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Metabolic Status of Women with Gestational Diabetes Mellitus Six Months after Delivery

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Abstract: The aim of this study was to find the relationship between GDM and metabolic disorders such as glucose intolerance, abnormal lipid profile and androgen level, which are known as the risk factors in GDM. A total of 107 patients with recent history of GDM underwent clinical and metabolic evaluation six months after delivery. Laboratory tests performed for these patients included, fasting blood sugar, glucose tolerance test, serum lipid profile and blood androgen level for comparison of means , students t-test were performed. Results show that 19.6 and 15.9% of patients had DM alone and IGT after pregnancy. A significant statistical relationship was found between higher prevalence of diabetes mellitus after pregnancy and history of recurrent GDM. Patients showed abnormality in lipid profile. Regardless the high prevalence of diabetes in patients with GDM, it is necessary for health authorities to follow up and completely evaluate these patients and to educate the health care personnel in this field.

Key words: Diabetes, pregnancy, lipid, hirsutism, GDM, blood androgen level

INTRODUCTION

GDM is one of the most important metabolic complications with prevalence about 1-14% during pregnancy. Women with a positive history of GDM are at higher risk for developing hypertension, hyperlipidemia and finally death (Gestational Diabetes, 1998). These patients should be acknowledged about the risk of development of GDM to diabetes type II in later life and they should be educated about the means by which its development could be delayed. In case the patient is evaluated as normal after delivery, annual glucose metabolism studies must be performed and advice should be given to lose weight, perform regular exercise and to give up addiction. These changes in lifestyle can help decrease the annual financial burden related to diabetes (Gestational Diabetes, 1998; Buchano and Kjos, 1999). Metabolic studies performed for woman with history of GDM, 3 to 11 months after delivery, have shown that woman with GDM have a normal glucose tolerance test and a lipid profile similar to woman without history of GDM.

However, in women with overt GDM the triglyceride and cholesterol HDL levels are higher than women without overt GDM (Weller, 1996; Greenbevg and Murphy, 1995).

Follow up studies have shown that 29% of women with GDM are at risk of developing D.M type II later (Clopten, 1998) such that 50% of these women will have overt diabetes after 20 years (Herranz *et al*., 1999).

Considering the relationship between glucose intolerance and abnormal lipid profile, which are among important cardiovascular risk factors, it is important to identify patients with glucose intolerance as early as possible and to give prompt treatment. While unaware of their disease, about 14 million people with DM type II are at risk of developing related complications (Cabbe *et al*., 1998). The aim of this study was to determine the frequency of glucose intolerance and abnormal lipoprotein and androgen changes and their relationships in patients with history of GDM in order to diagnose these problems as early as possible and to give prompt prevention, thereby decreasing the long term complications of this disease.

MATERIALS AND METHODS

This study was performed from 2001-2002 in vail-e-Asr Hospital, Imam Khomeini Hospital Complex (Tehran-Iran). All women with GDM who had given birth or who were receiving treatment in this hospital were enrolled. A total of 126 women with GDM attended the hospital; 19 of whom were excluded because they were unwilling to participate in the study or due to difficulties in contacting them. Thus a total of 107 women were enrolled and metabolic tests were performed for them six months after delivery. Laboratory test performed included triglyceride, total cholesterol (HDL and LDL), OGTT with 75 g of glucose and blood testosterone and DHEAS levels and experiment manner about glucose

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Depending on OGTT results shown in Table 1, the patients were divided into three groups, normal, patients with D.M. and patients with glucose intoleranc (Gestational Diabetes, 1998). Data were then analyzed by SPSS program with inference studies. It accepted by the university moral commity.

Table 1:Existence criteria for diagnosis of IGT, diabetes mellitus and normal

	FBS	Bs below 2 h in the 2 h OGTT	Bs after 2 h in the 2 h OGTT
Diabetes	FBS≥126	≥200	≥200
IGI	110<FBS<126		140<BS<200
Normal	FBS<110		Bs<200

RESULTS

Mean age was 30.4±5.8 year (range, 16-42 years) and mean BMI was 29±4.6 Mean gravidity and mean parity was 2.8±1.2 (range, 1-8) and 2.1±1.1 (range, 1-7), respectively. Patients were in the normal, 69(64.5%), IGT 17 (15.9%) and D.M21 (19.6%) group, respectively.

The distribution of each quantitative variable in patients with IGT and patients with D.M were compared with the normal group.

All variables followed the normal distribution. The groups were compared with each space other by post Hoc test (a type of Turkey HDS test) By Comparing these groups, a significant statistical difference was found only to exist between the normal and diabetic group (diabetes after delivery0 regarding age, gravidity and parity.

According to BMI, a significant statistical difference was found to exist only between the normal and the other two groups (Table 2).

Statistical significance was found for plasma triglyceride concentration and total cholesterol level in all

Table 2: Relation between OGTT according to age, gravidity, parity and BMI

Statistical index	Normal		IGT		DM	
Variable	Number	Mean±SD	Number	Mean±SD	Number	Mean±SD
Age (Years)	69	29.1±5.8	17	31.2±5.8	21	34.2±4.3
Gravidity	69	2.5±1.4	17	2.7±1.2	21	3.7±2
Parity	69	1.8±0.7	17	2.4±1.1	21	2.9±1.6
BMI	69	27±3.5	17	32.3±2.7	21	32.8±4.6

A.N.O.V.A. test was used to compare the three groups, According to age , F = 7.2, P = 0.001, According to Gravidity ,F = 4.25, P = 0.017, According to Parity F = 6.4, P = 0.002, According to BMI, F = 26.5 , P<0.001

Table 3: Relation between OGTT and plasma lipid concentration

Statistical index	Normal		IGT		DM	
Variable	Number	Mean±SD	Number	Mean±SD	Number	Mean±SD
Triglyceride (mg dl^{-1})	69	107.5±28.9	17	185.8±50.3	21	278.7±118.4
Cholesterol (mg dl^{-1})	69	181±16.1	17	200.8±21.8	21	229.9±34.9
LDL Cholesterol (mg dl^{-1})	69	109.7±15.9	17	124.5±19.4	21	134.6±24.7
HDL Cholesterol (mg/dl)	69	49±7.7	17	42.1±6.4	21	46.3±8.1

For triglyceride: F = 67.8, P = 0.001,For total cholesterol: F = 41.5, P = 0.001, For LDL cholesterol: F = 16.3, P = 0.001, For HDL Cholesterol: F = 14.6, p<0.001

Table 4: Relation between OGTT and blood androgen level

Statistical index	Normal		IGT		DM	
Variable	Number	Mean±SD	Number	Mean±SD	Number	Mean±SD
Testosterone (nmol L^{-1})	69	0.5±0.2	17	0.6±0.1	21	0.7±0.1
DHEAS (μg dl^{-1})	69	162.5±52	17	161±52	21	185.5±62

For Testosterone: F= 7.3, P = 0.001, For DHEAS: F = 1.5, P = 0.2

Table 5: Relation between OGTT and blood pressure

Statistical index	Normal		IGT		DM	
Variable	Number	Mean±SD	Number	Mean±SD	Number	Mean±SD
S.BP	69	115±13.9	17	120.9±12	21	112.9±12
D.BP	69	72±9.6	17	75.9±5.7	21	78±7.6

For SBP: F = 3.5, P = 0.03, For DBP: F = 4.6, P = 0.01

three groups, namely, normal as compar ed to the IGT group and the IGT group as compared to the diabetes group ($p<0.001$) HDL and LDL cholesterol also showed significant statistical differences between the normal compared to the other two groups. However, such difference was not found between the group with IGT and the group with diabetes (Table 3).

A significant statistical difference ($p<0.001$) was found between the normal and diabetic groups in regard to testosterone level but there was no significant difference ($P = 0.2$) among these 3 groups in regard to DHEAS (Table 4).

Significant statistical difference ($p<0.01$) was found between the normal group and group with D.M for mean systolic and diastolic blood pressure (Table 5).

Among the 69 normal patients, 38 (55.1%) received insulin therapy and 31 (44.9%) received dietary regimen therapy during pregnancy. Among the 17 patients with IGT, 13(76.5%) received insulin during pregnancy and 4 (23.5%) received dietary regimen therapy.

Among the 21 patients with DM, all 71 patients (100%) received insulin during pregnancy. This difference was statistically significant using chi square test ($p<0.001$, chi square chi 2 = 15.5)

The dose of daily insulin injected was compared between the three groups. In the 38 normal patients who received insulin, the daily dose injected was 28.7±16 units. In the 13 IGT patients who received insulin, the mean daily dose injected was 52.7±22.8 units. In the 21 diabetic patients the mean daily dose of insulin injected was 80±31.9 units. These differences were statistically significant ($p<0.001$; $F = 32.5$, A.N.O.V.A. test).

Fourteen patients (13.1%) had history of GDM in their previous pregnancies, 6 patients (42.9%) were from the IGT group and 8 patients (57.1%) were from the DM group.

Among the 107 deliveries, 13 newborns (12.1%) had macrosomia. Among the 69 patients in the normal group, 2 (2.9%) and, among the 17 women with IGT, 2(11.8%) and among, the 21 women with DM 9 (42.9%) had given birth to a child with macrosomia. These differences were statistically significant ($p<0.001$; Fisher exact test).

Among the 107 deliveries, congenital abnormalities were found in 3 newborns (2.8%); one child had microcephaly, one had congenital heart malformation and one had pulmonary atresia with PDA and VSD. Two of these newborns belonged to mothers with DM but mother of one of these newborns was normal. The difference was statistically significant. ($P<0.003$ and Fisher exact test) Hirsutism was seen in 8 of 69 normal patients (11.6%), 7 of 17 patients with IGT (41.2%) and in 10 of 21 patients with DM (47.6%). These findings were statistically significant ($p<0.001$ Fisher exact test).

DISCUSSION

The incidence of abnormal glucose tolerance, one year after developing GDM, has been determined by the National Diabetes Society to be around 6/8-38% (Clopten, 1998) .

In our study, around 35.5% of patients had both IGT and DM and 19.6% had DM alone. Comparison of gynecological and clinical history shows that obesity and history of GDM is more common among women who had developed IGT and DM after GDM. These findings are in accordance with previous studies performed in this field (Weller, 1996; Kjos *et al*., 1991).

One of the risk factors related to the development of DM after GDM is the dose of insulin injected during pregnancy. Our findings agree with the findings of the study performed in Madrid in 1999 (Weller, 1996). The amount of insulin injected during pregnancy is an important factor in determining the progression of GDM to DM in later years.

Like the study performed in Madrid (Weller, 1996), we also found that macrosomia was more common in children of women who had developed DM after GDM.

Metabolic assessment of patients after delivery shows a significant statistical relationship with glucose intolerance after delivery and cardiovascular risk factors such as abnormal lipid profile and high blood pressure. In our study, women with IGT and DM had a higher triglyceride, total cholesterol, LDL cholesterol and had a lower HDL cholesterol level than normal.

Abnormal lipid profile can increase the risk of cardiovascular complications in later years. Kjos, in 1991, studied the cumulative rate of DM in women with GDM 36 months after delivery and estimated it to be around 45%, 32 months after delivery.

Lipid profile changes in these women 3-11 months after delivery was in the form of increased triglyceride and increase in HDL cholesterol level. However, we did not find significant changes in the levels of LDL and total cholesterol as compared to normal patients (Kojos *et al*., 1991).

In the present study serum testosterone level in patients who developed DM after pregnancy was significantly higher that the group normal.

Today, a clinical relationship has been found between insulin resistance, hyperinsulinemia and anovulatory menstrual cycles along with hyperandrogenemia and it has been found in all racial groups. Hyperinsulinemia and hyperandrogenemia usually coexist and in most patients, abnormal insulin function is seen prior to increase in androgen level (Robert and Nattan, 1999).

Finally, it should be stressed that coexistence of glucose intolerance with abnormal lipid profile as well as abnormal increased androgen levels as well as other cardiovascular risk factors such as obesity and hypertension, which have been found in our study and previous studies, call for primary preventive measures to be taken by the health authorities for women with history of GDM.

During this study higher prevalence of diabetes and change in Lipid profile and androgen level and hypentension after delivery in G.D.M have studied.

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