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RESEARCH ARTICLE

A COMPARATIVE STUDY OF MORPHOLOGY OF PLACENTA IN NORMAL AND HIGH RISK PREGNANCIES

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Abstract

BACKGROUND Placenta forms a vital link between mother and fetus. Status of both maternal and fetal health is reflected in placenta. Complications of pregnancy and high risk pregnancies may lead to changes in placenta or vice versa.

OBJECTIVE Evaluation of the morphology of placenta in various high risk groups and a control group.

METHODOLOGY The study was conducted in the department of Gynecology and Obstetrics Government Medical College Srinagar over a period of two years and recruited 100 patients in the control group and 100 patients each in the three high risk groups vie Gestational Hypertension; Gestational Diabetes Mellitus and Intra Uterine Growth Retardation. After taking informed consent all patients were subjected to a detailed history taking and a thorough general, systemic and obstetric examination. Routine investigations were performed and examination of the placental morphology was undertaken

.STATISTICAL ANALYSIS Statistical Data was described as mean±standard deviation and percentages. The parametric data was analyzed by student's t-test whereas Mann-Whitney 'U' test and Chi square tests were applied for non-parametric data. All p-values of less than 0.05 were considered significant. Software used were Statistical Package for Social Sciences (SPSS 10; Chicago) software program.

RESULTS The mean age among all groups was comparable ($p > 0.05$). The gestational age at time of delivery was significantly higher in controls as compared to intra uterine growth retardation group and gestational diabetes (38.2 ± 1 vs. 37.3 ± 0.5 and 38.2 ± 1 vs. 37.2 ± 0.5; $p < 0.001$) insignificant difference in gestational age between controls and gestational hypertension group (38.2 ± 1 vs 37.7 ± 0.8; $p < 0.05$). 80% patients were primigravidas in gestational hypertension compared to 56%, 56% and 40% respectively in the controls, intra uterine growth retardation group and gestational diabetes ($p < 0.05$). Significant difference when gestational diabetic patients were compared to gestational hypertension patients (40% v/s 80%; p=0.004). The systolic and diastolic blood pressure was significantly higher in gestational hypertension group as compared to other groups ($p < 0.001$). The incidence of edema was significantly higher ($p = 0.001$) in gestational hypertension group (68%) as compared to controls (12%), intra uterine growth retardation (12%) and gestational diabetes patients (16%).The placental weight of controls was significantly more than IUGR (509 ± 38.6) vs. (426.2 ± 48.1) but less than gestational diabetes mellitus.(509 ± 38.6) vs. (592 ± 66.1).The placental diameter in Gestational Diabetes was significantly more than all other groups (controls, gestational hypertension, and IUGR) (21.3 ± 2.9 vs. 17.4 ± 1.4 ; 17.8 ± 1.4 and 16.9 ± 1.3).($p<0.001$), The thickness of placenta was comparable among controls and gestational hypertension (1.9 ± 0.2 vs. 1.9 ± 0.2) whereas significant difference was observed between IUGR and

Gestational Diabetes (1.7 ± 0.2 vs. 2.3 ± 0.3). Multiple infarcts were significantly higher in IUGR patients compared to controls (p = 0.02).

INTRODUCTION

Mother and baby form an intimate relationship which begins right from conception and starts to grow in utero and this relationship is cemented by the placenta. The placenta develops from the chorion frondosum of the conceptus and grows along with the fetus right up to term and it is the placenta that provides the fetus with nourishment removes its metabolic wastes and maintains the wellbeing of the baby.

As the fetus grows and develops, so does the placenta and thus changes in the status of fetal health are reflected on the placenta and vice versa where it is assumed that it is the health of the placenta that determines the health of the fetus. The placenta though has a very short life span from conception to delivery yet it is in constant state of change in its morphology and its appearance changes as gestation proceeds and these changes may also reflect the changes in the fetomaternal milieu, whether physiological or pathological. The placenta can thus be presumed to have a record of the fetomaternal mileui with changes in the latter leaving its imprint on the former or vice versa.

The placenta is rarely subject to any scrutiny and is under examined as compared to the mother and fetus. The examination of placenta may provide information about various lesions in placenta and their association with various complications of pregnancy like preterm delivery, Intra Uterine Growth Retardation, Gestational hypertension, diabetes etc.

The present study was focused on the evaluation of the morphology of placenta in various high risk groups and a control group.

MATERIAL AND METHODS

The present study was conducted in the Department of Obstetrics and Gynecology, Government Medical College, Srinagar. The patients were recruited from Government Lal Ded Hospital attached to Government Medical College, Srinagar. During the study period 400 pregnant females with term pregnancies (gestation age ≥ 37 weeks calculated from the 1st day of last menstrual period) were recruited. An informed consent was obtained from all patients. Four groups of patients were enrolled as follows:

1) Controls
2) Gestational hypertension
3) Gestational diabetes mellitus
4) Intrauterine growth retardation

Normal full term pregnancies (Control)

100 Rh positive patients with Gestational age of 37 - 40 weeks with a Single viable fetus, No congenital abnormality, No systemic disease, **Normal** blood pressure, Normal liver functions, blood urea, glucose and urine analysis formed the control group.

Gestational hypertension (G-HTN)

100 Rh positive patients with Gestational age 37 - 40 weeks who were diagnosed as gestational hypertension according ACOG criteria (Systolic blood pressure >140 mmHg and diastolic blood pressure >90 mmHg on two separate occasions more than 6 hours apart after 20 weeks of gestation and normalization up to 12 weeks postpartum) with No history of past hypertension, having a Single viable fetus without any congenital abnormality, No proteinuria, no systemic disease, Normal liver functions, blood urea, glucose and urine analysis.

Gestational Diabetes Mellitus

100 patients of Rh positive status with a Gestational age 37 – 40 weeks who were diagnosed as gestational diabetes mellitus according to Carpenter and Couston criteria **having a** Single viable fetus, No congenital abnormality, Normal blood pressure, No proteinuria, No systemic disease and having Normal liver functions, blood urea, and urine analysis.

Intrauterine Growth Retardation (IUGR)

100 Rh positive patients having a single viable fetus of Gestational age between 37 -40 weeks with Sonograpgic estimated fetal weight below the 10^{th} percentile for the gestational age with no associated disease or congenital abnormality having a normal blood pressure, No proteinuria or systemic disease (diabetes mellitus, infections and others) and Normal liver functions, blood urea, glucose and urine analysis

All recruited patients underwent detailed history taking, meticulous general, systemic and obstetric examinations. The baseline investigations like Haemogram, Blood Grouping and Rh typing, HIV, HBsAg, Thyroid stimulation test, Liver function tests, Urea and Creatinine, Uric Acid, Blood sugar, Urine Examination(Sugar, Albumin, Microscopy) and USG – Obstetric, routine were carried out in all patients and Doppler in selected cases.

Collection of Placenta:

Just after delivery the placenta was collected in a clean tray. The membranes and cord at their attachment to the placenta were cut off. The umbilical cord was ligated leaving a 2 cm stub attached. The placenta was gently expressed so as to remove its blood content and then washed thoroughly under tap water, mopped with dry cotton pad. The following parameters were noted and used for comparison among various study groups

1) Weight in grams
2) Diameter in cms
3) Thickness in cms
4) Placental fetal ratio
5) Attachment of umbilical cord – central or eccentric
6) Umbilical cord vessels - number
7) Color of membranes – normal or abnormal
8) Retro placental hematoma - present or absent
9) Infarctions – nil, single or multiple
10) Calcifications – nil, !+ or 2+.

Diameter of placenta was measured by placing it on a flat surface along a measuring scale and the largest diameter was measured by measuring the distance between the two farthest points in cms (Bemarsehels, 1961).

Thickness of the placenta was measured by piercing the placenta at maximum bulk with a knitting needle and then compared it with a measuring scale.

Retro placental hematoma was defined as hematoma which lies between basal plate of placenta and uterine wall

RESULTS

Out of 400 placentas, 100 were from control group and 100 each from pregnancies complicated by Gestational hypertension, IUGR, and Gestational Diabetes.

Table 1: Four Study Groups of Patients

Patient Groups	**Type of patients**	**No of cases**
Group I	Controls	100
Group II	Gestational hypertension	100
Group III	Intrauterine growth retardation	100
Group IV	Gestational diabetes	100
Total		400

Table 2: Baseline Parameters

Parameters	Controls	Gestational hypertension	Intrauterine growth retardation	Gestational diabetes
Maternal age in years				
• Mean	28.9 ± 4.5	27.1 ± 3.4	27.2 ± 2.8	29.4 ± 3.6
• Range	23 – 35	22 – 34	24 - 33	24 - 36
Gestational Age in weeks	38.2 ± 1	37.7 ± 0.8	37.3 ± 0.5	37.2 ± 0.5
Obstetrical history				
• Primigravidas	56 (56%)	80 (80%)	56 (56%)	40 (40%)
• Multigravidas	44 (44%)	20 (20%)	44 (44%)	60 (60%)

There was no significant differences in the mean age among all groups ($p > 0.05$). The gestational age at time of delivery was significantly higher in controls as compared to intra uterine growth retardation group and gestational diabetes (38.2 ± 1 vs 37.3 ± 0.5 and 38.2 ± 1 vs 37.2 ± 0.5; $p < 0.001$) but the difference in gestational age was insignificant between controls and gestational hypertension group (38.2 ± 1 vs 37.7 ± 0.8; $p < 0.05$). It was observed that 80% patients were primigravidas in gestational hypertension compared to 56%, 56% and 40% respectively in the controls, intra uterine growth retardation group and gestational diabetes Percentage of primigravidas was significantly higher in gestational hypertension as compared to intra uterine growth retardation or gestational diabetes and controls ($p < 0.05$). However there was a significant difference when gestational diabetic patients were compared to gestational hypertension patients (40% v/s 80%; $p=0.004$). Furthermore the percentage of primigravidas was higher in gestational hypertension compared to controls and intra uterine growth retardation groups. The systolic as well as diastolic blood pressure was significantly higher in gestational hypertension group as compared to other groups ($p <0.001$). The systolic and diastolic blood pressures were not significantly different among the control, intra uterine growth retardation and gestational diabetes groups. The incidence of edema was significantly higher ($p =0.001$) in gestational hypertension group (68%) as compared to controls (12%), intra uterine growth retardation (12%) and gestational diabetes patients (16%). There was no significant difference ($p<0.05$) in the frequency of anemia in different groups of patients. Although the frequency was higher in intra uterine growth retardation group of patients but difference was not statistically significant compared to other groups ($p =0.40$).

Table 3: Blood pressure and frequency of edema and anaemia among different groups of patients

Parameters	Controls	Gestational Hypertension	Intra uterine growth retardation	Gestational diabetes
Systolic Blood Pressure (mm Hg)	110 ± 6.7	149 ± 6.4	112.4 ± 8.3	112.4 ± 7.9
Diastolic Blood Pressure (mmHg)	69.1 ± 3.9	97.2 ± 4.9	71.7 ± 12.8	72.4 ± 7.1
Edema	12 (12%)	68 (68%)	12 (12%)	16 (16%)
Anemia	44 (44 %)	48 (48%)	56 (56%)	44 (44%)

Table 4: Laboratory investigations in various groups

Parameter	Controls	Gestational Hypertension	Intrauterine growth retardation	Gestational Diabetes
Hb (gm/dl)				
• Mean ± SD	9.7 ± 1.6	9.2 ± 1.7	9.3 ± 1.6	9.5 ± 1.5
• Range	7 – 12	7 – 12	7 – 11.5	7 – 11.4
Blood sugar (mg/dl)				
• Mean ± SD	72.6± 4.2	72.5 ± 6.2	77.32 ± 6.8	96.6 ± 5.7
• Range	66 - 83	64 - 83	65 – 90	85 – 105
Urine for albumin	Nil	Nil	Nil	Nil

Rest of the lab parameters viz total leucocytes count, DLC, platelet count, blood urea and creatinine, liver function tests, routine urine examination were within normal limits. All patients were negative for hepatitis B surface antigen and HIV.

Table 5: Placental weight, fetoplacental ratio, placental thickness and diameter in all four groups.

Parameter	Controls	Gestational Hypertension	Intra uterine growth retardation	Gestational Diabetes
Placental weight (gm)	509 ± 38.6	491.4 ± 30.3	426.2 ± 48.1	592 ± 66.1
Placental weight gms				
• <400	-	-	24 (24%)	0
• 401 – 500	36 (36%)	36 (36%)	64 (64%)	4 (4%)
• 501 – 600	64 (64%)	64 (64%)	12 (12%)	52 (52%)
• >601	-	-	-	44 (44%)
Fetal-placental ratio	6.0 ± 0.3	6.0 ± 0.4	4.8 ± 0.3	5.7 ± 0.4
Placental diameter(cm)	17.4 ± 1.4	17.8 ± 1.4	16.9 ± 1.3	21.3 ± 2.9
Placental Thickness (cm)	1.9 ± 0.2	1.9 ± 0.2	1.7 ± 0.2	2.3 ± 0.3

The placental weight of controls was significantly more than IUGR (509 ± 38.6) vs (426.2 ± 48.1) but less than gestational diabetes mellitus. (509 ± 38.6) vs. (592 ± 66.1) However there was no statistically significant difference in placental weight of controls and Gestational hypertension. (509 ± 38.6) vs. (491.4 ± 30.3)

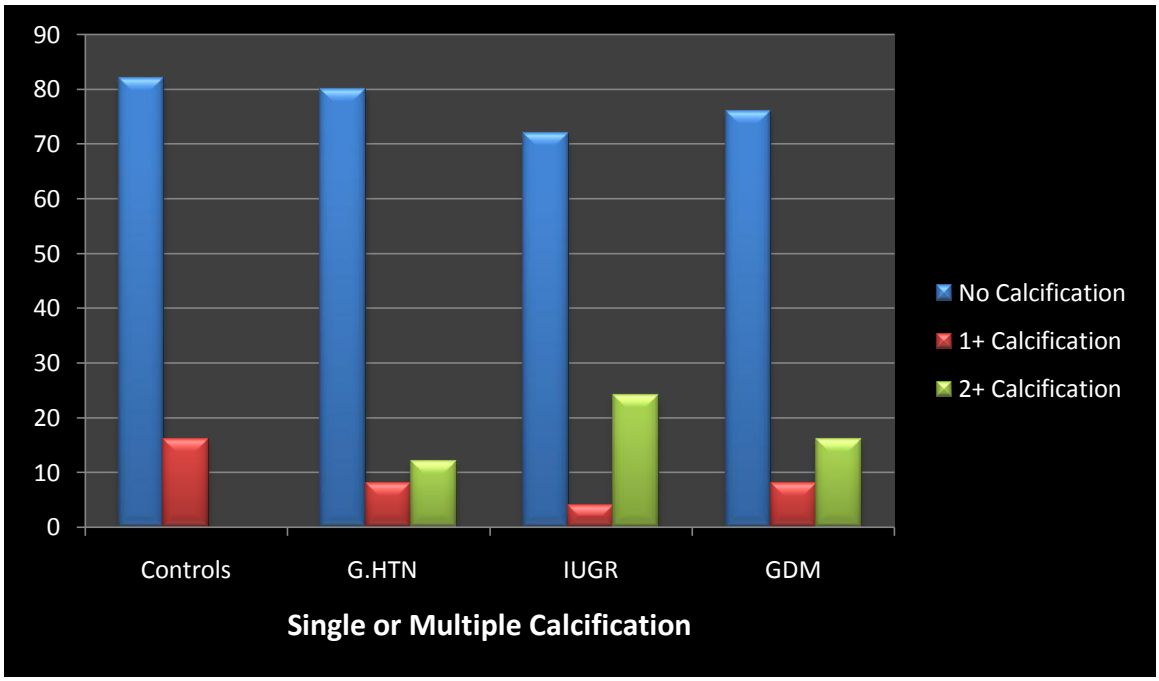
The placental weight was significantly higher in gestational diabetes than other groups and weight in IUGR group significantly lesser than other groups. ($p<0.001$) . Placental weight was more than 600 grams in 44% of gestational diabetics compared to none in the other groups. Also a placental weight less than 400 grams were observed in 24 % of the patients in IUGR group while none of the patients in other groups had such an observation. (Figure 7) .

The placental diameter in Gestational Diabetes was significantly more than all other groups (controls, gestational hypertension, and IUGR) (21.3 ± 2.9 vs. 17.4 ± 1.4; 17.8 ± 1.4 and 16.9 ± 1.3). ($p<0.001$), but there was no significant difference in placental diameter in gestational hypertension, controls and IUGR. ($p>0.5$) . The thickness of placenta was comparable among controls and gestational hypertension (1.9 ± 0.2 vs. 1.9 ± 0.2) whereas significant difference was observed between IUGR and Gestational Diabetes (1.7 ± 0.2 vs. 2.3 ± 0.3).

Table 7: Placental pathology in different groups in

Parameter	**Controls**	**Gestational Hypertension**	**Intra uterine growth retardation**	**Gestational Diabetes**
Number of umbilical cord vessels • 2 • 3	 4 (4%) 96 (96%)	 0 1OO (100%)	 4 (4%) 96 (96%)	 0 100 (100%)
Membrane color • Normal • Abnormal	 88(88%) 12(12%)	 76(76%) 24(24%)	 68(68%) 32(32%)	 96(96%) 4(04%)
Retroplacentalhematoma	4(4%)	12(12%)	4(4%)	0
Calcification • Nil • +1 • +2 • +1 and +2	 84(84%) 16 0 16 (16%)	 80(80%) 8 12 20 (20%)	 72(72%) 4 24 28 (28%)	 76 (76%) 8 16 24 (24%)
Infarcts • Nil • Single • Multiple • Single and multiple	 84 (84%) 8 (8%) 8 (8%) 16(16%)	 64 (64%) 12 (12%) 24 (24%) 36 (36%)	 52 (52%) 12 (12%) 36 (36%) 48 (48%)	 68 (68%) 20 (20%) 12 (12%) 32 (32%)

Abnormal color of membranes was observed more often in IUGR patients (32%) compared to gestational hypertension (24%) and gestational diabetes (4%) and controls (12%). These differences were statistically insignificant (p=0.5).All these patients had meconium stained liquor. The proportion of patients with single or multiple calcifications was more in IUGR group (28%) than gestational hypertension (20%) and gestational diabetes groups (16%). (Figure 7). The differences among the groups was statistically insignificant (p=0.2). Multiple infarcts were significantly higher in IUGR patients compared to controls (p = 0.02) (Figure 8). Though multiple infarcts were higher in gestational hypertension and gestational diabetes mellitus groups as compared to controls but differences were insignificant (controls vs. gestational hypertension; p=0.24 and controls vs. gestational diabetes; p = 0.6).



DISCUSSION

Gestational Hypertension, GDM & IUGR constitute the major high risk pregnancy groups all over the world and a similar trend is observed in the valley. Moreover the number of pregnancies complicated by these factors is increasing day by day. These high risk pregnancy groups are associated with obstetric complications as well as perinatal mortality and morbidity.

In our study the placentae of patients with IUGR were significantly lesser in weight, and smaller in diameter and thickness as compared to those of controls whereas those of gestational hypertension were comparable in these parameters to the controls or the differences were not statistically significant. The placentae of GDM group were significantly heavier in weight, larger in diameter and more in thickness as compared to controls. Similar observations have been noted by Ashfaq M et al (9), Rahman et al (11), Mayhew TM et al (15) and Biswas et al (16).

Also the proportion of patients with single or multiple calcifications were more in IUGR group than gestational hypertension and gestational diabetes group. Multiple infarcts were significantly higher in IUGR patients compared to controls (p=0.02). Multiple infarcts were also higher in gestational hypertension (p=0.24) and gestational diabetes group (p=0.6) as compared to controls. Boyd and Scott (10), Salgado and Pathmeswaran (12), Soma et al (13) and Sodhi S et al (14) have also reported similar observations in their studies.

CONCLUSION

Placental examination can provide better insight into the physiology of pregnancy and pathological mechanisms operating in the complications of pregnancy. Understanding of these can open new visions into their better

prevention and management strategies that can be evolved to tackle these complications and hence the perinatal mortality and morbidity arising from them can be significantly reduced.

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