ORIGINAL ARTICLE:

Placental Gross Morphology in Gestational Diabetes Mellitus

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ABSTRACT:

Objective: To examine the placental gross morphological features in patients having gestational diabetes mellitus.

Materials and Methods: One hundred patients were enrolled following written informed consent. At term the placentae were collected, preserved in formalin. Examination was done for size, shape, consistency, color, membrane completeness, detailed cord examination and for any gross pathology on cut section. The mean was taken out for numerical parameters and percentages were calculated for categorical data using SPSS version 16.

Results: Mean placental size was 15.98±2.75 cm and 13.58±2.54 cm. The mean placental width was 2.4±0.67 cm, mean weight of placentae was 630±137.4gm. Out of 100, 73 placentae were disc shaped,66 were soft, 85 had complete membrane covering ,59 were pale in color, 66 had central cord insertion and 30 had blue discoloration of the cord.23 had brown lesions, 29 had white lesions and 17 had both types of lesions whereas remaining 35 had no gross lesion.

Conclusion: Examination of the placental gross morphology in patients having gestational diabetes mellitus revealed features which necessitates that placenta should be examined in the labor rooms after delivery in GDM patients as it provides important information regarding prenatal life of the new born.

Keywords: Placenta, Placental examination, Placental size, Placental shape, Placental consistency, Cord examination.

INTRODUCTION:

Placenta is an important organ of communication between the mother and the growing fetus.[1]It is essential for the survival of the fetus of all the mammals. The successful development, growth and maturity of placental vessels are important for normal fetal growth and continuation of pregnancy[2] Human placenta has a complex vascular system that allows exchange of different materials with fetal and maternal blood without actual mixing of the two. The maternal surface of placenta is divided in too many portions known as cotyledons. With the progressive development primary, secondary and tertiary villi are formed. Villi are the functional unit of the placenta[3]. On gross examination the placenta is a round disc like structure with multiple cotyledons on the maternal surface. The chorion and amnion are the membranes covering fetal part of placenta, with the large number of chorionic vessels converging towards the umbilical cord. At birth the umbilical cord may be 5 0-60 cm in length with 1.5- 2 cm in diameter. It has a tortuous structure forming spirals and false knots. Excessively long cord may entangle the fetal neck causing strangulation[4]Cotyledons receive blood from multiple spiral arteries. These 80-100 spiral arteries cross the maternal decidual plate and enter the intervillous space. There is development of pressure as spiral artery narrows in the end in inter villous space. The villous tree baths in the oxygenated blood. When the pressure is decreased, the blood flow back to the maternal circulation. Intervillous space contains approximately 150 ml of blood at one time and is replenished 3-4 times per minute. Placental circulation does not take place in all of the villi. Placental membrane separating maternal and fetal blood consists of endometrial lining, connective tissue in villous core, cytotrophoblast and finally syncytiotrophoblast[5].

During the 9 months period, placenta performs multiple functions. Nutrients and electrolytes are transferred to the growing fetus such as amino acids, free fatty acid, carbohydrates, folic acid and vitamins. Exchange of gases oxygen, carbon-di-oxide and carbon mono oxide occurs as simple diffusion.20-30ml of oxygen is diffused per minute through placenta. Placenta releases multiple hormones especially progesterone is the main hormone necessary for the continuation of pregnancy. Besides estrogen, placental lactogen (growth like hormone having strong diabetogenic effect), human chorionic gonadotrophin (used for detection of pregnancy in urine test) are the other important

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Received: May 22, 2014 Revised: June 3, 2014 Accepted: June 4, 2014

Placenta acts as a barrier and does not allow crossing of multiple infections and drugs from maternal circulation to the fetus At birth placenta is torn from maternal uterine cavity and is expelled out after approximately 30 minutes of delivery. Much of the decidua remains inside the uterine cavity and is expelled from the body with uterine bleed.[6]

Placenta is not being studied routinely unless and until a doctor wants to know the pathophysiology in certain bad obstetric outcome, as it can provides extensive information and facts regarding infants prenatal experiences.7 Present study was designed to examine the placental gross morphological features in patients having gestational diabetes mellitus.

MATERIALS AND METHODS:

1. The study was approved by the IRB & ERB of Dow University of Health Sciences
2. After the written informed consent a total of 126 diagnosed GDM patients were enrolled from diabetic obstetric clinics of Mamji and Lyari General Hospital, in 6 months duration.
3. Placentae were collected from 100 diagnosed GDM patients who delivered at term per vaginally and through caesarean section at the above specified places ,after 3 0-40 minutes of delivery
4. GDM patients without any other co-morbidity were included in the study.
5. GDM patients with HBA1C within control limits were included in the study.
6. Placentae were preserved in 10% formalin labeled containers of adequate sizes
7. In gross examination of placenta8:
   - Shape and color was observed by placing the fetal side on the top of the cutting board.
   - Placental weight was measured by using a kitchen weighing machine.
   - Consistency was observed by finger tips.
   - Size was measured by using simple measuring tape in all three dimensions (x, y, z)
   - Examination of membranes was done for any obvious hemorrhages, color and transparency.
   - Cord examination was done for the site of insertion of the cord and color of the cord
   - Examination of fetal and maternal surfaces was done for any gross pathology in the placental tissue.
8. Placenta was cut with a sharp knife in pieces of 1.5 cm approximately to observe any other obvious deformity or lesion in placental tissues.
9. All the parameter findings were documented on a predesigned data form.

STATISTICAL ANALYSIS:

Means were calculated for numerical values and percentages were carried out for categorical data, using SPSS 16.

RESULTS:

Mean age of our study participants was 30.3 1±3.83 years. Mean placental size was 15.98±2.75 cm and in other dimension (placental size 2) wasl3.58±2.54 cm. The mean placental width was 2.4±0.67cm.The mean weight of placentae was 6.2±137.4kg.(Table 1)When placental shapes were evaluated, it was observed that out of 100 placentae 73 were disc like and 27 were of certain other shapes (oval and irregular).66placentae were soft whereas 34 were found hard in consistency. Out of 100, 85 placentae had complete membrane covering whereas 15 had incomplete membranes. When color of the membranes was evaluated it was noticed that 70 placentae were pale and 30 were reddish in color. On cord examination, 66 cords were inserted centrally and only 34 had peripheral insertion. 70 of the cords were pale whereas 30 of them had blue color. When placental pathology was done on cutting 1.5cm sections it was seen that 23 placentae had brown lesion, 29 placentae had prominent white lesions 17 placentae had both types of lesions whereas 35 had no lesions (Table 2)

Table 1
Gross Examination of Placentae
N=100

Placental Variables	Mean ± SD
Placental size1(cm)	15.98±2.75
Placental size2(cm)	13.58±2.54
Placental width(cm)	2.41±0.67
Placental weight(gm)	630±137.4
Cord length(cm)	43.1±7.45
Cord width(cm)	1.5±0.49

Table 2
Gross Examination of Placentae
N=100

Placental Variables	Percentage (%)
Placental shape	
Disc-like	73
Non-disc like	27
Placental consistency	
Soft	66
Hard	34
Cord color	
Blue	30
Pale	70
Cord insertion	
Central	66
Peripheral	34
Membranes	
Complete	85
Incomplete	15
Membrane Colour	
Pale	59
Normal	41
Gross deformity:	
Present	69
Brown lesions (haemorrhage)	23
White lesions (infarction)	29
Both	17
Absent	35

DISCUSSION:

Mother - Placenta - baby act as a single unit with the placenta having the central position between the two. It is the main communicating factor between the growing fetus and the mother and any effect produced in the mother is transmitted to the fetus through the placenta[9] It has both maternal and fetal components. Due to pathological reason when maternal milieu is different from the normal, the placenta also exhibit changes. When the first two of the above mentioned triad (mother and placenta) are affected, impact is also produced on the third part that is the baby. Our results have shown that the mean size of placentae in two dimensions were 15.98cm and 13.58 cm with the width of 2.4 1cm. Then mean weight of our samples was 63Ogms.Mean length of the cord was 44 and cord width was 1 .5cms. Joseph stated that in humans, the normal placenta averages 22 cm (9 inch) in length in both the dimensions and 2—2.5 cm (0.8—1 inch) in thickness. It typically weighs approximately 500-600 grams. It has a pale, dark reddish or maroon color. It is connected to the fetus by an umbilical cord of approximately 5 0—60 cm (22— 24 inch) in length[10]Our results are not coinciding to those described by Joseph. Dombrowski has highlighted that thick placentae are associated with perinatal mortality, lower apgar score and adverse fetal outcomes.[11]

Normally placentae are discoid in shape, our results indicated that 73 placentae had normal disc shape and remaining 27 were either oval or irregular shape. Whole of the tissue is covered with membranes in 85 placentae. Jansson and Haffner have documented that reduced placental growth, reflected by its weight and volume, generally precedes diminished fetal growth.[12,13] As importantly, placental weight can be modified by maternal metabolic changes because placental weight at delivery is more when mothers receive high carbohydrate diet in the first trimester and high protein loads in end pregnancy [14]and it also correlates the weight of the infant[15,16] The placenta is typically described as round or oval in shape, but other shapes such as irregular, bilobate, or circumvallate can also be seen in clinical practice[17] Irregular placental shapes have been associated with lower infant birthweight,[18]suggesting that it might be associated with altered placental function. It has been proposed Kajinti that Women with preeclampsia have placentae with reduced surface area and the shape is more of oval than round [19]Salafia and Yampolsky conducted a detailed study to evaluate placental proportions and concluded that deviations in placental shape and relative thickness modify placental functional. [20,21]In our study 27 placentae had shapes other then discoid. This could have accounted for modified placental functions in the respective babies.

Our results indicate that on cord examination, 66 cords were inserted centrally while 34 had peripheral insertion. Insertions of the umbilical cord into the placental margin rather than into the main placental mass are well known to be associated with small placentae and subsequently smaller infants. However, Salafia and colleagues recently have applied mathematical analyses to the gross parameters of the placenta and had finally concluded that non marginal eccentric, cord insertion associates with reduced transport efficiency of the placental vasculature, and a reduced birth weight of the baby. Placentae which have a non-centrally inserted umbilical cord are usually heavier because of increased thickness due to developmental plasticity of the placenta to supply fetal demands for nutrients. This whole suggest that infants with eccentric insertions of the umbilical cord may be predisposed to effects of fetal programming that are not directly related to maternal nutrient deficiency or reductions in the maternal supply line to the placenta. It has also been indicated that the development of the gross appearance of the placenta can influence fetal outcomes and, in the process, predispose the fetus to programming.[22'23]

85 placentae had complete membranes and cotyledons in our results. Yatter has emphasized that maternal surface of the placenta should be inspected for the cotyledons and completeness of membranes. At times an entire placental lobe (e.g., succenturiate or accessory lobe) may be present and can be left inside the uterus. The color of maternal surface should also be assessed properly.

In our results 59 placentae were pale colored. Yatter documented that pallor of the maternal surface indicates the presence of fetal anemia and can be related to anaemia in mother. Anaemia in females is highly common in our population[24]Excessive thickening of the placenta can be related to increased calcification and it can also be a complication of storage of placentae in the formalin. Extra soft and spongy placenta can indicate excessive insulin release in the fetus due to gestational diabetes. In our results 66 placentae were soft.[25]

Benirschke has given in detail that firm areas in the placenta may represent fibrin deposition or infarction. These hemorrhages and infarcts affect the obstetrical outcome. Fresh infarcts are red, while older infarcts appear gray. Fibrin deposits are usually whitish gray and, if extensive, may be associated with intrauterine growth retardation and other poor fetal outcomes. Hemorrhages appear jelly like, dark red in color.[26]In our study brown lesions indicative of hemorrhages were 23%, white lesions indicative of infarctions were 29%and 17% GDM patients had both brown and white lesions both. This implicates that blood supply to these babies in utero was defective.

CONCLUSION:

Examination of the placental gross morphology in patients having gestational diabetes mellitus revealed features which necessitates that placenta should be examined in the labor rooms after delivery in GDM patients as it provides important information regarding prenatal life of the new born.

ACKNOWLEDGEMENTS:

The authors are highly thankful to all GDM patients who participated in this study.

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