OBSTETRICS

Mode of delivery in women with class III obesity: planned cesarean compared with induction of labor

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OBJECTIVE: To compare maternal and neonatal outcomes between planned cesarean delivery and induction of labor in women with class III obesity (body mass index $\geq$40 kg/m^2).

STUDY DESIGN: In this retrospective cohort study, we identified all women with a body mass index $\geq$40 kg/m^2 who delivered a singleton at our institution from January 2007 to February 2013 via planned cesarean or induction of labor (regardless of eventual delivery route) at 37-41 weeks. Patients in spontaneous labor were excluded. The primary outcome was a composite of maternal morbidity including death as well as operative, infection, and thromboembolic complications. The secondary outcome was a neonatal morbidity composite. Additional outcomes included individual components of the composites. Student *t*, χ^2, and Fisher exact tests were used for statistical analysis. To calculate adjusted odds ratios, covariates were analyzed via multivariable logistic regression.

RESULTS: There are 661 mother-infant pairs that met enrollment criteria—399 inductions and 262 cesareans. Groups were similar in terms of prepregnancy weight, pregnancy weight gain, and delivery body mass index. Of the 399 inductions, 258 had cervical ripening (64.7%) and 163 (40.9%) had a cesarean delivery. After multivariable adjustments, there was no significant difference in the maternal morbidity composite (adjusted odds ratio, 0.98; 95% confidence interval, 0.55—1.77) or in the neonatal morbidity composite (adjusted odds ratio, 0.81; 95% confidence interval, 0.37—1.77) between the induction and cesarean groups.

CONCLUSION: In term pregnant women with class III obesity, planned cesarean does not appear to reduce maternal and neonatal morbidity compared with induction of labor.

Key words: cesarean, class III obesity, induction of labor, mode of delivery

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Over the last 2 decades, the rate of obesity has increased dramatically such that in the United States greater than 30% of reproductive-age women are obese (body mass index [BMI] $\geq$30) and approximately 8% are extremely obese (class III obesity — BMI $\geq$40 kg/m^2).[1,2] The obesity epidemic affects all racial and ethnic groups and is highly associated with major medical comorbidities and poor pregnancy outcomes.[3-6] Compared with normal-weight women, those with class III obesity have higher rates of labor induction and induction failure.[7] In addition, increasing maternal obesity is associated with longer durations of labor, greater oxytocin requirements, and higher cesarean delivery rates.[3-8] These longer durations of labor and greater oxytocin requirements result in increased rates of clinical chorioamnionitis, postpartum hemorrhage, and neonatal morbidity.[4,9] Obese patients undergoing cesarean delivery also have an increased risk of endometritis and surgical complications, including wound infection, seroma, hematoma, skin disruption, and fascial dehiscence.[10,11]

These prior studies demonstrate that there are increased risks with either labor induction or cesarean delivery in class III obese pregnant women. In addition, rates of postcesarean complications are significantly higher in those women who undergo cesarean delivery after an unsuccessful labor attempt.[12,13] To date, few studies have evaluated the role of planned cesarean as opposed to labor induction in this high-risk population. Because of the increased risk of labor induction and the increased risk of morbidity in women with class III obesity who undergo labor induction, we hypothesized that planned cesarean delivery may result in less morbidity than induction in this high-risk group. Thus, our objective was to evaluate, in women with class III obesity at term, the differences in maternal, obstetric, and neonatal outcomes between planned cesarean delivery and induction of labor.

Materials and Methods

Following institutional review board approval, we identified all women from our validated obstetric research database (Obstetric Automated Record) with a

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singleton gestation and BMI $\geq$40kg/m^2 at delivery who underwent a planned cesarean (malpresentation, repeat, elective, suspected macrosomia) or induction of labor at $37^{0/7}$-$41^{6/7}$ weeks' gestational age from January 2007 to February 2013. In this retrospective cohort study, we excluded patients in spontaneous labor as well as those with severe immunodeficiency (AIDS, chronic steroid use), multifetal gestations, fetal demise before presenting for delivery, and prenatally diagnosed congenital anomalies. Individual chart review was undertaken. Data were abstracted and entered into a relational database (Access 2003; Microsoft Corporation; Redmond, WA).

The primary outcome of this study was a composite of clinically relevant maternal morbidities including operative complications, infections, wound morbidity, venous thromboembolism (radiographically documented deep vein thrombosis or pulmonary embolism), and maternal death. Operative complications included hysterectomy, operative injury (uterine artery laceration requiring an O'Leary stitch; bladder, ureteral, or bowel injury; and/or extension of the hysterotomy into the contractile portion of the uterus), and postpartum hemorrhage (defined clinically as blood loss >500 mL after vaginal delivery, blood loss >1000 mL after cesarean delivery, or need for uterotonic medications other than oxytocin). Infections included clinical chorioamnionitis (temperature of at least 38°C before delivery and antibiotics administered for that indication), endometritis (temperature of at least 38°C postpartum and antibiotics administered for that indication), wound infection (defined as cellulitis or abscess), urinary tract infection (>100,000 colony forming units/mL of a single uropathogen on urine culture), radiographically diagnosed pneumonia, and culture-proven sepsis. Wound morbidity included cellulitis, wound disruption (hematoma or seroma), intraabdominal hematoma, need for wound exploration, debridement, packing, or antibiotic therapy.

The secondary outcome was a neonatal composite including intrapartum stillbirth, hypoxic ischemic encephalopathy (HIE) (defined as arterial cord pH <7.0 and seizures or other end organ dysfunction), neonatal intensive care unit admission for >72 hours, mechanical ventilation >24 hours, grade III or IV intraventricular hemorrhage, respiratory distress syndrome, necrotizing enterocolitis, suspected sepsis with antibiotics administered >72 hours during the first week of life, culture proven early-onset (first 7 days of life) sepsis, or neonatal death. Other neonatal outcomes evaluated but not included in the composite variable were 5-minute Apgar score <7, umbilical artery pH <7.1, transient tachypnea of the newborn, hyperbilirubinemia, and metabolic disturbances (hypo/hyperglycemia, hypo/hypernatremia). We considered neonatal diagnoses to have been made if they were included in the infant's discharge summary or inpatient progress notes when available.

Individual components of composite variables were also analyzed independently. Owing to the imprecise nature of clinically diagnosed postpartum hemorrhage, we also analyzed the proportion of women in each group who had a decrease in the pre- to postdelivery hematocrit of at least 10% and those who received a blood transfusion. Patient demographics (age, race/ethnicity, parity, BMI) and maternal medical comorbidities were assessed as covariates. Intrapartum characteristics such as duration of labor, mode of delivery, indication for cesarean delivery, estimated blood loss, and use of cervical ripening were also ascertained.

The primary and secondary outcomes were compared between 2 groups: planned cesarean and induction of labor. We also stratified the induction of labor group into successful vaginal delivery and cesarean delivery to compare outcomes between 3 groups: planned cesarean, induction of labor with vaginal delivery, and induction of labor with cesarean delivery. Furthermore, in a prespecified secondary analysis, we compared the 2 original groups stratifying women into subsets with a BMI 40-49.9 and $\geq$50.

We used the unpaired Student t test for continuous variables. The χ^2 and Fisher exact tests were used for categorical data as appropriate. Odds ratios (ORs) were calculated. Covariates were chosen based on differences identified in the key characteristics between the 2 cohorts ($P < .05$). Multivariable logistic regression was used to analyze the association between mode of delivery and outcomes, and adjustments were made for covariates. All statistical analyses were conducted using SAS version 9.2 (SAS Institute; Cary, NC).

With regards to obesity, Alabama perennially is in the top 3 or 4 states in the United States. In a study from our center over a 20-year period, the obesity rate in the obstetric population more than doubled from 16% in 1980 to 36% in 1999.[14] The rate at our center now exceeds 40%, with the rate of class III obesity being 10%. Assuming that the primary outcome variable would occur in 30% of those in the labor induction group and that there would be a 2:1 ratio of inductions of labor to planned cesarean deliveries, we calculated that a sample size of 600 was needed to detect a 40% decrease in that outcome (to 18%) in the planned cesarean group (alpha = .05; 1-beta = 0.90).[15] We thought that smaller differences might not justify choosing a cesarean delivery over attempting a vaginal delivery. Since there are approximately 4000 deliveries annually at our institution, we calculated that a 5-year study period would be sufficient as long as 3% of our patient population met enrollment criteria.

RESULTS

A total of 661 patients met enrollment criteria and were included for analysis. Of these, 262 (39.6%) patients had a planned cesarean delivery, whereas 399 (60.4%) patients underwent induction of labor. For patients undergoing planned cesarean delivery, indications for cesarean included repeat (n = 219), malpresentation (n = 22), macrosomia (n = 10), elective (patient demand or inability to perform intrapartum monitoring) (n = 6), and other (n = 5). In women undergoing labor inductions, there were 236 vaginal deliveries (59.1%) and 163 cesarean deliveries (40.9%). Of the women undergoing induction, 258 (64.7%) had cervical ripening with a Foley catheter (majority)