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ORIGINAL ARTICLE

Correlation between Maternal Glycemic Status in Third Trimester of Pregnancy and Neonatal Birth Weight

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Abstract

Objectives:*To study the relation between maternal third trimester glucose values and neonatal birth weight.*

Design: *Retrospective review analysis*

Materials and methods: *Maternal glycemic values were determined by 75 gm Oral Glucose Challenge Test(OGCT) in the third trimester. Maternal glucose values were divided into three groups i.e.<120mg/dl, 121-139mg/dl and >140mg/dl so as the neonatal birth weight i.e.<2.5kg, 2.5-3.5kg and >3.5kg. Both maternal glucose values and neonatal birth weights were tabulated and were looked for any relation between them.*

Results: *A total of 1940 cases were analyzed in the study period in which 1643(84.7%) of cases had OGCT value of <120 mg/dl, 123 cases (6.3%) had OGCT values between 121- 139 mg/dl and 174 cases (9%) were Gestational Diabetes Mellitus (GDM)i.e. OGCT value of >140 mg/dl. Out of 1940 babies 435 babies had a birth weight of <2.5 kg (22.4%), 1321 babies were between 2.5-3.5 kg (68.1%), and 184 babies were >3.5 kg (9.5%). In cases with normal OGCT values i.e.< 120mg/dl 86.6% of babies were < 2.5kgs, 86.4% of babies were between 2.5-3.5 kgs and 67.9% of babies were >3.5kgs; whereas in GDM cases 7.6% of babies were < 2.5kgs, 7.9% of babies were between 2.5-3.5 kgs and 20.1% of babies were >3.5kgs with a significant p value of <0.0001.*

Conclusions:*Fetal growth is an important determinant not only of infant survival but also of future chronic disease risk. From the above study there is a relation between high maternal glucose values and increased birth weight. Due to the lifelong implications of fetal growth defined by size-at-birth good control of glucose values is necessary of a better future for both mother and the baby.*

Introduction

The prevalence of diabetes mellitus (DM) is increasing worldwide and more in developing countries including India. The increasing prevalence in developing countries is related to increasing urbanization, decreasing levels of physical activity, changes in dietary patterns and increasing prevalence of obesity. As women with gestational diabetes mellitus (GDM) and their children are at increased risk of developing diabetes mellitus in future, special attention should be paid to this population especially in developing countries.

GDM is defined as glucose intolerance of varying degree with onset or first recognition during pregnancy.1The fetal complications in GDM include macrosomia, neonatal hypoglycemia, perinatal mortality, congenital malformation, hyperbilirubinemia , polycythemia, hypocalcaemia ,and respiratory distress syndrome. Neonatal hypoglycemia can occur within a few hours of delivery. This results from maternal hyperglycemia causing fetal hyperinsulinemia. Long term complications to the offspring include an increased risk of glucose intolerance and obesity. Maternal complications like preeclampsia,and an increased risk of cesarean delivery and more important is women with GDM have an increased risk of developing diabetes after pregnancy when compared to the general population, with a conversion rate of upto 3% per year.2 So to prevent these adverse effects both on the mother and the fetus a strict glycemic control in pregnancy is essential.

Objectives

To study the relation between maternal third trimester glucose values and neonatal birth weight.

Materials and methods

It is a retrospective review analysis of the cases who were delivered at JSS Hospital Mysore between Jan 2013 to Nov 2014. Mothers who had undergone a 75 gm Oral Glucose Challenge Test in the third trimester were included in the study.

Oral Glucose Challenge Test – It is a one step procedure where mothers attending the antenatal clinic are challenged with 75 gm oral glucose and 2 hours later plasma glucose values are determined. If plasma glucose value is >140 mg/dl it is categorized as 'Gestational Diabetes Mellitus'(GDM), values between 121- 139 mg/dl are grouped as ' Gestational Glucose Intolerance' and glucose values <120 mg/dl were considered as normoglycemic mothers.

Neonatal birth weights were divided into three groupsi.e.<2.5kg as low birth weight, 2.5-3.5kg as normal birth weight and >3.5kg was considered as macrosomia for Indian population. Both maternal glucose values and neonatal birth weights were tabulated and were looked for any relation between them.

Results

A total of 1940 cases were analyzed in the study period in which 1559 cases were primigravida and 381 cases were multigravida out of which 8.3% of primigravida were detected to have GDM and 11.8% of multigravida had GDM. 301(16%) mothers were <20 yrs, 1302(67%) mothers were between 21-30 yrs and 337 (17%) mothers were >31 yrs out of which GDM was detected in 10% of mothers with age < 20 yrs, 8.4% of mothers between 21-30 yrs and 10.4% with >31 yrs. 8%(n=157) of cases had BMI of <23 kg/m2, 44% (n=854) cases had BMI between 23.1-28 kg/m2 and 48% (n=929) cases had BMI >28 kg/m2 . 6.3% of cases with BMI <23 kg/m2 had GDM, 7.3% of cases with BMI between 23.1-28 kg/m2 had GDM and 11% of cases with BMI >28 kg/m2 had GDM (Table I).

Out of 1940 cases in the study, 1643(84.7%) cases had OGCT value of <120 mg/dl, 123 cases (6.3%) had OGCT values between 121- 139 mg/dl and 174 cases (9%) were GDM i.e. OGCT value of >140 mg/dl. Out of 1940 babies 435 babies had a birth weight of <2.5 kg (22.4%), 1321 babies were between 2.5-3.5 kg (68.1%), and 184 babies were >3.5 kg (9.5%).

In cases with normal OGCT values i.e.< 120mg/dl 84.4% (n= 377) of babies were < 2.5kgs, 86.4% (n=1141) of babies were between 2.5-3.5 kgs and 67.9% (n=125) of babies were >3.5kgs.In Gestational Glucose Intolerance cases i.e. OGCT values between 121-139 mg/dl 5.8% (n= 25) of babies were < 2.5kgs, 5.8% (n =76) of babies were between 2.5-3.5 kgs and 12% (n=22) of babies were >3.5kgs. Whereas in GDM cases 7.6% (n=33) of babies were < 2.5kgs, 7.9% (n=104) of babies were between 2.5-3.5 kgs and 20.1 %(n=37) of babies were >3.5kgs with a significant p value of <0.0001 (Table II). Also the maternal mean glucose value for neonatal birth weight of <2.5 kg was 103.84 mg/dl, for 2.5-3.5 kg it was 104.87 mg/dl and for .3.5 kgs it was 113.83 mg/dl (Figure 1).

Discussion

Prevalence of gestational diabetes mellitus varies widely. Depending on the population studied and the diagnostic

Table I: Relation between parity, age and BMI with OGCT values

		OGCT values in mg/dl						
		<120		121-139		>140		Total
		No of cases	%	No of cases	%	No of cases	%	No of cases
Gravida	Primi	1324	84.9	106	6.8	129	8.3	1559
	Multi	319	83.7	17	4.5	45	11.8	381
Age in yrs	<20	252	83.7	19	6.3	30	10	301
	21-30	1107	85	86	6.6	109	8.4	1302
	>31	284	84.3	18	5.3	35	10.4	337
BMI kg/m2	<23	140	89.2	7	4.5	10	6.3	157
	23.1-28	733	85.8	59	6.9	62	7.3	854
	>28	760	81.8	67	7.2	102	11	929

Table II:Relation between neonatal birth weight & maternal glucose values

OGCT values									
		<120 mg/dl		121-139 mg/dl		>140 mg/dl			
		No of cases	%	No of cases	%	No of cases	%	Total No of cases	Mean glucose value
									(mg/dl)
Birth weight	<2.5	377	86.6	25	5.8	33	7.6	435	103.84
In kgs	2.51-3.5	1141	86.4	76	5.8	104	7.9	1321	104.87
	>3.5	125	67.9	22	12	37	20.1	184	113.83

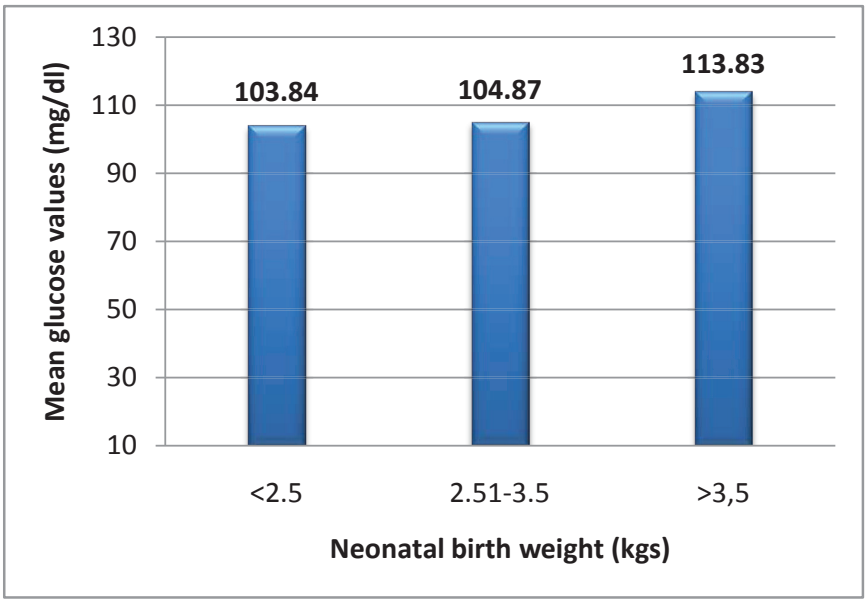

Figure 1: Relation between maternal mean glucose values for neonatal birth weights

test employed, prevalence may range from 2.4 to 21 per cent of all pregnancies. In India it is difficult to predict any uniform prevalence levels because of wide differences in living conditions, socio-economic levels and dietary habits.1 In the present study the incidence of Gestational Diabetes Mellitus was found to be 9% and 6% of patients were Gestational Glucose Intolerant. The prevalence of GDM was 9.2% in 2010 among the 15 states and New York City3andin a random survey performed in various cities in India in 2002-2003, an overall GDM prevalence of 16.55 per cent was observed.4 In another study done in Tamil Nadu, GDM was detected in 17.8 per cent women in urban, 13.8 per cent women in semi-urban and 9.9 per cent women in rural areas.5 In another study by Wah Cheung et al6 the incidence of GDM was 9.2%; among women born in China, it was 8.6% (66 of 764), the Philippines 6.7% (40 of 599), Sri Lanka 10.5% (31 of 293), and Vietnam 10.6% (121 of 1,141).

In the present study, the prevalence of GDM was found to be more in multigravidas with 11.8% in comparison of 8.3% in primigravidas and an increased maternal age >31 yrs also had a high prevalence for GDM (10.4%). Also the increase in the glucose values was noted both in the Gestational Glucose intolerance (GGI) group and GDM group as BMI increased. It was noted that 4.5% of cases were GGI for a BMI of <23 kg/m2 and 7.2% for a BMI of >28 kg/m2 similarly 6.3% of cases were GDM for a BMI of <23 kg/m2 and 11% for a BMI of >28 kg/m2 (Table 1). The increase in GDM prevalence with increasing parity, advanced maternal age and increased BMI is well supported by other studies.1, 6-8

The present study shows a significant relationship between maternal glucose values in third trimester and neonatal birth weight as shown in Table 2 with 5.8% of babies were <2.5 kgs in GGI group whereas 12% of babies were >3.5 kgs in likewise 7.6% of babies in GDM

group were <2.5 kgs when compared to 20.1% of babies were >3.5 kgs with a statistically significant p value of 0.0001.

GDM exists in women without pregestational diabetes, when the maternal β-cell function cannot adapt to the increased insulin demand of late pregnancy; usually it disappears after delivery. Hyperglycemia in mothers with GDM usually develops during the third trimester when organogenesis is largely completed. Therefore, congenital malformations are not significantly increased. Fetal visceromegaly and macrosomia in neonates exposed to GDM may be largely due to the growth-promoting effects of fetal insulin which is produced in response to the high levels of maternal glucose (overstimulation of fetal β-cells).9 Since Barker et al first noted the association between fetal growth and the occurrence of metabolic disorders later in life10, a large number of epidemiologic studies demonstrated that the infants of diabetic mothers are more susceptible to complex diseases, including obesity11, type 2 diabetes12, metabolic and cardiovascular complications13 and even cancer14. Pedersen highlighted the striking adiposity of an infant of a diabetic mother: "Most conspicuous is obesity, the round cherub's cheeks, buried eyes, and short neck". He ascribed this to fetal hyperglycemia and hyperinsulinemia stimulating excess growth of insulin-sensitive tissues to cause macrosomia. Subsequent studies revealed that the real shape of this relationship was U shaped, i.e., both low and high birth weight increased the risk of type 2 diabetes in future. It is important to understand that the story is not about birth weight but about fetal programming, and that intergenerational prevention of type 2 diabetes will need to target maternal nutrition and metabolism.15

Conclusions

Fetal growth is an important determinant not only of infant survival, but also of future chronic disease risk. Both low and high birthweight have been associated with increased infant mortality and long-term morbidity. Low birthweight has additionally been associated with elevated risk of type2 diabetes, while high birthweight for gestational age has been associated with increased risk of overweight and obesity in adulthood. From the above study there is a relation between high maternal glucose values and increased birth weight. Due to the lifelong implications of fetal growth defined by size-at-birth, good control of glucose values is necessary for a better future of both the mother and the baby.

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