ORIGINAL ARTICLE

OUTCOME OF PREGNANCY AMONG MALAYSIAN WOMEN WITH DIABETES MELLITUS - A SINGLE CENTRE EXPERIENCE

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ABSTRACT

To observe the maternal and neonatal outcomes among women with diabetes mellitus in pregnancy as compared to healthy control. A case-control study involving 400 women with DM who delivered between 2005 to 2009 was done with age-matched control group. A total of 305 women (76.25%) were gestational diabetes mellitus (GDM) on diet control, 79 (19.75%) were GDM on insulin and 16 (4%) were pre-existing DM. The mean body mass index of the women with diabetes was higher compared to the age-matched healthy women (p <0.001). Approximately one-third of diabetic woman had no antecedent risk factor. About half of the women with diabetes (n=205, 51.3%) had unplanned pregnancy. Women with DM had greater risk of having spontaneous miscarriage and caesarean section (OR 1.4, 95% CI (1.2-1.7), OR 1.3, 95% CI (1.1- 1.5) respectively). Women with diabetes on insulin had higher risk of preterm delivery and caesarean delivery as compared to those with diet control, (OR 1.7, 95% CI (1.2- 2.5), OR 2.5, 95% CI (1.6-4.1) respectively). The incidence of macrosomia, low Apgar score, need for NICU admission, hypoglycaemia and respiratory distress syndrome (RDS) were higher among women with diabetes as compared to healthy control, and especially in those on insulin. Women with higher HbA1c had significantly increased need for caesarean section and NICU admission with higher incidence of macrosomia and RDS. The overall outcome of women with diabetes especially with higher level HbA1c remained poor as compared to a normal pregnancy.

***Key words**: diabetes mellitus, type 2 diabetes mellitus, gestational diabetes mellitus, complication, maternal and neonatal morbidity.*

INTRODUCTION

Diabetes in pregnancy may pose some challenges for both mother and baby. Despite achieving near normoglycaemia, poor maternal and fetal outcome remains a real risk among pregnant diabetic women[1]. Controversies still exist on the issues pertaining to its prevalence, screening, clinical management, and impact on maternal and neonatal outcome. A massive cross-sectional household survey conducted in 2006 involving 34,539 respondents aged 18 years and beyond had identified the prevalence of diabetes among Malaysian as 11.6%[2]. Despite being a common medical disorder that complicates pregnancy among Asian, there is lack of data available in this region[3-5]. A major measure taken to improve diabetes care came in the form of a national guideline, which had been introduced since 1992 in Malaysia.

Diabetes in pregnancy is associated with an increase in maternal and neonatal morbidities [3-7]. A 10-year audit that was undertaken to determine the influence of different levels of glucose tolerance on pregnancy complications, revealed a significantly increased risk of pre-eclampsia, caesarean section, intrauterine fetal death, neonatal hypoglycaemia and hyperbilirubinaemia for women with GDM as compared with women with normal glucose tolerance[7]. The risk of adverse maternal and infant outcomes increases with higher plasma glucose values[8]. A prospective study among Asian Indian mothers attending a tertiary care centre revealed a significant increase in frequency of miscarriage with delivery of extreme weighted babies ie. low birth-weight or macrosomia with increasing serum fructosamine level [6]. Women with treated diabetes in pregnancy have comparable maternal and neonatal outcome as that of women with normal glucose tolerance.

Pre-pregnancy care was associated with improved glycaemia control and reduced the risk of fetal anomaly, stillbirths and neonatal death[8,9]. Women with unplanned pregnancy usually do not receive adequate folic acid supplement.

The aim of study was to observe the maternal and neonatal outcome among women with diabetes mellitus in pregnancy. This study focused on comparing between diabetic women with age-matched healthy control and also, between diabetic women

on insulin treatment and diabetes on diet therapy.

METHODOLOGY

This was a retrospective case-control study involving 400 pregnant women with diabetes in pregnancy who delivered in UKMMC over a five-year period from 1st January 2005 to 31st December 2009. They were age-matched against healthy women as control. Foreigners and non-Malaysian women were excluded.

The pregnant diabetic patients were seen in the general antenatal clinics of the hospital and additionally attend the combined clinics. Routine investigations such as blood group, Rhesus identification, haemoglobin concentration were done at booking, while ultrasound was done to rule out congenital anomaly. Our institution does not routinely screen all pregnant women for gestational diabetes. Modified Glucose Tolerance Test (MGTT) was performed based on presence of risk factors either at booking or at 28 weeks gestation. Risk factors include obesity, first-degree relative with diabetes, previous GDM, previous history of macrosomic baby or stillbirth, and recurrent urinary tract infection (UTI) or vaginal infection. Blood was taken for fasting blood sugar (FBS) and 2-hour postprandial for glucose estimation using enzymatic method (glucose oxidase and peroxidase methods). Diagnosis of diabetes in pregnancy was confirmed in the group of patient with FBS equal or more than 6.0mmol/L and postprandial glucose level of more than or equal to 7.8mmol/L following ingestion of 75g glucose.

Diabetic pregnant women were seen every 2 weeks until 32 weeks gestation and weekly thereafter until delivery. Level of control was estimated at every trimester using blood sugar profile series, HbA1c and serum fructosamine measurement. Aim of therapy was to maintain pre- and post-prandial blood glucose level at 4 to 6mmol/L and that was achieved using dietary control and if necessary, insulin. No oral hypoglycaemic drugs were used. Adequate control on insulin will allow pregnancy to continue to 38 weeks gestation, whereas with adequate control on diet, the pregnancy is allowed up to 40 weeks. However, if diabetic control was poor or the women developed any complications such as pre eclampsia, delivery should be earlier than 38 weeks gestation. Vaginal delivery was aimed at if there was no contraindication. All diabetic women were followed up until 6 weeks post partum and were scheduled for 75g oral glucose tolerance test (OGTT).

Definitions used in this study are: **Diabetes Mellitus** (DM) in pregnancy: pre-pregnancy onset of Type I and Type II DM. **Gestational Diabetes Mellitus** (GDM): restricted to pregnant women whose impaired glucose tolerance is discovered during pregnancy. **Diabetes Mellitus on insulin**: All diabetic patient requiring insulin treatment regardless including Type I, Type II and GDM. **Diabetes Mellitus on diet control**: All diabetic patient requiring only diet control. **Preterm premature rupture of membrane (PPROM):** spontaneous rupture of fetal membrane that occurs before 37 completed week and before the onset of labour. **Premature rupture of membrane (PROM):** spontaneous rupture of fetal membrane that occurs after 37 completed week and before the onset of labour. **Preterm labour**: labour before 37 completed weeks gestation (259 days from the first day of the mother's last menstrual period or 245 days after conception). **Postpartum haemorrhage** : the loss of 500 mL of blood or more after completion of the third stage of labour. **Polyhydramnios**: Amniotic fluid more than 2 L or amniotic fluid index greater than 24 cm. **Miscarriage**: non survivable state as an embryo or fetus weighing 500 grams or less which typically corresponds to a fetal age (gestational age) of 20 to 22 weeks or less. **Macrosomia** : birth weight of 4000 grams or greater. **Hypoglycemia**: a clinically significant episode of hypoglycaemia characterised by a blood glucose concentration of ≤ 2.6mmol/L with clinical manifestations resolving within minutes of reestablishing normoglycaemia. **Respiratory distress syndrome (RDS)**: a clinical diagnosis in newborn with respiratory difficulty, including tachypnoea (>60 breaths/min), chest retractions, and cyanosis at room air that persists or progresses over the first 48-96 hours of life with a characteristic chest radiographic appearance (uniform reticulogranular pattern and peripheral air bronchograms). Surfactant deficiency is the primary cause.

Names and identification data of 800 women (400 subjects and 400 controls) were

obtained from delivery record and then the files of the patients according to their names and registration number were traced from the record office of UKMMC. In the event the names and registration number were invalid, the record is searched according to the ICD-9 code 648.0 (diabetes in pregnancy). Controls will be healthy women who deliver immediately after the index patients. Data collection sheets were used to enter the demographic data, types of diabetes, risk factors, antenatal records, the level of diabetic control, maternal and neonatal outcome.

Tabulation of data and statistical analysis were performed using SPSS version 18.0. All qualitative data were analysed using Chi square (X^2) to test the difference between two proportions and Fisher's exact test for contingency tables with minimum expected frequencies of less than 5. Odds ratios (ORs) with a 95% confidence interval (CI) were performed when necessary. All *p* values were for two-tailed tests, with the level of significance set at 0.05. Logistic regression was performed where applicable, while quantitative data were analysed using Student T test.

RESULTS

Among 7,530 deliveries during the period of the study, 400 (5.3%) women were diabetic. The demographic data between the age-matched healthy women were also comparable for race, occupation and parity. Among the diabetic women studied, 305 women (76.2%) were gestational diabetes mellitus (GDM) on diet control, 79 (19.8%) were GDM on insulin and 16 (4.0%) were pre-existing DM.

The mean body mass index of the women with diabetes in pregnancy was higher compared to the control group, 26.5±5.7 vs 23.1±4.4, which was significant according to Welch's t-test, $t(399) = 11.9$, $p < 0.001$. The 95% confidence interval for the BMI is between 2.8 and 4.0 percent. Approximately 190 (47.5%) women with diabetes had positive family history and 47 (11.8%) of them had previous miscarriage. A total of 124 (31.0%) women diagnosed with diabetes in pregnancy had no apparent risk factor (Table 2). About half of the women with diabetes (n=205, 51.3%) had unplanned pregnancy (Table 1).

Table1. Demographic features of women with diabetes in pregnancy vs control

Characteristics	DM (n=400)(%)	Healthy control (n=400)(%)	p value	OR (95% CI)
Age (years)				
<25	33 (8.2)	33 (8.2)	1.00[a]	ns
25 to 35	291 (72.8)	291 (72.8)		
>35	76 (19.0)	76 (19.0)		
Race				
Malay	260(65.0)	293(73.2)	0.074[a]	ns
Chinese	115(28.8)	86(21.5)		
Indian	21(5.2)	16(4.0)		
Others	4(1.0)	5(1.3)		
Parity				
Primigravida	129(32.3)	150(37.5)	0.120 [a]	ns
1 to 4	231(57.7)	223(55.7)		
Grandmultipara	40(10.0)	27(6.8)		
Occupation				
	142(35.5)	112(28.0)	0.072 [a]	ns
Housewife/unemployed	166(41.5)	182(45.5)		
Non-professional	92(23.0)	106(26.5)		
Professional				
Planning of pregnancy				
Planned	195(48.8)	199(49.8)	0.777 [a]	ns
Unplanned	205(51.2)	201(50.2)		
Time of booking				
(weeks)	396(99.0)	399(99.8)	0.178 [a]	ns
<20	4(1.0)	1(0.2)		
20-28				
Pre-pregnancy BMI				
(kg/m^2)	23.1 ± 4.4	26.5 ± 5.7	p <0.001[b]	2.8-4.0
Mean				
Underweight	25 (6.3)	43 (10.8)		
Normal	150 (37.5)	250 (62.5)		
Pre-obese	126 (31.5)	78 (19.5)		
Obese class 1	70 (17.5)	25 (6.25)		
Obese class 2	24 (6.0)	2 (0.5)		
Obese class 3	5 (1.3)	2 (0.5)		

[a]chi square, [b]t-test

Table2. Comparison of risk factor between women with DM and women without DM

Risk factor	DM (n=400)(%)	Healthy control (n=400)(%)	p value	OR (95% CI)
No risk factor	124(31.0)	333(83.2)	<0.001	0.34 (0.29-0.40)
Family history of diabetes	205(51.2)	45 (11.3)	0.0001	2.20 (1.95-2.50)
Previous miscarriage	47 (12.0)	21 (5.3)	0.0001	1.433 (1.20-1.71)
Previous fetal anomaly	0 (0)	0 (0)	-	-
Previous pregnancy with GDM	19 (4.8)	1(0.2)	0.000	1.95 (1.72-2.20)
Recurrent vaginal infection	3 (0.8)	0(0)	0.249	2.01(1.87-2.15)

*each women may have more than one risk factor.

Table 3 and 4 list the main obstetrics and neonatal complications. Concerning maternal outcome, women with DM in pregnancy had higher risk of spontaneous miscarriage in comparison to the healthy control (5.9% vs 2.6%, OR 1.4, 95%CI (1.20-1.71)). Overall, the incidence of preterm delivery was not statistically significant among diabetic women as compared to healthy control. It was observed diabetic women on insulin had 1.7 times higher risk of earlier delivery as compared to those on

diet control, 25.0% vs 13.5%, 95%CI (1.2-2.5). The incidence of premature leaking (PPROM) and term leaking (PROM) were not statistically significant between both groups. Caesarean section rate was 10 times higher among diabetic women than healthy women, 28.5% vs 18.8%, OR 1.3, 95% CI (1.12-1.49).

Table3. Comparison of maternal and neonatal complications between diabetic women and control

Maternal outcomes	DM (n=400)(%)	Healthy control (n=400)(%)	p value	OR (95% CI)
ANTENATAL				
Polyhydramnios	5 (1.3)	2 (0.5)	0.255	ns
Malpresentation	14 (3.5)	13 (3.3)	0.845	ns
Pre-eclampsia	11 (2.8)	5 (1.3)	0.130	ns
Spontaneous miscarriage (before week 20)	17 (4.3)	13 (3.3)	0.457	ns
PROM	30 (7.5)	29 (7.3)	0.837	ns
PPROM	2(0.5)	5(1.3)	0.569	ns
Recurrent vaginal infection	12 (3)	6 (1.5)	0.153	ns
INTRAPARTUM				
Gestational week at delivery - <37 - ≥ 37	65 (16.3) 335 (83.7)	52 (13.0) 348 (87.0)	0.193	ns
Mode of delivery - Spontaneous vaginal delivery - Instrumental delivery - Caesarean section (Elective and Emergency)	266 (66.5) 20 (5.0) 114 (28.5)	307 (76.7) 18 (4.5) 75 (18.8)	0.001	1.29 (1.12-1.49) [a]
POSTPARTUM				
Primary post-partum hemorrhage (PPH)	5 (1.3)	2 (0.5)	0.226	ns
Secondary PPH	0 (0)	0 (0)	-	-
Neonatal Complications				
Mean weight of baby	3.17±0.5	3.09±0.43	0.02	(0.006-0.07) [b]
IUGR	1 (0.3)	2 (0.5)	0.563	ns
Macrosomia	18 (4.5)	4 (1.0)	0.002	1.7 (1.4-2.1)[a]
Apgar score , 7 in 1 minute	20 (5)	9 (2.3)	0.037	2.3 (1.0-5.1)[a]
NICU admission	18 (4.5)	7 (1.8)	0.025	1.46 (1.13-1.88)[a]
Hypoglycaemia	4 (1.0)	0 (0)	0.045	2.0 (1.9-2.2)[a]
Jaundice	7 (1.8)	6 (1.5)	0.780	ns
Shoulder dystocia	3 (0.8)	0 (0)	0.249	ns
Erb's palsy	1 (0.3)	0 (0)	1.000	ns
RDS	10 (2.5)	0 (0)	0.002	2.03 (1.89-2.17)[a]
Anomalies	2 (0.5)	3 (0.8)	0.927	ns
IUD	6 (1.5)	1 (0.3)	0.058	ns

[a]chi square, [b]t-test

Table 4. Comparison of maternal and neonatal complications between women with DM on insulin versus diet control

Maternal outcomes	Diabetic on insulin (n=96)(%)	Diabetic on diet control (n=304)(%)	p value	OR (95% CI)
ANTENATAL				
Polyhydramnios	0 (0)	5 (1.6)	0.209	ns
Pre-eclampsia	5 (5.3)	6 (2.0)	0.086	ns
Spontaneous miscarriage (before week 20)	5 (5.3)	12 (4.0)	0.159	ns
PROM	9 (9.5)	21 (6.9)	0.522	ns
Recurrent vaginal infection	4 (4.2)	8 (2.6)	0.432	ns
INTRAPARTUM				
Gestational week at delivery				
- <37	24 (25.0)	41 (13.5)	0.008	1.72 (1.2-2.5)
- ≥ 37	72 (75.0)	263 (86.5)		
Mode of delivery				
- Spontaneous vaginal delivery	46 (47.9)	104 (34.1)	0.000	2.51 (1.55-4.06)
- Instrumental delivery	8 (8.3)	128 (42.1)		
- Caesarean section (Elective and Emergency)	42 (43.8)	72 (23.7)		
POSTPARTUM				
Primary post-partum hemorrhage (PPH)	3 (3.2)	4 (1.3)	0.231	ns
Secondary PPH	0 (0)	0 (0)	-	-
Neonatal Complications				
IUGR	1 (1.05)	2 (0.5)	0.073	ns
Macrosomia	6 (6.25)	12 (3.95)	0.007	2.6 (1.5-4.5)[a]
Apgar score , 7 in 1 minute	10 (10.53)	11 (3.61)	0.008	3.1 (1.3-7.7)[a]
NICU admission	17 (17.89)	13 (4.26)	0.000	4.3 (2.0-9.3)[a]
Hypoglycaemia	4 (4.21)	1 (0.33)	0.003	13 (1.5-121)[a]
Jaundice	4 (4.21)	4 (1.31)	0.078	ns
Shoulder dystocia	2 (2.11)	1 (0.33)	0.080	ns
Erb's palsy	0 (0)	1 (0.33)	0.576	ns
RDS	8 (8.42)	4 (1.31)	0.000	6.9 (2.0-24)[a]
Anomalies	0 (0)	2 (0.66)	0.429	ns
IUD	6 (1.05)	5 (1.64)	0.681	ns

Among the diabetic women, those on insulin had 2.5 times higher risk of having a caesarean section than women on diet control only, 43.8% vs 23.7%, 95% CI (1.55-4.06). The reasons were mainly due to suspected big baby and failed induction of labour. There was 59.5% of babies with birth weight of >4.0kg were delivered via Caesarean section, as compared to only 25.3% of those with birth weight <4.0kg were delivered via same mode.

The mean weight of babies with diabetic mother was higher compared to the control group, 3.17±0.5 vs 3.09±0.43 which was significant according to Welch's t-test, $t(799) = 2.33$, $p = 0.02$, 95%CI (0.006-0.07). Eighteen babies of women with diabetes were macrosomic with birth weight ranged from 4.0 to 5.1kg which was statistically higher as compared to women without diabetes, 4.5% vs 1.0%, OR 1.7, 95% CI (1.35-2.06). There was one case of intra-uterine growth restriction and six cases of intra-uterine death in women with diabetes.

The need for NICU admission was also higher among babies of women with diabetes, 4.5% vs 1.8%, OR 1.5, 95% CI (1.13-1.88). Babies of women with diabetes were 2.3 times more likely to have low Apgar score (<7) in 1 minute as compared to babies of normal

pregnancy, 5.0 vs 2.3%, 95% CI (1.03-5.09). Respiratory distress syndrome (RDS) and hypoglycemic remained as the main complication among babies of women with diabetes (Table 3). Babies of diabetic women on insulin had higher number of macrosomia, need for NICU admission with Apgar score less than 7 in 1 min, RDS and hypoglycaemia as compared to those on diet control (Table 4). Higher HbA1c was associated with higher rate of caesarean section, increased NICU admission, higher incidence of macrosomia and RDS (Table 5).

Table 5. Correlation between level of HbA1c (third trimester) and maternal and neonatal outcome among women with DM.

Factors	B	S.E.	p value	F	R
Caesarean section	1.701	0.028	0.007*	7.191	0.095
Baby weight at delivery	3.193	0.031	0.014*	6.06	0.087
NICU admission	1.945	0.011	0.014*	6.049	0.087
RDS	1.973	0.007	0.014*	6.078	0.087

* significant $p<0.05$

DISCUSSION

Near-normal maternal and neonatal outcomes have been reported in several prospective trials where strict metabolic control and normoglycaemia is achieved prior to or early in pregnancy [1,9] but recent trials have reported that adverse outcome in diabetic pregnancy is still higher than the general population despite strict metabolic control[10-11].

This study reflects on the outcome of diabetes in pregnancy in a single tertiary centre in Malaysia. The cases seen here may be of high risk cases referred from smaller district hospitals or facilities and may not represent the true scenario of diabetes outcome in Malaysian population. The overall outcome of women with diabetes especially on insulin remained poor as compared to a normal pregnancy.

The co-existence of obesity with diabetes had been apparent. Obesity (BMI > 30 kg/m^2) was prevalent in 51.5% of our diabetic women. A study by Bays, H.E et al. reported that an increment in BMI is associated with a significant increase in the prevalence of diabetes mellitus, hypertension and dyslipidaemia[12]. A study by Ahmed et.al showed that 67% of their patients with diabetes mellitus had BMI ≥25[13]. Diabetes in pregnancy will continue to be existing problems as a result of increasing obesity worldwide that will later predispose to Type 2 DM development in later life. Pre-pregnancy obesity increases the risk of adverse perinatal outcomes in GDM women[11]. A BMI of 28 kg/m^2 and beyond was associated with increased adverse pregnancy outcome and this occurs independently of maternal glucose[14].

Although universal screening is recommended for Asian population, the selection for screening for diabetes among pregnant Malaysian women had been based on presence of risk factors that was found to be more cost-effective. Should there be a change to this type of screening?

One of the risk factor that has been a main consideration for selective screening was family history. Family history of diabetes, as in our study, has a higher correlation with occurrence of diabetes[15-16]. Family history of diabetes mellitus has shown to have an independent significant association with the risk for macrosomia and caesarean section during pregnancy[17]. It is very striking that as many as one-third of women with diabetes in our study had no antecedent risk factor but was screened for diabetes following detection of glycosuria in pregnancy. The role of universal screening hence should receive full consideration to reduce missed opportunity and minimise adverse outcome of late diagnosis of diabetes in pregnancy.

According to Confidential Enquiry into Maternal and Child Health (CEMACH), 67% of women with DM had a higher incidence of caesarean section, which was mainly iatrogenic as a result of early induction of labour[18]. A multicentre Italian study on pregnancy outcome in women with diabetes reported the rates of caesarean section and preterm deliveries were higher than in the

general population (35.3% and 5.8%)[11]. This was in agreement with our study that revealed higher rates of caesarean section and preterm deliveries among diabetic women especially those on insulin.

Macrosomia is one of the major neonatal complications in women with diabetes. This is explained by Lambert and Germain in their study in which the fetus secretes insulin (also function as a growth factor) in response to hyperglycemic condition that circulates across to the placenta by facilitated diffusion of glucose and hence increases their growth potential to the 95th centile[19]. Upon delivery, the high level of insulin will expose the newborn to dangers of hypoglycemia. There is increased in incidence of hypoglycemia and respiratory distress syndrome among babies of women with diabetes as compared to babies of healthy women in this study as agreed by Forsbach-Sanchez et al [20].

Macrosomia is often associated with shoulder dystocia. Although there were three cases reported among babies of women with diabetes (birth weight range between 3.3 to 3.8kg) and none in the control group, this was not statistically significant. This incidence may be reduced with vigilance in anticipation for shoulder dystocia and advocating elective caesarean section for babies suspected macrosomia.

In this study, there was no significant association between DM and intrauterine death. There were 4 (1.0%) cases of IUD found in women with DM, which was mostly found in women with GDM on diet control. However, in another study done by Gunter HH et al, there was increased incidence of IUD in women with diabetes on insulin as compared to a control group[21]. Hence, this shows that there is still significant risk of intrauterine death in women with diabetes as compared those without diabetes.

Studies in the past have revealed that tight glycemic control may significantly reduce perinatal morbidity in diabetes [4-6,22]. Macrosomia, caesarean section, neonatal hypoglycemia, RDS and low Apgar scores were less common in women with good glycemic control.
Despite achievement of near normoglycemia with diligent monitoring and therapy, a surprisingly high rate of complications has been reported among the neonates of mothers with diabetes. However, controversy remains whether these are best prevented by tight maternal glycemic control[22]. In this study, higher HbA1c was correlated to higher rates of macrosomia, increased NICU admission and RDS incidence. These findings are in agreement with other studies that have linked higher HbA1c to higher risk of adverse perinatal outcomes[4-6,22]. A randomized controlled trial revealed that treatment of diabetes in pregnancy, not only could decrease perinatal morbidity, but also augment the health-related quality of life of pregnant women [23].

According to Persson et al, perinatal outcome does not vary significantly between diabetic women on insulin or diet control[24]. Fan ZT et al did not find higher rates of perinatal complications in diabetic woman on insulin[22]. The present study found higher rates of caesarean section and perinatal complications in the diabetic women on insulin. Therapeutic goals for normoglycemia may not always be easily attained in clinical practice and it is therefore difficult to prevent all adverse outcomes. One important issue that is observed is that maintaining a tighter glycaemia control with lower HbA1c level will minimise adverse maternal and perinatal outcome.

It is disappointing that more than half of the women with diabetes had unplanned pregnancies. Pre-conception care for pre-existing diabetes was associated with good glycaemic control in early pregnancy and thus significant reduction in adverse birth outcomes such as congenital malformation, stillbirth and neonatal death[8]. Pre-conception education and care must be emphasized via various modes especially via media. Consistent use of birth control needs to be addressed by doctors for better planning[8-9]. In conclusion, this study emphasised the need for universal GDM screening in population, achievement of near normoglycaemia and prevention of high HbA1c to reduce adverse maternal and neonatal outcome.

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