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Short Communication

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Hemoglobin A1 Concentration of Diabetic Mother as a Predictor of Perinatal Morbidity and Mortality

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ABSTRACT

Prospective study of diabetic mothers delivered in obstetric department Alkhadra Hospital, Tripoli Libya during the period from Jan 1st to Dec 31st 2005. 66 diabetic mothers were included in this study, 27 of them with gestational diabetes, 30 with insulin dependent diabetes (IDDM), and 9 with noninsulin dependent (NIDDM), mean age 31.6 years. They have glycosylated hemoglobin (HbA1C) values > 8.5%. The study showed high values in early pregnancy were associated with major neonatal congenital anomalies (2 cases), and in second and third trimesters were associated mainly with infants large for gestational age (7 infants), and neonatal hypoglycemia (14 infants).

Keywords - *Diabetes mellitus; Glycosylated hemoglobin; HbA1c; Morbidity; Mortality; Ion-exchange chromatography.*

INTRODUCTION

Diabetes mellitus is the most common endocrine and metabolic disorder[1] which leads to recognized complications in pregnancy[2], and the outcome of pregnancy may be adversely affected when pregnancy is complicated in women with gestational diabetes.[3] The incidence of macrosomia in diabetic mothers which may be accompanied by birth trauma approaches 30%. Maternal diabetes may also be associated with neonatal congenital heart disease, respiratory distress syndrome, policythemia, hypoglycemia, and hypocalcaemia.[4] Glycosylated hemoglobin (HbA1C) is when glucose binds to amine functional units of all proteins by ketoamine bonding as a result of a non-enzymatic process known as glycation. The intensity of glycation depends on plasma glucose level and the lifetime of the protein, its structure and its accessibility.

The proportion of proteins having under gone glycation thus reflects the plasma glucose balance and its variation, and this constitutes a sort of glycemic memory. Hemoglobin is the most widely used protein because of its limited inters-individual variation and long lifetime (120 days). Glucose binds to the n-terminal of the beta–chains, modifying their physiochemical characteristics of the isoelectric$_{PH}$, that enables separation and assay of HbA1C.

The objective for diabetic subjects can be translated into glycated hemoglobin objectives <6.5%, optimal objective <8% for two successive determination acceptable control.[5]

The purpose of this study was to determine the relation of diabetic control as measured by glycosylated hemoglobin (HbA1c) during pregnancy and perinatal outcome of infant of diabetic mothers.

MATERIALS AND METHODS

Sixty six diabetic patients who received obstetric care in Alkhadra hospital between 1st Jan. to 31st Dec. 2005, and who are known to be diabetic or diagnosed during pregnancy by the use of O·Sullivcan and Mahan criteria[6] which was included in the study.

In those, female gestational diabetes was diagnosed; dietary therapy was instituted and supplemented with insulin therapy, if repeated fasting blood sugar concentrations exceeded (105 mg/dl). Maternal surveillance included fasting as well as postprandial glucose determination at clinical visits and daily normal blood glucose monitoring by those women receiving insulin therapy.

Fetal surveillance was begun at (32 weeks to 36 weeks) gestation by twice weekly nonstress testing and timing of delivery was based on maternal and fetal status. Hemoglobin A1 concentration (HbA1C) as an indication of blood glucose regulation over a period of several weeks to months has been determined by ion-exchange chromatography method in which glycated hemoglobin A1 concentration (HbA1c) is measured in contrast to the specific determination of non enzymatically glycated hemoglobin A1 concentration by affinity chromatography is more precise.[7] Mean glycated hemoglobin A1 concentration was taken in each trimester. Gestational age was determined by the date of the mothers last menstrual period (Naegele·s rule)[8] and confirmed or corrected by ultrasounography examination as well as by clinical assessment of the newborn.[9] APGAR scores were assigned by the pediatrician attended the delivery, and the presence of congenital anomalies. All infants of diabetic mothers were admitted to neonatal intensive care unit (NICU), received care in incubators, monitored blood sugar every six hr, full blood count, serum calcium,

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C. reactive protein, urea, sodium, potassium, serum bilirubin total and direct. Admission duration was at least 24 hr. Data was analyzed by X2 determination Fisher's test of exact probability.

RESULTS

The sixty six patient satisfied the criteria for inclusion in the study (GDM = 27, IDMM = 30, NIDDM = 9). The mean age was (31.6 years), there were (16) primigravidas[5] and (50) multigravidas[6], the values of glycated hemoglobin A1 concentration > 8.5% was taken as abnormally high and these values were correlated with the neonatal outcome, and was no perinatal death. Two cases with major congenital malformation were associated with high maternal HbA1c in early pregnancy (10.2% and 11.5%). The one minute APGAR scores were low in the infants of diabetic mothers within third trimester, glycated HBA1c > (8.5 %). Table (1) shows the age group, parity, previous history, treatment of the study mothers, Table (2) shows pre-eclampsia and its severity in a relation with large/ small for gestational age and congenital anomalies. Table (3) shows the affect of glycosylated hemoglobin in second and third trimester on the outcome of the newborn babies, and the *P*. value as follows.

Table 1: Characteristic gestation diabetes mellitus.

	Gestation diabetes mellitus.	Insulin dependent diabetes.	Noninsulin dependent diabetes mellitus.
Total number	27	30	9
Age group			
<20 years	-	-	-
20-29 years	6	22	7
30-39 years	18	22	7
>40 years	3	2	2
Parity			
Primy gravida	11	5	-
1-2	9	10	2
>3	7	15	7
Previous history of			
Caesarian section	9	15	3
Macrosomia	5	11	3
Congenital anomalies	3	3	1
Intra uterine fetal death	1	1	2
Gestational diabetes mellitus	8	9	5
Neonatal death	3	9	2
Family history of diabetes mellitus	17	24	7
Treatment			
Diet control for gestational diabetes mellitus.	11	2	2
Insulin for known diabetes mellitus.	2	2	1

Table 2: The relationship between HbA1c and infant of diabetic mother complication.

	Mean HbA1c=6.5%.	Mean HbA1c> 11.5%	*P.* value
Large for gestational age	1	3	0.583
Small for gestational age	1	0	0.667
Congenital anomalies	0	2	0.083
Pre-eclampsia			
Mild.	12	9	3
Sever.	1	1	-
Abortion.	2	2	1

Table 3: The affect of glycosylated hemoglobin in second and third trimester on the outcome of the newborn babies.

Babies complications	HbA1C<8.5%, (mean=6.0%) 52	HbA1c>8.5 (mean=11.2).14	*P*.value
Large for gestational age	7(14%)	7(50%)	0,007
Small for gestational age	2(3.8%)	0.0	0.618
Congenital anomalies	0.0	3(5.7%)	0.008
Hypoglycemia	18(36%)	14(100%)	0.001
Polycythemia	4(7.6%)	3(21.4%)	0.528
Hypocalcaemia	0.0	4(28.5%)	0.001
Hyperbilirubinemia	0.0	4(28.5%)	0.001

(Mean HbA1c=6.47%) *P*. value.

DISCUSSION

Glycated hemoglobin (HbA1c) concentration is the only parameter affording a reliable reflection of plasma glucose balance and it constitutes a validated index for predicting the emergence or progression of complications. The percentage of (HbA1c) is directly proportional to the mean plasma glucose value.[7] The objectives for the diabetic subject can be translated into glycosylated hemoglobin objectives <6.5%, optimal objective, the incidence of infants large for date (birth weight >90% based on growth standard developed), and hypoglycemia (when 2 consecutive value of plasma glucose were 40mg/dl or less during first hr after birth), hyperbilirubinemia when the result is greater than 12 mg/dl[8], are increased in women with increased concentration of glycosylated hemoglobin (HbA1c) in the second and third trimesters of pregnancy and all of these reflect the effect of chronic maternal hyperglycemias on fetal pancreas and fetal hyperinsulinemia, in which the low incidence was found in those women with low level of glycosylated hemoglobin concentration.

The high incidence of malformation noticed in this study indicates the poor control of the chronic hyperglycemia at the time of embryogenesis, and in those patients who received medical care before the pregnancy better glycemic control had low incidence of fetal malformation.[9] Poor blood sugar control in third trimester of pregnancy will lead to abnormal placental function[10] and poor fetal reserve that could explain the low one minute APGAR scores noticed in this study which the immediate response of the fetus to the antepartum stress. Bilirubin production may be increased by macrosomic infants due to the stimulation of both effective and ineffective erythropiosis by hyperisulinaemia.[11]

CONCLUSION

Poor blood sugar before, as well as during pregnancy and neonatal outcome is associated with high level of glycosylated hemoglobin (HbA1c), and good neonatal outcome needs better metabolic control throughout pregnancy.

RECOMMENDATIONS

Proper metabolic control should be started even before pregnancy, as well as hemoglobin A1c (HbA1c) should be 6.5% or less throughout the pregnancy which leads to a good perinatal, natal, and postnatal outcome of infant of diabetic mothers.

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REFERENCES

[1] Sperling MA (1996) Diabetes Mellitus. *In*: Nelson Textbook of Pediatrics, 15th edn. Eds. Nelson WE, Behrman RE, Kliegman RM, Arvin AM. Philadelphia, W.B. Saunders Co, pp. 1646-1666.

[2] Hadden DR (1966–1977) Screening for Abnormalities of Carbohydrate Metabolism in pregnancy; the Belphast experience.

[3] Yleinen KK, Ravivo KT (1981) HbA1c predicts perinatal outcome in infant of diabetic mothers, *BR .O Bst Gynecol* **88**, 10.

[4] Behrman R (1995) Nelson textbook of pediatric, 15th edn, Hardcover, Publisher: W B Saunders Co. pp.476.

[5] Frier BM, Fisher BM (2005) Diabetes mellitus, Davidson's Principles and Practice of medicine,19th edn, edited by Christopher Haslett, Churchill Livingstone, pp.660.

[6] O· Sullivan JB, Mahan CM, Charles D, Dandrow RV (1973) Screening criteria for high risk gestational diabetic patients, *J Obest Gynnecol* **116**, 895.

[7] Gabbe SG, Mestman JH, Freeman RK, Geobelsmann UT, Lowensohn RI, Cetrulo D, Quillingan EJ (1977) Management and outcome of pregnancy in diabetes mellitus classes, *Am J Obest Gynecology* **129**,723.

[8] Sally C. et al. (2008) Oxford Handbook of Obstetrics and Gynecology 2nd edn, Normal Pregnancy, Chapter **1**, pp. 2-13.

[9] Robert MK (1996) Nelson Text Book of Pediatrics, 15th edn. Philadelphia, W.B. Saunders, pp.443-457.

[10] Von Hanrnak (Hrsg) (1994) Kinderheilkunde,9th edn, pp.80-83

[11] Oh W (1995) Neonatal outcome and care, 2nd edn, In: Reece EA, Livingstone, pp. 369-378.