

Gross and Histological Alteration in the Placenta of Mothers Suffering from Gestational Diabetes

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ABSTRACT

OBJECTIVE: This descriptive study aimed to observe the anatomical including both and microscopic changes in diabetic placenta to increase our knowledge as very few studies are done on anatomy of placenta.

INTRODUCTION: The placenta is a dynamic organ of unique function with short life-span. It is physiological site of exchange between maternal-fetal circulation. It is responsible for respiratory, nutritional, excretory, endocrine, and immunological functions.

MATERIALS AND METHODS: Macroscopic and microscopic examination was carried out on total of 50 freshly delivered placentae from diabetic's mothers. Variables used for macroscopic examination are weight, diameter, number of cotyledons. On histology degenerative changes, fibrinoid necrosis, vessel thrombosis and infarction were examined.

RESULTS: Morphological examination of placentae of diabetic mothers showed larger, heavier and more cotyledons. Similarly microscopic examination revealed dilated blood vessels, necrotic and degenerative foci, thrombosis and infarction in placentae of diabetic mothers.

CONCLUSION: An adequate knowledge of the placental changes can prove to be valuable in the understanding the complications to fetus caused by diabetes. This study shows significant changes in placenta on gross as well as on microscopy. Out of many abnormal changes infarction is single most important change. Infarction lead to fibrin deposition in villi and leading to avascularity hence uteroplacental insufficiency which is important factor for fetal development.

KEYWORDS: Diabetes, macroscopic, placenta, macroscopic, cotyledons..

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INTRODUCTION

The placenta is a complex organ which integrates signals from the fetus and the mother in an effort to match fetal demand with maternal nutrient supply so play crucial role in fetal growth and well-being^{1,2}. Maternal diseases, which result in abnormal growth and development of placenta during pregnancy are directly associated with impaired fetal growth.³ Diabetes Mellitus (DM) affects nearly 2-5% of all pregnancies^{4,5}.

DM during pregnancy produces various placental abnormalities such as thickening of basal membranes of trophoblast, distension and proliferation of endothelial cells, disarrangements of perivascular space and decrease of vascular surface of terminal villi. These pathological changes in the placentae of diabetic mothers are in turn important risk factors contributing to fetal anoxia and fetal compromise in pregnancy^{6,7}. Alterations in placental function due to uncontrolled diabetes result in disturbances in growth and develop-

ment, macrosomia, congenital malformations and intrauterine growth retardation^{8,9}.

This study is aimed to detect possible gross and microscopic changes in the structure of placentae of diabetic mothers which contribute to pregnancy outcome.

METHODS

Fifty placentae of full term pregnancy from mothers with a history of gestational diabetes were collected from labour room/ operation theatre of gynecology and obstetrics department, Liaquat university hospital Hyderabad/Jamshoro Sindh, Pakistan.

Subjects included in this study were aged between 20–35 years and with history of gestational diabetes. All mothers with pre-existing diabetes and below 20 or above 35 years of age were excluded from the study. There were no racial, cultural or environmental differences among the subjects. All were from low socioeconomic group. The parity ranged from primi gravida to gravida 6. All placentae obtained; were either deliv-

ered by vaginal route or by Cesarean section; after taking consent on prescribed proforma. The collected placentae were washed in running tap water and preserved in 10% formalin after trimming amnion and chorion for 48 hours for fixation. The umbilical cord was cut 5 cm away from its site of insertion and placentae were tagged with code numbers.

Morphological/gross or Macroscopic examination:

The study of gross morphology was carried out in the department of Anatomy, Liaquat university of Medical and Health Sciences Jamshoro, Sindh Pakistan. The shape and consistency of the placentae were examined. Once inspected, weight of placentae was measured on a weighing machine graduated in grams, diameter was measured with the help of a measuring tape in centimeters, and thickness in center was measured by piercing thick needle and then measured with scale. Cotyledons were counted by taking placenta in both hands in such way that gentle pressure was applied on the central part of the fetal surface with thumbs of both hands while holding the periphery of the placenta with the other fingers. By this procedure, the cotyledons on the maternal aspect became prominent and separated. The counting was started from the left side of the one end of the placenta going rightward and again turning back to the left in a way of

loop. This counting procedure was repeated until the other end of the placenta was reached. The total number of cotyledons was recorded^{10, 11}.

Microscopic Examination

Placenta was cut along the maximum diameter into two halves. Approximately one cm piece of placenta was cut from one half and were processed for routine paraffin embedment, sections were made with the help of automatic microtome and slides were prepared, stained with Haemotoxylin & Eosin. The slides were then allowed to dry before being mounted in DPX (non aqueous mounting medium for microscopy containing Xylen mixture of isomers Dibuty Phthalate) and covered with cover slips. The prepared slides were examined under light microscope on 10 HPF and photo micrographs were taken as described previously¹².

RESULTS

Shape and consistency of placenta

All the 50 placentae were discoid in shape with soft consistency. Out of 50 diabetic placentae weight ranges b/w 700 to 1000 grams, diameter ranges b/w 20 to 25 centimeters whereas thickness ranges between 2.4 to 3 centimeters and number of cotyledons in diabetic placentae were minimum 25 and 35 maximum as shown in table I.

TABLE I: SHOWING WEIGHT, DIAMETER, THICKNESS AND NO. OF COTYLEDONS OF DIABETIC PLACENTAE

Weight in Grams	No. of Placentae	Diameter in cms	No. of placentae	Thickness in cms	No. of Placentae	Cotyledons in Placentae	No. of Placentae
700	6 (12%)	20	1 (2%)	2.4	3 (6%)	25	5 (10%)
750	2 (4%)	21	3 (6%)	2.5	4 (8%)	27	7 (14%)
800	17 (34%)	22	5 (10%)	2.6	2 (4%)	29	6 (12%)
850	2 (4%)	23	14 (28%)	2.7	2 (4%)	30	11 (22%)
900	11 (22%)	24	14 (28%)	2.8	13 (26%)	32	12 (24%)
950	2 (4%)	25	13 (26%)	3	26 (52%)	35	9 (18%)
1000	10 (20%)						

TABLE II: SHOWS MICROSCOPIC/HISTOLOGICAL CHANGES IN DIABETIC PLACENTA

	Degenerative changes/ Fibrinoid necrosis	Vessel Thrombosis	Infarction	Avascular with villous fibrinoid necrosis	Nucleated RBC
Grade 0	00	05	13	04	20 cases
Grade 1	6	13	19	15	30 cases
Grade 2	26	22	12	17	
Grade3	18	10	06	14	

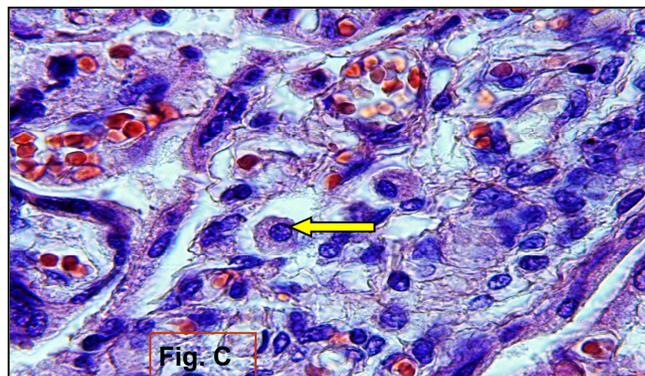
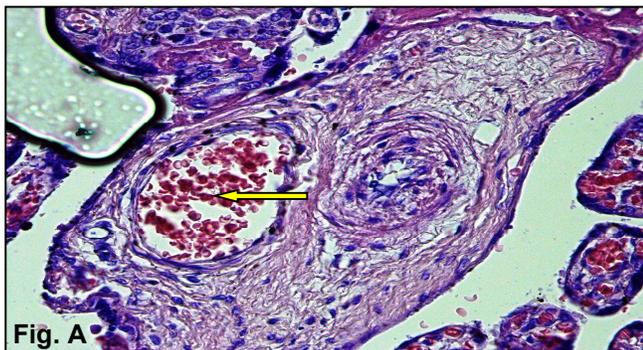
Various microscopic changes (shown in table 2) are analyzed and graded as under.

- Grade 0, No foci
- Grade 1 1-5 foci
- Grade 2 6-10 foci
- Grade 3 more than 10 foci.

FIGURE I: SHOWING GROSS MORPHOLOGY OF PLACENTA OF DIABETIC MOTHER SHOWING INCREASED NUMBER OF COTYLEDONS AND LARGE SIZE



FIGURE II (A,B,C): SHOWING PHOTOMICROGRAPH OF 5 MM SECTIONS OF PLACENTA OF DIABETIC MOTHERS STAINED WITH H& E UNDER MICROSCOPE (MAGNIFICATION X 40). (A) SHOWING SHOW DILATED BLOOD VESSELS, (B) SHOWING NECROSIS (C) SHOWS FEW NUCLEATED RBCS INDICATED BY (YELLOW ARROWS) RESPECTIVELY



DISCUSSION

Diabetes mellitus is a common metabolic disorder. Apart from affecting major organ systems of body diabetes mellitus during pregnancy produces complications both in mother and offspring. It is believed that if metabolic control is good, perinatal mortality should not be higher than general population. Serious complications of maternal diabetes on fetus are congenital malformations, macrosomia and intrauterine growth retardation. Maternal diabetes is associated with many placental abnormalities such as placentomegaly, infarcts, abnormalities of the basement membrane and abnormalities of placental villi such as fibrosis. The most consistent of these features is the enlargement of the placenta, which is usually associated with fetal macrosomia^{13, 14}.

The placenta is highly specialized organ of pregnancy that supports normal growth and development of the developing fetus. The fetus, placenta and mother form a triangle of dynamic equilibrium. Disturbances in any of these affect the others. Pregnancies complicated by gestational diabetes mellitus (GDM), have been associated with alterations in placental anatomy and physiology. These changes significantly based anatomical and/or even molecular level including aberrant villous vascularization which enhanced oxidative stress^{15,16,17}. This study indicates that all placentae from pregnancies complicated by diabetes mellitus, regardless of age, parity and onset of diabetes were larger in size, more in weight and had more cotyledons. These findings are comparable to the findings of a study carried out by Ashfaque and his fellows, which showed significant increase in the weight and size of placentae of diabetic mothers. In another study gross examination of placenta revealed that weight of placenta from diabetic mothers was more with histological alterations more in the form villous immaturity and dysmaturity in diabetic placenta^{18, 19}.

These findings are in line with one previous study conducted to compare gross and histological pathologies of placentae from mothers complicated by gestational diabetes with controls. The study showed same

histological abnormalities such as nucleated fetal RBCs, fibrinoid necrosis, are observed in our study²⁰. Similar findings were also observed in another study conducted by Madazli and fellows. Although no gross abnormalities were observed in placentae of diabetic mothers by Verma and his fellows, however histological findings such as fibronoid necrosis, villous edema, villous fibrosis were exhibited which further support our findings. Histological pathologies such as the presence of nucleated fetal red blood cells, fibrinoid necrosis, villous immaturity and chorangiosis were observed more often in the diabetic placentae^{21, 22}.

Maqseed and Tewari define the infarction is characterized by the deposition of fibrin in the decidua basal is that extends into the intervillous space entrapping chorionic villi. Avascularity of chorionic villi is also a predominant feature of diabetic placenta. The histological findings of their studies coincide with findings observed in present studies^{23, 24}.

As this study is conducted on low socioeconomic, uneducated and rural population of Pakistan and majority of women from these areas are unaware about the dietary plans during pregnancy and also are unaware regarding achievements of good glycemic control and taking of medications or diets full of antioxidants and other nutrients. It is therefore advisable to create mass awareness in these less developed areas of Pakistan in order to save the life of mother and offspring.

CONCLUSIONS

The placenta in pregnancy complicated with diabetes is generally larger than normal with numerous structural abnormalities which may affect fetal growth and development so study of microscopic structure of placenta is significantly helpful.

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