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What We Have Learned About Trial of Labor After Cesarean Delivery from the Maternal-Fetal Medicine Units Cesarean Registry

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ABSTRACT

The cesarean delivery rate in the United States has risen steadily over the past 5 decades such that approximately one in three women now undergo cesarean section. The rise in repeat operations and accompanying decline in trial of labor after cesarean (TOLAC) have been major contributors to this phenomenon. The appropriate use of TOLAC continues to be a topic of interest with the recognition that most women with a history of prior cesarean are candidates for trial of labor. The NICHD MFMU Network Cesarean Registry conducted from 1999 to 2002 provided contemporary data concerning the risks and benefits of TOLAC, which in turn have helped inform practitioners and women considering their options for childbirth following cesarean delivery.

Introduction

Prior to 2010, there had been a progressive rise in the overall cesarean delivery rate to over 30% in the United States. Efforts to reduce the number of cesarean births, although initially successful, failed to achieve the 1990 U.S. Public Health Service goals. These goals included achieving an overall cesarean rate of 15% and a rate of vaginal birth after cesarean (VBAC) of 35% by the year 2000. The Healthy People 2000 report proposed a target rate of VBAC of 37%. In the early 1980s, as the number of repeat cesareans began to rise, VBAC was recommended in clinical management guidelines as a method to help reduce the overall cesarean rate. This recommendation resulted in a rise of VBAC from 3% in 1981 to 31% in 1998. With the trial of labor after cesarean (TOLAC) being more widely applied, reports of adverse outcomes associated with uterine rupture surfaced. The concerns about maternal and perinatal morbidity associated with TOLAC challenged the safety and appropriateness of this procedure. These issues, along with medicolegal concerns and the introduction of more stringent criteria for TOLAC, led to a substantial decline in the rate of VBAC to 12.7% in 2002.

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In 2003, a report by the Agency for Health Care Research and Quality concluded that the magnitude of risk of uterine rupture and its attendant morbidity remained uncertain, owing to methodologic deficiencies in various studies and differences among these reports with respect to definitions and the ascertainment of uterine rupture. In essence, the data were of insufficient quality to make recommendations concerning the optimal route of childbirth for women with prior cesarean delivery. The MFMU Network embarked upon a prospective cohort study from 1999 through 2002 at 19 academic medical centers to assess the risks of uterine rupture and neonatal and maternal morbidity associated with TOLAC as compared with repeat elective cesarean delivery.[1] The cesarean registry was originally planned as 3-year study in order to collect sufficient data about rare and uncommon outcomes such as uterine rupture. However, because the rate of TOLAC declined during the first 3 years of the study period (1999, 48.3%; 2000, 42.7%; 2001, 34.4%), data were collected for an additional year.

Methodology

The registry included all women who had a pregnancy at 20 weeks or more of gestation or whose infant weighed at least 500 g. The labor and delivery logbook or database at each participating center was screened daily to identify cases. Medical records for each woman were reviewed by trained study nurses. Demographic data, details of obstetric history, and information concerning antepartum and intrapartum events were recorded. The prospective nature of the study allowed treating physicians to be contacted to resolve questions about complications of delivery. Neonatal data were collected up to 120 days following delivery or at the time of hospital discharge. Additional detailed data were collected for all infants admitted to the neonatal intensive care unit. A separate data collection form was used for all infants who had a clinical diagnosis of hypoxic-ischemic encephalopathy (HIE), for all cases of uterine rupture, and for all infants with seizures, cardiopulmonary resuscitation, umbilical artery pH < 7.0, head imaging at term, or 5-min Apgar score < 4. All instances of uterine rupture and HIE of the newborn underwent secondary review by local study investigators and a final central review by two of the investigators to ensure accurate diagnoses.

Maternal and perinatal outcomes were compared between women who had a TOLAC ($n = 17{,}898$) and those who underwent scheduled repeat operation ($n = 15{,}801$) without labor or who had obvious indications for repeat cesarean such as prior classical incision, abnormal presentation, placenta previa, prior myomectomy, non-reassuring antepartum fetal status, or any other medical condition precluding TOLAC ($n = 9013$). Women presenting in labor with cervical dilation of at least 4 cm, as well as those receiving oxytocin, were classified as having undergone a TOLAC. Women presenting in early labor ($n = 3276$) without obvious indications for a planned repeat cesarean delivery and who subsequently underwent cesarean delivery were excluded from the analysis owing to the difficulty in distinguishing between a failed intended TOLAC and planned cesarean delivery.

Success rates for TOLAC

The overall success rate for TOLAC has been reported to be in the 60–80% range. We confirmed this probability in our study, as the success rate was 13,139/17,898 or 73.4%. Using the extensively collected data in the registry, we sought to identify precisely which factors were associated with success when controlling for multiple potential confounders.[2] We found that women with previous vaginal birth had an 86.7% success rate compared with 60.9% in women without such a history [OR = 4.2 (95% CI: 3.8–4.5, $P < 0.001$)]. In addition, VBAC success rates also increased with increasing number of prior VBACs as 63.3%, 87.6%, 90.9%, 90.6%, and 91.6% for those with 0–4 or more prior VBACs, respectively.[3] TOLAC success rates were predictably affected by previous indication for cesarean, need for induction, cervical dilation at admission, and birthweight. Rates were also affected by race/ethnicity and body mass index. Multivariable regression analysis identified several factors that were independently associated with TOLAC success: previous vaginal delivery (OR = 3.9, 95% CI: 3.6–4.3), previous indication not being dystocia (OR = 1.7, 95% CI: 1.5–1.8), spontaneous labor (OR = 1.6: 95 % CI: 1.5–1.8), birthweight < 4000 g (OR = 2.0, 95% CI: 1.8–2.3), and White race (OR = 1.8; 95% CI: 1.6–1.9). The success rate in obese women (BMI > 30) was lower (68.4%) than in non-obese women (79.6%). Using these data, we developed a prediction model for VBAC among women with one prior cesarean and a term singleton gestation undergoing TOLAC that is based on factors that could be assessed at the first prenatal visit. These included the variables of age, body mass index, race and ethnicity, prior vaginal delivery, prior VBAC, and a recurrent indication for the cesarean delivery.[4] After development and internal validation, the model has been found to be accurate and has been validated in multiple populations other than the MFMU study population. The calculator is available online at http://https://mfm.bsc.gwu.edu (Fig.). Because circumstances at the time of admission for delivery may affect the chance of successful TOLAC, a second calculator was created to take these additional factors into account. This second calculator also is available using a link at the same website. The additional factors include BMI at delivery, cervical status, need for induction, and the presence or absence of preeclampsia. The MFMU Network also reported in a separate analysis that the TOLAC success rate was 66% in women with multiple prior cesareans compared to 74% with a single prior operation.[5] The rate of success in 186 twin gestations reported by Varner et al.[6] for the MFMU Network was 64.5%.

Uterine rupture and risk factors

Prior to the MFMU study, terminology, definitions, and ascertainment for uterine rupture varied significantly in the existing VBAC literature. The investigators of the MFMU Network recognized that it was critical to differentiate between uterine rupture and uterine scar dehiscence. This distinction is