OBSTETRICS

Delivery timing and cesarean delivery risk in women with mild gestational diabetes mellitus

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OBJECTIVE: The purpose of this study was to evaluate the relationship between gestational age (GA) and induction of labor (IOL) and the rate of cesarean delivery in women with mild gestational diabetes mellitus.

STUDY DESIGN: We conducted a secondary analysis of data from a multicenter randomized controlled trial of mild gestational diabetes mellitus treatment. Cesarean delivery rate of women delivering at term (≥37 weeks' gestation) was evaluated by 2 complementary approaches: (1) IOL vs spontaneous labor: women who were induced at each GA compared with those who spontaneously labored at the same GA and (2) IOL vs expectant management: women who delivered after IOL at each GA compared with those who delivered after spontaneous labor at the same GA or subsequently after spontaneous or induced labor (outcome at each week compared with expectant management at that week). Logistic regression adjusted for potential confounders.

RESULTS: The overall cesarean delivery rate was 13%. When compared with 39 weeks' gestation (either IOL or spontaneous labor) as the referent, there was no significant difference in the cesarean delivery rate in women who delivered at 37, 38, or 40 weeks' gestation. However, IOL was associated with a 3-fold increase in cesarean delivery rate at 41 weeks' gestation and beyond, as compared with IOL at 39 weeks' gestation. Similarly, there was a 3-fold increase in the cesarean delivery rate in women who were induced when compared with those who were treated expectantly at 40 completed weeks' gestation.

CONCLUSION: Induction of labor in women with mild gestational diabetes mellitus does not increase the rate of cesarean delivery at <40 weeks' gestation.

Key words: cesarean delivery, gestational diabetes mellitus, induction of labor

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The cesarean delivery rate has continued to rise to a recent high of 32%, increasing >50% in the last decade.[1] Similarly, the rates of induction of labor (IOL) have increased, now affecting 23% of all births.[1] Previous observational studies have suggested that induction predisposes women to cesarean delivery (CD). Specifically, when

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comparing women who undergo IOL to those who experience spontaneous labor, an increased rate of CD has been observed.[2,3] However, when compared with expectant management, elective IOL ≥41 weeks' gestation is associated with a decreased rate of CD.[4,5] A recent Cochrane metaanalysis suggests that elective IOL at term, when compared with expectant management, is associated with a decreased rate of CD as well as other adverse perinatal outcomes.[6]

The discrepancies in the findings of these are explained partially by differences in comparison groups. Although initial studies compared IOL with spontaneous labor, more recent studies have used an expectant management comparison group that includes patients who spontaneously delivered as well as those who were induced at later gestational ages (GAs). This comparison is more appropriate in clinical decision-making because expectant management, not spontaneous labor, at a particular GA is the only alternative.

The Maternal-Fetal Medicine Units Network randomized controlled trial for the treatment of mild gestational diabetes mellitus (GDM) demonstrated that treatment of mild GDM is associated with a lower rate of IOL (26.9% vs 33.8%; $P = .02$).[7] This reduced risk was apparent even after excluding CD indications such as malpresentation, placenta previa, oligohydramnios, and previous CD. A high proportion of patients (27%) underwent IOL in each group.

The primary aim of this study was to compare the rate of CD by GA and by IOL vs expectant treatment in women with GDM. As a secondary aim, we compared perinatal outcomes among the study groups.

Methods and Materials

We performed a secondary analysis of a multicenter randomized trial that evaluated the effect of treatment in women with mild GDM.[7] In the original trial, women at 24-30 weeks' gestation with blood glucose levels of 135-199 mg/dL after a 50-g glucose loading test were invited to enroll. Eligible women underwent a blinded 3-hour 100-g oral glucose tolerance test. *Mild GDM* was defined as fasting glucose levels of <95 mg/dL and at least 2 abnormal timed measurements (>180 mg/dL at 1 hour; >155 mg/dL at 2 hours, and >140 mg/dL at 3 hours). Women with mild GDM were assigned randomly to usual prenatal care or treatment with dietary modifications, glucose monitoring, and insulin, if indicated. Providers and patients were blinded to GDM diagnosis in the standard care group. The original study was approved by the institutional review boards of all participating clinical centers, and all enrolled women gave informed consent.

Women in both the treatment and standard care groups were included in this secondary analysis if they delivered at term (≥37 weeks' gestation), underwent induced or spontaneous labor, and had cephalic presentations. Patients were excluded from analysis if they had an elective scheduled CD, had ≥1 previous CDs, had a noncephalic presentation, or a major fetal anomaly. The primary outcome was CD. The CD rate was assessed by 2 approaches: (1) patients who delivered at a specific GA (in completed weeks) and type of labor were compared with those who delivered at 39 weeks' gestation and (2) patients who underwent IOL at a specific GA were compared with those who were "expectantly treated," which included patients who delivered at the same GA after spontaneous labor and patients who delivered at subsequent GA after spontaneous or induced labor. We examined several secondary outcomes. The composite perinatal outcome included one of the following outcomes that have been associated with GDM: hypoglycemia, hyperbilirubinemia, respiratory distress syndrome, and birth trauma. We also assessed the frequency of admission of the infant to the neonatal intensive care unit (NICU), of birthweight >4000 g, and of large-for-gestational age (LGA) infants (defined as birthweight >90th percentile).[8]

Categoric variables were analyzed with the chi square or Fisher exact test. Continuous variables were analyzed with the Wilcoxon rank sum or the Kruskal-Wallis test. Study outcomes by completed GA week were calculated by type of labor for the 2 comparison methods. Multivariable logistic regression analysis was used to adjust for potential confounders for most outcomes that included maternal age, race/ethnicity, prepregnancy body mass index, parity, smoking status, IOL (for neonatal outcomes), infant sex (for neonatal outcomes), timing of dating ultrasound scan (trimester), small-for-gestational-age status, and treatment group. No adjustments were made for the outcome of NICU admissions because of the small numbers. Adjusted odds ratios and 95% confidence interval (CI) were estimated relative to the IOL group at 39 weeks' gestation in method 1 and the expectant treatment group at each GA in method 2.

Statistical analyses were conducted with SAS software (SAS Institute, Cary, NC). A nominal 2-sided probability value of $< .05$ was considered for statistical significance with no adjustments made for multiple comparisons.

Results

Of the 958 women who were enrolled in the original randomized controlled trial, 679 women met the inclusion and exclusion criteria for this secondary analysis. Baseline characteristics of the study population are shown in Table 1. Reflective of the original study population, more than one-half of the women were Hispanic, and the mean body mass index at enrollment was approximately 30 ± 5.0 kg/m^2. Race/ethnicity and GDM screen results differed by completed GA at delivery.

The overall rate of CD was 13%. The indications for CD were failed induction (69.3%), nonreassuring fetal tracing (26.1%), cord prolapse (3.4%), and chorioamnionitis (1.2%). The crude and adjusted results for CD are presented in Table 2. Of note, the results were adjusted for maternal age, ethnicity, body mass index, parity, smoking, timing of dating ultrasound scan, small-for-gestational-age status, and assigned control vs treatment group. The CD incidence increased from 10.3-22.7% as GA at delivery increased from 37-41 completed weeks. This pattern was restricted primarily to the IOL group. When comparing the rate of CD at each GA with 39 completed weeks' gestation as the referent (method 1), there was no