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Original Research Article

Retrospective study on assessment of risk for gestational diabetes using fetal medicine foundation's gestational diabetes risk assessment calculator in a tertiary care hospital in coastal Karnataka, India

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ABSTRACT

Background: Gestational diabetes is defined as impaired glucose tolerance with onset or first recognition during pregnancy. Undiagnosed or inadequately treated gestational diabetes can lead to significant maternal and fetal complications. Even though there are guidelines for diagnosis of GDM (gestational diabetes mellitus) by the Government of India, there is poor penetration of the implementation throughout the nation.

Methods: The study was conducted in A. J. Institute of Medical Sciences between April to June 2019. 56 patients were evaluated with the fetal medicine foundation GDM risk calculator to assess the risk for gestational diabetes in a retrospective approach.

Results: Incidence of GDM in the study was 15.9%. At a cut-off of 1/80, the calculator predicted increased risk for 37 out of 56 patients. There was a sensitivity of 91.6% and specificity of 63.6% with a negative predictive value of 96.5% and positive predictive value of 29.5%. there was a false positive rate of 43.2%.

Conclusions: The fetal medicine foundation GDM risk calculator will prove to be an invaluable tool to predict high risk patients who need closer monitoring of blood glucose into the third trimester.

Keywords: Fetal medicine foundation, Gestational diabetes, Risk calculator

INTRODUCTION

Gestational diabetes (GDM) is defined as impaired glucose tolerance with onset or first recognition during pregnancy. Undiagnosed or inadequately treated gestational diabetes can lead to significant maternal and fetal complications.¹

Normal pregnancy is commonly associated with insulin resistance like that found in type 2 diabetes. Physiological resistance to insulin action during pregnancy becomes apparent in the second trimester, and this progresses gradually to term. The increased insulin resistance facilitates transplacental transfer of glucose to the fetus, which in turn stimulates fetal insulin secretion, and insulin acts as an essential growth hormone.² The

excessive insulin in turn predisposes more accumulation of carbohydrates into the fetus, leading to large for gestational age or macrosomic babies. During delivery, macrosomia increases the risk of shoulder dystocia, clavicle fractures and brachial plexus injury and increases the rate of admissions to the neonatal intensive care unit.³

In India alone, GDM complicates nearly 4 million pregnancies annually, representing large subset of population at high risk for adverse perinatal morbidity and mortality if left inappropriately managed.⁴ GDM is associated with increased rate of neonatal hypoglycaemia, preterm birth, hyperbilirubinemia, hypocalcemia, polycythemia, childhood obesity, neuropsychological disturbance, anomalies like anencephaly, spina bifida, renal agenesis, TGV, VSD,

single umbilical artery, sacral agenesis. Women with GDM demonstrated high rate of caesarean section and future risk of diabetes. Women with gestational diabetes and their offspring are also at an increased risk of developing Type 2 diabetes later in life. In India rates of GDM are estimated to be 10 to 14.3%.¹ Despite government of India mandate to screen all Indian pregnant women for GDM as a part of routine antenatal package according to national operational guidelines, its real operationalization at primary health care level is still unclear. In a study in Bangalore less than half of

government doctors (44%) employed oral glucose tolerance test (OGTT) to diagnose GDM with mere 74% prescribing recommended 75 g glucose. Few utilized 50 g (18%) and 100 g (8%) glucose for performing OGTT. Most doctors were utilizing other screening tests like random blood glucose (46%), fasting plasma glucose (18%), and postprandial blood glucose (12%) for diagnosing GDM, outside recommended national guidelines.⁴ The Government of India guidelines have been compared with other standardised screening and diagnostic criteria in Table 1.

Table 1: Comparison of various guidelines for detecting gestational diabetes.

Guidelines	FBS (mg/dl)	Glucose load	1-hour blood sugar (mg/dl)	2-hour blood sugar (mg/dl)	3-hour blood sugar (mg/dl)
WHO ⁶	≥ 126	75 g	Not required	≥ 140	Not required
ACOG ⁷	≥ 95	100 g	≥ 180	≥ 155	≥ 140
Canadian diabetes association ⁸	≥ 95	75 g	≥ 191	≥ 160	Not required
IADPSG ⁹	≥ 92	75 g	≥ 180	≥ 153	Not required
DIPSI ¹⁰	Not required	75 g	Not required	≥ 140	Not required

The fetal medicine foundation's gestational diabetes risk calculator is an online application based on a logistical regression model. Input of maternal age, height, weight, racial origin, family history of diabetes, use of ovulation induction drugs, history of gestational diabetes and previous baby's birth weight and gestational age at delivery returns gestational diabetes risk in current pregnancy as a ratio.⁵

Objective of this study was to assess the feasibility of using the fetal medicine foundation gestational diabetes risk calculator to assess risk for gestational diabetes in a tertiary care hospital in coastal Karnataka.

METHODS

The study was conducted in A. J. Institute of Medical Sciences, Mangaluru between the months of April to June 2019. Data was collected from all patients who were admitted and underwent delivery during this time window.

Inclusion criteria

- All antenatal patients who have delivered in our Hospital in the time window of April to June 2019, with a recorded 1st trimester weight, and evaluated for GDM.

Exclusion criteria

- Out born
- Antenatal patients with overt diabetes.

GDM was diagnosed as per MoHFW (Ministry of Health and Family Welfare, India) guidelines (2018), and an

antenatal patient was said to be having gestational diabetes if she has an elevated OGTT more than 140 mg/dl after a 75 g load irrespective of fasting state, or either an elevated fasting blood sugar more than 95 mg/dl or post prandial blood sugar more than 120 mg/dl.¹

Data collected included the following

- Maternal age
- Height
- Weight in 1st trimester
- Racial origin
- Family history of diabetes
- Use of ovulation drugs
- History of gestational diabetes previous pregnancy
- Previous baby's birth weight and gestational age at delivery

The collected data was entered into the Fetal Medicine Foundation risk calculator WEBAPP (used with permission) which provided the risk for GDM as a ratio, with maximum probability being 1 in 2 (Figure 1, 2). The data collected was tabulated in a spreadsheet.

RESULTS

Incidence of GDM was 15.9% in the population. 56 of all the antenatal mothers met all the parameters of the inclusion and exclusion criteria. Out of these 12 were diagnosed as GDM.

At an arbitrary cut off of 1/80 on the GDM risk calculator, the test predicted increased risk for 37 patients and decreased risk for 29 patients (Table 2).

Figure 1: Parameters to be entered in the FMF GDM risk calculator for a primigravida.

Figure 2: Parameters to be entered in the FMF GDM risk calculator for a multigravida.

The figures are screenshots from the web app from fetal medicine foundation’s gestational diabetes risk calculator. After entering the mentioned values, the calculator provides the risk as a ratio.

Table 2: distribution of subjects based on diagnosis and outcome from the risk calculator.

	High probability of GDM	Low probability of GDM	Total
Diagnosed as GDM	11	1	12
Diagnosed as non GDM	16	28	44
Total	27	29	56

Consequently at 1/80 cut off the GDM risk calculator had a sensitivity of 91.6% and specificity of 63.6%. The negative predictive value was 96.5% and positive predictive value was 29.5%. There was a false positive rate of 43.2%.

Any result from the risk calculator more than 1/80 was taken as high probability and less than 1/80 taken as low probability.

DISCUSSION

Worldwide incidence of GDM is estimated to be about 10%, with Asian ethnicities having a higher risk at an incidence of up to 17%.¹¹ The study presented with an incidence of 15.9% of patients having gestational diabetes. The study by Zheng et al showed an incidence of GDM in 12.8%.¹² The study by Karacam et al, showed maximum incidence of 17.6% for GDM when detecting GDM based on advanced maternal age, BMI, weight gain in pregnancy, family history of diabetes, history of GDM or large baby in previous pregnancy.¹³

The fetal medicine foundation calculator considers all the risk factors for a better detection ratio, when compared to the individual factors in accordance to NICE guidelines. The calculator was created based on the study by Syngelaki et al. The multivariate model was created from 75,161 singleton pregnancies. The study demonstrated a sensitivity of 83.2% at a false positive rate of 40%.⁵ Comparatively, present study showed a sensitivity of 91.6% and specificity of 63.6% at a false positive rate of 43.2%. Similarly, a population study by Caliskan et al, to determine effectiveness of a risk factor based scoring for GDM had a sensitivity of 71% at an FPR of 40%.¹⁴ Nanda et al, reported detection rates of GDM at 61.6% at 20% false positive rate based on maternal age, body mass index, racial origin, previous history of GDM and macrosomic neonate, and an improved detection rate of 78% at a false positive rate of 40%.¹⁵

In present study, 42% of the patients with GDM were diagnosed in the third trimester. Similarly, in the study by Kaira et al, 51.2% of GDM mothers was detected in third trimester.¹⁶ Naylor et al in their prediction model showed a detection rate of 67%, with false positive rate 40% when using a logistic regression model.¹⁷ Similarly, at 40% false positive rate, Teede et al, demonstrated a detection rate of 77% in their GDM risk prediction tool.¹⁸ Van Leeuwen et al, in their study using a prediction model, detected 79% of GDM at a false positive rate for 40%.¹⁹

CONCLUSION

The fetal medicine foundation GDM risk calculator will prove to be an invaluable tool to predict high risk patients who need closer monitoring of blood glucose into the third trimester.

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