A FIVE - YEAR REVIEW OF MATERNAL AND FEOTAL OUTCOME OF GESTATIONAL DIABETES MELLITUS IN USMANU DANFODIYO UNIVERSITY TEACHING HOSPITAL SOKOTO

¹Hassan M, ¹Abubakar S, ¹Panti AA, ²Tambuwal S H

¹Department of Gynaecology and Obstetrics and ²Department of Internal Medicine Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria

Abstract

Background: Gestational diabetes mellitus (GDM) is medical disease in pregnancy associated with high morbidity and mortality to both the mother and the baby. Gestational diabetes accounts for large proportion of diabetes in pregnancy

Objectives: To determine the maternal and neonatal outcome of gestational diabetes mellitus in Usmanu Danfodiyo University Teaching, Sokoto, Nigeria.

Methods: This was a retrospective cross-sectional study on Gestational diabetes mellitus carried out in Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria. Folders of patients with GDM seen between 1st January 2012 to 31st December 2016 were retrieved from Medical Records Department. Relevant information on socio-demographic characteristics, booking status, parity, risk factors and complications of GDM were obtained. Data analysis was done using SPSS version 21. Level of significance was set at $p < 0.05$.

Results: The total number of deliveries during the study area was 7,273. The prevalence of GDM in this study is 1.1%. Most patients are within the age group of 31-35 years with mean age of 31 ± 5 years. The common risk factors of GDM found in this study were family history of diabetes mellitus and previous history of foetal macrosomia of 19.2% and 18.4% respectively. The commonest fetal complication was fetal macrosomia in 57.4% and commonest maternal complication was preterm delivery in 14.5 % of cases. The common predictors of progression to Type 2 diabetes among GDM patients in this study were the use of Insulin in the management (19.4%), BMI $\geq 30 \text{ kg/m}^2$ (19%) and fetal birth weight $\geq 3.5 \text{ kg}$ (17.3%).

Conclusions: Gestational diabetes mellitus is a high risk pregnancy that is associated with adverse maternal and fetal outcomes. There is need for routine screening and monitoring of mothers for Gestational diabetes mellitus to improve maternal and foetal outcomes.

Keywords: Gestational diabetes mellitus, risk factors, maternal, foetal, outcome, Sokoto

Corresponding Author:
Dr. Mairo Hassan

Department of Gynaecology
and Obstetrics, Usmanu
Danfodiyo University
Teaching Hospital, Sokoto,
Nigeria.
mayroh123@gmail.com.
+234 803 504 1729

INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance of variable severity with onset or first diagnosis during the index pregnancy.¹ GDM occurs in 2-9% of all pregnancies.²⁻³ GDM affects up to 15% of pregnant women worldwide⁴, overall prevalence (in total deliveries) GDM reported in Nigeria is 13.9%.^{5,6} Gestational diabetes mellitus is associated with significant rates of maternal and perinatal complications, including macrosomia and its related complications, hypoglycaemia and long term diabetes.² Risk factors for developing GDM include obesity, family history of diabetes, black race, increase maternal age, previous history of GDM, previous history of delivery of a macrosomic fetus, glycosuria, previous intrauterine fetal death, previous stillbirth and unexplained perinatal loss and presence of Polyhydramnios or recurrent vaginal candidiasis in

present pregnancy.^{-5,7,10}

Pregnancy is a diabetogenic condition due to hormones leading to increase in insulin resistance, these counter-regulatory hormones are HCG, human placenta lactogen (HPL), prolactin, cortisol, oestrogen and progesterone, with the exception of HCG all these hormones are produced in increasing amounts as pregnancy advances.¹

Women with underlying insulin resistance are at risk for developing GDM. Decreased insulin sensitivity towards the end of pregnancy increases the risk of GDM. This progression to GDM is thought to be due to physiologic changes of late pregnancy. In pregnancy, human placental lactogen, which is structurally similar to growth hormone, and tumour-necrosis factor-alpha induce changes in the insulin receptor and in post-receptor signaling higher maternal IGF-I levels at mid- and late gestation which may indicate greater placental and fetal growth. IGF-I may be implicated in fetal

hypertrophy in gestational diabetes¹¹. GDM is associated with higher incidence of maternal, perinatal and neonatal morbidity and mortality.¹²

Maternal complications of GDM occur throughout the trimesters, which include recurrent spontaneous abortion, preterm labour, urinary tract infections and vulvovaginitis and increased incidence of preeclampsia and Polyhydramnios. Increase in diabetic complications such as diabetic ketoacidosis, diabetic retinopathy and Nephropathy had been reported¹⁰ During labour, there is increased incidence of prolonged labour due to large baby, shoulder dystocia due to disproportionate growth with increase shoulder/head ratio, perineal injuries, postpartum haemorrhage and operative deliveries. There is also increase puerperal sepsis and lactation failure during postpartum period^{1,2,10,12}.

Fetal and neonatal complications of GDM include fetal macrosomia, congenital malformations, birth injuries, shoulder dystocia, and growth restriction, hypoglycaemia, respiratory distress syndrome, hyperbilirubinaemia, polycythemia, hypocalcaemia, hypomagnesaemia and cardiomegaly, while long-term effects are childhood obesity, neuropsychological effects and diabetes.^{1,2,10,12}

The diagnosis of GDM is made using a single- step 75g OGTT and any fasting plasma glucose of 5.1-6.9 mmol/l, 1 hour post 75g oral glucose load >10mmol/l and 2hour post75g oral glucose load 8.5-11.0 mmol/l at any other time during the course of pregnancy is diagnostic of GDM according to FIGO. Recent well conducted studies suggest that treatment of GDM include dietary advice, blood glucose monitoring, the use of medical therapy (metformin and glyburide) and insulin therapy are safe and effective therapies which reduces the rate of serious maternal and perinatal outcomes^{12,13,14}

Despite these untoward effects, there is limited published data on the prevalence, risk factors and outcome of pregnancy complicated by GDM in this region, hence the need for this study. Findings from the study will help in identify risk factors,

relationship between management and outcome, in order to minimize maternal and perinatal morbidity and mortality.

MATERIALS AND METHODS

This was a retrospective cross-sectional study conducted among patients diagnosed with GDM in the Department of Gynaecology and Obstetrics, Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto, Nigeria. Folders of patients with GDM between 1st January 2012 and 31st December 2016 were retrieved from Medical Records Department. The study populations were women diagnosed with GDM in UDUTH, Sokoto during the study period. Relevant information from the case files on socio-demographic characteristics, booking status, parity, risk factors and complications of GDM were obtained.

The information obtained was analysed using SPSS version 21. Tables and figures were used to display results. Chi square test was used to test the association between level of glycaemic control and complications of GDM. The level of significance was set at $p < 0.05$.

Ethical approval was sought and obtained from the Health Research and Ethics Committee of UDUTH, Sokoto.

RESULTS

During the study period there were 72,727 deliveries, 126 patients were diagnosed with GDM. However, only 80 case records were available for retrieval from Medical records department. The prevalence of GDM during study period was therefore, 1.1%

Table 1 shows the socio-demographic characteristics of the subjects in this study. The mean age of the subjects is 31 years $\pm$ 5 years and. Majority of the subjects were within the age group of 31-35 years (33.7%) and mostly multigravidae (51.2%) in their third trimester (48.8%). Most patients weigh >90kg at diagnosis (53.7%). The booking status of the patients showed that majority of the patients with gestational diabetes mellitus 65 (81.25%) had antenatal care

Table 1: Socio-demographic characteristics of the study populations

Characteristics	Frequency	Percentage
Age group		
21-25	12	15.0%
26-30	24	30.0%
31-35	27	33.7%
36-40	16	20.0%
41-45	1	1.3%
Total	80	100%
Weight at diagnosis		
<90 kg	37	46.3%
>90kg	43	53.7%
Total	80	100%
Educational level		
None	9	11.3%
Primary	8	10.0%
Secondary	21	26.2%
Tertiary	42	52.5%
Total	80	100%
Parity		
Primigravida	8	10.0%
Multigravida	41	51.2%
grand multigravida	31	38.8%
Total	80	100%
Trimester		
First trimester	5	6.2%
Second trimester	36	45.0%
Third trimester	39	48.8%
Total	80	100%
Tribe		
Hausa	56	70.0%
Yoruba	11	13.8%
Igbo	8	10.0%
Others	5	6.2%
Total	80	100%

Family history of Diabetes mellitus and foetal macrosomia were the commonest risk factors for GDM 48 (19.2%) and 46 (18.4%) respectively. Some patients had more than one risk factor.

Table II: The risk factors associated with GDM in the study populations

Risk factors for GDM	Responses	
	N	Percent
Weight >90kg	45	18.0%
Hypertension	10	4.0%
Family history	48	19.2%
Previous GDM	26	10.4%
Previous fetal macrosomia	46	18.4%
Previous congenital abnormalities	1	0.4%
Previous stillbirth	20	8.0%
Previous IUFD	23	9.2%
Advanced maternal age	31	12.4%
Total	250	100.0%

Maternal Body Mass Index of the patients at presentation

Most of the patients were obese with BMI of greater than 30kg/m² 55 (76.3%) while only 25(23.68%) had BMI of less than 30kg/m².

Modalities of treatment

Most patients were managed with Insulin in combination with appropriate dietary control in 68 (85.0%) while 7 (8.75%) were managed with dietary control alone. Five (5) patients (6.25%) were managed with metformin and diet. Majority of patients on Insulin achieved good glycaemic control 48 (70.6%) while 3 (60.0%) of patients on metformin alone and Only 2 (28.6%) of patients on diet alone achieved good glycaemic control.

Mode of delivery

Caesarean section was the mode of delivery in 40 (50.0%) of the patients. Among the patients that had SVD 38 (47.50%), 2 (5.26%) had induction of labour with misoprostol due to preterm rupture of membranes. Instrumental vaginal delivery (vacuum) was conducted in 2 (2.50%) patients.

Table III: Indications for Caesarean section

Indications for CS	Responses	
	N	Percentage
Breech presentation	4	7.5%
Postdatism	5	9.4%
Macrosomia	28	52.8%
Previous CS	9	17.0%
Malposition	2	3.8%
Bad obstetric history	5	9.4%
Total	53	100%

The commonest indication for Caesarean section was foetal macrosomia 28 (52.8%), followed by previous C/S 9 (17%) while the least indication for C/S was malposition 2 (3.8%).

Neonatal Birth weight Apgar score at Birth

Neonatal birth weight ranged from 2.5 to 3.9kg in 33 (41.25%) followed by range of 4kg to 4.5kg in 30 (37.50%), while 10 (12.50%) of the babies have birth weight > 4.5kg. Most neonates had Apgar score of 7-9 at 1 minute 59 (73.3%). The Apgar score at 5 minutes for majority of neonates 65 (81.2%) was within the score of 7–10.

Glycaemic Control in the Third Trimester

Fasting blood sugar in the third trimester ranged between 2.0 – 5.3mmol in 51 (63.8%) Few patients 6 (7.5%) had fasting blood sugar range greater than 8.7mmol/l.

Table IV: Maternal Complications Associated with GDM

Maternal complications	Responses	
	N	Percent
Postpartum haemorrhage	1	1.4%
Puerperal sepsis	5	7.2%
Urinary tract infection	4	5.8%
Polyhydramnios	3	4.3%
Post-surgical wound infection	3	4.3%
Diabetic Ketoacidosis	2	2.9%
Diabetic hand/foot?	2	2.9%
Preeclampsia	4	5.8%
Pregnancy induced Hypertension	4	5.8%
Shoulder dystocia	3	4.3%
Recurrent abortion	8	11.6%
Community Acquired Pneumonia	2	2.9%
Bad Obstetric History	9	13.0%
Preterm delivery	10	14.5%
Breech	2	2.9%
Premature rupture of membrane	7	10.1%
Total	69	100%

Forty-one (41) patients developed complications. The most common complication is preterm delivery 10 (14.5%) followed by bad obstetric history in 9 (13.0%). Many patients had more than one complication.

Table V: Foetal Complications of GDM

Fetal complications	Responses	
	N	Percent
Macrosomia	39	57.4%
Intrauterine Fetal death	9	13.2%
Abortion	1	1.5%
Prematurity	10	14.7%
Birth injury	2	2.9%
Congenital abnormality	2	2.9%
Birth asphyxia	4	5.9%
Stillbirth	1	1.5%
Total	68	100%

The table above shows that the most common complication is fetal macrosomia 39 (57.4%) followed by intrauterine fetal death 9 (13.2%).

Table VI: Predictors of Progression to Type 2 DM among GDM Patients

Predictors of progression to Type 2 DM	Responses	
	N	Percentage
Age More than 30 years	34	14.3%
Management of GDM with Insulin	46	19.4%
BMI = 30kg/m ²	45	19.0%
Multigravida	31	13.1%
Family history of Diabetes	27	11.4%
Fetal Birth weight = 3.5kg	41	17.3%
Previous history of GDM	13	5.5%
Total	237	100.0%

The common predictors of progression to Type 2 Diabetes among GDM patients in this study are the use of Insulin in the management 46 (19.4%), BMI $\geq 30\text{kg/m}^2$ 45 (19%), that is overweight and Fetal Birth weight $\geq 3.5\text{kg}$ in 41(17.3%)

DISCUSSION

The prevalence of GDM in Nigeria varies with

centers. It is reported to be between the range of 4.8-11.2% of all pregnancies. However a higher prevalence of 13.9% was reported in Tanzania.^{5,6} The prevalence varies due to different diagnostic criteria for GDM. The prevalence in this study is 1.1% using FIGO criteria for diagnosis of GDM. The lower prevalence reported in this study may probably be due to lack of adequate screening for GDM during booking of pregnancies. The mean age of the patients was 31 ± 5 years. Age above 30 years is an important risk factor for GDM as well as a predictor of progression to type 2 DM.^{35 - 38} Majority of the patients in this study were above 30 years. This is similar to findings in studies conducted by Seshiah *et al*¹⁷ and Chukwunyere *et al*.¹⁹ Contrary to this finding, S. Kumari *et al*³⁹ found up to 50% of patients were 30 years and below.

Multiparity is an important risk factor for GDM and a significant predictor for progression to Type 2 DM.^{12,23,35,36} It is therefore not surprising to see that most patients in this study were multigravida 51.2%. This is in agreement with findings by Chukwunyere *et al*¹⁹ and S. Kumari *et al*.³⁹ Majority of the patient in this study were diagnosed with GDM during antenatal care 81.25%. Anzaku *et al*²¹ also found higher prevalence of GDM among patient who attended antenatal care. Family history of diabetes mellitus and previous delivery macrosomic babies were the commonest risk factors for GDM in this study 19.2% and 18.4% respectively. Previous history of foetal macrosomia among GDM patients was also found to be high in a study conducted in Jos,²¹ while in a study conducted in the South-eastern Nigeria, the commonest risk factor for GDM was family history of diabetes.⁴⁰ These risk factors are also predictors for the progression to Type 2 DM.^{35,36} Most of the subjects in this study have body mass index of $> 30 \text{ kg/m}^2$ 82% at the time of diagnosis, that is, they were overweight. S. Kumari *et al*³⁹ also reported that 69.0% of his patient had BMI $> 30 \text{ kg/m}^2$ (Overweight). Several authors reported that BMI $> 30 \text{ kg/m}^2$ is a risk factor of developing GDM and recommended the screening of patients with BMI

of $> 30 \text{ kg/m}^2$ during antenatal care.⁷

The gold standard for the treatment of gestational diabetes is insulin therapy. It gives good glycaemic control, reduces serious perinatal morbidity and improves maternal health.^{31,38,40} Insulin combined with diet was the commonest modality of treatment used in the management of patients in this study. Insulin therapy was also reported as the commonest modality of treatment by Opara *et al*¹⁹ and Chukwunyere *et al*.²⁵ Recently, metformin was recommended as treatment modality for treatment of GDM when life style modification fails.¹² In this study, few patients were treated with metformin and most of them achieved good glycaemic control. Management with insulin is a significant predictor for the development of T2DM among patients with GDM. Mothers with gestational diabetes were found to have two times risk of having caesarean section due to foetal macrosomia than due to obstructed labour.²⁶ In this study, the rate of C/S was up to 50% and foetal macrosomia was the commonest indication for C/S. Similar findings were reported by Opara *et al*¹⁹ and Chukwunyere *et al*.²⁵ This is in contrast to the study conducted in India where only (27.37%) of patients had C/S,³⁹ although the incidence of macrosomia and indications for C/S were not reported in this study.

Studies done in the past have revealed several maternal complications of GDM including Polyhydramnios, puerperal sepsis, bad obstetric history, pre-eclampsia, shoulder dystocia, preterm delivery and increase in operative delivery.^{12,13,16,26,27,33} The most common maternal complication in this study is preterm delivery 14.5%. This finding is in contrast to studies by Chukwunyere *et al*²⁵ and Kumari *et al*.³⁹ who reported bad obstetric history and abortion as commonest complications respectively. Other maternal complications in this study are bad obstetric history, puerperal sepsis, pre-eclampsia, shoulder dystocia, Polyhydramnios and diabetic ketoacidosis.

Foetal macrosomia is the commonest neonatal

complication of GDM as reported by many authors^{30,41,43} This is in agreement with findings in this study where the rate of foetal macrosomia was 57.4%. The high rate of foetal macrosomia in this study may be related to poor glycaemic control at the early stages of pregnancy since most patient were detected to have GDM in the third trimester due to late booking. Foetal macrosomia continues to remain an important morbidity for the neonate because it is associated with increased risk for traumatic birth injury, obesity, and development of Diabetes mellitus in later life.²⁵ Even though it is argued that there is no relationship between GDM and increased risk of babies with congenital anomalies since significant maternal hyperglycaemia occurs when organogenesis is completed in GDM⁴³, some studies reported higher Congenital malformation among neonates of mothers with Gestational Diabetes mellitus compared to neonates of non-GDM mothers.⁴² In this study, there were 2 (2.9%) cases of congenital anomaly. Other foetal complications found in this study were prematurity, IUFD, birth asphyxia and stillbirth.

Many patients in this study were identified to be at risk of progression to Type 2 DM having predictors of progression which include the use of Insulin, BMI $\geq 30\text{kg/m}^2$ at the time of diagnosis delivery of babies with birth weight $>3.5\text{kg}$, maternal age >30 years and family history of Diabetes mellitus.³⁶ Most patients in this study have multiple risk factors, however the most important risk factor is previous GDM with 60% life time risk of progression to Type 2 DM.³⁴

CONCLUSIONS

GDM is a high risk pregnancy associated with high maternal and neonatal complications. Foetal macrosomia is the commonest neonatal complication as well as the commonest indication for C/S in patients with GDM, while the commonest maternal complication is preterm delivery. GDM is also associated with high rate of operative delivery. Many patients in this study have multiple risk factors for progression to Type 2 DM.

RECOMMENDATIONS

Due to high number of patients at risk of progression to Type 2 DM, adequate measures should be implemented to closely monitor them to prevent development of Diabetes mellitus. This can be achieved by instituting Preconceptional care for the patients.

Early booking for antenatal care should be encouraged so as to detect patients with GDM and offer early interventions to prevent maternal and fetal complications. There is also need to enlighten women about risk factors for both GDM and Type 2 DM.

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