Clinical and Diagnostic Profile of Pregnant Women with Gestational Diabetes Mellitus

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ABSTRACT

BACKGROUND

Gestational diabetes is a disease in which high blood glucose develops during pregnancy and usually disappears after delivery. The disease can start at any stage of pregnancy. Though any woman can develop Gestational Diabetes Mellitus (GDM), there are few factors which increase the risk. The measurement of glucose levels during screening test can diagnose the condition.

METHODS

This was a cross sectional study conducted in the Department of Obstetrics and Gynaecology, Institute of Maternal and Child Health, Medical College, Calicut. 50 pregnant women with GDM were studied. Age, gravida, parity, detailed obstetric history, and history of any treatment were recorded. Height and weight were recorded. Body Mass Index (BMI) was calculated Blood pressure was recorded. Oral Glucose Challenge Test (OGCT) was accepted screening test for detection of GDM. Data analysis was performed in SPSS software version 16. Qualitative data was expressed as percentage.

RESULTS

The age of mothers ranged from 19 - 37 years. Majority fell in the age group of 24 - 28 years. Mainly they were first or second gravid. Among the status of living children, 34% had one kid. Majority 28 mothers (52%) had previous delivery before 0 - 2 years. Majority of mothers, 39 (78%) did not have a history of previous abortion. The systolic and diastolic BP was normal among majority of mothers. 6% of mothers had increased systolic BP. Diastolic BP was high among 10% of mothers. Height of mothers ranged from 1.5 m to 1.6 m. Majority fell in 61 - 65 Kg category. The BMI was in overweight category in 70% of mothers. The birth weight of babies was assessed. 10 (20%) fell in 2.1-2.5 Kg category, 19 (38%) in 2.6 - 3.0 Kg category, 17 (34%) in 3.1 - 3.5 Kg category and 4 (8%) in 3.6 - 4.0 Kg category. Majority OGCT was in 130 - 140 mg/dL category. The cord blood glucose of neonates was assessed. Majority (72%) had blood sugar between 61 - 90 mg/dL.

CONCLUSIONS

Onset of GDM is found to be more common in women of 24 - 28 years age group. History of abortions was slightly high in GDM mothers. Systolic and diastolic BP was normal in majority of mothers. Birth weight of neonates was higher as compared to neonates of normal mothers.

KEYWORDS

Glucose Tolerance, Gestational Diabetes, Blood Glucose, Pregnancy**,** Body Mass Index, Blood Pressure

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BACKGROUND

Gestational diabetes mellitus (GDM) is a common metabolic disorder in several populations. It affects approximately 1 to 14% of all pregnancies and represents nearly 90% of all pregnancies complicated by diabetes.[1] Analysing the clinical features of mothers having GDM can help in implementation of newer modalities of management.

The prevalence varies according to racial and ethnic groups as well as according to the prevalence of obesity. A study conducted in India by Sheshiah et al revealed a high prevalence of 18.9% of GDM.[2]

Gestational diabetes mellitus is detected through screening of pregnant women for clinical risk factors. It appears to result from the same broad spectrum of physiological and genetic abnormalities that characterize diabetes outside of pregnancy. GDM thus provides a unique opportunity to study the early pathogenesis of diabetes and develop interventions to prevent progression of the disease. It was found that the degree of glucose intolerance during pregnancy was related to the risk of developing diabetes after pregnancy. Treatment of GDM reduces perinatal morbidity and maternal complications. Management of insulin resistance at this stage is associated with a reduction in the risk of diabetes and preservation of β cell function.[3,4]

We wanted to study the clinical and diagnostic features of gestational diabetes mellitus

METHODS

The study was conducted in the Department of Obstetrics and Gynaecology, Institute of Maternal and Child Health, Medical College, Calicut. A total of 50 mothers were included in the study. According to institutional policy all pregnant ladies had oral glucose challenge test (OGCT) done at 24 to 28 weeks of gestation. The cases included 50 pregnant women with GDM diagnosed oral glucose tolerance test.

For OGCT, they were given 50 gm of glucose in about 200 mL of water over 2 to 3 minutes. Exactly at 1 hour 1 ml of blood is drawn from a forearm vein using a disposable syringe under aseptic precautions into a clean dry bottle containing oxalate. The blood glucose is determined by the Glucose Oxidase/ Peroxidase method. (GOD/POD method)

Women with diabetes, hypertension and renal disease diagnosed before pregnancy were excluded from the study. Age, gravida, parity, detailed obstetric history and history of any treatment were recorded. Height and weight were recorded in second trimester of pregnancy. BMI was calculated using the formula, Weight in Kg/Height in m^2. Blood pressure was recorded. OGCT is the most widely accepted screening test for detection of GDM.

Study was approved by Human Ethical Committee and Review Board of Institution. Study mothers were counselled separately about the study and a written consent was procured from them.

All statistical data were analysed using SPSS software version 16. Qualitative data was expressed as percentage.

RESULTS

A total of 50 mothers with GDM were included in the study. The age of mothers ranged from 19-37 years. Majority fell in the age group between 24 - 28 years. The frequencies were 15 (30%) in 19-23 years, 18 (36%) in 24-28 years, 13 (26%) in 29-33 years and 4 (8%) in 34-38 years. Majority of mothers were first or second gravida. Parity was zero among half of the study population. Among the status of living children, 34% had one kid.

Number	Gravida	Parity	Living
0	NA	24 (48%)	26 (52%)
1	18 (36%)	17 (34%)	17 (34%)
2	18 (36%)	7 (14%)	6 (12%)
3	9 (18%)	2 (4%)	1 (2%)
4	3 (6%)	0	0
5	1 (2%)	0	0
6	1 (2%)	0	0

Table 1. Gravida, Parity and Living Children among GDM Mothers

Majority 28 mothers (52%) had previous delivery before 0-2 years. 14 (28%) was delivered before 3-4 years. 5 (10%), 2 (4%) and 1 (2%) mothers delivered before 5-6, 7-8 and 9-10 years respectively. Majority of mothers, 39 (78%) did not have a history of previous abortion. 7 (14%) had 1, 3 (6%) had 2 and 1 (2%) abortions in their lifetime.

Systolic BP (mmHg)	Frequency	Diastolic BP (mmHg)	Frequency
100-110	4 (8%)	60-70	4 (8%)
111-120	22 (44%)	71-80	33 (66%)
121-130	18 (36%)	81-90	8 (16%)
131-140	4 (8%)	91-100	4 (8%)
141-150	2 (4%)	101-110	1 (2%)

Table 2. Systolic and Diastolic BP of Mothers with DGM

The systolic and diastolic BP was normal among majority of mothers. 6% of mothers had increased systolic BP. Diastolic BP was high among 10% of mothers.

Height (m)	Frequency	Weight (Kg)	Frequency	BMI Range	Frequency
1.50	6 (12%)	50-55	5 (10%)	18-25	10 (20%)
1.51	4 (8%)	56-60	10 (20%)	26-30	35 (70%)
1.52	7 (14%)	61-65	16 (32%)	31-35	5 (10%)
1.53	3 (6%)	66-70	12 (24%)	35-40	0
1.54	7 (14%)	71-75	5 (10%)		
1.55	1 (2%)	76-80	1 (2%)		
1.56	10 (20%)	81-85	0		
1.57	5 (10%)	86-90	1 (2%)		
1.58	5 (10%)	91-95	0		
1.59	1 (2%)	96-100	0		
1.60	1 (2%)	101-105	0		

Table 3. Height, Weight, and BMI of Mothers with GDM

OGCT (mg/dL)	Frequency	Cord Blood Sugar (mg/dL)	Frequency
130-140	19 (38%)	40-50	2 (4%)
141-150	17(34%)	51-60	8 (16%)
151-160	7 (14%)	61-70	12 (24%)
161-170	2 (4%)	71-80	12 (24%)
171-180	4 (8%)	81-90	14 (28%)
181-190	1 (2%)	91-100	1 (2%)
191-200	0	101-110	0
201-210	0	111-120	1 (2%)

Table 4. OGCT of Mothers with GDM and Cord Blood Glucose of Neonates

The height of mothers was analysed, and it ranged from 1.5 m to 1.6 m. When weight was tabulated, majority fell in

61-65 Kg category. The BMI was in overweight category in 70% of mothers. The birth weight of babies was assessed. 10 (20%) fell in 2.1-2.5 Kg category, 19 (38%) in 2.6-3.0 Kg category, 17 (34%) in 3.1-3.5 Kg category and 4 (8%) in 3.6-4.0 Kg category. When OGCT of mothers were evaluated, majority was in 130-140 mg/dL category. The cord blood glucose of neonates was assessed. Majority (72%) had blood sugar between 61-90 mg/dL.

DISCUSSION

In this study majority of mothers were in the age group 24-28 years. Beyond 30 years there were 34% of mothers. Advanced maternal age was found to be associated with increased incidence of GDM in few studies.[5] Magee et al, in a prospective observational outcome study on GDM, found that increasing maternal age and family history were associated with GDM.[5] Other retrospective and prospective studies also revealed similar findings.[6] Increasing maternal age has been considered as a risk factor by the ADA and the Fourth International Work Shop on GDM.[1,3]

The current research showed that majority of study mothers were primi or second gravid. 22% of mothers included in this study had history of abortion. Prior to the introduction of insulin therapy in 1921, diabetes was found to be a rare complication of pregnancy due to high incidence of amenorrhea, infertility and miscarriage in women with the disease. Miscarriage was found to be directly related to the degree of hyperglycaemia. Early 20th century has been a remarkable time for the diabetic woman who becomes pregnant due to the poor prognosis. There was a near 50% maternal and fetal mortality when diabetes complicated pregnancy.[7]

The discovery of insulin in 1921 by Banting and Best revolutionized the prognosis of pregnancies complicated by diabetes. The maternal mortality was drastically reduced to 2 to 3% within a decade of introduction of insulin therapy but the fetal mortality remained high.[8]

In the late 1940s it was recognized that the fetal and neonatal mortality in women who later developed diabetes was much higher than normal in the years immediately preceding the diagnosis of diabetes. This led to the concept of 'prediabetes' subsequently recognized as a period of transient diabetes induced by pregnancy. By the 1950s the term 'gestational diabetes' was applied to what was thought to be a transient condition that affected fetal outcomes adversely, then abated after delivery.[7]

Majority of mothers included in this research had normal systolic and diastolic BP. The high systolic and diastolic BP was recorded in 4% and 10% respectively. Maternal complications of GDM include hypertension, preeclampsia, polyhydramnios, shoulder dystocia and an increased risk of caesarean delivery. Women with a history of GDM have an increased risk of developing diabetes after pregnancy compared to the general population with a conversion rate of up to 3% per year. Long term follow up studies reviewed by Kim et al showed that 10% have diabetes soon after delivery and over 10 years there is a stable long term risk of approximately 70%.[4]

The height of mothers ranged from 1.5-1.6 m. Weight ranged from 50-90 Kg. 80% of mothers fell in overweight or obese based on categorization as BMI <18.5-Underweight, 18.5-24.9-Normal, 25-29.9-Overweight, 30-34.9-Obesity. Diabetes mellitus in pregnancy continues to be a relatively neglected problem and is not adequately recognized. Studies have revealed an increase in the prevalence of GDM with age, gravida and Body mass index (BMI).

The incidence of gestational diabetes mellitus has doubled over the last 6 to 8 years and is paralleling the obesity epidemic. GDM is the most prevalent of all types of diabetes complicating pregnancy. It includes a heterogeneous group of women with minimal abnormality in glucose tolerance and those with undetected overt diabetes. The use of the term 'gestational diabetes' has been encouraged in order to communicate the need for increased surveillance and to convince the woman of the increased fetal and neonatal risks as well as the long-term risks for the mother and offspring.

Women with GDM present peculiar challenges to the clinician because they have their metabolic disorder for a limited time and may not appreciate the potential risks to the fetus and themselves. But the resultant derangement of metabolic fuels, carbohydrates, lipids and amino acids, has adverse effects on the fetus even in women with impaired glucose tolerance. Structural defects occur in 3 to 8% of offspring of diabetic mothers and the rate drops 3 to 4 fold with good glycaemic control during embryogenesis. According to the ACOG, excessive fetal and neonatal mortality attributable to GDM should be considered preventable.[8]

GDM can be recognized as a link to diabetes after pregnancy and has been proposed as a model with which to identify early metabolic defects that precede the development of diabetes in young women.[9] Obesity, increased maternal age, gravida, family history of diabetes and ethnicity were found to be associated with GDM in several studies.[1, 2, 3, 4] These are factors known to be associated with type 2 diabetes.[10, 11]

Though glucose levels were high among mothers, majority had an OGCT between 130 and 150 mg/dL. A knowledge of risk factors helps in identifying abnormal glucose tolerance that may be mild and asymptomatic. Most of those women with GDM would not be diagnosed to have abnormal glucose tolerance because majority have lower glucose levels and only some have glucose levels that would be diagnostic of diabetes outside pregnancy. Pregnancy, in essence, serves as a metabolic stress test that uncovers underlying insulin resistance and β cell dysfunction.

In spite of early recognition that rigid control of diabetes was vital for an optimal pregnancy outcome, fetal mortality remained above 40% in diabetes associated with pregnancy until late 1950s. This, perhaps, was due to an incomplete understanding of the pathophysiology of the condition and lack of suitable technology for assessing adequate diabetic control. In the 1950s O'Sullivan found that the degree of

glucose intolerance during pregnancy was related to the risk of developing diabetes after pregnancy.[7] It is now recognized that diabetes complicating pregnancy represents a unique short - term 'tissue - culture', from which a great deal can and has been learned about the long-term complications of diabetes and the ways in which these can be avoided.

Gestational diabetes mellitus is defined as glucose intolerance of various degrees with onset or first recognition during pregnancy.[1,2,8] The term 'gestational' implies that the disorder is induced by pregnancy, perhaps due to exaggerated physiological changes in glucose metabolism. The definition applies regardless of whether or not insulin is used for treatment or whether the condition persists after pregnancy. It does not exclude the possibility that unrecognized glucose tolerance may have antedated or begun concomitantly with pregnancy. Some women with gestational diabetes have previously unrecognized overt diabetes.[8] The definition also includes type 1 diabetes arising de novo during pregnancy and persists in the long term.[7] GDM is a common medical problem that mainly results from an increased severity of insulin resistance as well as an impairment of the compensatory increase in insulin secretion.[3,8] It is a form of hyperglycaemia resulting from an insulin supply that is inadequate to meet tissue demands for normal blood glucose regulation. There is a reduced insulin response to nutrients in women with GDM.[9]

Gestational diabetes mellitus can occur in all the three major settings which characterize diabetes outside pregnancy. The majority of cases of GDM occur on a bacKground of chronic insulin resistance, other causes are autoimmune and monogenic.[1,3,8]

The focus for antepartum care in GDM is on appropriate nutrition and the use of standard antidiabetic treatments. The management modalities include glucose monitoring, medical nutrition therapy, exercise and exogenous insulin. The aim is to minimize fetal overnutrition thereby preventing complications during pregnancy and immediate postpartum. The main focus of clinical care after pregnancy should be on reducing risk of diabetes and detecting and treating diabetes if it develops. Women with GDM should be tested for glucose intolerance 6 weeks after delivery and annually thereafter. Studies have shown that treatment of insulin resistance results in preservation of β cell function.[4,12,13] Troglitazone in the Prevention of Diabetes' (TRIPOD) study was conducted in Hispanic women to test the hypothesis. Troglitazone is an insulin-sensitizing drug which reduces secretory demands placed on β cells.[14]

The drug was found to reduce incidence of diabetes by 55% in women with GDM. In the US Diabetes Prevention Program, (DPP) intensive lifestyle modification to promote weight loss and increased physical activity resulted in a 58% reduction in risk of type 2 diabetes. Treatment with metformin also reduced the risk but only to a lesser extent. Exercise has been shown to increase the insulin sensitivity of muscle cells and glucose uptake to muscle cells. Myocytes initially use glycogen stores for energy but are soon forced to use serum glucose thus lowering blood glucose levels in the short term.[15] Peterson et al (1998) have shown that exercise improves glycaemic control.[8] The ACOG and American Diabetes Association (ADA) also recommend moderate exercise in GDM. Exercise is an advisable cheap method to burn out calories.

A significant proportion of female diabetics might have been detected earlier through diagnosis of GDM according to several studies.[1,8] GDM is a risk factor for diabetes and can be considered as a model for the development and implementation of diabetes primary prevention programmes. Casey and colleagues[16] compared universal screening with selective screening for GDM and found that in spite of doubling the number of women tested, the number of gestational diabetics and obstetrical outcomes remain unchanged. A selective screening approach developed by Naylor et al including age, BMI and race resulted in a 34.6% reduction in the number of screening tests performed without any decrease in GDM detection rate.[6] Since 1980s there have been four International Workshop Conferences on GDM and these have attempted to provide consensus statement on screening for diabetes. At the most recent workshop in 1997, prior recommendations for universal screening were changed to selective screening. According to the ADA, it is probably not cost effective to screen patients with low risk for development of glucose tolerance during pregnancy.[1,7]

The study yielded results on neonatal parameters. Birth weight and glucose levels ranged from 2-4 Kg and 40-120 mg/dL respectively. For more than a century, it was known that diabetes antedating pregnancy can have several adverse effects on fetal and neonatal outcomes.[17] Extreme fetal macrosomia occurred in the first reported case of diabetes in pregnancy in 1823.[6] The belief that the diabetic condition is in some way a symptom of pregnancy dates to that first report.

CONCLUSIONS

Onset of GDM is found in women of earlier age group. History of abortions was slightly high in GDM mothers. Systolic and diastolic BP was normal in majority of mothers. Birth weight of neonates was higher compared to neonates of normal mothers.

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