

DIABETES MELLITUS IN PREGNANCY; MATERNAL & PRENATAL OUTCOME

Rabia A Alkaban* & Methal A AL-Rubaee@

*MB,ChB. @MB,ChB, DGO, CABOG, Department of Obstetric & Gynecology, Medical College, University of Basrah

Abstract

This is a case-control comparative study carried out over the period (July 2007-July 2008) to identify the frequent type of D.M., analyze demographic features of diabetic cases as well as to identify maternal, fetal & neonatal complications of D.M. during pregnancy.

This study included 160 diabetic pregnant women as (cases) compared to 180 non-diabetic pregnant women as (control) who were admitted to three known hospitals with obstetrical & Gynecology department during same period of study. Such controls had approximated age & parity to that of cases.

Type 2 DM was the commonest type among cases who tend to be more advanced in their age with higher BMI compared to controls. Three major risk factors that predispose to develop GDM were family history of type 2 or GDM, advanced maternal age & obesity.

Diabetic pregnancy was more likely complicated by abortions, hypertensive disorders, polyhydramnios and preterm delivery with high C/S rate as well as P.P.H. & birth tract injury in comparison to controls. Cephalo-pelvic disproportion consequent to macrosomia was main indication for C/S in diabetic cases in whom not only macrosomic newborns were more but also stillbirth rate was higher with lower Apgar score & more admission to NICU.

Diabetic newborns were more likely to be affected by RDS, hypoglycemia & congenital malformation.

In conclusion, D.M. is a major medical disorder that exhibit burden on health of both mother & fetus with high maternal morbidity, prenatal & neonatal morbidity & mortality.

Introduction

The WHO recognizes three main forms of DM: Type 1: Insulin dependent DM, Type 2: Non insulin dependent DM. Gestational DM. Defined as glucose intolerance of variable degree with onset or first recognition during present pregnancy¹.

Epidemiology: Only 10% of diabetes in pregnancy is pre-gestational while 90% is gestational. The incidence of type1 in the general population is 0.1-0.4% while type2 represent 3% of pregnancies². Recent studies suggest that prevalence of

DM among women of child bearing age is increasing which is believed due to: More sedentary life styles, Changes in diet, Continued immigration from high risk population, Virtual epidemics of childhood & adolescent obesity.

GDM occur in between (5-10%) of all pregnancies between 1-14%]in various studies³.

Fetal Morbidity: 1. Miscarriage: Current data suggest strong association between degree of glycemic control prior to pregnancy & miscarriage rate. In those

with glycol-hemoglobin exceeding 11%; the miscarriage rate reach up to 44%⁴.

2. Congenital anomalies: - Approximately 3-8% of infants of diabetic mothers suffer from major congenital anomalies⁵.

Neural tube defects & cardiac malformation are more common than in non diabetic population⁵.

3. Growth restriction: Growth restriction occurs significantly in pregnancies complicated by pre-existing type 1 DM⁴.

4. Growth acceleration: Excessive body fat stores stimulated by excessive glucose delivery during diabetic pregnancy often extend into childhood & adult life⁴.

5. Fetal Obesity: Macrosomia occur in 15-45% of pregnant diabetic women; (3 fold) increase from normoglycemic women⁴.

6. Preterm Labor: Spontaneous preterm labor complicate about 20% of pregnancies with diabetes⁶, Maternal Morbidity: Diabetic retinopathy, Diabetic nephropathy.

3. Chronic hypertension: This complicate 1 in 10 diabetic pregnancies. Patients with underlying renal or retinal vascular disease are at higher risk with 40% having chronic hypertension⁷.

4. Pre-eclampsia: The risk in diabetic women is related to maternal age & duration of pre existing diabetes⁸.

5. Infection: It has been estimated that about (80%) of pregnancies in women with type 1 DM will have at least one episode of infection compared with 25% in non pregnant⁹.

6. Operative Delivery¹⁰.

7. Pelvic floor trauma: Macrosomia, nulliparity, episiotomy & instrumental delivery are established risk factors for 3rd & 4th degree perineal tear. Shoulder dystocia is also risk factor for perineal trauma¹¹.

Prenatal morbidity & mortality:

Prenatal mortality: The current prenatal mortality rates remain high; Congenital malformations, RDS & extreme prematurity account for the most prenatal deaths in diabetic pregnancies¹².

Polycythemia: Its rate is 1% in gestational diabetes while 3% in both type 1 & 2 diabetes¹².

Neonatal hypocalcaemia: Its rate is 1% in both GDM & type 2 while it is 4% in type 1¹².

4. Postnatal hyperbilirubinemia: Its rate is highest in type 1, 55% while it is 44% in type 2 & 29% in GDM¹².

5. Respiratory Problems: RDS incidence has been declined dramatically from 31% to 3% after improved prenatal management for DM & new techniques in obstetrics for timing & mode of delivery. RDS affect 8% of type 1, 4% of type 2 & 3% of GDM¹².

6. Birth injury: Common birth injuries associated with D. M. are shoulder dystocia, brachial plexus trauma, facial N. injury & cephalic-haematoma¹³.

7. Hypoglycemia: Hypoglycemia may lead to seizures, coma & brain damage. The rate of hypoglycemia is 29% in type 1 24% in type 2 & 9% in GDM¹³.

Materials and Methods

A prospective case control comparative study carried out over a period of one year from 1st of July 2007 till 1st of July 2008 in Basra Maternity child Hospital, AL-Basrah General Hospital, AL-Tahrer Hospital including 160 pregnant women who were admitted to labor room diagnosed as diabetics as (cases) compared to 180 pregnant women who were non diabetic as (control), whose age & parity is similar or approximated to

those with diabetes to identify the risk of diabetes per se.

DM was diagnosed by history taken from mother, to identify the onset of disease & the type of treatment so to conclude the type of diabetes; then it is confirmed by biochemical blood test to measure glucose level.

A special printed questionnaire papers were used for all participants including data about age, parity, maternal body weight & height, type of D., gestational age, existing hypertension, previous obstetrical history including abortion, macrosomic newborn, unexplained intrauterine death, preterm labor & instrumental delivery as well as family history of DM and the result of this pregnancy in term of abortion, C/S or instrumental delivery, birth weight of newborn, PPH. or genital tract injury & neonatal complication with admission to NICU.

BMI was estimated by measuring maternal weight in kilograms divided by height in meter squared (kg/m^2). It is classified as:

1. Acceptable: if it range between 19-25.
2. Over weight: if it is 25-30.
3. Obese: if it is 30-40.
4. Morbidly obese: if it is > 40 ¹⁴.

Evaluation of apgar score including heart rate, respiratory effort, muscle tone, facial grimace & color was done within 5 minute after birth. A score of 7-10 indicate best possible condition while a score of 0-3 require immediate resuscitation including intubations & admission.

A score of 4-7 indicate use of some measures of resuscitation newborn will be in favorable condition¹⁵.

To test the significance of difference; Z test was used to estimate (p value). If $P <$

0.05 it was considered statistically significant and $P < 0.01$ it was highly significant.

Results

Diabetic patients in this research had been classified according to WHO classification as shown in table I.

About 50) of cases were of type 2 followed by GDM (34%) & the least frequent were those of type 1 (17%). Those of type 2 gave history of previous GDM in (30 cases; 38.5%).

Maternal demographic characters of both cases & control groups were shown in (table II). Diabetic cases found to be of advanced age (i.e. >35 years) in about one fourth of cases (25%) compared to only (11.6%) of controls with statistically highly significant difference ($p < 0.01$). About (70%) of diabetic cases found to be grandmultiparae (i.e. >5 deliveries) compared to only (42%) of controls with statistically highly significant difference ($p < 0.01$). Obesity is evident among diabetic cases where about (70%) had BMI classified as obese & morbidly obese compared to (35%) of controls with statistically highly significant difference ($p < 0.01$).

Diabetic cases with GDM whom constitute about one third of studied group in this research found to have one or more of the risk factors for GDM as in (table III). About (65%) of those had family history of type 2 or GDM in their 1st degree relatives.

Obesity (58%) & advanced maternal age (50%) were a frequent risk factors for developing GDM as noted also in table 3. Also previous history of macrosomic newborns was a frequent risk factor as about half of those with GDM had such history before.

Pregnancy complications & outcome were shown in (table IV) where about half of cases (47%) gave history of hypertensive disorders compared to only (17%) in controls with statically highly significant difference ($p < 0.01$). Pregnancy induced hypertension tend to be more frequent. Polyhydramnious was evident in about one fourth of cases (26%) compared to only (3%) of controls with statistically highly significant difference ($p < 0.01$). Pregnancy of diabetic cases ended by abortion in about (14%) compared only to (6%) of controls as well as preterm delivery in (10%) compared to (4%) of controls with statistically highly significant difference ($p < 0.01$).

C/S rate found to be higher in diabetic cases (39%) compared to only 13% in controls while N.V.D was the usual end result in controls which constitute about three fourths (77%) compared to only (37%) in diabetic cases with statistically highly significant difference ($p < 0.01$). One fourth of diabetic cases (26%) developed PPH. compared only to 5.5% in controls as well as birth tract injury was more in diabetics (9%) compared to 4% in controls with statistically highly significant difference ($p < 0.01$).

Indications of C/S were listed in (table V); about half of C/S (48%) in diabetic cases were indicated for cephalo-pelvic disproportion consequent to macrsomia

compared to only 13.0% in controls while C/S for malpresentation which constitute about one fourth (26%) of C/S rate in controls is the commonest compared to only 5% in diabetics with statistically highly significant difference ($p < 0.01$).

Neonatal outcome was shown in table VI; (9%) of diabetic cases had stillborn neonate compared to only (3%) in controls with statistically highly significant difference ($p < 0.01$). More than half of newborns (56%) who delivered to diabetics had B.W. (4000gm->) (i.e. macrosomic) compared to only (12%) in controls with statistically highly significant difference ($p < 0.01$).

Newborns of both diabetics & controls delivered in good status according to Apgar score although the score tend to be higher in those born to non-diabetic mothers. All newborns delivered to diabetic mothers were admitted to NICU for early detection & urgent treatment of hypoglycemia if develop.

Table VII, represent frequent early neonatal complications; the commonest was RDS which developed in about one fourth (25%) of newborns delivered to diabetic mothers compared to only (6%) in non-diabetics. Hypoglycemia tend to occur more in newborns of diabetic mothers (14%) compared to only (2%) in those of non-diabetic mothers with statistically highly significant difference ($p < 0.01$).

Table I: Classification of D.M.

Type	No.	%
Type 1	27	16.8
Type 2	78	48.8
G. D. M.	55	34.4
Total	160	100

Table II: Maternal demographic characters

Character	Cases		Control	
	No.	%	No.	%
1. Maternal age:-				
16-20 yr.	15	9.3	27	15.0
21-25yr.	26	16.3	42	23.3
26-30 yr.	20	12.5	50**	27.7
31-35 yr.	59**	36.8	40	22.4
> 35	40**	25.1	21	11.6
Total	160	100	180	100
2. Maternal parity				
Primigravida	20	12.5	38*	21.1
1-4	46	16.3	67*	37.2
5-7	63**	39.4	38	21.2
> 7	31	31.8	37	20.5
Total	160	100	180	100
3. BMI:-				
1. Acceptable	25	15.6	56**	31.2
2. Overweight	22	13.7	61**	33.8
3. Obese	64**	40.1	33	18.4
4. Morbidly obese	49**	30.6	30	16.6
Total	160	100	180	100

*: P < 0.05 **: P < 0.01

Table III: Risk factors for GDM

Risk factors	No.	%
Family history of GDM or type 2D.M.	36	65.4
Obesity		
Maternal age > 35years	32	58.1
Previous macrosomic infant	28	50.9
Previous pregnancy with GDM	26	47.2
Previous unexplained I.U.D	18	32.7
	8	14.5

Table IV: Pregnancy outcome

Events	Case		Control	
	No.	%	No.	%
Hypertension:-	75**	46.8	36	16.6
a. PE	45**	28.1	22	12.2
b. chronic hypertension	30*	18.7	14	7.7
Polyhydramniotic	42**	26.2	6	3.3
Abortion:-	22**	13.7	10	5.5
Missed	12**	7.5	3	1.6
Incomplete	8*	5	6	3.3
Complete	2	1.2	1	0.5
Preterm	16**	10	8	4.4
N. V. D	59	36.8	139**	77.2
C/S	63**	39.3	23	12.7
Instrumental delivery.	0	0	0	0
P. P. H.	42**	26.2	10	5.5
Birth tract injury	15**	9.3	7	3.8

Table V: Indications of C/S

Indications	Case		Control	
	No.	%	No.	%
1. C.P.D.	30**	47.6	3	13.1
2. Repeated C/S	14	22.3	3	13.1
3. Prolong labor	10	15.8	7	30.4
4. Ante partum haemo	6	9.6	4	17.3
5. Malpresentation	3	4.7	6**	26.1
Total	63	100	23	100

Table VI: Neonatal Outcome

Outcome	Case		Control	
	No.	%	No.	%
Alive	125	90.5	165*	97
Dead	13**	9.4	5	2.9
Fresh	8**	5.7	3	1.7
Macerated	5*	3.7	2	1.1
B.W.: <3000gms	16	11.5		
3000-3499gms	23	16.6	25*	14.7
3500-3999gms	20	14.4	75**	44.1
4000-4499gms	39**	28.2	49**	28.8
4500-4999gms	30**	21.7	12	7.0
5000->	10**	7.2	8	4.7
Birth injury			1	0.5
Shoulder dysticia				
Brachial pleux injury	4	2.8	1	0.5
Apgar score within 5 min	1	0.7	0	0
0-3	0	0	0	0
4-7				
>7			10	5.8
Admission to NICU	15		58	34.1
	88**		112	65.8
	35		23	
	All**			

Table VII: Early Neonatal complications

Complications	Case		Control	
	No.	%	No.	%
RDS	35**	21.8	10	5.5
Hypoglycemia	20**	21.5	4	2.2
Congenital malformation	8**	5.0	2	1.1
Total	63	39.3	16	8.8

Discussion

In this research: type 2 DM was the most frequent type that affect about half of cases; this agrees the concept that there is worldwide increase in the prevalence of type 2 DM probably related to rising in population obesity and shift in

ethnicity as well as the prevalence of GDM varies in direct proportion to that of type 2 D.M. for a given population & ethnic group¹⁶. The above result was against what was reported that 90% of D.M. in pregnancy was GDM & only

10% was pregestational². Such difference can be explained by small size sample with short duration of study in this research as well as lack of established screening program for GDM in our community so GDM may pass undiagnosed as its onset is during pregnancy.

Diabetic cases in this research tend to be of more advanced in their age (i.e.>30 years) & obese as evident by their BMI in comparison to the controls. This agrees the result achieved in other study that mean age was (34+5 years) with BMI of (31.7-7.5)¹⁷. The existence of high parity in diabetic cases (i.e.>5 deliveries) is probably related to advanced age because of the approach of early marriage and conception in our community with tendency to have large family.

Those with GDM had more than one of risk factors that predispose to GDM; commonly were family history of type 2 or GDM, obesity and advanced maternal age as well as they were an Asian which is regarded as high risk ethnicity¹⁸, so that GDM was diagnosed in 11.6% of those with family history of D.M. in their first degree relatives, (12.3%) of those with preconception BMI of (30->), (8.5%) of women aged over 30 years.

Hypertensive disorders had been complicated about half of diabetic cases in this study; this agrees the result stated by other study where preeclampsia was more frequent among diabetics occurring in 12% compared to (8%) in non diabetics as well as chronic hypertension complicated (1 in 10) diabetic pregnancy¹⁹ while preeclampsia affected 8.9% of diabetics in other study¹⁷.

Risk of preeclampsia was related to maternal age & duration of pre-existing D.M. while risk of chronic hypertension

increased in those with underlying retinal or renal vascular disorders¹⁹. Polyhydramnios had been affected about one fourth of diabetic cases which indicate poor control of D.M. throughout pregnancy consequent to poor antenatal follow up or poor compliance to insulin treatment by some patients.

Abortion occurred in 14% of diabetic cases, significantly more than in non-diabetics, it approximates the result of 13.6% reported in other study¹⁷. Commonly such abortion was consequent to congenital anomalies which increased in their incidence as there was poor preconceptional control of DM.

Preterm delivery had been complicated (10%) of diabetic cases in this research; less than what was evident in other study (21.4%)¹⁷. This difference may attributed to small size sample & short study period of my research.

About 40% of diabetic cases had been delivered by C/S; a percentage approximated to that reported by other research which was (42.9%)¹⁷ & (38.7%)²⁰. PPH was a frequent complication affect about one fourth of diabetic cases (26.2%) consequent to uterine atony that may result from uterine over distension by both polyhydramnios & macrosomic fetus, also birth tract injury mainly vaginal & perineal tears was significantly complicate delivery of macrosomic fetuses (9.3%); these approximated to (30.2%) for PPH & (7%) for birth tract injury obtained in other study²⁰.

Cephalo-pelvic disproportion consequent to macrosomia was the frequent indication for C/S in diabetic cases as the established approach in our hospitals is to perform C/S rather than induction of labor for treatment of macrosomia.

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Stillbirth rate was higher in diabetic cases (9.5%) in comparison to the controls; such rate was higher than what reported in other study (4.8%)¹⁷; this can be explained by poor ante partum monitoring of fetal welling consequent to inadequate antenatal care & poor control of maternal hyperglycemia. Diabetic cases tend to deliver heavier newborns in their B.W. where about (57%) of them delivered macrosomic newborns (i.e. 4000gms->) compared to only (12%) in the controls. Such rate exceed what was reported by other study (41%)¹⁷. Despite this; most of diabetic newborns delivered with favorable Apgar score, although all were admitted to NICU for early diagnosis & urgent treatment of early neonatal hypoglycemia. One fourth of diabetic newborns developed RDS that was usually expected consequent to delay in pulmonary maturation in diabetic newborns. This result approximated the result obtained by other study (31%)²¹ while hypoglycemia affect only (14.4%) of diabetic newborns in this study less than what reported by other study (41.5%)²¹.

Congenital malformation affected (5.7%) of diabetic newborns similar to that of (5.1%) evident by other study²¹.

In Summary:- Pregnancy outcome in D.M. was still unsatisfactory in term of high maternal, fetal & neonatal complications consequent to suboptimal preconception & pregnancy care including preconceptional counseling, glycaemic control before, during pregnancy, appropriate screening & management of diabetic complications & fetal surveillance during pregnancy.

Various clinical skills & training issues for medical staff were found to be the cause of this as well as social & lifestyle for the women. Maternal social deprivation was found to be associated with poor outcome.

Recommendation:- The above findings support the argument that preparation for pregnancy, glycaemic control, screening programme & the standard of preconception & pregnancy care need to be improved if better pregnancy outcome are to be achieved for women with DM.