THE PREVALENCE AND RISK FACTORS FOR GESTATIONAL DIABETES AND PREGNANCY OUTCOME IN A TERTIARY HOSPITAL IN ABUJA, NIGERIA

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ABSTRACT

Objectives: To determine the common diabetes risk factors for OGTT; the prevalence of GDM; and the maternal and perinatal outcomes of GDM pregnancies in a Nigerian urban antenatal population

Patients and Methods: A retrospective study of pregnant women, who attended antenatal clinic, screened for diabetes mellitus, had OGTT when indicated and delivered in the hospital over a three year period at a tertiary hospital in Abuja, Nigeria. The main outcome measures were diabetes risk factors for OGTT referral, prevalence of GDM, maternal complications, mode of delivery, birth weight, fetal and neonatal complications. **GDM diagnosis was based on the 1999 WHO criteria of glucose level at fasting** (0-hour) ≥7.0mmol/L (126mg/dl) or 2-hour ≥7.8mmol/L (140mg/dl).

Results: During the period under study 4,755 women had antenatal care and delivered in the hospital. Five hundred and six patients with various risk factors for diabetes had OGTT. The mean age of the women was 31.6 ± 4.1 years, mean height 1.64 ± 0.1m; and mean weight 85.1 ± 15.5kg. The three commonest GDM risk factors for referral for OGTT were family history of diabetes mellitus, history of previous delivery of macrosomic baby (≥4.0 kilogram) and maternal weight greater than 90kg. The risk factors associated with GDM in this study are maternal weight greater than 90kg (OR=2.39; 95% CI 0.74-6.59) and suspected big baby in index pregnancy (OR=2.51; 95% CI 0.45-9.22). Twenty four patients met the criteria for GDM giving a prevalence of 0.5% among the antenatal population. The majority, 19(79.2%) of the GDM mothers were delivered by caesarean sections compared with 170 (35.3%) women with normal OGTT. Hypertensive complication was present in 7 (29.2%) GDM clients compared with 58 (12.1%) women with normal OGTT. Six (25%) babies born to GDM mothers suffered from jaundice compared with 37 (7.7%) for normal OGTT mothers. The birth of macrosomic babies was however, more common in normal OGTT mothers, 107 (22.2%) compared with 4 (16.3%) in GDM mothers, though this difference did not reach significance level.

Conclusion: OGTT remain a reliable tool for the diagnosis of GDM. The risk factors for OGTT in our setting need to be reviewed. The detection and management of GDM is essential for prevention of diabetes associated adverse pregnancy outcomes.

Keywords: Gestational diabetes mellitus; Risk factors for OGTT, pregnancy outcome

INTRODUCTION

Increases in the incidence of diabetes mellitus (DM) in the non-pregnant and pregnant states have been reported globally in recent times[1-3]. The adverse effects of Diabetes Mellitus on pregnancy are well documented. It affects the pregnant woman, fetus,

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and the offspring. The mother suffers increased risk of pre-eclampsia, polyhydramnios and caesarean delivery. The newborn have increased risk of macrosomia, shoulder dystocia, birth trauma, nerve palsies, fractures, respiratory distress syndrome, neonatal hypoglycaemia, hyperbilirubinaemia, polycythemia, hypocalcaemia, congenital malformation, stillbirths and neonatal deaths. Later in life the offspring of diabetic mothers have increased risk of future obesity and type 2 diabetes mellitus(T2DM)[4,5].Most women who suffered GDM also progresses to T2DM in later life. The effective management of hyperglycemia during pregnancy has been associated with significant reduction in the complications of diabetes during pregnancy[6,7].

Gestational diabetes mellitus (GDM), defined as any degree of glucose intolerance with onset or first recognition during pregnancy[8,9]. GDM usually occurs in the late second trimester (about 24 – 28 weeks of gestation) due to development of insulin resistance associated with increased levels of hormones of pregnancy. The inability to produce adequate insulin to compensate the increased resistance results in state of hyperglycaemia. GDM encompasses women with overt diabetes mellitus and women with intermediate hyperglycemia – impaired glucose intolerance test (IGT) and impaired fasting glycaemia (IFG). Recent consensus by the International Association of Diabetes and Pregnancy Study Group (IADPSG) favor differentiating between those with overt diabetes mellitus and those with lesser degrees of glucose intolerance in pregnancy[10].The WHO in 2013 restricted the use of the term GDM to only pregnant women with abnormal glucose tolerance that is below the recommended threshold for diabetes mellitus[11]. A clear relationship exist between hyperglycaemia and adverse pregnancy outcomes and many recent studies have shown a continuum of risk across maternal glucose levels less severe than those with diabetes mellitus for the various adverse pregnancy outcomes.[12-18].

While there is general agreement on the need to ascertain the presence of diabetes during pregnancy, there is however, lack of international uniformity in the approach. Many strategies have been devised for screening, diagnosis and management of diabetes during pregnancy. Two main models of screening have been used – Universal or routine screening, usually where all women are offered a 50gram oral glucose challenge test (OGCT), and selective or risk factor screening (through women's historical and current risk factors for diabetes) including maternal age, body mass index (BMI) or weight, ethnicity, previous GDM, family history of DM, previous bad obstetrics history. Other methods used for screening for GDM include urine testing for glucosuria, fructosamine testing, random plasma glucose measurements, fasting plasma glucose measurements and glycated haemoglobin (HbA1c)[19-22]. Though the oral glucose tolerance test (OGTT) is used in the diagnosis of GDM, the glucose load utilized for the test and criteria for diagnosis varies within and between countries. The 75gram, 2-hour OGTT and the 100 gram, 3-hour OGTT are employed for diagnosis of GDM and different cut-off points of plasma glucose level at fasting, 1-hour, 2-hour and 3-hour have been proposed and used for diagnosis[8,23-27].

In spite of the reported increasing trend in prevalence of GDM, its effect in pregnancy and the potential public health implication, there is paucity of information on the prevalence of GDM in many obstetric populations[28,29]. Recent GDM prevalence estimates reported in the literature from some countries vary widely from less than 1% in Croatia[19] to about 18% in India[30]. This study determines the prevalence of GDM, associated risk factors and pregnancy outcomes among antenatal clients in an urban population in Nigeria.

PATIENTS AND METHODS

The study was undertaken at the National Hospital Abuja, Nigeria. This is a tertiary hospital and main referral health facility in the metropolis of the Federal Capital Territory. It is a retrospective cohort study of registered pregnant women who had OGTT during the antenatal period and delivered in the hospital between January 1, 2006 and December 31, 2008.

All registered antenatal clients in the hospital among other services are screened for diabetes mellitus by appropriate history, physical examination and urinalysis. The identified high risk clients are referred for OGTT at 24-28 gestational weeks. Those that are detected to have GDM are managed jointly with the dietician and physician until six to eight weeks after delivery. The management essentially includes dietary control, exercise, blood glucose level monitoring and insulin use as necessary.

OGTT Procedure at National Hospital Abuja

The patient is counseled on the need to be on a diet containing adequate calories, protein, and at least 150g carbohydrate per day for 3 days; drugs that may influence results (steroids, oestrogen, propranolol, phenytoin, thiazides) are withheld for 3 days before the test.

Blood sample is drawn from the patient after an overnight fast of at least 8hours; 75gram glucose dissolved in 300mls of water is ingested by the patient within 5minutes period. Blood samples are drawn for plasma glucose analysis before ingestion (0- hour), 1- hour and 2- **hour. GDM diagnosis was based on the 1999 WHO criteria of glucose level at fasting** (0-hour) ≥ 7.0mmol/L (126mg/dl) or 2-hour ≥7.8mmol/L (140mg/dl)[8].

Data Collection and analysis

A data sheet was designed to collect information on demographic data, risk factors (indications) for OGTT, OGTT results, maternal clinical characteristics, maternal outcome, mode of delivery, neonatal characteristics, and newborn outcome. The OGTT results were retrieved from the chemical pathology laboratory logbook. The other sources of information were the antenatal register, delivery register, neonatal intensive care unit register, special care baby unit register and individual patient's case files.

The data were entered using SPSS version 14.0 (SPSS, Chicago, Illinois, USA) software, and analyzed using STATA (release 12; Stata Corporation). The data were collated as statistical averages and presented as mean ± standard deviation. Odds ratio (OR) analysis was used to determine the association between risk factors and GDM. A p-value of < 0.05 is considered to be statistically significant. Ethical approval was obtained for this research from the National Hospital Ethical Review Board.

RESULTS

During the three year period, 4,755 had antenatal care and delivered in the National Hospital Abuja. Further analysis is based on 506 (10.6%) patients who had risk factors for diabetes and had OGTT.

The mean age of the women was 31.6 ± 4.1 years, with a range of 20 to 40 years, while their heights ranged from 1.04m to 1.80m, with a mean of 1.64 ± 0.1m; their mean weight was 85.1 ± 15.5kg, with a range of 50kg to 128kg. The mean gestational age for commencement of ANC was 19.7 ± 6.9 weeks, with the earliest booking at 6 weeks and the latest at 37 weeks. More than 90% of the women were between Para 0 and 3.

The risk factors (indications) for referral for OGTT are shown in Table 1. The three commonest indications are family history of diabetes mellitus, history of previous delivery of macrosomic baby (≥ 4.0 kilogram) and maternal weight greater than 90kg. Of the 506 OGTT results analyzed, 24 (4.7%) had gestational diabetes mellitus, while the rest had

study. Caesarean delivery, pregnancy induced hypertension and neonatal jaundice were more common in GDM cases. However, more macrosomic babies were delivered by mothers with normal OGTT (22.2%), compared to mothers who had gestational diabetes mellitus (16.3%). The high incident of macrosomia in the non-diabetic group in this study is an indication that some potential GDM cases could have been missed out with the diagnostic criteria used during this study. This could be a pointer to the fact that the adverse effect of high glucose level in pregnancy are occurring below the cut-off points used for diagnosing GDM through OGTT. WHO and the International Association of Diabetes and Pregnancy Study Group (IADGSG) recently reviewed the criteria for the diagnosis of GDM and there are indications that the frequency of diagnosis of GDM will increase significantly above current levels[10,11]. Based on the new recommended criteria, the diagnosis of GDM can be made if any of the following threshold of plasma glucose is reached following a 75 gram 2-hour OGTT – fasting: 5.1-6.9 mmol/L (92-125mg/dl); 1-hour: ≥ 10.0 mmol/L (180mg/dl) and 2-hour: 8.5-11.0mmol/L(153-199mg/dl). The review of GDM diagnostic criteria is supported by the landmark study – Hyperglycemia and Adverse Pregnancy Outcomes (HAPO)[12], a large scale international multicenter cohort of 25,505 pregnant women, which demonstrate that risk of adverse maternal, fetal, and neonatal outcomes continuously increased as a function of maternal glycaemia at 24 – 28 weeks, even within ranges considered normal. It is expected that the new recommended criteria which is stricter than the one used in this study will meet international acceptance. This will improve diagnosis and with proper management of identified cases, reduced potential adverse maternal and perinatal effects of hyperglycaemia during pregnancy. The application of uniform criteria will also enhance national and international comparability of GDM prevalence. Subsequent prospective study utilizing the 2013 WHO[11] criteria is desired.

CONCLUSION

OGTT remains a reliable tool for the diagnosis of gestational diabetes mellitus. The risk factors for OGTT in our setting need to be reviewed. The detection and management of GDM is essential for prevention of diabetes associated adverse pregnancy outcomes.

TABLE 1: GESTATIONAL DIABETES MELLITUS RISK FACTORS AND ORAL GLUCOSE TOLERANCE TEST

Risk Factors	OGTT Result		Total	Odds ratio	95% CI	p-value
	GDM	Normal				
Family History of DM						
Yes	11	225	236	0.96	0.38-2.39	0.935
No	13	257	270			
Total	24	482	506			
Previous Macrosomic baby						
Yes	4	110	114	0.68	0.16-2.08	0.338*
No	20	372	392			
Total	24	482	506			
Maternal weight >90kg						
Yes	6	59	65	2.39	0.74-6.59	0.068
No	18	423	441			
Total	24	482	506			
Suspected big baby						
Yes	3	26	29	2.51	0.45-9.22	0.152*
No	21	456	477			
Total	24	482	506			
Previous IUFD/Stillbirth						
Yes	0	20	20	0	_	0.371*
No	24	462	486			
Total	24	482	506			
Presence of Glycosuria						
Yes	0	9	9	0	0-8.69₸	0.643
No	24	473	497			
Total	24	482	506			
Previous GDM						
Yes	0	9	9	0	0-8.69₸	0.643
No	24	473	497			
Total	24	482	506			
Previous Miscarriages						
Yes	0	6	6	0	0-13.18₸	0.582
No	24	476	500			
Total	24	482	506			
Previous END						
Yes	0	6	6	0	0-13.18₸	0.582
No	24	476	500			
Total	24	482	506			
Previous IUGR						
Yes	0	3	3	0	0-26.63₸	0.864
No	24	479	503			
Total	24	482	506			

Abbreviations: DM- Diabetes mellitus; GDM- Gestational diabetes mellitus; IUFD- Intrauterine fetal demise; IUGR-Intrauterine growth restriction; END- Early neonatal death

*Fischer's exact p-value

₸Cornfield approximation used for estimating confidence interval

TABLE 2: ORAL GLUCOSE TOLERANCE TEST (OGTT) AND MATERNAL, FETAL AND NEONATAL OUTCOMES

Maternal, Fetal and Neonatal Outcomes	OGTT Result Normal Number (%)	GDM Number (%)	Significance (P- value)
Mode of Delivery			p<0.001*
Caesarean Section	170(35.3)	19(79.2)	
Normal Vaginal Delivery	309(64.1)	5(20.8)	
Instrumental Delivery	3(0.6)	0(0.0)	
Total	**482(100.0)**	**24(100.0)**	
Hypertensive Complication			0.031*
Nil	425(87.9)	17(70.8)	
Pregnancy Induced Hypertension	47(9.8)	7(29.2)	
Pre-eclampsia	11(2.3)	0(0.0)	
Total	**482(100.0)**	**24(100.0)**	
Apgar Score at 1 minute			-
< 7	66(13.7)	3(14.2)	
7-10	416(86.3)	21(85.8)	
Total	**482(100.0)**	**24(100.0)**	
Birth Weight (kilogram)			0.222*
< 2.50	24(5.0)	0(0.0)	
2.50-3.99	351(72.8)	20(83.3)	
≥ 4.00	107(22.2)	4(16.3)	
Total	**482(100.0)**	**24(100.0)**	
Neonatal Jaundice			0.003*
Yes	37(7.7)	6(25.0)	
No	445(92.3	18(75.0)	
Total	**482(100.0)**	**24(100.0)**	

*Likelihood–ratio chi-squared p-value

ǂFischer's exact p-value

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