Original Research Article

Gestational diabetes: know your risk by simple and single step criteria (DIPSI)

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ABSTRACT

Background: Gestational diabetes mellitus (GDM) has associations beyond the index pregnancy, identifying two generations at risk of future diabetes. Thus, detection of gestational diabetes mellitus becomes an important public health issue. This study aimed to estimate the prevalence of gestational diabetes mellitus by using simple and single step DIPSI criteria (Diabetes in pregnancy study group India) and risk factors associated with GDM.
Methods: This cross-sectional study was carried out in 800 antenatal patients attending the antenatal clinic. These patients have given 82.5 gm mono-hydrous (75 gm anhydrous) oral glucose irrespective of the meals and their plasma glucose was estimated at 2 hr. Patients with plasma glucose value ≥140 mg/dl were diagnosed as GDM.
Results: The present study estimated that the prevalence of GDM was 14.75% at their 1st visit. We found a positive association of GDM by age, BMI, hypertension and family history of diabetes. Older women had 4.5 times greater risk of GDM than younger women, obese women had 52 times higher risk of GDM than underweight women and hypertensive pregnant women had 4 times greater risk of GDM.
Conclusions: It was realized that the test (DIPSI) could be easily performed in high volume hospitals comfortably and the patient were at ease as they were not fasting. Simple, cost effective tests, if made universal and available in developing country like ours will surely aid health care providers to screen, diagnose GDM and offer preventive and treatment measures at the earliest.

Keywords: Diabetes in pregnancy study group India criteria, Gestational diabetes mellitus

INTRODUCTION

Gestational diabetes mellitus (GDM) is characterized by carbohydrate intolerance of varying severity with onset or first recognition during pregnancy.[1] GDM has associations beyond the index pregnancy, identifying two generations at risk of future diabetes.[2] GDM is associated with increased pregnancy morbidity and increases the risk of subsequent type 2 diabetes in the mother. GDM also predisposes the offspring to an increased risk of developing glucose intolerance in the future. Thus, GDM women are an ideal group for the primary prevention of future diabetes. Early detection and management of women with GDM becomes necessary for better maternal and fetal outcome. The modified WHO test as proposed by Diabetes in Pregnancy Study Group India (DIPSI), does not require fasting, whereas WHO protocol mandates fasting state. Furthermore, DIPSI test is a single-step procedure which serves both as screening and diagnostic tool. It is the simplest test, feasible and has a high sensitivity to diagnose GDM, almost as high as the IADPSG (International Association of The Diabetes and Pregnancy Study Groups) testing.[3]

In 2015, IDF (International Diabetes Federation) estimated that one in seven births is affected by

gestational diabetes and in South East Asia, one quarter of all births are affected by high blood glucose in pregnancy.[4] It is estimated by IDF (International Diabetes Federation) that 20.9 million or 16.2% of live births to women in 2015 had some form of hyperglycemia in pregnancy. An estimated 85.1% of those subjects were due to gestational diabetes, 7.4% due to other types of diabetes first detected in pregnancy and 7.5% due to diabetes detected prior to pregnancy. The South-East Asia Region has the highest prevalence at 24.2% compared to 10.5% in the Africa Region.[5] Majority (87.6%) of subjects of hyperglycemia in pregnancy were in low and middle-income countries where access to maternal care is often limited.

GDM was detected in 17.8% women in urban, 13.8% in semi urban and 9.9% in rural areas.[6] It varies with geographic location and has been reported to range from 3.8% in Kashmir, to 6.2% in Mysore, 9.5% in Western India and 17.9% in Tamil Nadu.[7-10] In recent studies prevalence rates as high as 35% from Punjab and 41% from Lucknow have been found.[11,12] It is estimated that about 4 million women are affected by GDM in India, at any given time point.[13] The prevalence of GDM shows increasing trends it was 2% in 1982 which increased to 7.62% in 1991 and doubled to 16.55% in 2002.[14-16]

The increased prevalence is because of urbanization, obesity, and physical inactivity. While all these factors contribute to the epidemic of diabetes, intrauterine exposures are emerging as potential risk factors.[17] The "fetal origin of adult disease" hypothesis recommends that gestational programming may influence adult health and disease.[17] In Gestational programming stimuli or stresses occurring at critical or sensitive periods of fetal development, permanently change structure, physiology, and metabolism, which predisposes individuals to disease in adult life.[18] Hyperglycemia in pregnancy predisposes the offspring to an increased risk of developing glucose intolerance in the future. Therefore, preventive measures against type 2 diabetes should start during the intrauterine period. In this respect, detection of gestational diabetes mellitus (GDM) becomes an important public health issue. The etiopathogenesis of glucose intolerance that develops in women with GDM could be the result of their inability to increase insulin secretion enough to overcome insulin resistance that occurs even in non-diabetic pregnancy. The present concept is that chronic β cell dysfunction, rather than development of relative insulin deficiency leads to development of GDM.[19]

As India is now rated as diabetes capital of the world, there is immense need for a sensitive, cost effective and feasible test to diagnose GDM so that preventive and therapeutic measures can be adopted to prevent adverse maternal and fetal outcome and lay down health care strategies for women in future. Universal screening for gestational diabetes mellitus (GDM) should be recommended as Indian women have 11 fold increased risk of developing GDM compared to Caucasians.[21]

This study aimed to estimate the prevalence of Gestational diabetes mellitus and to find out risk factors of Gestational diabetes mellitus in antenatal patients attending antenatal clinic at their first visit by using simple and single step criteria (DIPSI).

METHODS

The present cross-sectional study was conducted at the antenatal clinic in the Department of Obstetrics and Gynaecology during the period, 1st March 2015 to 31st August 2016. A total 800 antenatal subjects were counselled and screened by using DIPSI criteria (2 hr 75 gm post plasma glucose ≥ 140mg/dl, irrespective of the last meal timing) and prevalence of Gestational diabetes was estimated. The inclusion criteria included antenatal subjects attended their 1st antenatal visit at the antenatal clinic in the Department of Obstetrics and Gynecology, while all patients with known diabetes and unwillingness for test were excluded.

The adequate required sample size was estimated using following formula

$$N = z^2pq / d^2$$

Where −n = sample size, z = 1.96 (considering 0.05 alpha, 95% confidence limits and 80% beta), p = assumed probability of occurrence or concordance of results, q = 1 − p, d = marginal error (precession)

To calculate the adequate required sample size, we have taken assumptions that 15% probability with 2.5% absolute precision (12.5 - 17.5) would be targeted. This accumulates 783.7 by using above given formula. Therefore, minimum 800 subjects were adequate number for the study.

The study was initiated with the approval of the Institutional Ethics Committee. Informed consent was taken during initial assessment from all the patients. A detailed clinical assessment of patient was performed in the antenatal clinic and recorded in a standard proforma including general information on demographic characteristics, socio-economic status, education level, obstetric history, family history of diabetes, height, and pre-pregnancy weight and BMI. General physical examination and obstetric examination was done. Routine investigations were done. According to DIPSI (Diabetes in pregnancy study group of India) criteria 75gm anhydrous glucose or 82.5gm mono-hydrous glucose can be used. We used 82.5gm mono-hydrous glucose. 82.5gm glucose was given after dissolving in 200mL water irrespective of the last meal timings. The intake of the solution should be completed within five minutes. In case vomiting occurred within 30 minutes of oral glucose intake, the test was repeated next day. But if it occurred after 30 minutes, the test continued. Venous blood was drawn after 2 hrs. The plasma glucose level was estimated by the glucose oxidase peroxidase (GOD-POD)

method. Women with 2-hr PG ≥140 mg/dl (DIPSI criteria) were diagnosed as GDM and rest were classified as normal glucose tolerant (NGT). Women diagnosed as GDM were managed extensively.

Statistical analysis

Data was entered in MS Office excel. The prevalence of GDM was estimated. All the quantitative variables were grouped accordingly. Chi-square test and ODDS ratio was calculated for each qualitative variable. Data analysis was done using STATA 12.1. P value less than 0.05 was considered as statistically significant.

RESULTS

A total 800 subjects screened by single and simple step DIPSI (Diabetes in pregnancy study group India) criteria, of which 118 (14.75%) were diagnosed as GDM at their 1st visit.

Table 1: Background characteristic of study subjects.

Variables		N/D (%)	OR (95% CI)	P Value
Locality	Rural	55/471 (11.67%)	1	
	Urban	63/329 (19.14%)	1.79 (1.21-2.66)	0.003
Occupation	Housewife	40/275 (14.5%)	1	
	Laborer	56/360 (15.6%)	1.08 (0.70-1.68)	0.72
	Business	16/120 (13.3%)	0.90 (0.48-1.69)	0.75
	Salaried Job	6/45 (13.3%)	0.90 (0.36-2.28)	0.83
Educational status	Illiterate	19/170 (11.2%)	1	
	Primary	30/265 (11.3%)	1.01 (0.55-187)	0.96
	Middle	26/163 (16%)	1.51 (0.79-2.85)	0.20
	Higher Secondary	36/142 (25.4%)	2.70 (1.45-5.02)	0.001
	College	7/60 (11.7%)	1.05 (1.42-2.64)	0.92
Socio economic status	Lower	73/495 (14.7%)	1	
	Middle	44/296 (14.9%)	1.01 (0.67-1.51)	0.96
	Higher	1/9 (11.1%)	0.72 (0.09-5.88)	0.76

*N = GCT Positive, *D = Total Subject

Table 2: Univariate logistic regression analysis for potential risk factors of gestational diabetes.

Risk Factors		N/D (%)	OR (95% CI)	P Value
Age (year)	< 20	10/102 (9.8%)	1	
	21-30	84/625 (13.4%)	1.43 (0.71-2.86)	0.31
	> 30	24/73 (32.9%)	4.51 (1.92-10.58)	0.0001
BMI	< 18.5 Underweight	2/80 (2.5%)	1	
	18.5-24.99 Normal weight	63/518 (12.16%)	5.40 (1.28-22.73)	0.0098
	25-29.99 Over weight	33/167 (19.76%)	5.60 (2.15-42.96)	0.0003
	> 30 Obese	20/35 (57.14)	52.0 (6.82-396.32)	<0.0001
Hypertension	No	83/700 (11.86%)	1	
	Yes	35/100 (35%)	4.00 (2.47-6.48)	<0.0001
Hypertension in previous pregnancy	No	107/770 (13.9%)	1	
	Yes	11/30 (36.7%)	3.59 (1.65-7.80)	0.0006
H/o Diabetes in First degree relative	No	91/722 (12.6%)	1	
	Yes	27/78 (34.6%)	3.67 (2.17-6.21)	<0.0001
H/o Diabetes in Second degree relative	No	98/749 (13.1%)	1	
	Yes	20/51 (39.2%)	4.29 (2.33-7.90)	<0.0001

Demographically (Table 1) most of the subjects i.e. 471 (58.87%) belong to rural locality but urban pregnant women had 1.7 times higher risk of GDM [OR 1.79 (95%CI 1.21-2.66)] which was statistically significant (p=0.003). Prevalence of GDM found more in labourer and middle socioeconomic class, whether it is because of study population bias is uncertain. This may be because of Malnutrition-related diabetes mellitus (MRDM).[20] Present study observed that 16.1% GDM subjects were illiterate and 30.5% GDM subjects were educated up to

higher secondary, this difference was statistically significant. Maximum prevalence found in Higher Secondary class, 36 out of 142 were diagnosed as GDM which was significant statistically (P=0.001).

In the present study, it was found that older age, BMI>30 kg/m^2, hypertension, history of hypertension in previous pregnancy and family history of diabetes mellitus was significantly associated with GDM. Table 2 shows that most of the study subjects 625 (78.12%) belong to 21-30 year age group although Women with >30 years old were 4.5 times greater chances of GDM [OR 4.51(95% CI 1.92-10.58)] than younger (≤20 years old) which is significant statistically (p<0.0001). Analysis of GDM prevalence according to BMI revealed that obese pregnant women (BMI> 30) were more likely to GCT positive than underweight pregnant women (BMI<18.5). Obese pregnant women (BMI> 30) had 52 times more chances of GDM [OR 52(95%CI 6.82-396.32)] which was significant statistically (p<0.0001). Further, overweight pregnant women (BMI 25-29.99) were found to have 5.6 times higher chances of GDM [OR 5.60(95%CI 2.15-42.96)] which was significant statistically (p<0.0003). We found significant correlation between GDM and Hypertension that Hypertensive pregnant women had 4 times greater risk of GDM [OR 4 (95%CI (2.47-6.48)] and Pregnant women with history of hypertension in previous pregnancy had 3.59 times greater risk of GDM even at their 1st visit [OR 3.59 (95%CI 1.65-7.80)] which was also significant statistically (p<0.0006). As the diabetes runs in family and we also analyzed that Pregnant women with history of diabetes in first degree relatives had 3.6 times greater risk of GDM [OR 3.67 (95%CI 2.17-6.21)] and Pregnant women with history of diabetes in second degree relatives had 4.2 times greater risk of GDM even at their 1st antenatal visit [OR 4.29 (95%CI 2.33-7.90)] which was significant statistically (p<0.0001).

DISCUSSION

A study conducted by Seshiah V et al at Government Maternity Hospital Chennai, they found 18.9% GDM prevalence when taking both FPG ≥126 mg/dl and/or 2 hr PPG ≥140 mg/dl as cut-off values and 16.2% GDM prevalence when taking only 2 hr plasma glucose for analysis.[21] The prevalence of GDM in Asian-Indian women was found 13.4% in a study conducted by Balaji, et al. in 2009-10, in which a total of 1463 pregnant women underwent 75 g oral glucose challenge test (GCT) according to DIPSI criteria.[22] Similar results found in present study, a total 800 subjects screened by single and simple step DIPSI criteria, of which 118 (14.75%) were diagnosed as GDM at their 1st visit.

Thus, it was analyzed that prevalence of GDM in Jabalpur district was 14.75% at 1st visit itself. Alpana Singh, B. Uma conducted a study Bhaskar Medical College and Hospital, Hyderabad, and they found 5.7% incidence of GDM by using the DIPSI method.[23]

Various studies conducted in different parts of India and observed that prevalence varied with different geographical locations and diagnostic methods used. Prevalence was found 6.6% in Jodhpur Rajasthan, 9.7% in Uttar Pradesh, 5.2% in Odisha, 17% in Kollam district Kerala, 14.42% in Kanpur Uttar Pradesh, 6.94% in Jammu Region.[24-29]

We observed positive association of GDM by age group. The prevalence proportion increased with age from 9.8% in the age group ≤20 years to 32.9% for the age groups >30 years. A study conducted by Seshiah V et al. Gestational Diabetes Mellitus in India concluded that among 891 pregnant women, the mean age was 23±4 years. The prevalence proportion increased with age from 15.7% (confidence limits: 8.6%-25.3%) in the age group 15-19 years to 32.1% (confidence limits: 20.3%- 46.0%) for the age groups >30years.[21]

A study conducted by Wahi P, et al in Jammu showed that a significant proportion of subjects with GDM were overweight 19 (30.65%) and obese 16 (25.8%).[29] Similarly in present study, 53 (44.9%) GDM patients had BMI >25 with 27.96% being obese (BMI >30). This was further supported by a study by Kalra, et al. which concluded that significant proportion of subjects with GDM were overweight 22 (66.67%) and obese 6 (18.18%).[25] The mean BMI found in GDM positive subjects was 25.32±4.91 and p value was <0.0001 which was highly significant. A study conducted by Balaji, et al: Diagnosis of gestational diabetes mellitus in Asian-Indian women concluded that the mean BMI of the 1463 pregnant women was 21.5 ± 4.06 kg/m^2.[22] A study conducted by Alpana Singh, B. Uma showed that 39.1% GDM subjects were having BMI ≥ 25 kg/m^2.[23]

Kalra et al showed that 36.4% GDM subjects were associated with hypertension.[25] Similarly, in present study 35(29.66%) GDM subjects were hypertensive, which was statistically significant. A study conducted by Wahi P et al in Jammu found that 6.45% GCT positive subjects were associated with hypertension.[29]

A study conducted by Alpana Singh, B. Uma et al. showed that 13% subjects with history of GDM in previous pregnancy develop GDM.[23] Similarly, we found that 6 subjects had past history of gestational diabetes, of which 2 (33.34%) subjects diagnosed as GDM even at their 1st visit in present pregnancy, although this was not found significant. Since the study included a single screening, it could not be ascertained whether the remaining 4 become diabetic in later pregnancy. According to Kalra et al. family history of diabetes mellitus was found in 33.3% of GDM women.[25] Similarly, in present study 22.88% GDM women had history of diabetes in their first degree relatives and 16.94% GDM women had history of diabetes in their second degree relatives. A study conducted by Balaji, et al. Diagnosis of Gestational diabetes mellitus in Asian-Indian women concluded that pregnant women who had

family history of diabetes were 18.3%.[22] A study conducted by Wahi P et al. in Jammu concluded that family history of diabetes mellitus found in 24.19% of subjects.[29] Jain R, et al. Gestational diabetes as perinatal and maternal complication concluded that GDM subjects had 20.6% positive family history of diabetes.[28]

Since the diagnosis of GDM at the 1st antenatal visit will not identify all subjects, it may be concluded that more pregnant women will become diabetic at repeat testing.

CONCLUSION

The DIPSI test is simple, cost effective and economic test. The test can be easily performed in high volume hospitals in a small time and economically and the patients were more at ease as they were not fasting. There is a need to enhance awareness amongst health care providers especially working at rural setups about the maternal and perinatal risk of GDM and the ease of the screening test and its interpretation.

The prevalence of GDM in present study was 14.75% at 1st antenatal visit itself. So, to find out the exact prevalence of GDM, repeat screening should be done at recommended interval at least in high risk population.

Recommendations

The recommendations for the universal screening for GDM in all antenatal clinics should be laid down because of high prevalence rate and the significant impact it has on maternal and fetal outcome. This will help us in calculating the economic impact as well as designing preventive strategies.

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