

Pregnancy outcome in undiagnosed gestational diabetes

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ABSTRACT

Objective: To investigate the outcomes of macrosomia and compare the risk factors associated with neonatal and maternal complications between mothers with gestational diabetes (GDM) and Non-GDM mothers, and determine whether it is important to screen for GDM before birth.

Methodology: We sampled the venous blood of the mothers of 120 macrosomic neonates in the first 24 hours after delivery, and assessed glycohemoglobin (HbA1c) levels. A diagnosis of GDM was based on a HbA1c > 5.9%.

Results: Twenty-three (19%) mothers had an HbA1c > 5.9%. Maternal and neonatal complications were not significantly different in undiagnosed GDM and non-GDM women. Except for the mother's age, parity, and BMI, other risk factors for the development of GDM didn't differ significantly between the two groups.

Conclusions: The frequency of neonatal and maternal complications associated with the birth of macrosomic neonates are not significantly different between GDM and non-GDM mothers. Hence, the universal screening of pregnant women for GDM is not recommended.

KEY WORDS: Gestational Diabetes, HgbA1c, Macrosomia, Screening.

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INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as glucose intolerance that begins, or is first detected, during pregnancy.¹ The prevalence of GDM in the United States ranges from 1.4% to 12.3%, and 2.3% to 6.3% in Iran.²

Macrosomia—defined as an estimated fetal weight in the 90th percentile or higher for gestational age—is the most frequently cited complication of GDM. Most observers have recognized that both the macrosomic infant and its mother are at high risk for injury. However, examinations of neonatal morbidity are largely retrospective.³ Although studied extensively for more than 30 years, there is no consensus on specific screening strategies, criteria for screening, or even whether diagnosis and treatment have an effect on fetal outcome. This study assessed the presence of GDM, the importance GDM risk factors, and any related complications in Iranian women with macrosomic infants.

METHODOLOGY

An analysis of women with macrosomic infants—based on an Alexander curve⁴ was performed at hospitals of the Ahvaz Jundishapur University of Medical Sciences (AJUMS) from March to December 2008. The study was approved by the ethical committee of AJUMS. The gestational age was estimated based on either the date of the last menstrual period, early ultrasound dating (at 10–20 weeks) or the Ballard scoring system. Women known to have been diabetic before pregnancy, or diagnosed with GDM at a gestational age of less than 34 weeks, were excluded from the study. A venous blood sample was obtained from each woman in the study and assessed for glycohemoglobin (HbA1c) levels in the first 24 h after delivery. The blood samples were collected in tubes containing EDTA and stored at a temperature of 4°C for a maximum period of 72 h before the measurements were taken.

The samples were manually mixed for one minute, after which portions were analyzed by high performance liquid chromatography (HPLC) with HPLC analyzer D-10 BIO RAD. The criterion for the diagnosis of GDM was an HbA1c reading greater than 5.9%. Data on maternal age, weight, height, mode of delivery, and maternal blood pressure were collected; as well as data regarding infants' birth weight, Apgar scores at one and five minutes, neonatal complications, and intensive care unit admissions. Hypertension was defined as a blood pressure reading $\geq 140/90$ mmHg in two or more measurements. Neonatal hypoglycemia was considered as having a blood glucose level of 40 mg/dL or less.

Statistical Analysis: Data were analyzed using SPSS, version 14.0 (SPSS, Chicago, IL). Results were expressed as mean \pm SD. The unpaired student's t-test, chi-square test and Fisher's exact test were used. P-values <0.05 were regarded as being statistically significant.

RESULTS

Of 120 women with macrosomic infants who met the inclusion criteria, 23 (19%) had an HbA1c value greater than 5.9%. The mean birth weight of all 120 infants was 4133 ± 287 g at 38.73 ± 1.37 weeks of gestation. The mean birth weight of infants of GDM mothers and those of non-GDM mothers was 4176 ± 319 and 4122 ± 280 g, respectively ($P = 0.42$). The mean gestational age of infants of GDM mothers was 38.13 ± 1.54 weeks and was 38.87 ± 1.30 weeks in non-GDM women ($P = 0.02$). The neonatal outcomes are shown in Table-I. Sixty-four (53.3%) of

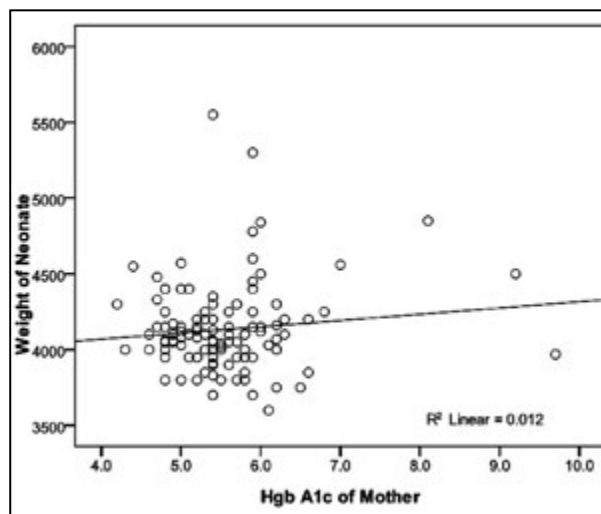


Fig 1: Relationship of mothers' HbA1c and newborns' birth weight.

the macrosomic fetuses were delivered by cesarean section. Maternal outcomes are shown in Table-II. Linear regression analysis was applied. The relationship between maternal HbA1c level and infant birth weight was not significant ($p=0.22$) (Figure 1).

DISCUSSION

In this study we did not find any advantages of screening for GDM during pregnancy because outcome and complications between undiagnosed GDM and healthy women were not different.

In the United States, the standard screening and diagnostic test for GDM is a two-step procedure (as also performed in Iran). The initial step is a non-fasting 50-g glucose challenge test (GCT). Women

Table-I: Neonatal outcome among macrosomic infants delivered from GDM and non-GDM mothers.

Outcome	GDM No. (%)	Non-GDM No. (%)	Total No. (%)	P Value
Hypoglycemia	3 (14)	12 (13)	15 (13)	N.S*
Apgar 1 ≤ 7	3 (13)	4 (4)	7 (6)	N.S
Respiratory Distress	2 (9)	8 (8)	10 (10)	N.S
Erb's Palsy	0 (0)	2 (2)	2 (1.6)	N.S
Shoulder Dystocia	0 (0)	4 (4)	4 (3.3)	N.S
Congenital Anomalies	0 (0)	2 (2)	2 (1.6)	N.S
Mortality	0 (0)	2 (2)	2 (1.6)	N.S
Total	23 (19.2)	97 (80.8)	120 (100)	N.S

*Not significant

Table- II: Maternal outcome among GDM and non-GDM mothers.

Characteristics	GDM No. (%)	Non GDM No. (%)	Total No. (%)	P Value
Cesarean Section	14 (61)	50 (51)	64 (53.3)	N.S*
Normal Vaginal Delivery	4 (17)	13 (13)	17 (14.2)	N.S
Abnormal Vaginal Delivery	5 (22)	34 (35)	39 (32)	N.S
Transfusion	1 (4)	1 (1)	2 (1.7)	N.S
Post Delivery Fever	1 (4)	3 (3)	4 (3.2)	N.S

*Not significant

with plasma glucose levels greater than 140 mg/dL receive a 100-g 3-h oral glucose tolerance test (OGTT).⁴ We measured HgbA1c levels in order to test for gestational diabetes mellitus. HbA1c measures average glycemic levels over the past 2-3 months. In women who develop GDM, glucose metabolism becomes impaired in a short period after 24 weeks of gestation; therefore, mothers with a gestational age greater than 34 weeks were included in this study. Nielsen has reported normal HbA1c levels of 4.4% to 5.6% in late pregnancy.⁵

In Rohulfings' study, HbA1c was demonstrated to have high sensitivity (83.4%) and specificity (84.4%) for the detection of undiagnosed diabetes at an HbA1c cut-off above 5.6%.⁶ In another study, Radder reported HbA1c levels of 3.4%-5.9% in healthy pregnant women.⁷ In a multicenter study, the HbA1c reference intervals were 4%-5.5% for pregnant, non-diabetic women.⁸ In our study—based on the Radder study—the maximum reported HbA1c level in healthy pregnant women (5.9%) was accepted as the HbA1c cut-off point. In the present study, 23 cases (19%) had an HbA1c greater than 5.9% and were thus considered diabetic (GDM). This value is consistent with the frequency reported by Berard (19%), a study that evaluated mothers of one hundred macrosomic neonates for GDM.⁹ The one-minute Apgar score and frequencies of hypoglycemia, respiratory distress, Erb's palsy, shoulder dystocia, congenital anomalies, and mortality were not significantly different between neonates of GDM and non-GDM mothers.

We however found, that the frequency of cesarean section was higher in GDM mothers. The frequency of cesarean section in GDM women was reported at 33.6% compared to 20.2% in healthy women, but the difference between the two groups was not significant. However, this finding does suggest that

a diagnosis of GDM often alters the delivery route to that of cesarean section. There were no significant differences between frequencies of hypertension, abnormal vaginal delivery, transfusion, and postpartum fever between GDM and non-GDM women. Among GDM risk factors, being of an age above 25 years, having a BMI \geq 30, and parity \geq 3 were significantly different between the two groups. Further, in the Naylor study only the mother's age \geq 30 years, BMI \geq 25, and parity \geq 3 were significantly different between GDM and non-GDM women.¹⁰ Risk factors defined by our study were compatible with Naylor's report but the reasons of differences in borders were 1- we included all women's age groups in comparison with >24 in Naylor study, 2- we have used postpartum weight which is significantly higher than preconception weight used by Naylor.

History of previous macrosomia, stillbirth, congenital anomalies, hypertension, and a familial history of diabetes mellitus were not different between the two groups. Linear regression analysis did not indicate a relationship between mother's HbA1c and neonatal birth weight. This finding is consistent with some studies¹¹ and inconsistent with others.¹² HbA1c changes may not be so sensitive as to reflect slight but recurrent episodes of hyperglycemia, which may nevertheless be enough to cause fetal hyperinsulinism and hypoglycemia.

Finally post-partum weight used by this study, does not show the actual normal preconception weight- and could be considered as a limitation- in fact weight gaining is not similar in all women but we avoided bias made by inaccurate questionnaire records for preconception. Because post partum weight is still significantly higher than preconception, both groups were in the near equal over weight state, then comparison could be acceptable but limit of BMI \geq 30 as a risk factor must be reduced to overweight state instead.

CONCLUSION

The present study showed that when a macrosomic neonate is born, the frequency of neonatal and maternal complications is not significantly different between GDM and non-GDM pregnant women. Hence, it seems that universal screening of pregnant women for GDM is not cost-effective. If selective screening for GDM is to be considered, we recommend the following risk factors be considered: maternal age $>$ 25 years, state of overweight, and parity \geq 3.

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