Plant Archives Vol. 20 Supplement 1, 2020 pp. 1823-1827 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

A STUDY ON OCCURRENCE OF GESTATIONAL DIABETES MELLITUS AND ITS CLINICAL MANAGEMENT

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Abstract

Early diagnosis of gestational diabetes mellitus is the key that may allow proper measures to be taken to make a satisfactory outcome of pregnancy. To determine the occurrence, association between certain factors, and GDM along with the diagnostic criteria and its clinical management. This prospective observational study was conducted on in-patients and out-patients of the obstetrics and gynecology department. The data was collected from subjects, their relatives, in and out patient's clinical records. The results were summarized using frequency and percentage. The risk factors for GDM were analyzed using the Chi-square test. A total of 207 pregnant women were enrolled, and 89 were diagnosed with GDM. The occurrence of GDM was 43%. The known risk factors for GDM were identified as advanced age, overweight, obesity, and history of DM in first degree relatives had a significant association with GDM ($P<0.05$). Metformin was the most prescribed drug during all trimesters (3.3%, 7.8% and 31.4%) as compared with insulin (2.2%, 2.2% and 6%). This study finds the occurrence of GDM among pregnant women and also suggests the probable association between risk factors and GDM, which will contribute to improved management.

Key Words: Gestational Diabetes Mellitus, obesity, hyperglycemia, metformin.

Introduction

According to the World Health Organization(WHO), "Diabetes mellitus (DM) is a metabolic disorder of multiple etiologies, characterized by chronic hyperglycemia with disturbance of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both" (Bhat *et al.,* 2010). It is grouped into type1 DM (ß-cell demolition, leading to insulin deficit), type 2 DM (due to escalating insulin secretory deficiency on the backdrop of insulin resistance), and gestational diabetes mellitus (GDM) (diabetes mainly diagnosed in the second or third trimester of pregnancy (Paulose *et al.,* 2008).

Increased blood glucose level (Hyperglycemia) is one of the metabolic disorders and complications women confront through pregnancy, and it is called GDM. It is defined "as any degree of glucose intolerance with onset or first recognition during pregnancy" (Sefali *et al.,* 2006).

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During pregnancy, the placenta produces hormones that help for the growth of the baby, and it obstructs the outcome of insulin in hyperglycemic women (ADA, 2015).

As per the International Diabetes Federation (IDF), GDM occurrence is being promptly rising. GDM affects 1 in 7 births (Duman *et al.,* 2015). In India, GDM occurrence varies from 0.6% - 27.3%. The occurrence of GDM is higher in India than to other countries worldwide (Mpondo *et al.,* 2015). Several diagnostic criteria (WHO, ADA, CDA and Australasian criteria, and NDDG) and screening procedures are remarked for GDM since it improves maternal and neonatal prognosis. WHO proposes a 2-hour 75-gm OGTT with an increase in PG levels (>140 mg/dl) at 2 hours to systematize the diagnosis (Kayal *et al.,* 2016). There is a correlation between the likelihood of congenital malformations and maternal blood glucose levels. GDM raises the probability of fetal and neonatal complications (Melchoir *et al.,*

2017). Hence, this study was carried out to determine the occurrence, association between certain factors, and GDM along with the diagnostic criteria and its clinical management.

Materials and methods

Study design and ethical approval

A prospective observational study was carried out for six months in the obstetrics and gynecology department of Justice K.S. Hegde Charitable Hospital, Mangaluru, Karnataka, India, after obtaining the ethical clearance (Ref: NGSMIPS/IEC/08/2018-19). Both outpatient and hospitalized pregnant women meeting inclusion criteria were enrolled in the study.

Sample size:

The calculated sample size was 195 pregnant women. Estimation of proportion (presence of at least one risk factor) was used at a 95% confidence interval. The samples were taken randomly.

$n = Z^2_{1\,\%} P(1-P)/d^2$, where

n = sample size

$Z^2_{1\,\%}$ = confidence interval

P = estimated proportion

d = desired precision

Study procedure:

Pregnant women newly diagnosed with gestational diabetes during the antenatal checkups were enrolled in the study. The participants were above 18 years of age and willing to participate in the study. The suitable data collection form was prepared to contain demographic details, past medical history, past medication history, past family history, vital signs, biochemical tests, diagnosis, medication, and diabetic diet plan. Relevant data were collected directly from subjects, their relatives, inpatient and outpatient clinical records, patient case sheets, laboratory investigations, and drug treatment charts.

Statistical analysis

Qualitative data were analyzed using frequency and percentage. Chi-square/Fisher's exact test was used to find an association between the GDM and risk factors. A p-value of less than 0.05 was statistically significant, using SPSS version 20.0.

Results

Estimation of GDM occurrence

During the study period, a total of 207 pregnant women were enrolled. Eighty-nine were diagnosed with GDM. The occurrence of GDM (GCT e"140 mg/dl) was 43 % (89/207).

Assessment of various parameters in pregnant women

The participants were assessed for various parameters like age, BMI, family history of DM, history of HTN, gestational hypertension, PCOD, thyroid disorders, and recurrent miscarriage in prior pregnancies. The distribution of various parameters among pregnant women is summarized in Table: 1.

Assessment of various parameters in gestational diabetes mellitus women

Distribution of various parameters among gestational diabetes women is summarized in Table 2.

Status of GDM under different parameters

In the study group, the known risk factors for GDM were advanced age, BMI, and family history of DM. It has been seen that the history of DM in first degree relatives, age, and BMI had a positive impact on GDM compared with other risk factors. The distribution of high factors conferring with GDM was summarized in Table 3.

Age stratified distribution in GDM

In the study, pregnant women were grouped into four age groups. With the increasing age, the occurrence of GDM rises from 0% in the youngest age group to over 41.5% among women more than 25 years of age. Chi-square value obtained was 8.55 and the p-value was 0.036, which is <0.05, which shows there is a significant relationship exist between age and GDM.

Distribution based on BMI in GDM

In this study, there was a high occurrence of unfavorable pre-pregnancy nutritional status (overweight and obesity). At an overweight BMI (>25kg/m^2), 49/89 (55.05%) were identified with GDM. The study showed there is a significant association between GDM and increased BMI with a Chi-square value of 17.1 and a p value<0.05. These results emphasize the need for pregnant women to be professionally monitored so that modifiable risk factors can be managed.

Association of family history with GDM

Family history is a common indication for GCT during pregnancy. Results showed that nearly 23% of pregnant women underwent GCT because of positive family history. 48/207 (23.1%) pregnant women had a family history of DM, and 35/89 (39.3%) women had both GDM and positive family history compared to women without GDM, 13/118 (11.01%). Association is shown to be

statistically significant ($p<0.05$) and the Chi-square value obtained was 22.87.

Distribution based on parity of mother

In this study, the highest incidence of GDM was reported during second pregnancies 47/89 (52.9%). 40(34.8%) GDM cases were during first pregnancies, and 37 (41.6%) mothers having more than three children had GDM. There was no significant association between GDM and parity. Percentage distribution of parity of pregnant women is being illustrated below in Table 4.

Distribution of GDM based on the trimester of pregnancy

In the study population65/89 (73.1%) of GDM women belonged to third trimester (27-40 weeks).17/89 (19.1%) Had GDM in the second trimester, and only 7/89 (7.8%) had GDM during the first trimester due to the presence of one or more risk factors. Percentage distribution of GDM based on the trimester of pregnancy is given below in Table 5.

Distribution of comorbidities in GDM

Women with a history of hypothyroidism, 4/89(4.4%) had a high occurrence of GDM compared to women with a history of hyperthyroidism (0 %). One out of eighty-nine (1.1%) had a history of HTN, and 11/89 (12%) had a history of previous abortion, and there was no significant association between comorbidities and GDM. Percentage distribution of comorbidities is summarized below in Table 6.

Distribution of diagnostic tests in pregnancy

Standard OGTT may not be necessary for all groups of women. Women with age (>30 years), standard 75g OGTT should be performed at 24–28week of gestation because of the high chance of glucose intolerance. The majority of pregnant women underwent GCT 152/207 (73.4%) during their first antenatal visit. The distribution of diagnostic tests in pregnancy is given below in Table 7.

Drugs prescribed in pregnant women

Most of the patients were prescribed iron, calcium supplements, and folic acids during their pregnancy period. All the GDM patients were prescribed with vitamin D supplements to avoid the future risk of getting type II DM. 37/207(17.8%) were prescribed with ranitidine, which is safe in pregnancy.

Management of GDM in the present study

Distribution of clinical management in GDM

In GDM patients with borderline/slightly elevated GCT value prescribed with GDM diet alone 37/89 (42%). Moderate glycemic control was treated with metformin 37/89 (41.50%) or insulin 9/89(10.11%). A percentage representation of clinical management in GDM women is summarized below in Table 8.

Metformin versus Insulin for GDM mana-gement

Metformin was the most prescribed drug among all trimesters (3.3%, 7.8% and 31.4%) compared with insulin (2%, 2% and 6%).

Control achieved after initiation of pharmaco-therapy in GDM Women

All the therapeutic regimens had a good impact on blood glucose levels. Metformin groups achieved 81% of glycemic control based on PPBS values, which was the most prescribed drug. Distribution of glycemic control in GDM women are summarized below in Table 9.

Impact of GDM management in glycemic control

In the study, 51/89 (57%) had a positive response towards the therapy. The majority of patients achieved good glycemic control after the treatment, which may reduce the risk of both fetal and perinatal complications.

Discussion

The present study was conducted at the antenatal clinic in the Department of Obstetrics and Gynecology. A total of 207 patients were scrutinizing for GDM, and 89 (43%) women were diagnosed with GDM, which was similar to the study conducted by (Shefali *et al.,* 2006). But more than the study conducted by (Poulose K *et al.,* 2008, Melchoir HK *et al.,* 2017 and Cossen E *et al.,* 2004).

Age (>25 years), BMI (≥ 25kg/m^2), family history of DM, was significantly associated with GDM which is similar to the studies conducted by (Shefali *et al.,* 2006, Erem C *et al.,* 2015 and Quasi *et al.,* 2016). This is contrary to the study performed by (Cosson *et al.,* 2004) where age had no significant association with GDM. There was no significant correlation existed between GDM and the number of pregnancies, similarly illustrated in a study done by (Bhat *et al.,* 2010 and Duman *et al.,* 2015). In the present study, 53.2% (<25 years) of the study group were at lower risk category of developing GDM, whereas 46.8% of study subjects come under the high-risk category (>25 years. A study conducted by (Seshiah *et al.,* 2006), the percentage of the patient at risk age group is almost similar to the present study population. But in the study performed by (Anand *et al.,* 2017), the occurrence rate of GDM was low, but risk factors had a significant association with GDM.

In the present study, majority of pregnant women (151/207) was between 27 to 40 weeks of gestation and

GDM were estimated with elevation of GCT value which is similar to the studies conducted by (Mpondo *et al.,* 2015, Erem C., 2015 and Coustan *et al.,* 1989) whereas a study performed by (Anand *et al.,* 2017, Tsang *et al.,* 2005, and Veciana *et al.,* 1995) reveals the laboratory parameters used for diagnosis for GDM were PPBS, FBS, and HBA1C which is contrary to the present study.

Table 1: Distribution of various parameters among pregnant women.

FACTORS	N (%)
BMI(kg/m^2)	
<18.5	15 (7.20%)
18.5-25	97 (46.80%)
>25	95 (45.80%)
AGE(years)	
<20	1.2 (0.90%)
21-25	60 (28.90%)
26 – 30	92 (44.40%)
>30	53 (25.60%)
FAMILY HISTORY OF DM	48 (23.18%)
PARITY	
Gl	72 (34.70%)
G2	70 (33.80%)
>G3	65 (31.48%)
Abortion	29 (14%)
Hypertension	4 (1.93%)
Hypothyroidism	10 (4.83%)
PCOD	2 (0.96%)
Gestatitional hypertension	13 (6.46%)

Table 1: Distribution of various parameters in GDM women.

FACTORS	N (%)
BMI(kg/m^2)	
<18.5	5(5.61%)
18.5-25	35 (39.32%)
>25	49 (55.05%)
AGE(years)	
<20	0 (0.00%)
21-25	21 (23.50%)
26 – 30	37 (41.57%)
>30	31 (34.80%)
FAMILY HISTORY OF DIABETES	35 (39.32%)
PARITY	
Gl	25 (28.08%)
G2	37 (41.57%)
>G3	27 (30.33%)
Abortion	11 (12%)
Hypertension	4 (4.49%)
Hypothyroidism	4 (4.49%)
PCOD	0 (0.00%)
Gestatitional hypertension	4 (4.49%)

In the present study, GDM women were treated with dietary advice, blood glucose monitoring, and clinical therapy. The purpose of the study was to compare the efficacy of clinical management versus MNT. MNT (37), metformin (37), insulin (9) and combination therapy (6) were given, respectively. The patients initiated with metformin showed a lower rate of adverse events and increases insulin sensitivity. Nowadays, there are options to be considered like oral hypoglycemic agents (OHAs) before considering insulin therapy, which is contrary to a study performed by (Langer *et al.,* 2000), where glyburide was used as an alternative for insulin therapy.

The present study put forward the use of clinical management along with MNT and exercises if glucose control has not been achieved. Approximately 70%-90% of Metformin use in GDM women was shown good acceptance. Metformin was selected as first-line agents

Table 3: Distribution of significant risk factors associated with GDM.

AGE GROUP (years)	GDM n (%)	n (%)	p-value
<20	0 (0.00%)	2 (2%)	< 0.05
21-25	21 (23.50%)	39 (33%)	
26 – 30	37 (41.57%)	55 (47%)	
>30	31 (34.80%)	22 (18.60%)	
BMI (kg/m^2)			
<18.5	5(5.61%)	10 (8.47%)	< 0.05
18.5-25	35 (39.32%)	57 (48%)	
>25	49 (55.05%)	51 (43.20%)	
FAMILY HISTORY			
YES	35 (39%)	13 (11%)	< 0.05
NO	54 (61%)	105(89%)	

Table 4: Distribution based on parity of pregnant women.

Gravida	GDM n (%)	n (%)
Gl	25 (28.08%)	47 (39.80%)
G2	37 (41.57%)	33 (27.90%)
>G3	27 (30.33%)	38 (32.20%)

Table 5: Distribution of GDM based on the trimester of pregnancy.

TRIMESTER	GDM n (%)
1-13 weeks	7 (7.80%)
14-26 weeks	17 (19.10%)
27-40 weeks	65 (73.10%)

Table 9: Distribution of glycemic control in GDM women.

Management	Glycemic control achieved	Glycemic control not achieved
GDM diet alone	24.35%	75.60%
Metformin	81.00%	18.90%
Insulin	77.70%	22.20%
Combination therapy	83.33%	16.60%

Table 6: Distribution of comorbidities in GDM.

COMORBIDITIES	GDM n (%)	GDM n (%)
History of previous abortion	11 (12%)	104 (88%)
HTN	1 (1%)	117(99%)
Hypothyroidism	4 (4%)	113 (96%)
Gestational HTN	4 (4%)	113 (96%)

Table 7: Distribution of diagnostic tests in pregnancy.

Laboratory investigations	Pregnant women n (%)
GTT	13 (6.28%)
GCT	152 (73.42%)
FBS	88 (42.51%)
PPBS	90 (43.50%
HbA1C	48 (23.18%)

Table 8: Distribution of clinical management in GDM.

Management	GDM n (%)
GDM diet	37 (42%)
Metformin	37 (41.50%)
Insulin	9 (10.11%)
Metformin + Insulin	6 (6.74%)

as well as the safest substitute for GDM treatment in developing countries. NICE and ADA supported the use of OHAs, which were dynamically related to the study conducted by (Anwar *et al.,* 2018).

Conclusion

This study finds the occurrence of GDM among pregnant women, which reveals the high incidence of gestational diabetes mellitus. This study also finds a probable association between various risk factors and GDM. The occurrence of GDM and its association with various risk factors helps in understanding the social burden of diseases. This study will contribute to an improved understanding of the social and behavioral determinants of GDM. Thus, women who are at high risk of developing GDM should be appropriately screened to diagnose the GDM in the early stages, which ultimately helps in reducing maternal and fetal morbidity. The clinical management of pregnant women with GDM is challenging and puts additional stress on the health care system for the prevention and management of GDM.

Acknowledgment

We Authors are extremely thankful to Justice K. S. Hegde Charitable Hospital, Nitte (Deemed to be University), and NGSM Institute of Pharmaceutical Sciences, Mangaluru, Karnataka for providing us all the necessary facilities for carrying out this work.

Conflict of Interest

Authors declare no conflict of interest.

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