Original Article

A cross-sectional study to develop an early risk prediction tool for gestational diabetes mellitus for antenatal women diagnosed with this condition based on their characteristics and past obstetric history

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Abstract

Background: In India, the prevalence of gestational diabetes mellitus (GDM) is estimated to be 10%–14.3%, which is higher than in Western countries. Out of 10 pregnancies, one is associated with diabetes, and 90% of them are GDM. GDM influences not only maternal complications but also neonatal complications. Moreover, women with GDM and their children are at increased risk of developing type-2 diabetes later. **Method and Material:** A cross-sectional study was conducted on 220 patients to develop an early risk prediction tool for GDM for antenatal women diagnosed with this condition based on their characteristics and past obstetric history. **Results:** The mean age (in years) of patients in the study was 27.69 ± 5.07. One hundred and twenty-six patients (57.27%) had a family history of DM in their first relatives. Eighty-three (58.86%) patients had a history of complications in a previous pregnancy. **Conclusion:** The early risk predictor tool with age, prepregnancy, body mass index (BMI), family history of DM, gravidity, past history of menstrual cycle, and complications in a previous pregnancy was easy to operate, and all predictors were easily obtained in the first trimester in primary healthcare centers.

Keywords: Antenatal women, early risk prediction tool, GDM, gestational diabetes mellitus, obstetric history

Introduction

The International Federation of Gynecology and Obstetrics has defined gestational diabetes mellitus (GDM) as "any degree of glucose intolerance with onset or first recognition during pregnancy."[1] In India, prevalence of GDM is estimated to be 10%–14.3%,[2] which is higher than in Western countries.

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Although GDM is a sizeable public health problem with serious adverse effects on mother and child, we do not have a standard Government of India guideline for diagnosing and managing GDM.[2] Moreover, women with GDM and their children are at increased risk of developing type-2 diabetes later.[2]

GDM influences not only maternal complications but also neonatal complications. Long-term clinical effects of GDM are essential contributors to the burden of noncommunicable diseases in many countries.[3,4]

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So, this study was an attempt to develop an early risk prediction tool for antenatal women diagnosed with GDM based on patients' characteristics and past obstetric history.

Methods and Material

Study design

Cross-sectional observational study.

Study site and duration

Tertiary care hospital and January 2018 to September 2019.

Sampling technique

Convenient sampling method.

Sample size

This was calculated using the anticipated population proportion (p) = 16.5%.[1] Formula used for sample size = $4pq/d^2$ and calculated sample size was 220.

Inclusion criteria

Antenatal women presenting to antenatal out patient department (OPD) diagnosed with GDM.

Ethical committee approval

The study was approved by local ethics committee and departmental review board.

Consent

All the patients were well informed about the study and written informed consent was taken.

Statistical data analysis

All responses were tabulated using Microsoft Excel 2016 Software. Graphical representations were made wherever necessary. Data was analyzed by using Statistical Package for the Social Sciences (SPSS) software version 25.0. Statistical tools used were mean and standard deviation.

Results

Sociodemographic data

It was observed that patients' mean age (in years) was 27.69 ± 5.07, and the range was from 17 to 40 years of age. Maximum patients, 88 (48.88%), belonged to lower middle-class family and were Muslim by religion. **(Table 1: Sociodemographic profile and Figure 1: Distribution according to age group)**

Out of 220 patients, 126 (57.27%) had a family history of DM in their first relatives [Figure 2].

The mean age (in years) of menarche was 13.56 ± 1.49 and the range of age of menarche was between 10 years to 17 years. A total of 59% of patients gave the history of irregular menstrual cycles.

Table 2 shows patients' prepregnancy body mass index (BMI). Most of the patients were in the overweight category.

Obstetric history

Gravida: The Table 3 shows the distribution of patients according to obstetric history of gravida. A total of 39% of patients were primigravida.

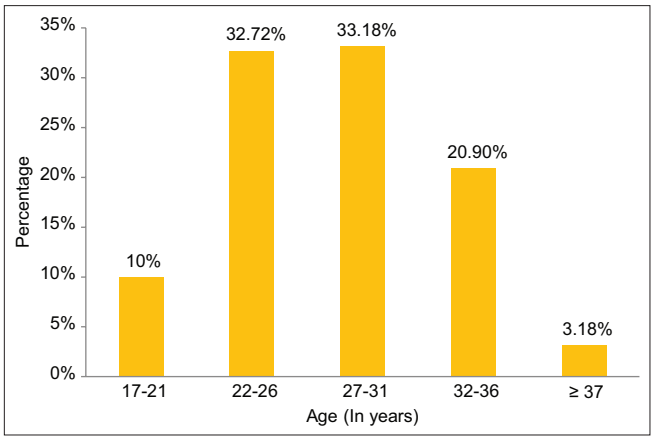

Figure 1: Age-wise distribution of patients (*n* = 220)

Table 1: Sociodemographic profile of patients (*n*=220)

Parameters	Percentage (%)
Age (years)	
17-21	10%
22-26	32.72%
27-31	33.18%
32-36	20.90%
≥37	3.18%
Type of Religion	
Hindu	35.45%
Muslim	39.54%
Buddhist	13.63%
Christian	6.81%
Others	4.5%
Modified Kuppuswamy scale for socioeconomic class	
Lower class	7.22%
Upper lower class	22.77%
Lower middle	48.88%
Upper middle	21.11%

Table 2: Distribution of patients with reference to prepregnancy BMI with classification of weight (*n*=210)

Classification of patients	Frequency	Percentage (%)
Underweight ≤18.5	16	7.61
Normal weight ≥18.5-22.9	57	27.14
Overweight=23-24.9	90	42.85
Obese ≥25	47	22.38
Total	210	99.98

Complication history in previous pregnancy

As it is seen in Table 3, 79 patients were with gravida 1 and therefore, they were excluded from history of complications in previous pregnancy and therefore sample size is 141 for history of complications in previous pregnancy. Eighty-three (58.86%) patients had history of complications in previous pregnancy and 58 (41.13%) did not have any history of complication. The most common complication noted in previous pregnancy was pregnancy-induced hypertension (PIH) in 34 (24.11%) patients [Figure 3].

Term of delivery

Seventy-nine patients were with gravida 1 [Table 3] and six patients had given a history of abortion [Figure 3], therefore, they were excluded from the history of term and mode of delivery for previous pregnancy and therefore, sample size for the history of term and mode of delivery in previous pregnancy was 135. In previous pregnancy, out of 135 patients, 128 (94.81%) had given a history of full-term delivery, whereas seven (5.18%) had given a history of preterm delivery [Figure 4].

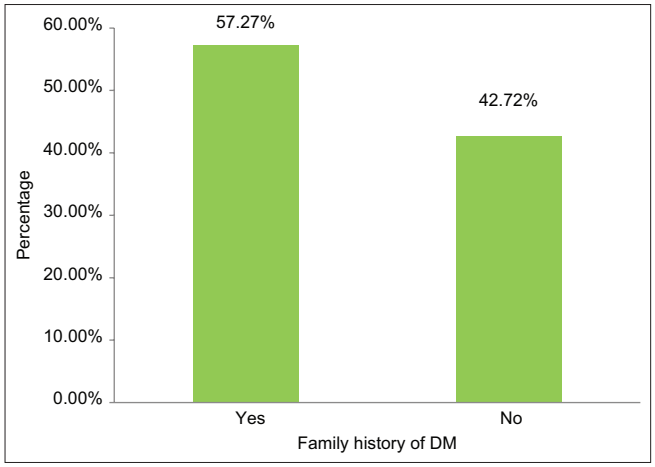

Figure 2: Distribution of patients in relation to family history of diabetes mellitus (*n* = 220)

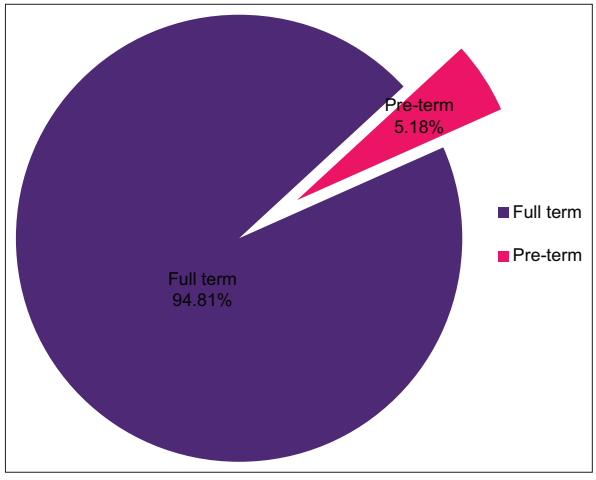

Figure 4: Distribution of patients according to history of term of delivery in previous pregnancy (*n* = 135)

Mode of delivery

Out of 135 patients, 97 (71.85%) had a vaginal delivery, and in 38 patients (28.41%) lower-segment cesarean section (LSCS) was performed [Figure 5], and out of 97 vaginal deliveries, eight (8.24%) were instrumental-assisted deliveries. Most common indication for LSCS was previous history of LSCS, i.e., 16 (42.15%), followed by pregnancy-induced hypertension 14 (36.84%), macrosomia (15.78%), obstructed labor (15.78%), oligohydramnios (15.78%), meconium passage in utero (7.89%),

Table 3: Distribution of patients according to history of gravida (*n*=220)

Gravida	Frequency	Percentage (%)
Primigravida	79	35.90
Gravida 2	56	25.45
Gravida 3	65	29.54
Gravida 4	17	7.72
Gravida >5	03	1.36
Total	220	99.97

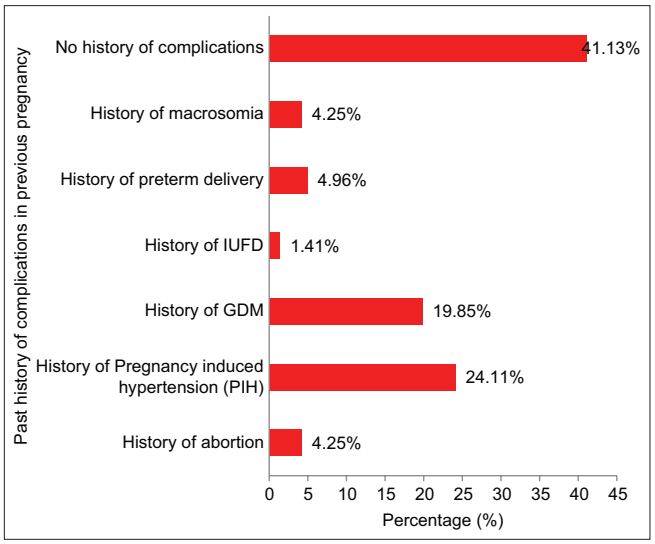

Figure 3: Distribution of patients according to past history of complications in previous pregnancy (*n* = 141)

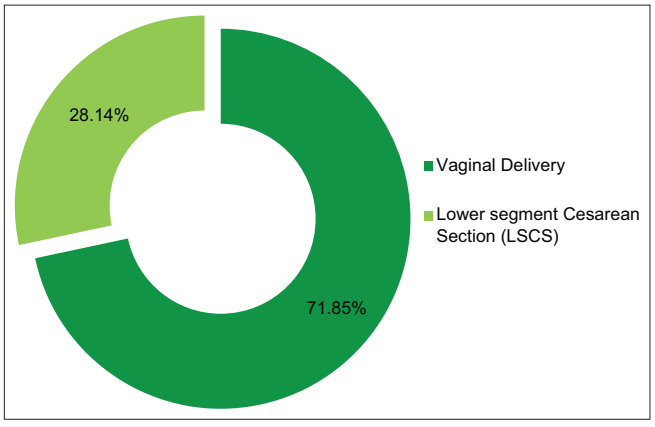

Figure 5: Distribution of patients according to history of mode of delivery in previous pregnancy (*n* = 135)

placental insufficiency (7.89%), post-dated pregnancy (5.26%), and malpresentation (2.63%).

Chief complaints

Most common chief complaint in relation to pregnancy in the present study was increased frequency of urination, i.e., 58 (32.22%). This was followed by disturbed sleep, i.e., 42 (23.33%), lower backache and decreased appetite each seen in 26 (14.44%) patients separately, lower abdominal pain 20 (13.33%), burning chest pain 10 (5.55%), and difficulty in breathing 01 (0.55%).

Comorbidity

A total of 93.63% did not have any associated comorbidity. The most common comorbidity was hypothyroidism 11 (5%).

Discussion

Out of 10 pregnancies, one is associated with diabetes and 90% of them are GDM.[2] The incidence of GDM is expected to increase to 20%, i.e., one in every five pregnant women is likely to have GDM.[2] Moreover, women with GDM and their children are at increased risk of developing type-2 diabetes later.[2]

A cross-sectional observational study was done to develop an early risk prediction tool for antenatal women diagnosed with GDM based on the patient's characteristics and past obstetric history. For this study variables studied were sociodemographic factors (age, age at menarche, and family history of DM), past obstetric history (complications in previous pregnancy, term of delivery, mode of delivery, and indications for LSCS in previous pregnancy), and present obstetric history (gravid, any complaints).

Age

In our study, mean age of study patients was 27.69 ± 5.07 and the range was from 17 to 40 years of age. This study's results were similar to a study conducted by Far *et al.* (2012)[5] in Iran (mean: 27.81 ± 4.11 and range of 17 to 40 years of age). The GDM condition is more likely to occur in older women.[5]

Family history of DM

In our study, more than half of patients (57.27%) had a family history of DM in their first relatives. A study conducted by Nilofer *et al.* (2019)[3] found that 77.7% of GDM patients had history of DM in their first relatives and found significant association of family history of DM with GDM (*P* value ≤ 0.05). This study's finding of family history of DM is higher than our study. In a study conducted by Sreekanthan *et al.* (2014),[4] 41.66% of GDM women had history of diabetes in first-degree relatives and Abu-Heija *et al.* (2017)[6] found that positive oral glucose tolerance test (OGCT) was observed in 34.9% of women with family histories of DM. And these study findings of family history of DM are lesser than our study. Moosazadeh *et al.* (2016)[7] and Saxena *et al.* (2017)[8] found that family history of DM was significantly higher among GDM mothers (OR = 3.46), (*P* value = 0.002).

Age of menarche

In present study, the mean age of menarche was 13.56 ± 1.49. More than one-third (36.36%) patients in the present study had menarche between 10 and 13 years. Sun *et al.* (2018)[9] did meta-analysis study in China and showed that women with menarche at an early age (≤11 years) had a higher GDM risk than those with menarche at age ≥12 years. (OR = 1.45). Wang *et al.* (2019)[10] conducted a study in China and found that the crude GDM prevalence was highest in those with an earlier age at menarche (OR = 1.08).

Prepregnancy BMI: In our study, mean prepregnancy BMI was 23.95 ± 3.8. Far *et al.* (2012)[5] conducted a study in Iran and found mean prepregnancy BMI (kg/m^2) with abnormal glucose tolerance was 27.01. This difference in mean BMI may be due to different genetic makeup according to geographical region.

Gravida

In our study, nearly two-thirds of patients (64.1%) were multigravida and 35.9% were primigravida. Seshiah *et al.* (2004)[1] conducted a study in Chennai and found that proportion of GDM increased with gravida, from 18.1% (confidence limits: 14.38%–22.29%) in the primigravida to 25.8% (confidence limits: 11.86%–44.61%) for the gravidas ≥4. Rajput *et al.* (2014)[11] conducted a study in Haryana and revealed that women with gravida ≥3 had significantly higher prevalence of GDM compared with gravida <3 (*P* = 0.010).

Term of delivery

In our study, 5.18% of patients had given history of preterm delivery. Yogev *et al.* (2007)[12] conducted a study in New York and found that proportion of GDM is higher among mothers with history of spontaneous preterm delivery (sPTD) (O.R. = 3.25).

History of complications

In the present study, 58.86% of patients had history of complications in previous pregnancy. The most common complication noted was pregnancy-induced hypertension (PIH) (24.11%), followed by history of GDM in previous pregnancy (20%). The finding of PIH in our study is attributed more to a study conducted by Abu-Heija *et al.* (2017)[6] in GDM patients (12%). The history of GDM in previous pregnancy was a significant risk factor shown by Saxena *et al.* (2017)[8] (*P* value = 0.022).

Conclusion

This study developed a simple tool for early risk prediction of GDM by considering following points: age (with increasing age), family history of DM, prepregnancy BMI (overweight and obese category), gravidity (with increasing gravidity), history of complications in previous pregnancy, term of delivery in

previous pregnancy (preterm), and early menarche and irregular menstruation.

Limitations

Most of the patients included in study did not have paper records of previous pregnancy. So data collected in this study is about what patients remembered about previous pregnancy. Therefore, there can be recall bias.

Strengths

This is a simple tool that can be helpful to categorize ANC women who are more prone to show impaired glucose level during pregnancy and therefore, can take preventive measures beforehand. This tool is easy to operate and all predictors were easily obtained in the first trimester in primary healthcare centers.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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