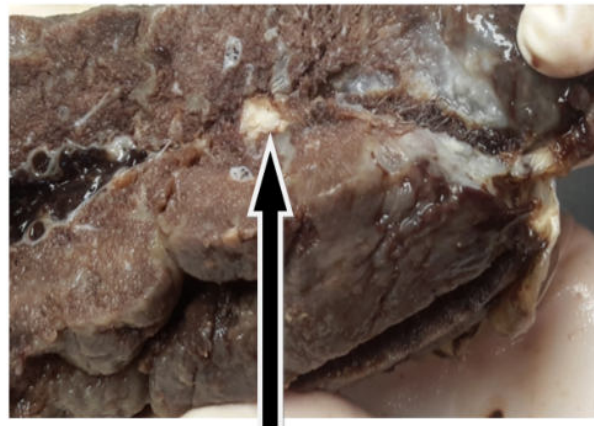


Figure 3: Calcification

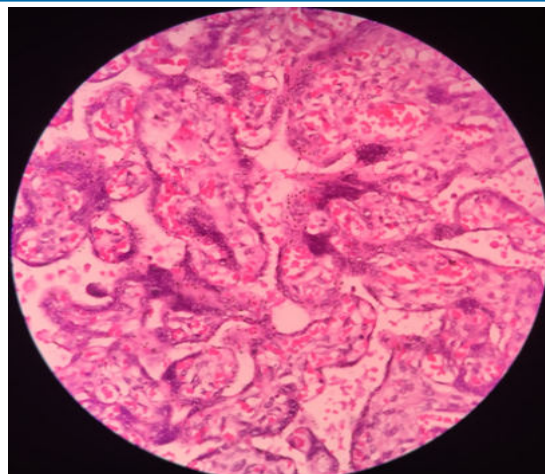


Figure 4: Syncytial knots (10x, H&E)

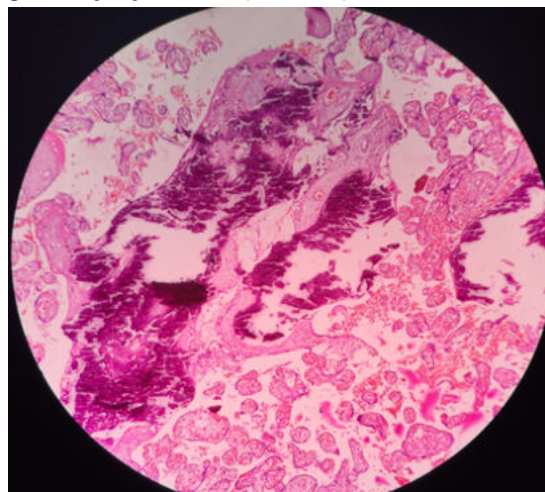


Figure 5: Calcification (10x, H&E)

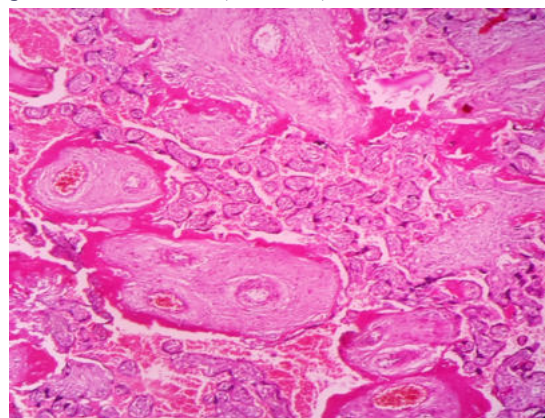


Figure 6: Fibrinoid necrosis (10x, H&E)

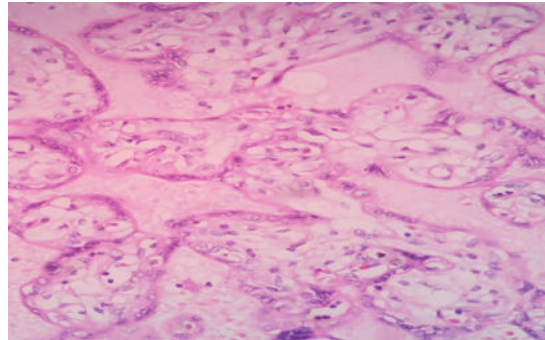


Figure 7: Hypovascular Villi (40x, H&E)

Table 8 Correlation between histological features of the placenta in control group and anaemic cases

Histological features of the placenta	% of the villi involved	Control group	Anaemic cases
Cytotrophoblastic Proliferation	≤ 20%	35(70%)	8(16%)
	>20%	0	26(52%)
Basement Membrane Thickening	≤ 3%	30(60%)	5(10%)
	>3%	0	23(46%)
Syncytial Knots (Fig. 4)	≤ 30%	10(20%)	1(2%)
	>30%	0	45(90%)
Stromal Fibrosis	≤ 3%	7(14%)	2(4%)
	>3%	0	30 (60%)
Fibrinoid Necrosis (Fig. 6)	≤ 3%	9(18%)	10(20%)
	>3%	0	40(80%)
Villous hypovascularity (Fig. 7)	≤ 30%	2 (4%)	2(4%)
	>30%	0	42(84%)

DISCUSSION:

Placenta is the most accurate record of the infants' prenatal experience K. Benirschke, (1981).¹⁸ After delivery if the placenta is examined minutely it provides much insight into the prenatal health of the baby and the mother. Anaemia is a one of common complications seen in pregnancy and contributes significantly to maternal and fetal morbidity and mortality. In developing countries, with uncared pregnancies, this entity on many occasions remains undetected till major complications supervene. Most obstetricians and paediatricians would agree that the examination of placenta often helps to explain an abnormal neonatal outcome. As in our country still many unbooked patients visit the hospital only for delivery, it may be possible to decide whether the pathological condition that endangered the well-being of the fetus was an acute or a chronic process. Conditions with the risk of recurrence can be recognized, resulting in counselling and management of subsequent pregnancies. Detail study of placenta morphologically done in cases anaemia and to know significant changes compared to normal and its fetal outcome.

Table 9 Comparison between various studies on anaemic cases regarding mean weight of the placenta

Various study	Mean weight of the placenta (gm)
Little ¹⁹	451
Gruenwald et al ²⁰	425
Gruenwald ²¹	488
Younszaï et al ²²	420
Shah et al ²³	522
Gopal Chandra Mondal et al ²⁴	466
Present study	480

In present study mean weight of placenta in anaemic cases was 480gm which is comparable with other study. Low birth weight babies are more commonly associated with severe anaemia. In this study 23 (46%) cases had weight of 1 to 1.5kg. These results are similar to studies done previously by Rani KU et al, Jain P. et al and Levy et al.^{25,26,27}

The umbilical cord insertion was more towards the margin with the increase in severity of anaemia as stated by Shashi Munjal Mongia et al.¹⁷ Similar finding was in this study showing 28 (56%) anaemic cases out of 50 had marginal insertion.

Table 10 Comparison between various studies on anaemic cases regarding mean weight of the newborn baby

Various study	Mean weight of the newborn baby (kg)
Little ¹⁹	3.2
Gruenwald et al ²⁰	3.0
Gruenwald ²¹	3.3
Younszaï et al ²²	3.3
Shah et al ²³	2.8
Gopal Chandra Mondal et al ²⁴	2.5
Present study	1.86

In present study mean weight of the newborn baby was slightly lower as compared to other study.

In the present study, light microscopy of placenta of maternal anaemia showed fibrinoid necrosis in 50(100%) cases, increased syncytial knotting in 46 (92%) cases and more hypovascular villi in 44(88%) cases as compared to those of the controls. Similar histological changes were observed by Mehrota et al. (1972), who observed increased villous fibrosis and syncytial knotting in placentas of anaemic mothers.²⁸ Dhall (1994) also found significant increase in the number of syncytial knots in anaemic placentas.²⁹ Villous hypovascularity, increased syncytial knots and fibrinoid necrosis were also noted by Joshi et al (1996).¹⁴ These features suggest hypoxia and reduced perfusion. Perivillous fibrin depositions were marked in the subchorionic areas and near the basal plates in some anaemic placentas.

Study done by Ram Hari et al showed perinatal death 5% in non-anaemic group & 11% in severely anaemic group.³⁰ Present study also showed early neonatal death 2 % in non-anaemic group out of 50 and 6 % in anaemic group out of 50.

CONCLUSION

Placental examination will help in understanding of the specific etiologies of adverse outcome which will lead to specific treatment and preventive measures for those with risk for recurrence in subsequent pregnancies. Present study suggesting that women with lower age group and with multiple pregnancies have increased the risk of anaemia during pregnancy. Anaemia during pregnancy has increase risk of low birth weight baby which may be the cause of asphyxia and death of the newborn baby as well as shock and death of pregnant women due to post partum haemorrhage and hypovolemia. Morphological features of placenta like irregular shape of the placenta, marginal insertion of umbilical cord, calcification, paranchymal fibrosis as well as Histopathological changes like Syncytial knots, Fibrinoid necrosis, Calcification, Fibrosis, Villous hypovascularity, Cytotrophoblastic proliferation and basement membrane thickening are more in placentas of anaemic cases, suggesting that more pathological changes in anaemic cases may be responsible for adverse maternal and fetal outcome. Present study supports the view that there is a very strong relationship between the placenta and high risk pregnancies like anaemia. Clinically, the adverse effects of anaemia on the outcome of pregnancy are well established but we have seen their gross morphological and microscopic impacts on placenta.

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