OBSTETRICS

Attempted operative vaginal delivery vs repeat cesarean in the second stage among women undergoing a trial of labor after cesarean delivery

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BACKGROUND: It is not well-characterized whether attempting operative vaginal delivery is a safe and effective alternative among women who undergo a trial of labor after cesarean delivery who are unable to complete second-stage labor with a spontaneous vaginal delivery.

OBJECTIVE: The purpose of this study was to compare maternal and neonatal outcomes that are associated with attempted operative vaginal delivery with those that are associated with second-stage repeat cesarean delivery without an operative vaginal delivery attempt among women who undergo a trial of labor after cesarean delivery.

STUDY DESIGN: This is a retrospective secondary analysis of data from Cesarean Registry of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. Women who underwent a trial of labor after cesarean delivery who were at least 36 weeks gestation were eligible for analysis if they had a live, singleton, nonanomalous gestation in cephalic presentation and reached second-stage labor (defined as complete cervical dilation) with a fetal station of at least +2. The data for women who had an attempted operative vaginal delivery with either forceps or vacuum were compared with those of women who underwent second stage repeat cesarean delivery without operative vaginal delivery attempt. Outcomes of maternal and neonatal complications were compared between groups with bivariable and multivariable analyses.

RESULTS: Of 1230 women whose cases were eligible for analysis, 945 women (76.8%) had an attempted operative vaginal delivery. Of those who underwent attempted operative vaginal delivery, 914 women (96.7%) achieved a vaginal delivery. Women who attempted operative vaginal delivery had a lower mean body mass index (30.4±6.0 vs 31.8±5.9 kg/m^2; P=.001) and gestational age (39.5±1.3 vs 39.8±1.2 weeks; P=.012) at delivery and were more likely to be of non-Hispanic black race (30.0% vs 22.1%; P=.002), to have had a previous vaginal delivery (34.9% vs 20.4%; P<.001), and to have fetal descent greater than +2 station at complete dilation (55.6% vs 16.8%; P<.001) and were less likely to have chorioamnionitis (6.8% vs 19.3%; P<.001). The frequency of endometritis was significantly lower among women who had an attempted operative vaginal delivery compared with those who had repeat cesarean delivery (2.5% vs 9.1%; P<.001). However, other serious maternal or neonatal adverse outcomes were not statistically different between the groups. These findings persisted after adjustment for potential confounders.

CONCLUSION: In the setting of a trial of labor after cesarean delivery in the second stage with a fetal station of at least +2, attempted operative vaginal delivery resulted in a vaginal birth after cesarean delivery in most women and was not associated with increased adverse maternal and neonatal outcomes but was associated with a reduced frequency of endometritis compared with repeat cesarean delivery without operative vaginal delivery attempt.

Key words: cesarean delivery, operative vaginal delivery, second stage labor, trial of labor after cesarean delivery

The cesarean delivery rate has increased substantially in the past 4 decades, and it is estimated that 32% of women have delivered by cesarean delivery in the United States in 2015.[1] Consequently, the number of women who are eligible for a trial of labor after cesarean delivery (TOLAC) has also increased. The finding that increased maternal and neonatal morbidities that are associated with TOLAC are attributed largely to women who undergo repeat cesarean delivery (RCD) after TOLAC is undertaken[2,3] underscores the potential benefits of achieving vaginal delivery.

If a spontaneous vaginal delivery does not appear possible after a woman has reached the second stage of labor, the clinical alternatives are an RCD or an attempt at operative vaginal delivery (OVD). Although previous studies have investigated outcomes that are associated with these strategies in the general population,[4-8] there are limited data specific to women who undergo TOLAC. Therefore, the objective of this study was to compare maternal and neonatal outcomes that are associated with attempted OVD with those outcomes that are associated with RCD without an OVD attempt among women in the second stage that underwent TOLAC.

Materials and Methods

This was a retrospective secondary analysis of data from the Cesarean Registry of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. The registry was the result of a 4-year multicenter observational study with concurrent data collection that was designed to assess maternal and neonatal morbidity associated with TOLAC vs scheduled RCD. Details of this registry have been published previously.[2] Notably, women were classified as undergoing TOLAC if they presented in labor with a cervical dilation of at least 4 cm, received oxytocin, or both.

In the present analysis, we included all women who underwent TOLAC who reached second-stage labor (defined as cervical dilation of 10 cm) and who had

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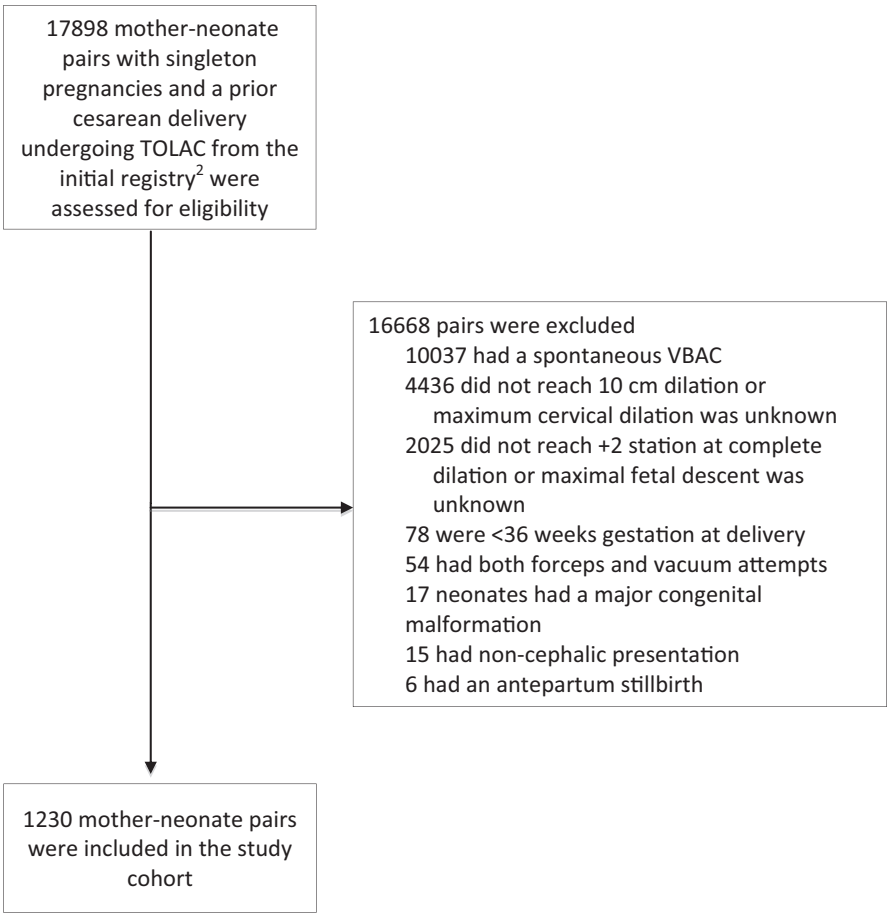
descent of the fetal vertex to at least +2 station.[9] Analysis was limited to women of at least 36 weeks of gestation who had had a live, singleton, nonanomalous gestation in cephalic presentation. Women with spontaneous vaginal birth after cesarean delivery (VBAC) and those who underwent sequential application of both forceps and vacuum were excluded from the study.

Maternal and perinatal outcomes were compared between eligible women who attempted OVD and those who underwent second-stage RCD without an OVD attempt. In the initial study,[2] *endometritis* was defined as a clinical diagnosis of puerperal infection in the absence of findings that suggest a nonuterine source of infection. Data on maternal transfusion of blood products and peripartum hysterectomy were collected. Neonatal injury at the time of delivery included brachial plexus injury, linear and depressed skull fracture, facial nerve injury, skin laceration, clavicular or other skeletal fracture, and other unspecified neonatal injury. Neonatal data were collected up to 120 days after delivery or at the time of hospital discharge. Importantly, detailed data were collected regarding the clinical course of all neonates who were admitted to the neonatal intensive care unit and those who experienced seizures or cardiopulmonary resuscitation during the first 24 hours of life or had umbilical-artery blood pH <7.0, head imaging at term, or 5-minute Apgar score <4. All cases of hypoxic-ischemic encephalopathy of the newborn infant underwent 2 additional reviews by the study investigators[2] to ensure accurate diagnoses.

Continuous variables were compared with the use of the Student *t* test; categoric variables were compared with the use of the chi-square test or Fisher's exact test. Multivariable logistic regression analyses were performed to adjust for potential confounding factors for the maternal and neonatal endpoints. Variables that significantly differed by exposure ($P<.05$) in the bivariable analyses were included in the multivariable logistic regression equations. All hypotheses tests were 2-tailed; a probability value of <.05 was used to define statistical significance without adjustment for multiple comparisons. No imputations for missing data were performed. All statistical analyses were performed with Stata software (version 14.1; StataCorp, College Station, TX). The primary registry[2] was approved by the institutional review boards of each clinical center and data coordinating center; participants had given written informed consent before enrollment. This secondary analysis was considered exempt by the Northwestern University institutional review board because publically available deidentified data were used.

FIGURE
Study cohort sample



Flow diagram of the selection of patients for the present analysis.
TOLAC, trial of labor after cesarean delivery; *VBAC*, vaginal birth after cesarean delivery.
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Results

Of the 17,898 women who underwent TOLAC,[2] 1230 women (6.9%) were eligible for the present analysis (Figure). In this study population, 945 women (76.8%) underwent an OVD attempt, and 285 women (23.2%) had a second-stage RCD without an OVD attempt. Of those who underwent an OVD attempt, 438 women (46.3%) had a vacuum attempt, and 507 women (53.7%) had a forceps attempt; 914 women (96.7%) achieved a vaginal delivery. Demographic and obstetric characteristics are shown in Table 1. Compared with women who underwent RCD without an OVD attempt, those who underwent an OVD attempt had a lower mean body mass index and gestational age at delivery, were more likely to be of non-Hispanic black race and ethnicity, have a history of a vaginal