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Original Article

Influence of Gestational Diabetes Mellitus on Fetal growth parameters

Vedavathi KJ[a], Swamy Rm[b], Kanavi Roop Shekharappa[c], Venkatesh G[d], Veerananna HB[c]

[a, c] *Rajarajeswari Medical College and Hospital, Bangalore*
[c] *Bangalore Medical College, Bangalore*
[b, d] *Sri Siddartha Medical College, Tumkur*

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ABSTRACT

Background & Objective: Gestational diabetes mellitus (GDM) is associated with maternal and fetal complications. Macrosomia is the common complication despite the attempts of maintaining the good glycemic control. Therefore, our study intended to evaluate the effect of gestational diabetes mellitus on the fetal growth parameters and birth weight. Methods: Ultrasonograms was performed on 30 patients with GDM and 30 control subjects in the age group of 18 to 34 years and 32 to 40 weeks of gestation. Fetal abdominal circumference (AC), fetal head circumference (HC) and Gestational weight (GW) were noted, calculated and followed up to record their Birth weight (BW). One hour post prandial blood samples were collected for glucose estimation. Results: The one hour PPBS was higher in GDM (cases: 146.3 ± 11.59 mg/dl, controls: 98 ± 13.25 mg/dl, p <0.001). AC (cases: 37.53 ± 2.04 cm, Controls: 34 ± 1.35, p <0.001), HC (cases: 35.28 ± 1.62, controls: 33.63 ± 0.77cm, p <0.001), GW (cases: 3629 ± 216.5 gms, controls: 2727 ± 186.2 gms, p <0.001) and BW (cases: 3859 ± 102 gms, controls: 2866 ±148.5 gms, p <0.001) were found to be significantly high in GDM patients. With in the GDM group, there was no statistically significant difference in values of fetal growth parameters between pimigravida and multigravida. Interpretation & Conclusion: Despite the attempts for good glycemic control there is a risk of macrosomia in GDM. Fetal growth parameters show a significant high values in GDM and there is no significant correlation with birth weight. Also, there is no significant difference in the PPBS and in fetal growth parameters between primigravida and multigravida in GDM cases.

1. Introduction

Gestational diabetes mellitus (GDM) is defined as "carbohydrate intolerance of variable severity with onset or first recognition during pregnancy". In India the prevalence of GDM varied from 3.8 to 21% across the different regions [1]. It has an adverse effect on both mother and the fetus. Maternal complications include hypertension, post partum hemorrhage and finally leading to the need of caesarian section delivery [2]. Also, they have increased risk for the later development of diabetes and cardiovascular disease [3]. Fetal complications include the risk of anomalies and macrosomia which is prone for trauma during delivery [4]. Macrosomia is the defined as a gestational age adjusted birthweight that exceeds the 90th percentile of a reference population or as a birth weight (BW) greater than 4000 grams [4]. Despite the prevailing trend in maintaining fairly strict glycemic control, excessive fetal size is the principle factor contributing to the birth traumas such as shoulder dystocia, asphyxia, brachial plexus injury etc [5]. Therefore, there is a need for constant monitoring of fetal growth in GDM. Fetal growth is monitored by ultrasonic examination of the fetus for the growth parameters namely Abdominal circumference (AC), Head circumference (HC) and Gestational weight (GW). This study intended to evaluate the effect of gestational diabetes mellitus on these fetal growth parameters and to correlate with BW.

* Corresponding Author : Dr. G. Venkatesh
Associate Professor, Department of Physiology
Sri Siddartha Medical College, Tumkur
Karnataka, India
Mobile : 09886215235
Email: g.venkatesh2@gmail.com

2. Materials and Methods

This cross sectional study was under taken by the department of Physiology, Bangalore Medical College, Bangalore, after the approval of the research and ethical committees. The study group included 30 patients with diagnosed Gestational diabetes mellitus (GDM) on Insulin treatment as cases. These patients were diagnosed as GDM by glucose challenge test during their 24 – 28 weeks of pregnancy and as per Carpenter & Coustan Criteria [6]. All were singleton pregnancies. Control group consisted of 30 age matched uncomplicated pregnant women who were shown to have glucose tolerance in their glucose challenge test. Both cases and controls were in the age group of 18 – 34 years and at 32 to 40 weeks of pregnancy determined from the period of amenorrhea. Except gestational diabetes, pregnant women with other complications were excluded from the study. Blood samples were collected from both cases and controls after 1 hour of the intake of breakfast for glucose estimation by glucose oxidase method [7]. Ultrasonogram of all the 60 subjects was performed; Addominal Circumference, Head Circumference and Gestational Weight were noted and calculated. All the subjects were followed up to delivery to record the birth weight and the time interval in terms of days between the dates of ultrasonogram and delivery. Gestational weight was assessed by Dr. Woo's formula [8]. Quantitative data was summarized to test the difference in mean values obtained for cases and controls. Paired student't' test was performed to find the significance of the difference between the two groups. Pearson's correlation was used to find the correlation of fetal growth parameters with the birth weight. Further, GDM group was classified into primigravida and multigravida, to find the probable effect of parity on fetal growth parameters. Data are presented as Mean±SD and significance is taken at 0.05 levels.

3. Results

The results obtained were tabulated in Table 1, 2 and 3. Table-1 shows the number of cases and controls above and below the 90th percentile. Abdominal circumferences(AC) of 27 (90%) cases, Head circumferences(HC) of 20 (67%) cases and Gestational Weight (GW) of 8 (27 %) cases were ≥90 percentile. Birth weight of 6 neonates was >4000 grams, of which 5 (18.5%) cases were with Abdominal circumference(AC)≥90 percentile, 4 (20%) cases with Head circumference(HC) ≥90 percentile and 2 (25%) cases with GW ≥ 90 percentile (Diagram 1). None of the controls had GW≥90 percentile and macrosomia. The fetal growth parameters of cases and controls were tabulated in the Table-2. Statistically all parameters in the 2 groups were found to be significantly different. The one hour PPBS was higher in GDM (cases: 146.3 ± 11.59 mg/dl, controls: 98 ± 13.25 mg/dl, p <0.001). Abdominal circumference (cases: 37.53 ± 2.04 cm, Controls: 34 ± 1.35, p <0.001), Head circumference (cases: 35.28 ± 1.62, controls: 33.63 ± 0.77cm, p <0.001) and GW (cases: 3629 ± 216.5 gms, controls: 2727 ± 186.2 gms, p <0.001) were found to be significantly high in GDM patients. Birth weight too was significantly high in GDM patients (cases: 3859 ± 102 gms, controls: 2866 ±148.5 gms, p <0.001).Within the GDM group, there was no statistically significant difference in values of fetal growth monitors between pimigravida and multigravida (Table 3). PPBS had no significant correlation with birth weight where as Abdominal circumference and GW showed significant correlation with birth weight (Table 4). The time interval in terms of days between the dates of ultrasonogram and delivery varied from 1 day to 28 days. The difference between the GW and BW varied between -20 to 261 grams per day which was not significant by one tailed Z-test (z=1.0, p=0.15).

Table 1. Shows the number of cases and controls above and below the 90th percentile

Parameters	Percentile	Cases N=30 (%)	Controls N=30 (%)
Fetal Abdominal Circumference (centimeters)	≥ 90	27 (90) 5 with *Macrosomia*	03 (10)
	<90	03 (10)	27 (90)
Fetal Head Circumference (centimeters)	≥ 90	20 (67) 4 with *Macrosomia*	02 (07)
	<90	10 (33)	28 (93)
Gestational Weight (grams)	≥ 90	08 (27) 2 with *Macrosomia*	00 (00)
	<90	22 (73)	30 (100)
Birth Weight	>4000 gms	6 (20)	00 (00)
	>4000 gms	24 (80)	00 (00)

Figures in the parenthesis indicates the percentages

Table 2: Comparison of parameters between Cases and Controls

Parameters	Cases	Controls	p value
Maternal Age (years)	24.63 ± 4.43	26.25 ± 3.28	0.07 (NS)
Blood Sugar (mg/dl)	146.3 ± 11.59	98 ± 13.25	0.001 (HS)
Gestational Age (weeks)	37.75 ± 1.50	37.81 ± 1.72	0.63 (NS)
Fetal Abdominal Circumference (centimeters)	37.53 ± 2.04	34 ± 1.35	0.001 (HS)
Fetal Head Circumference (centimeters)	35.28 ± 1.62	33.63 ± 0.77	0.001 (HS)
Gestational Weight (grams)	3629 ± 216.5	2727 ± 186.2	0.001 (HS)
Birth Weight (grams)	3859 ± 102	2866 ±148.5	0.001 (HS)

The values are expressed as their Mean± SD,
HS – Highly significant, S – Significant, NS – Not significant

Table 3: Comparision of parameters between primigravida and multigravida in GDM

Parameters	Primi gravida (n=19)	Multi gravida (n=11)
Maternal Age (years)	24.24± 4.08	25.31 ± 5.17*
Blood Sugar (mg/dl)	145.2 ± 12.19	147.7 ± 10.79*
Gestational Age (weeks)	37.71 ± 1.60	37.84 ± 1.40*
Fetal Abdominal Circumference (centimeters)	37.52 ± 2.24	37.54 ± 1.75*
Fetal Head Circumference (centimeters)	35.29 ± 1.57	35.15 ± 1.79*
Gestational Weight (grams)	3654 ± 212.6	3584 ± 221.7*
Birth weight (grams)	3869 ± 106	3842 ±97

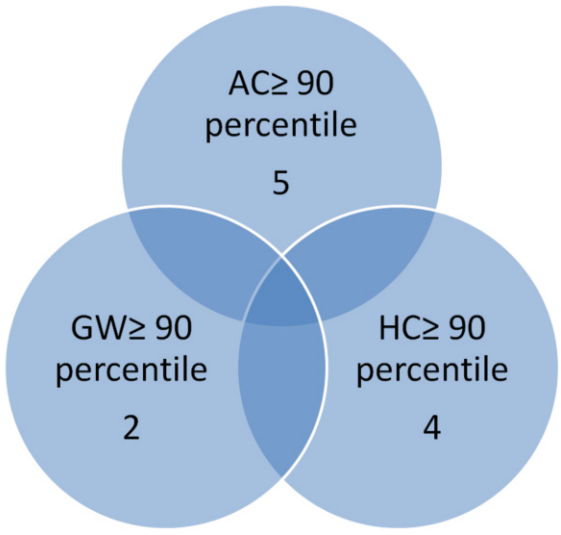
The values are expressed as their Mean ± SD *p value >0.05

Table 4: One tailed Pearson's correlation between the PPBS and fetal growth parameters with birth weight in GDM patients

Relationship between	r - Values	p – Value	Significance
PPBS Vs BW	+0.16	0.19	NS
AC Vs BW	-0.003	0.49	NS
HC Vs BW	+0.15	0.21	NS
GW Vs BW	+0.41	0.01	S

r = Pearson's correlation co-efficient.
HS – Highly significant (p<0.001)
S – Significant (p<0.05)

Diagram 1: Proportion of AC, HC and GW which are ≥ 90 percentile out of 6 Birth weight neonates >4000 grams



4.Discussions

Gestational diabetes attributes the risk factors for both mother and the fetus. Mothers with GDM are invariably led to the need of caesarian section delivery due to macrosomia [9]. The size also posed a risk of birth injuries for the fetus. A number of risk factors have been identified to be associated with likelihood of developing GDM and they include advanced maternal age, a family history of diabetes, obesity, and glycosuria. In the present study the cases and controls were age matched and in GDM cases there was little difference in the values of the parameters between primigravida and multigravida. The GDM cases in this study had a significantly high 1 hour PPBS values when compared to controls, practically the range between 130 mg/dl to 160 mg/dl of this study is fairly a good glycemic control to avoid hypoglycemic attack. Under this circumstance it was found that AC, HC and GW were found to be significantly high in GDM patients. But, the percentage of AC, HC and GW with ≥90 percentile associated with macrosomia was 18.5, 20 and 25 respectively. Therefore, the effect of growth parameters on birth weight is note worthy. Though GDM cases had high PPBS values it did not show the significant correlation with macrosomia, suggesting the fairly strict glycemic control was sufficient. GW had significant correlation with the birth weight making the necessity of monitoring the GW rather than the individual parameters. Also, the difference between the GW and BW was not significant. A prospective study suggested the use of ultrasound with clinical findings for assessing the risks [10]. Thus the fetal growth parameters can be considered as the warning signals and assessed in the background of clinical findings for taking the decisions on time and mode of delivery. Within the GDM cases, primigravida and multigravida had no significant difference in any of the parameters, suggesting absence of the role of parity in causing GDM. Small sample size is the limitation of this study, increased sample size would have enabled to classify the cases according to their gestational age and compared.

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