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Original Research Article

A study of placental morphology and correlation with colour doppler ultrasonography, maternal and neonatal outcome in high risk pregnancies

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ABSTRACT

Background: The placenta has multifaceted roles in foetal development and survival. Determination of placental abnormalities is very much essential in preventing intrauterine and perinatal morbidity and mortality. The aim of present endeavor was to study the placental histology and correlate with colour flow doppler ultrasonography, maternal and neonatal outcome.
Methods: A prospective comparative study was conducted in 50 antenatal women of >28 weeks gestation. Out of these, 25 cases of high risk pregnancies which included pregnancy induced hypertension, preeclampsia, intrauterine growth retardation (IUGR) and anaemia of chronic disease. Other 25 normal antenatal cases were taken as controls. All the women were subjected to colour doppler ultrasonography and study of placental histology done and results were correlated to maternal and neonatal outcome.
Results: The Doppler flow was abnormal in 44% of high risk groups. Abnormal histological changes were seen in all the high risk cases (100%). The mean diameter of the placenta (20.69 cms) and the mean birth weight in high risk group (2.34kgs) were comparatively less than that of control group. Abnormal histological changes were maximally found in high risk groups of abnormal Doppler in comparison to control group. Perinatal mortality (2.22%), Apgar score (90.9%), IUGR (4.44%) are higher in cases with abnormal histology of placenta compared to normal cases.
Conclusions: Placental abnormalities correlate well with the factors causing high risk pregnancies and the subsequent maternal and foetal outcomes. Placental examinations may help in better understanding of the mechanisms of placental dysfunctions that may contribute to more effective therapeutic strategies in the future.

Keywords: Colour doppler ultrasonography, High risk pregnancy, Maternal and foetal outcome, Placenta

INTRODUCTION

The placenta is crucial for foetal growth and survival, performing the most important functions of many somatic organs before birth. Thus, pathologic processes interfering with placental function may result in abnormalities of foetal growth or development, malformation, or stillbirth or CNS abnormalities.[1] Modern life's advent of technologies like ultrasonography are quite apt in localizing variations and detecting pathologies in high risk pregnant woman. Doppler flow velocimetry gives us the precise follow up

of hemodynamic events that happen subsequent to placental insufficiency.[2,3]

The aim of present endeavor was to study the morphology of placenta and its blood vessels in high risk pregnancies by Colour Doppler ultrasonography and correlate it with histology, and maternal and neonatal outcome.

METHODS

This is a one-year comparative and prospective study conducted in Department of Pathology, Andhra Medical College. This study includes a total 50 cases out of which 25 cases were of normal pregnancy in control group and 25 cases of high risk group.

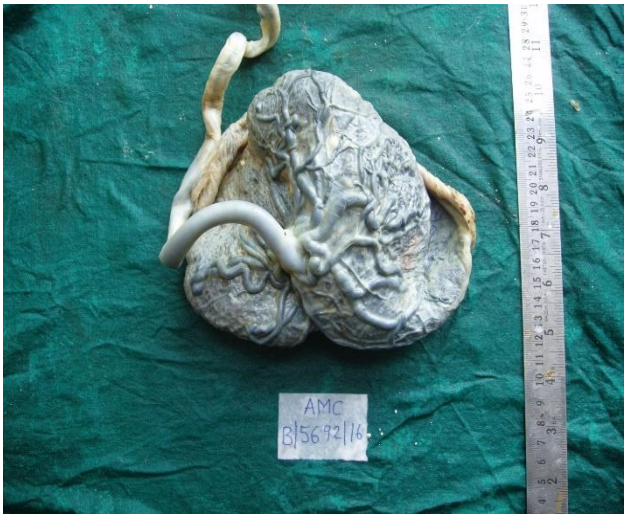

Figure 1: Gross photograph of small sized placenta weighing 350gms, measuring 15x12x2cm showing engorged veins with eccentric insertion of the cord in a case of preeclampsia.

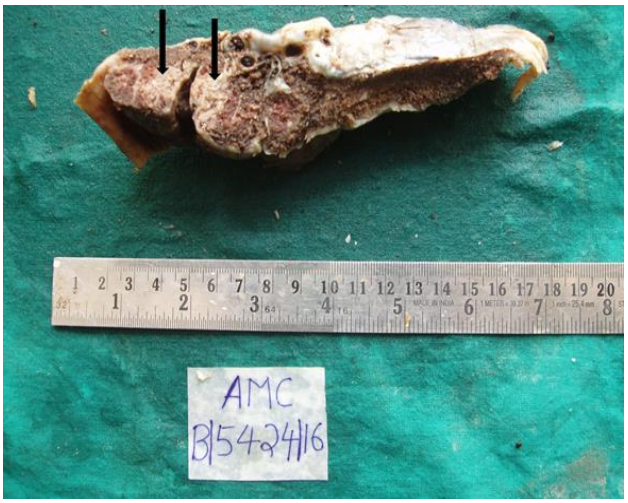

Figure 2: Gross photograph of cut section of placenta showing multiple infarcts (arrows) of 2x2cm size.

High risk pregnancy of >28 weeks gestational age (pregnancy induced hypertension, preeclampsia, suspected IUGR, anemia with heart disease) were included. Each patient was subjected to general physical examination, systemic examination and obstetric examination. Then each patient was subjected to serial colour Doppler ultrasound examination and obstetrical examination. The colour Doppler study was carried out using pulsed Doppler SONACE 8000 SE ultrasound system using 2.5 M.hz and 3.5 Mhz duplex transducers. Doppler readings were taken from umbilical artery. After the delivery the placenta was thoroughly examined. The placental weight, thickness, diameter and gross morphological fetaures were noted. (Figures 1 and 2) Umbilical cord was examined and manner of insertion of umbilical cord was noted. Maternal and neonatal outcomes were noted in the form of delivery, birth weight, APGAR score at 7min and perinatal mortality.

RESULTS

Maternal characteristics

Around 50 women selected for study were distributed into control and high risk group according maternal characteristics (Table 1).

Table 1: Maternal characteristics.

Maternal characteristics	Control group (25)	High risk group (25)
Mean age (years)	24.9	24.07
Primigravida (%)	11(44%)	14(56%)
Multiparity (%)	14(56%)	11(44%)

In the present study mean diameter of the placenta in high risk group is 20.69cm which is comparatively less than that of control group which is 21.84cm (Table 2).

In the present study mean birth weight in high risk group is 2.34kgs which is less than that of control group which is 2.85 kgs (Table 3).

In the present study doppler flow was normal in all cases 100% control group and 44% abnormal in high risk groups (Table 4).

Table 2: Diameter of the placentae (N=50).

Placental diameter in cms	Min.	Max.	Mean
Control (25)	18.6	28.8	21.84
High risk goup (25)	17	26	20.69

Table 3: Birth weight of newborn (N=50).

Birth wt. (kgs)	Min.	Max.	Mean
Control (25)	2.09	3.7	2.85
High risk group (25)	1.03	3.8	2.34

Table 4: Comparison of umbilical artery doppler flow in control and high-risk groups.

Doppler flow	Control group	High risk group	p value
Normal	25 (100%)	14 (56%)	0.0001 significant
Abnormal	0 (0%)	11(44%)	
Total	25	25	

In the present study abnormal histological changes were seen in 20 (80%) patients in control group and in high risk group all the 25 (100%) patients showed abnormal histological changes (Table 5).

Table 5: Distribution of cases according to presence/absence of histopathological changes in placenta.

Abnormal histological changes	Control group	High risk group
Absent	5 (20%)	0 (%)
Present	20 (80%)	25 (100%)
Total	25	25

Correlation of histopathological changes of the placenta with umbilical artery doppler flow in both control and high risk groups.

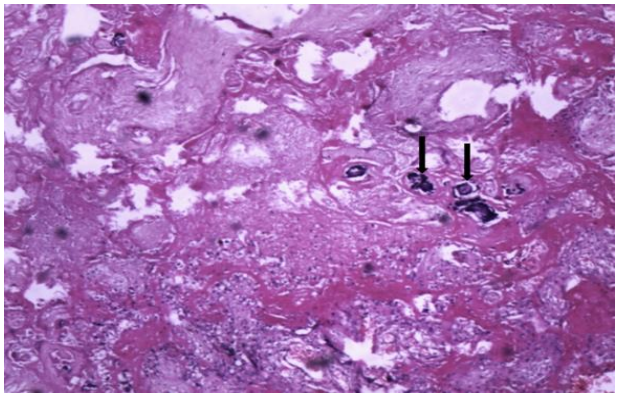

Figure 3: Villous infarcts with areas of calcifications (arrows) (H &E 100X).

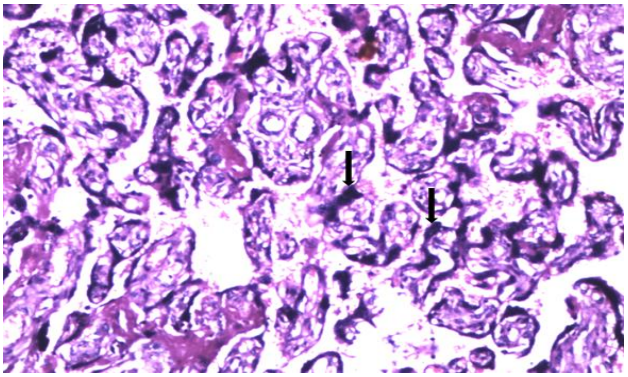

Figure 4: Increased syncytial knots (arrows) (H&E 100X).

In the present study abnormal histological changes; villous infarcts (54.54%) (Figure 3), syncytiotrophoblastic knots (54.54%) (Figures 4 and 5), hyalinized villi (72.72%) (Figure 6), thickening of villous trophoblastic basement membrane (27.27%) (Figure 7) and cytotrophoblastic proliferation (36.36%) (Figure 8) were maximally found in high risk groups of abnormal doppler in comparison to control group (Table 6).

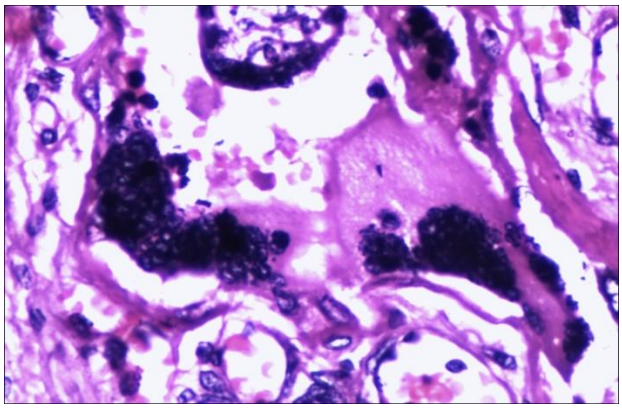

Figure 5: Increased syncytial knots (H&E 400X).

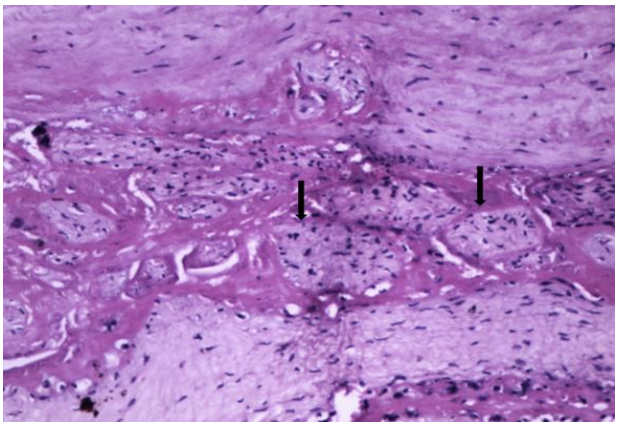

Figure 6: Hyalinised villi (arrows) surrounded by fibrinous material (H&E 100X).

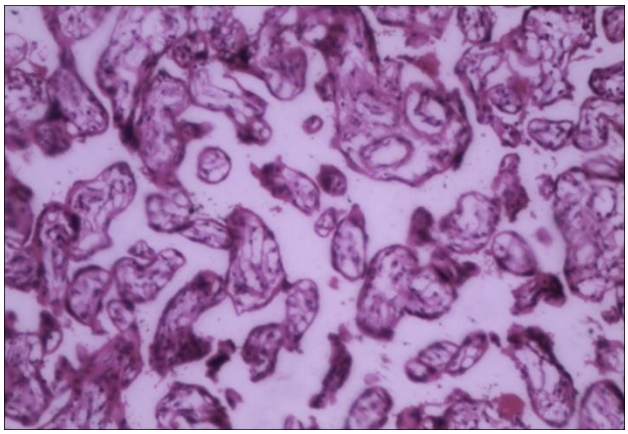

Figure 7: Thickened basement membrane (H&E 100X).

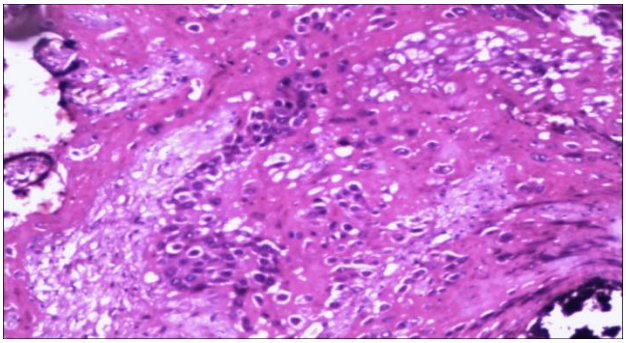

Figure 8: Cytotrophoblastic proliferation (H&E 100X).

Correlation between fetal and maternal outcome with umbilical artery doppler flow and histology of placenta

In the present study Perinatal mortality 1 (9.09%), Apgar Score 10 (90.9%), IUGR 1 (9.09%) are higher in cases with abnormal doppler flow compared to normal cases.

Cases with normal doppler shows more number of vaginal deliveries 87.18% whereas cases with abnormal doppler shows more number of caesarean section deliveries 6 (54.54%) (Table 7).

Table 6: Correlation of histopathological changes of the placenta with umbilical artery doppler flow in both control and high risk groups.

Histopathological changes	Umbilical artery doppler flow		
	Control group	High risk group	
	Normal	Normal	Abnormal
Villous infarcts	0	0	6 (54.54%)
Syncytiotrophoblastic knots	9 (36%)	6 (42.85%)	6 (54.54%)
Cytotrophoblastic proliferation	3 (12%)	4 (28.57%)	4 (36.36%)
Thickening of villous trophoblastic basement membrane	2 (8%)	3 (21.42%)	3 (27.27%)
Hyalinised villi	10 (40%)	9 (64.28%)	8 (72.72%)

Table 7: Correlation between fetal and maternal outcome with umbilical artery doppler flow.

Fetal outcome	Umbilical artery doppler flow		
	Normal (39)	Abnormal (11)	p value
Perinatal mortality	0	1 (9.09%)	0.04, significant
Apgar Score (<7 at 5 min.)	0	10 (90.9%)	0.001, Significant
IUGR	1(2.56%)	1(9.09%)	0.47, Insignificant
Maternal outcome	**Umbilical artery doppler flow**		
Vaginal delivery	34 (87.18%)	5 (45.45%)	0.008, significant
caesarean section	5 (12.82%)	6 (54.54%)	

Table 8: Correlation between fetal and maternal outcome with histology of placenta.

Fetal outcome	Histology of placenta		
	Normal (5)	Abnormal (45)	p value
Perinatal mortality	0	1 (2.22%)	0.736, Insignificant
Apgar Score (<7 at 5 min.)	0	8 (17.77%)	0.38, Insignificant
IUGR	0	2 (4.44%)	0.05, significant
Maternal outcome	**Histology of placenta**		
Vaginal delivery	5 (100%)	40 (88.88%)	0.239, Insignificant
caesarean section	0	5 (11.11%)	

Perinatal mortality (2.22%), low Apgar Score (90.9%), IUGR (4.44%) are higher in cases with abnormal histology of placenta compared to normal cases.

All cases with normal histology of placenta shows vaginal deliveries 100% whereas cases with abnormal histology shows 40 (88.88%) vaginal deliveries and 11.11% caesarean section deliveries (Table 8).

DISCUSSION

Placenta being a foetal organ shares the same stress and strain, to which the foetus is exposed. Thus, any disease process affecting the mother and foetus also has a great impact on placenta. The foetus, placenta and mother form a composite triad of dynamic equilibrium, and dysfunction of any one of them can affect the others.[4]

In the study on placenta Fox H, has stressed the importance of analyzing the placental pathology quantitatively and has stated that the importance of the lesions could be realized only when assessed in relation of foetal growth and maturation.[5]

In this study placenta and its blood vessels i.e., umbilical artery by colour doppler are correlated with histology of placenta. In this study, the diameter of placenta in high risk group was significantly reduced which mostly includes cases of preeclampsia. Kishwara S et al, Teasdale F, found significant reduction of transverse diameter in preeclampsia group; this reduction seems to be due to the small size of placenta in preeclampsia group.[6,7] Cibils LA, reported that the placentae from hypertensive patients were significantly smaller than the normal suggesting that the pathologic process interferes with the normal placental growth.[8]

In this study mean birth weight of babies born to high risk group are low when compare to newborn of control group. This is attributed to uteroplacental insufficiency and same finding has previously been reported by Udaina et al.[4] In this study, perinatal mortality and neonatal morbidity and incidence of caesarean section are significantly higher in groups with abnormal Doppler flow which is corelated with Seyam YS et al.[9]

In this study, histological findings like cytotrophoblastic cellular proliferation, syncytial knot formation, hyalinised villi and infarcts were present in greater amount in hypertensive placentae which is corelated with Deepti Gupta D et al, Majumdar S et al.[10,11]

Highly significant increase in the incidence of infarction, intervillous fibrin deposition, stromal fibrosis and syncytial knotting were found in IUGR placentas compared to full term normal placentas on microscopic examination. The incidence of basement membrane thickening and cytotrophoblastic hyperplasia were also higher in IUGR placentas. All the major histologic findings pointed towards reduced blood flow to the placentas resulting in the restriction of blood flow to fetus.[12]

Madazli R et al, showed that placenta from IUGR cases with abnormal umbilical artery doppler velocimetry had a significantly increased number of villous infarcts, cytotrophoblastic proliferation and thickening of villous trophoblastic basement membrane.[13] Abnormal placental pathology was significantly associated with abnormal umbilical artery doppler velocimetry. The patients with abnormal doppler velocimetry had lower mean birth weight.[13] In the present study perinatal mortality, low Apgar Score, IUGR are higher in cases with abnormal histology of placenta compared to normal cases which correlated with study by Gupta D et al.[10]

CONCLUSION

Although placental abnormalities cannot be modified to improve the perinatal outcome, identification in the antenatal period, and early referral to hospitals, can decrease the associated maternal and perinatal morbidity and mortality. Morphological and histopathological examination will help investigate the mechanism of placental dysfunction in detail. With this knowledge, more precise intervention strategies can be devised and can contribute to more effective therapies in the future.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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