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Delivery After Prior Cesarean: Maternal Morbidity and Mortality

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The dictum "Once a cesarean, always a cesarean" has largely permeated the obstetric practice for most of the twentieth century and today.[1] Although trial of labor after previous cesarean delivery (TOLAC) provides women who had a prior cesarean with an opportunity to achieve a vaginal birth after cesarean (VBAC), this was not considered a reasonable option until the 1970s to 1980s.[2–4] As the annual incidence of cesarean delivery increased from less than 5 per 100 live births during the 1970s to 23.5 per 100 live births in the United States in 1988,[5] the National Institute of Health (NIH) and the World Health Organization (WHO) held consensus conferences in the 1980s and concluded that cesarean delivery rates were too high and that VBAC was an acceptable approach for reducing cesarean delivery.[6,7] With this change in recommendations, the annual incidence of VBAC (defined as the number of VBACs per 100 women with a prior cesarean delivery per year) increased from 5/100 (5%) in 1985 to 28.3/100 (28.3%) in 1996.[8] At an individual level, successful VBAC

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is associated with a lower risk of maternal morbidity and fewer complications in future pregnancies; at a population level, VBAC is associated with an overall decrease in cesarean delivery.[9,10] However, neither elective repeat cesarean delivery (ERCD) nor TOLAC is without risks. With increasing number of TOLAC, there were also reports of uterine scar dehiscence or rupture and associated maternal and/or neonatal morbidity and mortality.[11–13] In the next decade, there was a steep decline in the frequency of VBAC down to an incidence of 8.5/100 (8.5%) in 2006,[14] likely caused by concern for perinatal morbidity and associated medical-legal liability.

The recent Practice Bulletin by the American College of Obstetricians and Gynecologists (ACOG) on Vaginal Birth After Previous Cesarean Delivery recommended that "most women with one previous cesarean delivery with a low transverse incision are candidates for and should be counseled about VBAC and offered TOLAC."[15] Despite this, the option of TOLAC is no longer available in one-third of hospitals[16] and clinicians are less inclined to offer TOLAC.[17] System-level changes, along with better identification of candidates of TOLAC, would likely be required to increase the VBAC rate.

This paper builds on a recent systematic evidence review conducted for the NIH Consensus Conference sponsored by the Agency for Healthcare Research and Quality (AHRQ) on VBAC[18] and 2 meta-analyses on prediction of VBAC[19] and associated perinatal outcomes.[20] It particularly emphasizes the information that clinicians and patients need to make decisions.

PRACTICE OF VBAC

The overall TOLAC among US studies was 58%, with a range of 28% to 70%.[18] For studies initiated after 1996, less than half of women (44%) had a TOLAC, compared with 62% of women in studies initiated before 1996.[18] Many factors, including site of delivery (rural vs urban), type of hospital (teaching vs community), history of prior vaginal delivery (including prior VBAC), and race/ethnicity (black and other minorities vs white), had been identified to modify TOLAC rates.[18,21–25] The incidence of VBAC among people who had TOLAC is approximately 74% in the United States.[18]

IDEAL CANDIDATES FOR VBAC

One of the greatest challenges in counseling and managing women with previous cesarean delivery regarding whether to undergo TOLAC versus ERCD is the inability to accurately identify women who have a high probability of VBAC and those who have increased risk of morbidity with TOLAC and thus may be better candidates for ERCD. Several factors have been identified to influence the likelihood of successful VBAC; these, in turn, can influence the decision to either undergo a trial of labor or proceed with elective repeat cesarean.

One of the strongest predictors of VBAC is previous vaginal delivery (Table 1). Studies consistently report that women with a history of vaginal delivery have a higher likelihood of VBAC than women who do not have prior vaginal deliveries. Although the probability of VBAC for women without history of vaginal delivery was 65%, women with prior vaginal delivery preceding cesarean had an 83% probability of achieving VBAC; for women with prior VBAC, the probability of subsequent successful VBAC was 94%.[26] A recent meta-analysis that examined predictors of VBAC similarly reported that prior vaginal delivery increases the odds of VBAC by more than threefold (odds ratio [OR] 3.41; 95% confidence interval [CI] 2.56–4.54).[19] More specifically, although having the experience of vaginal delivery is a favorable prognostic predictor of VBAC (a vaginal delivery preceding cesarean increased the odds of achieving VBAC [OR 1.60; 95% CI 1.22–2.09]), women who had prior VBAC had more than fourfold the odds of having VBAC again (OR 4.39; 95% CI

2.87–6.72).[19] Data from the National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network (MFMU) suggest that the number of prior VBACs remains positively correlated with increasing success of VBAC, such that, for women with 0, 1, 2, 3, and 4 or more prior VBACs, the likelihood of achieving VBAC in the current pregnancy was 63.3%, 87.6%, 90.9%, 90.6%, and 91.6%, respectively (P<.001).[27]

When the cesarean was performed for nonrecurrent indications, such as fetal malpresentation or breech, the probability of VBAC was approximately 75%.[18,19,28–30] One retrospective study reported that a previous cesarean delivery performed for malpresentation significantly increased the likelihood of VBAC (OR 7.4; 95% CI 2.8–19.2).[31] Another retrospective study also reported a similar association of VBAC for breech as the indication compared with nonbreech indications, although the estimated OR was smaller (OR 1.9; 95% CI 1.0–3.7).[32] These results were not pooled for meta-analysis because of differences in designation of reference comparisons but, overall, previous cesarean attributable to malpresentation as an indication was considered a favorable predictor of VBAC (see Table 1).[19] It was estimated that women with a previous cesarean for malpresentation carry a risk of repeat cesarean delivery that is similar to a nulliparous woman's risk of primary cesarean in labor: the estimated odds of repeat cesarean delivery is 0.95 (95% CI 0.7–1.30).[33]

Although previous cesarean for nonrecurring indications as discussed earlier is a favorable predictor of VBAC, it seems that the probability of achieving VBAC is lower if prior indication of cesarean was related to cephalopelvic disproportion (see Table 1).[18,19] More specifically, when failure to progress/active phase arrest, labor dystocia, arrest of descent, or cephalopelvic disproportion were the indications of previous cesarean, the likelihood of VBAC is about 54% (48%–60%).[18] The likelihood of VBAC is around 60% (49%–69%) if fetal intolerance of labor/fetal distress was the reason for prior cesarean.[18] Thus, compared with previous cesarean performed for nonrecurring indications (such as malpresentation/breech), women whose previous cesarean was performed for recurring indications had lower odds of achieving VBAC (adjusted OR [aOR] 0.42–0.8; 95% CI 0.3–0.6).[18,32,34,35]

Some obstetric factors (gestational age at delivery, birth weight) have been shown to modify the likelihood of VBAC (see Table 1). Infant birth weight is a strong predictor: as infant birth weight increases, the likelihood of VBAC decreases such that, for women whose infant weighed more than 4000 g, the probability of VBAC was reduced by 39% to 51% relative to that of women who had smaller infants.[35–38] A meta-analysis that examined 5 studies reported that women whose infant weighed more than 4000 g had nearly half the likelihood of VBAC (OR 0.55; 95% CI 0.49–0.61).[19] However, infant birth weight is not known before delivery, and estimating fetal weight in the third trimester is notoriously challenging and inaccurate.[39,40] Several studies also examined gestational age as a predictor of VBAC, but they varied in study design and thus pooled estimates of effect cannot be generated, although the overall trend seems to be that, as gestational age increases, the likelihood of VBAC is decreased, particularly when the pregnancy progresses beyond 41 weeks' gestation.[19]

Several maternal demographic factors have been examined for their potential to improve the clinician's ability to predict VBAC (see Table 1). Of the many demographic predictors, the strongest and most consistent seems to be race/ethnicity.[19] Three cohort studies report that, compared with non-Hispanic white women, Hispanic women and African American women had a lower likelihood of achieving a VBAC: a reduction of 29% to 50% for Hispanic women and 20% to 52% for African Americans.[34,41,42] When these studies were examined in a meta-analysis, Hispanic women had a significantly reduced odds of VBAC (pooled OR 0.59; 95% CI 0.50–0.71) as did African American women (pooled OR 0.62; 95% CI 0.48–0.80) compared with white women.[19] Although nonwhite women were more likely to undergo a TOLAC, they were less likely to achieve VBAC; the reasons for this remain

unclear.[25] Studies that examined the association between maternal age and VBAC report an inverse relationship: older women are less likely to have a VBAC (see Table 1). Compared with women aged 40 years or younger, women older than 40 years had nearly half the likelihood of VBAC in a meta-analysis (OR 0.53; 95% CI 0.32–0.86).[19] When age was examined as a continuous variable, for every 5-year incremental increase in maternal age, the odds of VBAC also decreased (OR 0.83; 95% CI 0.79–0.87).[19] When maternal age was examined as a risk factor for needing emergency cesarean in the setting of TOLAC, a positive association was again seen (OR 1.22 per incremental 5-year increase in age; 95% CI 1.16–1.28).[43]

Other maternal characteristics that can modify the likelihood of VBAC are maternal weight and presence of medical conditions (see Table 1). Increasing maternal body mass index (BMI) at first prenatal visit or at delivery decreases the probability of VBAC.[34,37] Each unit increase in BMI at first prenatal visit decreases the likelihood of VBAC (OR 0.94; 95% CI 0.93–0.95).[34] Compared with nonobese women (BMI<30 kg/m^2), women with a BMI greater than or equal to 30 kg/m^2 at delivery have much lower odds of VBAC (OR 0.55; 95% CI 0.51–60).[37] Because many medical conditions complicating pregnancy are associated with increased risk of cesarean delivery, 3 large cohort studies reported that women with medical diseases were less likely to have VBAC, by 17% to 58%, with the following aORs: chronic hypertension (OR 0.70; 95% CI 0.56–0.86); diabetes/gestational diabetes (OR 0.42; 95% CI 0.28–0.62); and presence of any hypertension, diabetes, asthma, seizures, renal disease, thyroid disease, or collagen vascular disease (OR 0.83; 95% CI 071–0.91).[35,37,42]

There is considerable interest in whether the number of prior cesareans affects the likelihood of VBAC (see Table 1). Because most studies of TOLAC/VBAC focus on women with 1 prior cesarean delivery, data on TOLAC in women with more than 1 previous cesarean delivery are less clear. Two large, multicenter cohort studies report that the probability of achieving successful VBAC appears to be similar for women with 1 prior cesarean (75.5%) or more than 1 cesarean delivery (74.6%), although 1 study reported higher risks of uterine rupture whereas the other did not.[44,45] Thus, the ACOG practice bulletin on VBAC stated that, “it is reasonable to consider women with 2 previous low transverse cesarean deliveries to be candidates for TOLAC, and to counsel them based on the combination of other factors that affect their probability of achieving a successful VBAC.”[15] Data on the risks and outcomes of women undergoing TOLAC with 3 or more previous cesarean deliveries are scant. One multicenter cohort study did not observe any cases of composite maternal morbidity and noted a similar probability of achieving VBAC (79.8%) for women with 3 or more previous cesareans as for women with 1 prior cesarean delivery (75.5%; aOR 1.4; 95% CI 0.81–2.41).[46]

CONSIDERATIONS FOR ANTEPARTUM AND INTRAPARTUM MANAGEMENT OF WOMEN WITH PRIOR CESAREAN

Induction/Augmentation of Labor and VBAC

Induction of labor (IOL) for maternal or fetal indications is increasingly common in obstetric practice and has increased from 9.5% in 1990 to 22.8% in 2007 in the United States[47] Although TOLAC remains an option in women for whom induction of labor is indicated, labor induction and augmentation is associated with a decreased likelihood of VBAC (OR 0.56; 95% CI 0.38–0.83.[18,19] Most studies on this topic examined the use of prostaglandin E_2 (PGE_2) as the cervical ripening agent: the pooled estimates of VBAC rate in women with previous cesarean who received PGE_2 for IOL was approximately 63% (95% CI 58%–69%).[18] Data on misoprostol or mifepristone as IOL agents are more limited; the

pooled estimates of VBAC rate range between 61% and 69%.[18] Although oxytocin can be used alone for the purpose of induction or for augmentation of labor, studies that examined use of oxytocin as an induction agent estimated the probability of VBAC to be 62% (95% CI 53%–70%); as an augmentation agent, oxytocin is similarly associated with decreased probability of VBAC (68%; 95% CI 64%–72%).[18] The pooled estimates from a meta-analysis report that women whose labor required oxytocin augmentation had nearly half the likelihood of VBAC compared with those who did not (OR 0.52; 95% CI 0.33–0.82).[19]

Cervical Status at Admission and VBAC

The likelihood of VBAC may be modified by intrapartum conditions such as cervical status and labor progression. Some studies have reported that women admitted with a more favorable cervical status (eg, cervical dilation >4 cm, advanced effacement) in spontaneous labor have a twofold increase in the likelihood of VBAC compared with those with unfavorable cervix (OR 2.2–2.6; 95% CI 1.7–2.8).[19,37,48] When As a continuous variable, each centimeter in cervical dilatation at admission is associated with increased odds of VBAC (OR 1.89; 95% CI 1.13–3.22).[49] More than 75% effacement of the cervix (compared with 25% effacement) at admission also increases the likelihood of VBAC (OR 2.72; 95% CI 2.00–3.71).[48]

OUTCOMES OF TRIAL OF LABOR VERSUS ERCD FOR INDEX PREGNANCY

Because a successful VBAC cannot be guaranteed, and because risks versus benefits may be disproportionately associated with a failed trial of labor after cesarean (in which a woman undergoes a repeat cesarean delivery after a trial of labor) compared with an elective repeat cesarean or a successful VBAC, the appropriate statistical comparison for both research and patient counseling regarding mode of delivery for women with a previous cesarean is by intention to deliver: TOLAC versus ERCD.[18] This article focuses on the risks of morbidity associated with TOLAC and those associated with ERCD.

Maternal Death

Despite improvement in medical technology and care, maternal mortality increased from 7 to 9 per 100,000 in the 1980s and 1990s to 12 to 15 per 100,000 since 2003.[50,51] Although the absolute risk of maternal death remains low, a meta-analysis found that maternal mortality is higher for ERCD, at 13.4 per 100,000 (95% CI 4.3–41.6 per 100,000 ERCD) compared with 3.8 per 100,000 TOLAC (95% CI 0.9–15.5 per 100,000 TOLAC).[18,20] One study examined whether hospitals with low delivery volumes (defined as fewer than 500 deliveries per year) were associated with increased odds of maternal mortality with TOLAC and did not observe a statistical significance because of the small number of maternal deaths.[52]

Uterine Rupture

Uterine rupture is potentially life threatening and catastrophic for the expecting mother and her fetus(es), and it is the outcome associated with TOLAC that most significantly increases the risk of perinatal morbidity and mortality.[9,18] Among studies that examined uterine rupture for both TOLAC and ERCD groups, the overall incidence of uterine rupture was 0.30% (95% CI 0.23%–0.40%); however, 96% of ruptures occurred in women who had TOLAC.[18] Thus, despite the absolute risk of uterine rupture remaining low, the risk of uterine rupture is higher for women undergoing TOLAC than ERCD (Table 2). In addition, the occurrence of uterine rupture was higher for studies limited to term pregnancies compared with studies that included women of any gestational age at delivery (0.78% vs

0.32%, respectively; $P = .03$).[18] When the direction of previous uterine incision was examined as a risk factor for uterine rupture, one multicenter cohort study reported that women with a low, transverse cesarean delivery or an unknown scar have the lowest risk of rupture (0.63%–0.75%).[18,53]

Another factor that may modify the risk of uterine rupture is IOL. More specifically, the risk of uterine rupture among women who had induction was lowest with oxytocin (1.1%), followed by PGE_2 (2%), and highest with misoprostol (6%); however, these risk estimations may be imprecise given the consistency in study design and methodology, so these results should be interpreted with caution.[18] In particular, the method of induction is likely associated with the cervical status as well as the duration of induction, which may confound the strength of the associations reported in many studies. Individual factors associated with uterine rupture included increasing maternal age, prior vaginal delivery or VBAC, increased number of previous cesarean deliveries, increased gestational age at delivery, shorter interpregnancy interval, induction/augmentation of labor, epidural anesthesia, and having a single-layer uterine closure on previous cesarean.[18]

Although the presence of risk factors may help identify women at higher risk of uterine rupture, the diagnosis of rupture can be challenging because there is no single sign that reliably indicates the occurrence of rupture. Fetal heart rate tracing abnormalities, especially fetal bradycardia (reported in 33%–100% of uterine ruptures), are the most commonly observed signs of uterine rupture.[3,54–56] Others include maternal vaginal bleeding, pain, and abnormal uterine contraction patterns.[48]

Hysterectomy

Among the 8 studies that examined the risk of hysterectomy among women with previous cesarean, the summary incidence was 0.28% for women who had ERCD (95% CI 0.12%–0.67%) and 0.17% for women who had a trial of labor (95% CI 0.12%–0.26%), which were not statistically significantly different (see Table 2).18 Among term pregnancies, the incidence of hysterectomy among women who had TOLAC and ERCD were similar (0.14% vs 0.16%, respectively; $P = .67$). When the risk of hysterectomy was compared among women who had TOLAC after 1 cesarean, TOLAC after 2 or more cesareans, and ERCD, the incidence of hysterectomy was lowest among women with TOLAC after 1 cesarean delivery (0.2%), whereas it was 0.4% among women who had ERCD, and highest (0.6%) among women who had TOLAC after multiple previous cesareans.36

Hemorrhage and Transfusion

Studies report increased rates of hemorrhage associated with ERCD (0.3%–29%) compared with TOLAC, but none found a statistically significant difference between the 2 groups (see Table 2).[18] Inconsistent definitions of hemorrhage used by various studies probably contributed to the wide range of hemorrhage rates reported. In addition, physicians' estimation of blood loss has been known to be imprecise and this adds to the challenge of studying this topic.[18] Because these studies did not use similar definitions to diagnose hemorrhage, these data were not combined to provide pooled estimates.

The difference in pooled incidences of transfusion among women who had TOLAC (0.9%) and women who had ERCD (1.2%) was not statistically significant (see Table 2).[18] However, when data were limited to only term pregnancies, the risk of transfusion was higher for TOLAC (0.7%; 95% CI 0.2%–2.2%) than for ERCD (0.5%; 95% CI 0.2%–1.3%), with a relative risk (RR) that is higher for TOLAC (RR 1.30; 95% CI 1.15 to 1.4).[18] When the risk of transfusion was stratified among women who had ERCD and women who had indicated repeat cesarean (IRCD) with or without labor, women who had IRCD without

labor had a higher risk of transfusion, suggesting that maternal comorbid conditions contribute to the risk of transfusion.[53]

Infection

There was no significant difference in the overall infection risk between women who had TOLAC and women who had ERCD (see Table 2).[18] When infection was further stratified by type (endometritis, chorioamnionitis, wound infection, and fever), a higher risk of endometritis was seen in women who had TOLAC (0.8%–30%) than those who had ERCD (1.2%–18%).[18] There was a significant increase in the rate of endometritis with increasing BMI such that, in morbidly obese women (BMI >40 kg/m^2), TOLAC is associated with more than twice the odds of endometritis than ERCD (aOR 2.4; 95% CI 1.7–3.5).[57] Similarly, a higher incidence of chorioamnionitis was seen in women who had TOLAC compared with those who had ERCD.[58,59] There was no statistically significant difference in the risk of wound infection in TOLAC compared with ERCD.[18] The pooled incidence of febrile morbidity was 6.5% (95% CI 4.4%–9.3%) for women who had TOLAC and 7.2% (2.5%–18.9%) for women who had ERCD; the relative risk of fever for TOLAC was significantly lower than ERCD (RR 0.63; 95% CI 0.43–0.91).[18] When the association of fever was further evaluated by outcomes of TOLAC, women who had either cesarean after a trial of labor or ERCD had higher risk compared with those who had successful VBAC, thus suggesting surgery as a risk factor for febrile morbidity.[18,59,60]

Surgical Injury

Surgical injury is a rare complication during delivery. Secondary data analyses from a multicentered large cohort study suggest that the risk of surgical injury between TOLAC and ERCD was not statistically significantly different (see Table 2).[18,46,53,57,61]

CONSIDERATIONS FOR FUTURE PREGNANCIES AND THE IMPACT OF MULTIPLE CESAREANS

Women who choose an ERCD or those who have an unsuccessful TOLAC will likely require cesarean delivery for all future pregnancies, making it important to understand the risks, including hysterectomy and placental abnormalities, associated with multiple prior cesareans.

Hysterectomy

Hysterectomy rates increased with each additional cesarean in all studies. [4,13,16,17,19,20,22] The OR for hysterectomy increased with the number of prior cesareans, from 0.7 to 2.14 with 1 prior cesarean, 1.4 to 7.9 with 1 or more prior cesareans, and to 3.8 to 18.6 with 2 or more prior cesareans. The association between increased risk of hemorrhage, blood transfusion, surgical injury, and adhesions with increasing number of cesarean deliveries was consistently reported in all studies.[18,20] Increasing number of cesarean deliveries was not associated with a change in perioperative infection or wound complications.

Placenta Previa

Prior cesarean was a statistically significant risk factor for placenta previa compared with prior normal spontaneous vaginal delivery (NSVD; OR 1.48–3.95).[18] The pooled analysis estimated the absolute risk of previa associated with any number of cesareans as 12 per 1000 (95% CI 8, 15 per 1000; $P<.001$).[20] The incidence with each additional prior cesarean delivery increased from 10 per 1000 with 1 prior cesarean delivery (95% CI 6, 13 per 1000) to 28 per 1000 (95% CI 18, 37 per 1000) with 3 or more cesarean deliveries. Women with

no prior cesarean delivery and previa required hysterectomy in 0.7% to 4% of cases compared with 50% to 67% in women with 3 or more prior cesarean deliveries.[34,62–64]

Placenta Accreta

The incidence of placenta accreta increased with increasing number of cesarean deliveries. The increased incidence did not reach statistical significance until women had at least 2 prior cesarean deliveries compared with no prior cesarean delivery (OR 8.6–29.8).[18] Women with 1 prior cesarean delivery had a rate of accreta of 0.3% to 0.6%. In comparison with women without prior cesarean delivery, the OR for accreta with 1 prior cesarean delivery was 1.3 to 2.16, which was not statistically significant. The incidence of accreta continued to increase with increasing prior cesarean delivery up to 6.74% for women with 5 or more prior cesarean delivery compared with no prior cesarean delivery, with an OR of 29.8.[18]

Two studies noted a statistically significant increase in accreta in women with previa and prior cesarean delivery.[3,4] As the number of prior cesarean delivery increased, the presence of placenta previa increased the likelihood of placenta accreta from 3.3% to 4% in women undergoing their first cesarean delivery to 50% to 67% in women with 4 or more prior cesarean delivery. The risk of hysterectomy in women with accreta and prior cesarean delivery was not reported separately, but 2 studies found that accreta was a significant risk factor for hysterectomy (OR 43–99.5; 95% CI 19.0,∞).[13,16]

Each additional cesarean is associated with increased maternal morbidity in a dose-response fashion, especially for women with 3 or more prior cesareans, who are at statistically significant increased risk of previa, accreta, and hysterectomy.

SHARED DECISION MAKING AND COUNSELING

For most of the twentieth century, “Once a cesarean, always a cesarean” was the standard obstetric practice. Although TOLAC is deemed an appropriate option in women with previous cesarean delivery, assessment of individual risks and the likelihood of successful VBAC are important in determining who may be appropriate candidates for TOLAC. Much effort has been put forth to improve the identification of prognostic factors associated VBAC and to develop normograms for predicting VBAC and associated morbidity.[31,34,49,65] In addition, patient involvement in the decision-making process and counseling of TOLAC/VBAC has been associated with increased choice of TOLAC as well as increased patient satisfaction. Early timing of counseling is likely to be important because nearly half of the women with prior cesarean make decisions about future TOLAC before becoming pregnant again.[19]

Ideally, good candidates for planned TOLAC are women in whom the balance between risks (desirably as low as possible) and success (as high as possible) is acceptable both to the patient and the clinician. However, this is often an individual decision, and what is considered acceptable for 1 patient may be different for another. Thus, counseling of women with previous cesarean delivery who are considering their delivery options involves personalized information. The key in facilitating a woman’s decision with respect to undergoing a TOLAC is proper counseling regarding her chances of success, a uterine rupture, and injury to herself or fetus if she experiences a uterine rupture.

Informed consent today for any woman who desires a TOLAC must address 4 specific questions: (1) what is her chance of having a successful VBAC? (2) What is the risk that she will have a uterine rupture if she does attempt a VBAC? (3) What is the chance of harm or death to her baby if the uterus ruptures? (4) What are the risks of undergoing a repeat cesarean delivery? In addition, future fertility/family plans present as a key factor that

should be considered because multiple cesareans increase a woman's risk for future pregnancy complications. In particular, the risk of placenta previa, accreta, and hysterectomy increases in a dose-response fashion with increasing number of cesarean deliveries, so clinicians should elucidate future pregnancy/family plans and incorporate such in the decision-making process with the patient.

SUMMARY

The annual incidence of cesarean delivery in the United States continues to increase such that today, nearly 1 in 3 pregnant women undergo cesarean.[48] This trend is contrary to the national goal of decreasing cesarean delivery in low-risk women.[66,67] Although there are many potential causes, the decline in VBACs contributes to the continual increase in cesarean deliveries. Prior cesarean delivery is the most common indication for cesarean and accounts for more than one-third of all cesareans. As the most common inpatient surgical procedure performed in the United States, cesarean delivery also accounts for nearly half of the childbirth-related expenses of hospitalization, at $7.8 billion annually.[18] Thus, the appropriate use and safety of cesarean and VBAC are of concern not only at the individual patient and clinician level but they also have far-reaching public health and policy implications at the national level. Although TOLAC/VBAC is a reasonable and safe option for most women with prior cesarean delivery, careful consideration of risks/benefits and assessment of individual factors is vital in this decision-making process.

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Table 1

Factors associated with VBAC (↑, favorable factors; ↓, unfavorable factors)

↑↑	**Previous VBAC, previous vaginal deliveries**
↑	Indication of prior cesarean as nonrecurring (eg, breech, fetal intolerance of labor)
↓	Hispanic compared with white; African American compared with white Increase in maternal age Increased maternal BMI Preexisting maternal medical disease Short interdelivery interval (<18 mo) Prolonged gestation >41 wk
↓↓	Indication of prior cesarean as recurring (eg, failure to progress, labor dystocia, or arrest of descent) Macrosomia (birthweight >4000 g)

Abbreviation: BMI, body mass index.

Table 2

Maternal outcomes associated with TOLAC versus ERCD

	Favors TOLAC	Favors ERCD	No Difference
Maternal death	✓	—	—
Uterine rupture	—	✓	—
Hysterectomy	—	—	✓
Hemorrhage and transfusion	—	—	✓
Infection	—	—	✓
Surgical injury	—	—	✓