

ABSTRACT

Objective: Gestational diabetes mellitus (GDM) affects 5-14% of pregnant women, many of whom will require treatment beyond diet and exercise. Despite this high prevalence, there is no consensus regarding the glycemic threshold for conversion from diet to medical treatment. The goal of this study was to compare two different thresholds for the number of elevated glucose values prior to initiation of medical treatment for GDM.

Study Design: This was a retrospective cohort study of women with a singleton pregnancy and diagnosis of GDM delivering in a single tertiary care center. GDM was diagnosed using Carpenter-Coustan two-step approach. Maternal and neonatal outcomes were compared using bivariable and multivariable analyses between women who started medical treatment (insulin or oral hypoglycemic agent) at two different thresholds of elevated capillary blood glucose (CBG) values: Group 1: 20-39% abnormal CBG values vs. Group 2: at least 40% or higher abnormal CBG values. The primary outcome was a composite neonatal outcome that included macrosomia, large-for-gestational-age (LGA), shoulder dystocia, neonatal hypoglycemia, hyperbilirubinemia requiring phototherapy, respiratory distress syndrome (RDS), stillbirth, and neonatal demise. The secondary outcomes were the rates of cesarean delivery and small for gestational age (SGA) infants.

Results: In univariable analysis, women who received medical treatment with less than 40% elevated CBG values, compared to 40% or greater were more likely to be non-Hispanic white (78.9% vs. 50.2%, $p < 0.001$) and had a lower BMI at the beginning of pregnancy (32.4 ± 8.5 vs. 35.4 ± 9.1 , $p = 0.002$). The composite neonatal outcome was statistically significantly lower in the lower treatment threshold group (47.0% vs 32.3%, $p = 0.004$). Higher rates of SGA infants were noted in the lower treatment threshold group. In multivariable analysis, controlling for race/ethnicity, early pregnancy BMI, total weight gain in pregnancy, gestational age at the time of GDM diagnosis, and gestational age when treatment was initiated, the primary composite neonatal outcome, preterm delivery and NICU admission were significantly lower, and the SGA rates remained higher in the lower treatment threshold group.

Conclusion: Lowering the threshold for medical treatment initiation for women with GDM was associated with lower rates of composite poor neonatal outcomes, however, higher rates of SGA were noted.

BACKGROUND

- Gestational diabetes mellitus (GDM) affects up to 14% of pregnant women, many of whom will require medical treatment
- There is no consensus regarding the glycemic threshold for conversion from diet and exercise to medical treatment for GDM
- It is important to establish criterion of medical treatment initiation for GDM as under-treatment leads to increased rates of adverse obstetric outcomes associated with poor glycemic control including:
 - Macrosomia
 - Preeclampsia
 - Cesarean delivery
 - Shoulder dystocia and birth trauma
 - Neonatal hypoglycemia and hyperbilirubinemia
 - Childhood obesity and metabolic syndrome

OBJECTIVE

To evaluate the difference between two different thresholds for the initiation of medical treatment for GDM and the rates of adverse perinatal outcomes associated with GDM. We hypothesized that a lower threshold for medical treatment initiation will be associated with lower rates of adverse perinatal outcomes.

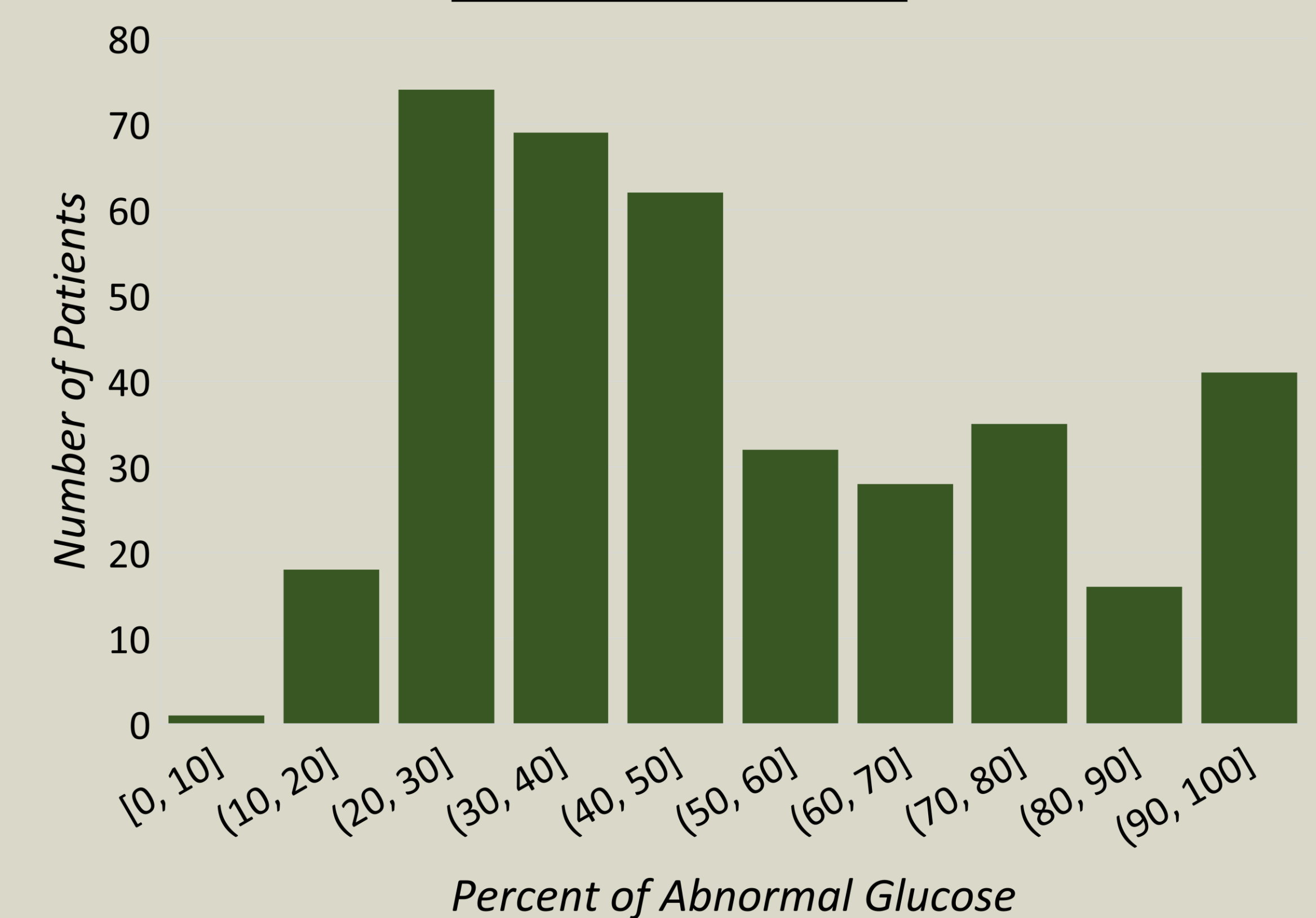
METHODS

- Retrospective chart review of 376 women with GDM started on medical treatment during pregnancy who delivered from 2011 to 2018 at Froedtert Memorial Lutheran Hospital (FMLH) and the Medical College of Wisconsin (MCW)
- Inclusion criteria:**
 - Pregnant women at least 18 years of age
 - Viable singleton pregnancy
 - Diagnosis of GDM and started on medication in pregnancy
- Exclusion criteria:**
 - Pre-gestational diabetes
 - Known major fetal anomaly
- Maternal and neonatal outcomes were compared at two different thresholds of abnormal CBG values:
 - Group 1: 20-39% abnormal CBG values
 - Group 2: At least 40% or greater abnormal CBG values
- Primary outcome: Composite neonatal outcome including macrosomia, large for gestational age (LGA), shoulder dystocia, neonatal hypoglycemia, hyperbilirubinemia requiring phototherapy, respiratory distress syndrome (RDS), stillbirth, and neonatal demise
- Secondary outcomes: Rates of cesarean delivery and SGA
- All tests were two-tailed and $p < 0.05$ defined statistical significance
- Univariable comparisons were conducted with Chi-square, Fisher exact, or one-way ANOVA as appropriate
- Multivariable logistic regression was used to estimate the independent association between the threshold of medical treatment initiation and rates of adverse perinatal outcomes

RESULTS

Baseline Characteristics	Treatment started at 20% abnormal values (n = 161)	Treatment started at 40% abnormal values (n=215)	p-value
Maternal age at delivery (yrs)	32.2 ± 4.7	31.6 ± 5.3	$p = 0.236$
Maternal ethnicity/race			
Non-Hispanic White	111 (68.9%)	108 (50.2%)	$p < 0.001$
Non-Hispanic Black	17 (10.6%)	57 (26.5%)	
Hispanic	1 (0.6%)	11 (5.1%)	
Other	32 (19.9%)	39 (18.1%)	
Nulliparity	58 (36.0%)	77 (35.8%)	$p = 0.966$
Maternal BMI in early preg (kg/m ²)	32.4 ± 8.5	35.4 ± 9.1	$p = 0.002$
Tobacco use in pregnancy	12 (7.6%)	19 (8.9%)	$p = 0.502$
Prior cesarean delivery	37 (23.3%)	48 (22.3%)	$p = 0.829$
Chronic hypertension	8 (5.0%)	9 (4.2%)	$p = 0.718$
Asthma	5 (3.1%)	8 (3.7%)	$p = 0.747$
Gestational age at diagnosis (wks)	25.0 ± 6.5	26.2 ± 5.5	$p = 0.053$
Gestational age at treatment (wks)	29.2 ± 5.8	29.6 ± 5.3	$p = 0.471$
Gestational weight gain (kg)	8.6 ± 6.7	9.8 ± 9.0	$p = 0.161$
Polyhydramnios	10 (6.7%)	12 (5.9%)	$p = 0.768$
Female gender	86 (53.4%)	99 (46.1%)	$p = 0.351$

Percentage of Abnormal Glucose Values at Medical Treatment Initiation



Pregnancy outcomes	Treatment started at 20% abnormal values (n = 161)	Treatment started at 40% abnormal values (n=215)	p-value
Composite neonatal outcome*	52 (32.3%)	101 (47.0%)	$p = 0.004$
Gestational age at delivery (wks)	38.6 ± 1.2	38.0 ± 1.8	$p < 0.001$
Preterm delivery < 37 wks	10 (6.2%)	33 (15.4%)	$p = 0.006$
Preeclampsia	16 (9.9%)	28 (13.3%)	$p = 0.324$
Cesarean delivery	69 (42.9%)	91 (42.3%)	$p = 0.918$
Birth weight (grams)	3303 ± 546	3391 ± 604	$p = 0.147$
Macrosomia	11 (6.8%)	26 (12.1%)	$p = 0.090$
Large for gestational age	15 (9.3%)	41 (19.1%)	$p = 0.009$
Small for gestational age	13 (8.1%)	6 (2.8%)	$p = 0.021$
Shoulder dystocia	1 (0.6%)	12 (5.6%)	$p = 0.009$
5 min Apgar < 7	5 (3.2%)	18 (8.4%)	$p = 0.039$
NICU admission	7 (4.4%)	27 (12.7%)	$p = 0.006$
3 rd /4 th degree laceration	3 (2.1%)	3 (1.6%)	$p = 0.754$

*Composite: macrosomia, LGA, shoulder dystocia, hypoglycemia, hyperbilirubinemia requiring phototherapy, RDS, stillbirth and neonatal demise

Multivariable analysis	aOR*	95% Confidence Interval
Composite neonatal outcome	0.56	0.35 - 0.89
Large for gestational age	0.53	0.26 - 1.05
Small for gestational age	4.04	1.32 - 12.37
Shoulder dystocia	0.13	0.02 - 1.07
Preterm delivery <37 weeks	0.35	0.15 - 0.81
5 min Apgar < 7	0.41	0.14 - 1.22
NICU admission	0.34	0.13 - 0.85

*Adjusted for race/ethnicity, early pregnancy BMI, gestational weight gain, gestational age at GDM diagnosis, and gestational age at GDM treatment initiation

CONCLUSION

When treating women with GDM, the addition of medical treatment to diet and exercise at an earlier threshold of elevated capillary blood glucoses was associated with an improved composite neonatal outcome, lower rates of preterm delivery, and lower rates of NICU admission. However, higher rates of small for gestational age infants were seen.