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Timing of delivery and pregnancy outcomes in women with gestational diabetes

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Abstract

Background—Women with gestational diabetes commonly undergo induction of labor at term, but the risks and benefits of induction of labor are incompletely understood.

Objective—We examined the relationship between gestational age, induction of labor and the rate of cesarean delivery in women with gestational diabetes.

Materials and Methods—We identified 863 women with gestational diabetes who underwent either induction of labor or spontaneous labor at or beyond 37 0/7 weeks. Demographic, cervical favorability and outcome data were abstracted from the medical record. We compared the cesarean delivery rate in women undergoing induction of labor at each week of gestation with expectant management to a later gestational age.

Results—When compared to women who were expectantly managed, induction of labor at 37 weeks (aOR 1.53, 95% CI 0.76–3.06, $p=0.23$), 38 weeks (aOR 2.07, 95% CI 0.89–4.80, $p=0.09$) and 39 weeks (aOR 0.79, 95% CI 0.44–1.42, $p=0.43$) was associated with similar risk for cesarean delivery as expectant management after adjustment for nulliparity, body mass index, baseline simplified Bishop score, and maternal age. Cesarean delivery rates were higher in nulliparous

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women, but did not differ significantly in those undergoing IOL or expectant management. In multiparous women, induction of labor was significantly associated with an increased risk for CD at 38 weeks (aOR 7.47, 95% CI 1.6-34.8, $p=0.01$) and rates of CD (17.39% vs. 2.2%, $p=0.001$) were significantly higher in multiparous women with an unfavorable Bishop score induced before 39 weeks. Neonatal morbidity was similar across gestational ages after adjustment for maternal body mass index and maternal glycemic control.

Conclusion—Induction of labor results in similar risk for cesarean delivery as expectant management between 37 and 40 weeks of gestation. Rates of cesarean delivery differed based on cervical exam and parity. These findings suggest that gestational age alone does not significantly impact maternal and neonatal outcomes, but that decisions regarding delivery in women with GDM should take into account cervical exam and parity.

Keywords

Gestational diabetes; Induction of labor; Timing of delivery

Introduction

Pregnancies complicated by gestational diabetes (GDM) are at increased risk for adverse maternal and neonatal outcomes including macrosomia and birth trauma¹, and for these reasons women with GDM frequently undergo induction of labor at term in the hope that maternal and fetal risks with continued gestation can be minimized². Decisions regarding delivery planning are important, because the cesarean delivery rate has risen to a recent high of 32%, increasing >50% in the last decade³. Rates of induction of labor have also increased in parallel, now affecting 23% of all births³.

The association between IOL and CD is complex. Early studies that compared women who undergo IOL to those who experience spontaneous labor at the same gestational age found that IOL was associated with increased risk for CD^{4,5}. However, physicians can never choose between spontaneous or induced labor at any given gestational age, and results from studies comparing IOL to expectant management are mixed, with some studies demonstrating a decreased rate of CD⁶⁻⁹, and others an increased risk for CD¹⁰. An unfavorable bishop score at the time of IOL may be associated with an increased risk for CD,^{11,12} but the largest studies have been unable to account for this important covariate. In addition, recent data in women with hypertensive disorders of pregnancy suggests that women with an unfavorable cervix have the greatest benefit from IOL⁸.

Optimal delivery timing in women with GDM remains controversial¹³. Observational studies have suggested that IOL after 38 weeks' gestation in women with GDM might reduce the risk of macrosomia and shoulder dystocia, but the impact of induction of labor on risk for cesarean delivery was mixed and neonatal outcomes were not assessed in all studies¹⁴⁻¹⁷. A single randomized controlled trial that included patients treated with insulin demonstrated a lower rate of large for gestational age (LGA) cases with IOL at 38 weeks compared to expectant management with no increased risk of cesarean delivery, shoulder dystocia or neonatal complications¹⁸, but these results may not be generalizable to all women with GDM given the inclusion of women with pre-gestational diabetes and only

those treated with insulin. In addition, a recent study of women with GDM found no increased risk for cesarean delivery in women undergoing induction of labor 40 weeks of gestation, but the authors were unable to account for cervical exam at the time of delivery, and some GDM diagnoses were blinded to patients and providers¹⁹. The goal of this analysis was to examine the relationship between gestational age, IOL and the rate of CD in women with GDM while accounting for cervical exam and parity. We hypothesized that delivery at 39 weeks would optimize maternal and neonatal outcomes irrespective of maternal cervical exam.

Materials and Methods

This was a retrospective cohort study of women with singleton gestations and gestational diabetes who were delivered at Magee-Womens Hospital (University of Pittsburgh, PA) from January 2009 to October 2012. Briefly, the cohort included 1374 women who were diagnosed with GDM if they had either a 50 gram, one-hour glucose challenge test that exceeded 200 mg/dL, or if they had two or more abnormal values on a 100 gram, three-hour oral glucose tolerance test as defined by the Carpenter-Coustan criteria²⁰. For each subject, we included only the first pregnancy during the study period. Women with a pre-labor indication for cesarean were excluded from this analysis. In order to examine the relationship between gestational age, IOL and the rate of CD in women with GDM, this analysis focused on the 863 women (62.8% of the overall cohort) with either IOL or spontaneous labor at or beyond 37 0/7 weeks (Figure 1). Women included in the study received prenatal care in the Maternal- Fetal Medicine and obstetrics clinics at our hospital. Regulatory approval was obtained from the University of Pittsburgh Institutional Review Board, and informed consent was not required given the retrospective nature of the study.

The primary objective of our study was to compare cesarean delivery rates in women undergoing IOL at each week of gestation with expectant management to a later gestational age. We divided women into categories based on their gestational age in weeks at delivery (37 0/7-37 6/7 weeks, 38 0/7-38 6/6, 39 0/7-39 6/7, and 40 weeks). Timing of IOL was determined by the managing physician, there were only 19/863 women (2.2%) delivered after 41 0/7 weeks' gestation so they were combined with the 40 weeks group. We excluded cases from the analysis if they had a scheduled CD, had 1 previous CDs, had a non-cephalic presentation, or a major fetal anomaly. Maternal and neonatal outcomes were first compared across gestational ages. Next, the impact of induction of labor was assessed by comparing women who underwent IOL at a specific GA compared with those who were expectantly managed, and this included women who delivered at subsequent GA after spontaneous or induced labor⁷. Because the presence of hypertensive disorders of pregnancy may influence the outcomes of induction of labor we excluded women in the induction of labor group at each gestational age, but included them in the expectant management group. For example, at 37 weeks, we compared the 64 women who underwent an IOL without a hypertensive disorder of pregnancy to the 712 women who delivered after 37 weeks (following IOL or spontaneous labor).

Maternal demographics and clinical characteristics were extracted from medical charts. Overweight and obesity was reported as an index of weigh-for-height (body mass index,

BMI) defined using the World Health organization guidelines. Birth weight was classified as large for gestational age (>90th percentile for gestational age) or small for gestational age (<10th percentile for gestational age) status based on US national birth weight data ²¹. Labor was defined as “none” if the patient had a cesarean delivery, “spontaneous” if the patient presented with complaints of contractions, and “induced” if women were asymptomatic at presentation and required interventions to initiate labor. Mode of delivery was either vaginal or cesarean, and the indication for cesarean delivery was coded by one member of the study team and independently verified by a second member of the study team (CS and MF). Cervical dilation, station, and effacement were recorded for each patient at the last outpatient exam after 35 weeks' gestation but prior to the time of either induction of labor or admission for spontaneous labor. We calculated the simplified bishop score from the cervical exam at the last outpatient exam (mean 37.5 weeks of gestation $\pm$ 2.5 weeks), and we defined a favorable cervix as a simplified Bishop score $\geq$ 5 because of comparable sensitivity and specificity for risk of cesarean delivery when compared to the original Bishop score of 8 or greater ¹². We also examined several secondary outcomes. The composite neonatal morbidity consisted of hypoglycemia (defined as a capillary glucose value < 35mg/dL within the first 24 hours of life), hyperbilirubinemia requiring phototherapy, and respiratory distress syndrome (RDS). We also assessed the frequency of neonatal intensive care unit (NICU) admission.

Statistical analyses were completed using Stata 13 software package Special Edition (StataCorp LP, College Station, TX). Categorical variables were analyzed with the chi-square or Fisher's exact test, and continuous variables were analyzed with ANOVA. Study outcomes by gestational age week were calculated. Univariate logistic regression analyses were undertaken to examine factors related to cesarean delivery and neonatal morbidity, and variables with p values <0.10 on univariate analysis were considered candidates for the multivariable model. Multivariable logistic regression analysis was then undertaken to adjust for potential confounders including nulliparity, prepregnancy BMI, simplified Bishop score, and maternal age for delivery outcomes associated with induction of labor. Because parity may have a significant impact on the outcomes associated with induction of labor, we also conducted subgroup analyses for both nulliparous and multiparous women. We controlled for both and maternal pre-pregnancy BMI, and glycemic control (mean fasting and mean postprandial glucose) for neonatal outcomes, and we chose not to include birth weight in the model because it is causally linked to the specified neonatal outcomes. P-values less than 0.05 were considered statistically significant in all analyses.

Results

Of the 863 women included in this analysis, 169 (19.6%) of women had a cesarean delivery while 694 (80.4%) had a vaginal delivery. There were significant differences in maternal characteristics by gestational age at delivery. Women delivered at earlier gestational ages were more likely to be black, and had higher pre-pregnancy BMI (Table 1). Women delivered at earlier gestational ages had higher values on the 50-gram GCT as well as higher fasting, 1-hour and 2-hour values on the 100-gram OGTT (Table 1). Similarly, mean fasting and postprandial home glucose values were higher in women delivered at earlier gestational ages, suggesting that concern for suboptimal maternal glycemic control may have influenced

physician behavior when planning for timing of delivery (Table 1). Spontaneous labor was more common in women who delivered before 39 weeks, and IOL was more common after 39 weeks. We also found that the proportion of women with a favorable simplified Bishop score was stable across gestation.

The risk of CD differed according to gestational age at delivery (Table 2). Overall, the risk of CD was highest in women who delivered at or beyond 40 weeks (27.7%). The risk for cesarean delivery after induction of labor was relatively stable at each gestational age (range of 20-29.1%), while the risk for cesarean delivery after spontaneous labor was low in women delivering prior to 40 weeks' gestation (9.2-13.5%) but increased significantly (25.6%, $p=0.04$) after 40 weeks. Indications for CD were similar across gestational age at delivery, and cephalopelvic disproportion was the most common indication for CD regardless of gestational age (Table 2). When stratified by simplified Bishop score, risk of cesarean delivery following induction was higher in women with a simplified Bishop score <5 , regardless of gestational age at delivery (data not shown). In addition, shoulder dystocia rates did not differ by gestational age groups (data not shown).

When induction of labor was compared to expectant management, the risk for CD was similar for delivery at 37 weeks (aOR 1.53, 95% CI 0.76-3.06, $p=0.23$), 38 weeks (aOR 2.07, 95% CI 0.89-4.80, $p=0.09$), and 39 weeks (aOR 0.79, 95% CI 0.44-1.42, $p=0.43$) after adjusting for nulliparity, maternal age, pre-pregnancy BMI, and simplified Bishop score. Not surprisingly, the rate of CD was higher in nulliparous women compared to multiparous women (Table 3). However, we observed slightly different findings when results were stratified by maternal parity (Table 3). In nulliparous women, the risk for CD was similar at all gestational age groups. By comparison, in multiparous women the risk for CD was increased in women undergoing IOL at 38 weeks (aOR 7.47, 95% CI 1.60-34.8, $p=0.01$) compared to women who were expectantly managed. Furthermore, when the analysis was limited to women with an unfavorable cervical exam, the rate of CD was similar across gestational age groups for nulliparous women, but was higher in multiparous women at 37 or 38 weeks (Figure 2).

Birth weight increased slightly with increasing gestational age but rates of macrosomia did not differ among gestational age categories (Table 4). There were higher rates of hyperbilirubinemia and the composite neonatal outcome in babies delivered at earlier gestations (Table 4). There was a non-significant trend towards decreasing rates of NICU admissions with increasing gestational age, but the incidence of RDS and hypoglycemia did not differ between gestational age categories (Table 4). The rate of composite neonatal outcome did not differ between delivery at 38 weeks (aOR 1.06, 95% CI 0.49-2.28), 39 weeks (aOR 1.13, 95% CI 0.57-2.24), and 40 weeks (reference group). However, the risk was higher in deliveries at 37 weeks (OR 2.33, 95% CI 1.16-4.66). This finding was no longer statistically significant after adjusting for maternal pre-pregnancy BMI and maternal glycemic control.

Comment

In our population of women with GDM, we observed an increase in the rate of cesarean delivery in women delivering 40 weeks of gestation in both nulliparous and multiparous women. Notably, the increased risk for cesarean delivery after 40 weeks was primarily driven by an increase in risk for cesarean delivery after spontaneous labor. When we compared the strategy of induction to expectant management, induction at 37, 38, and 39 weeks was associated with similar risk for cesarean delivery in the overall cohort. When stratified by parity, the risk for cesarean delivery was higher with induction of labor at or before 38 weeks in multiparous women, even after adjusting for prepregnancy BMI and simplified Bishop score, while risk for cesarean delivery remained stable across gestational age in nulliparous women. Because an unfavorable cervix creates a specific diagnostic challenge, we also examined outcomes after induction of labor at each gestational age by parity, and these results demonstrate that the risk for cesarean delivery is similar between women induced versus those who are expectantly managed across all gestational ages in nulliparous women, but multiparous women with an unfavorable cervix have higher rates of cesarean delivery at 37 and 38 weeks' gestation. Not surprisingly, birth weight increased with increasing gestational age at delivery, but the differences were small and the rate of macrosomia did not differ among gestational age group. We found no difference in neonatal outcomes in infants born beyond 38 weeks. Delivery at 37 weeks was associated with higher rates of a composite neonatal outcome. However, this difference was no longer significant after adjustment for prepregnancy BMI and maternal glycemic control. These findings highlight the challenges in balancing maternal and neonatal outcomes in women with GDM.

Previous studies have reported conflicting risks for cesarean delivery related to IOL. These differences may be explained by variations in the definition of expectant management. Some studies include women who deliver after spontaneous labor in the expectant management group^{22, 23} whereas others define the expectant management group as woman who deliver, after spontaneous or induced labor, during the week after the induction²⁴. This strategy mirrors the clinical setting where clinician's options at any given time are induction of labor or expectant management, which included the possibility of spontaneous labor or induction at a later gestational age. We chose to compare women who underwent IOL at a specific GA to those who were expectantly managed. These findings are consistent with several large cohort studies and a meta-analysis in women without GDM that demonstrated no increase in the CD rate in women with who underwent IOL at term^{25, 26}.

We chose to focus on GDM because it represents a unique clinical scenario with potential risks for macrosomia and other morbidity that could influence the decision for IOL and CD. In a randomized controlled trial of 200 women with GDM and type 2 diabetes, treated with insulin and without evidence of fetal macrosomia, IOL at 38 weeks resulted in a similar CD rate when compared to expectant management¹⁸. However, the study included a heterogeneous population of women who all required treatment, and therefore may not be applicable to all women with GDM. More recently, a secondary analysis of the Maternal Fetal Medicine Units treatment study of mild GDM reported that CD risk was 3-fold higher with IOL at 41 weeks' gestation or beyond compared to IOL at 39 weeks¹⁹. However, they only included women with mild disease, they did not account for cervical favorability, and

providers of some of the women with GDM were blinded to their diagnosis. This is an important consideration because our results would suggest that severity of GDM contributes to maternal and neonatal outcomes, which is an important consideration given that provider decision-making has a significant influence on the risk for cesarean delivery. Our results indicate that maternal disease severity influences the decision for timing of delivery, and our findings suggest that expectant management after 39 weeks does not reduce the risk for cesarean delivery even in nulliparous women with an unfavorable cervix. One surprising finding was that the risk for cesarean delivery was higher after spontaneous labor after 40 weeks' gestation for both nulliparous and multiparous women, suggesting that awaiting spontaneous labor beyond 39 weeks may not be an effective strategy in this patient population. In addition, the increased risk for cesarean delivery in multiparous women before 39 weeks suggests that early delivery may not always be beneficial.

One strength of our study is the inclusion of cervical exam data. We utilized the simplified Bishop score prior to admission for IOL or spontaneous labor, and although the bishop score was primarily designed for women undergoing IOL, Laughon et. al. found that the simplified score had similar predictive ability as the original score, and it also predicted the risk for cesarean delivery in women undergoing both IOL and spontaneous labor ¹². Our results also highlight the difficulties incorporating the cervical exam data into clinical practice. We found that the risk for cesarean delivery was significantly higher at each gestational age in women undergoing IOL with an unfavorable simplified bishop score when compared to a favorable score. The predictive value of the cervical exam is robust across studies, and others have found that a longer cervical length in mid-pregnancy is associated with an increased risk for CD ²⁷. In response to an unfavorable cervix the clinician response may be to await spontaneous labor or a more favorable cervix. However, a secondary analysis of the HYPITAT study found that a less favorable cervix was associated with an increased risk for maternal complications in women with gestational hypertension or preeclampsia who were randomized to expectant management ²⁸. There are several limitations to these data. Our results stem from a single institution and differences in study population and labor management may limit generalizability of our conclusions. In addition, other maternal outcomes such as post-partum hemorrhage or endomyometritis are clinically relevant, but these outcomes were too rare to analyze. Finally, our sample size may have limited our ability to detect small but potentially clinically relevant increases in the risk for cesarean delivery associated with induction of labor at different gestational ages. For example, the increased risk for cesarean delivery in multiparous women induced at 37 and 38 weeks could be related to other factors such as concern for macrosomia that could not be explored in these analyses due to the small sample size. Our findings highlight that adequately powered randomized clinical trials to answer questions regarding timing of delivery and IOL in women with GDM are needed.

Immediate neonatal complications are another significant concern when considering timing of IOL in women with GDM. We found an increased risk for jaundice with earlier delivery, and this was the main contributor to the increased neonatal composite morbidity at earlier gestational ages. Decision analysis models have suggested a decreased risk of perinatal mortality and severe morbidity with delivery before 39 weeks' gestation ²⁹, but less severe outcomes such as neonatal hypoglycemia and hyperbilirubinemia were excluded. Despite

their milder severity and transient nature, immediate neonatal complications occur frequently in pregnancies with GDM and can carry a significant health burden. Recent reports have described increased neonatal complications in early term deliveries³⁰, and one limitation of our study is that we were underpowered to detect rare but significant neonatal morbidity in those delivered in the early term period. However, based on our results it appears that the risk for neonatal morbidity is overall low with delivery at 39 weeks or beyond.

Our findings are important because the prevalence of GDM is increasing and decisions regarding timing and mode of delivery carry potential maternal and neonatal risks. While there was no difference in the risk for cesarean delivery with induction of labor compared to expectant management at different gestational age groups, our findings highlight the significance of including cervical exam findings and parity in counseling and delivery planning. A randomized controlled trial is needed to further evaluate maternal and fetal risks and establish recommendations for optimal timing of delivery in pregnancies with GDM.

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Figure 1. Flow diagram of study cohort

Nulliparous Women **Multiparous Women**

Figure 2. Cesarean delivery by gestational age in women with a modified Bishop score <5

Table 1

Maternal characteristics by Gestational Age at Delivery

	37 weeks (n=151)	38 weeks (n=184)	39 weeks (n=399)	40 weeks (n=129)	p-value
Age (years)	31.1 (± 5.6)	31.0 (± 5.2)	30.5 (± 5.4)	30.2 (± 5.6)	0.41
Primigravida	99 (51.0)	90 (48.9)	233 (58.4)	106 (81.5)	<0.001
Race					
White	107 (70.9)	135 (73.4)	312 (79.2)	89 (68.5)	
Black	32 (21.2)	29 (15.8)	42 (10.5)	17 (13.1)	
Other	12 (8.0)	20 (10.9)	45 (11.3)	24 (18.5)	0.005
Smoking	18 (11.9)	22 (12.0)	33 (8.3)	11 (8.5)	0.38
Pre-pregnancy BMI	30.8 (± 7.2)	30.3 (± 8.2)	29.3 (± 7.9)	27.0 (± 6.8)	<0.001
GCT result (mg/dL)	176.4 (± 33.7)	169.2 (± 29.0)	167.3 (± 26.4)	160.2 (± 20.3)	<0.001
GTT result (mg/dL)					
Fasting	95.7 (± 16.3)	91.3 (± 13.1)	90.0 (± 14.6)	87.2 (± 10.8)	<0.001
1 hr	197.2 (± 24.6)	196.4 (± 23.2)	194.4 (± 26.8)	190.0 (± 22.6)	0.10
2 hr	179.4 (± 29.8)	174.1 (± 24.1)	177.0 (± 28.8)	174.6 (± 20.1)	0.30
3 hr	129.7 (± 33.5)	119.2 (± 36.5)	127.8 (± 35.4)	129.1 (± 33.5)	0.03
Mean fasting glucose (mg/dL)	91.7 (± 13.1)	88.6 (± 9.7)	87.3 (± 8.7)	84.8 (± 7.6)	<0.001
Mean postprandial glucose (mg/dL)	127.2 (± 15.8)	122.5 (± 12.8)	122.0 (± 11.4)	116.7 (± 11.4)	<0.001
Labor type					
Spontaneous	63 (41.7)	96 (52.2)	109 (27.3)	43 (33.3)	<0.001
Induced	88 (58.3)	88 (47.8)	290 (72.7)	86 (66.7)	
Simplified Bishop score ≥ 5 (n=765)	25 (19.1)	34 (23.0)	72 (19.7)	18 (15.0)	0.44
Hypertensive disorder of pregnancy	31 (20.5)	42 (22.8)	45 (11.3)	6 (4.6)	<0.001
Labor	7 (11.1)	9 (9.4)	3 (2.8)	2 (4.7)	
Induced	24 (27.3)	33 (27.5)	42 (14.5)	4 (4.7)	

Continuous data presented as means (SD) and categorical data as frequency (%).

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Table 2

Maternal Outcomes by Gestational Age at Delivery

	37 weeks (n=151)	38 weeks (n=184)	39 weeks (n=399)	40 weeks (n=129)	p-value
Cesarean delivery	29 (19.2)	38 (20.7)	68 (17.0)	36 (27.7)	0.07
IOL	23 (26.1)	25 (28.4)	58 (20.0)	25 (29.1)	0.18
Spont labor	6 (9.5)	13 (13.4)	10 (9.2)	11 (25.6)	0.04
Indication for CD					
CPD	22 (75.9)	29 (76.3)	49 (72.1)	28 (77.8)	0.88
Fetal Intolerance	6 (20.7)	7 (18.2)	17 (25.0)	8 (22.2)	
Other	1 (3.5)	2 (5.3)	2 (2.9)	0	

Legend: Categorical data presented as proportion and/or frequency (%). CD (cesarean delivery), CPD (cephalo-pelvic disproportion)

Table 3
Induction of labor compared to expectant management in all women and stratified by parity

Week of induction (n induction group)	IOL CD	Expectant management CD	AOR (95% CI)	P
37 weeks (n=64)	23.4%	19.1%	1.53 (0.76-3.06)	0.23
38 weeks (n=55)	27.3%	19.7%	2.07 (0.89-4.80)	0.09
39 weeks (n=248)	18.2%	27.7%	0.79 (0.44-1.42)	0.43
Nulliparas				
37 weeks (n=29)	37.9%	29.3%	1.17 (0.53-2.63)	0.69
38 weeks (n=23)	47.8%	28.6%	1.29 (0.47-3.40)	0.64
39 weeks (n=131)	30.5%	32.1%	0.83 (0.45-1.50)	0.53
Multiparas				
37 weeks (n=35)	11.4%	4.2%	3.52 (0.97-12.8)	0.06
38 weeks (n=32)	12.5%	3.7%	7.47 (1.60-34.8)	0.01
39 weeks (n=117)	4.2%	8.3%	0.44 (0.04-5.24)	0.52

Legend: CD (cesarean delivery); AOR (adjusted odds ratio). Data presented as rates of cesarean delivery in the induction of labor versus expectant management group. The n by each week gestation represents the number of women in each gestational age undergoing induction excluding women who were induced with a diagnosis of hypertensive disorders of pregnancy. Multiple regression models were adjusted for maternal age, pre-pregnancy BMI, and modified bishop score. In addition, the model including all women was also adjusted for nulliparity.

Table 4**Neonatal Outcomes by Gestational Age at Delivery**

	37 weeks (n=151)	38 weeks (n=184)	39 weeks (n=399)	40 weeks (n=129)	p-value
Birthweight (g)	3226 ($\pm$ 443.7)	3343.7 ($\pm$ 440.2)	3382.3 ($\pm$ 386.3)	3437.9 ($\pm$ 354.9)	<0.001
Macrosomia	3 (2)	13 (7.1)	23 (5.8)	7 (5.4)	0.204
Neonatal composite	38 (25.2)	26 (14.1)	60 (15.0)	14 (10.8)	0.005
NICU	14 (9.3)	12 (6.6)	16 (4.0)	5 (3.9)	0.07
RDS	1 (0.67)	3 (1.6)	1 (0.3)	1 (0.8)	0.32
Hypoglycemia	21 (13.9)	18 (9.8)	46 (11.5)	10 (7.8)	0.38
Hyperbilirubinemia	10 (6.6)	4 (2.2)	8 (2.0)	2 (1.6)	0.02
Neonatal composite	OR 2.33 (1.16-4.66)	1.35 (0.66-2.76)	1.38 (0.73-2.62)	Ref	
	aOR [^] 1.54 (0.72-3.31)	1.06 (0.49-2.28)	1.13 (0.57-2.24)	Ref	

Continuous data presented as means (SD) and categorical data as frequency (%).

[^] Multiple regression model adjusted for maternal pre-pregnancy BMI, and mean postprandial blood sugars.