THE AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS
WOMEN'S HEALTH CARE PHYSICIANS

PRACTICE BULLETIN

CLINICAL MANAGEMENT GUIDELINES FOR OBSTETRICIAN–GYNECOLOGISTS

NUMBER 115, AUGUST 2010

(Replaces Practice Bulletin Number 54, July 2004 and Committee Opinion Number 342, August 2006)

Vaginal Birth After Previous Cesarean Delivery

Trial of labor after previous cesarean delivery (TOLAC) provides women who desire a vaginal delivery with the possibility of achieving that goal—a vaginal birth after cesarean delivery (VBAC)†. In addition to fulfilling a patient's preference for vaginal delivery, at an individual level VBAC is associated with decreased maternal morbidity and a decreased risk of complications in future pregnancies. At a population level, VBAC also is associated with a decrease in the overall cesarean delivery rate (1, 2). Although TOLAC is appropriate for many women with a history of a cesarean delivery, several factors increase the likelihood of a failed trial of labor, which compared with VBAC, is associated with increased maternal and perinatal morbidity (3–5). Assessment of individual risks and the likelihood of VBAC is, therefore, important in determining who are appropriate candidates for TOLAC. The purpose of this document is to review the risks and benefits of TOLAC in various clinical situations and provide practical guidelines for managing and counseling patients who will give birth after a previous cesarean delivery.*

Background

Between 1970 and 2007, the cesarean delivery rate in the United States increased dramatically from 5% to more than 31% (6, 7). This increase was a result of several changes in the practice environment, including the introduction of electronic fetal monitoring and the decrease in use of vaginal breech deliveries and forceps deliveries (8–10). The increase in cesarean delivery rates was partly perpetuated by the dictum "once a cesarean always a cesarean" (11). In the 1970s, however, some began to reconsider this paradigm, and accumulated data have since supported TOLAC as a reasonable approach in selected pregnancies (4, 5, 12–14).

This change in approach and recommendations favoring TOLAC was reflected in increased VBAC rates (VBAC per 100 women with a prior cesarean delivery) from just more than 5% in 1985 to 28.3% by 1996. The overall cesarean delivery rate decreased to approximately 20% by 1996 (15). Yet, as the number of women pursuing TOLAC increased, so did the number of reports of uterine rupture and other complications during TOLAC (16–18). In part, these reports, and the professional liability pressures they engendered, have resulted in a reversal of VBAC and cesarean delivery trends. By 2006, the VBAC rate had decreased to 8.5% and the total cesarean delivery rate had increased to 31.1% (15, 19, 20). In some hospitals, TOLAC is no longer offered.

*The term *trial of labor* refers to a trial of labor in women who have had a previous cesarean delivery, regardless of the outcome.

†The term *vaginal birth after cesarean delivery* is used to denote a vaginal delivery after a trial of labor.

Committee on Practice Bulletins—Obstetrics. This Practice Bulletin was developed by the Committee on Practice Bulletins—Obstetrics with the assistance of William Grobman, MD, and Jeffrey Ecker, MD. The information is designed to aid practitioners in making decisions about appropriate obstetric and gynecologic care. These guidelines should not be construed as dictating an exclusive course of treatment or procedure. Variations in practice may be warranted based on the needs of the individual patient, resources, and limitations unique to the institution or type of practice.

In a 2010 consensus conference, the National Institutes of Health (NIH) examined the safety and outcome of TOLAC and VBAC and factors associated with decreasing rates. The NIH panel recognized that TOLAC was a reasonable option for many women with a prior cesarean delivery (21) and called on organizations to facilitate access to TOLAC. In addition, the panel recognized that "concerns over liability have a major impact on the willingness of physicians and healthcare institutions to offer TOL [TOLAC]" (21).

Evaluating the Evidence

Data detailing rates of VBAC after TOLAC and attendant maternal and neonatal outcomes associated with TOLAC versus planned repeat cesarean delivery can guide the health care provider and patient when deciding the approach to delivery in women with a prior cesarean delivery. There are currently no randomized trials comparing maternal or neonatal outcomes between women undertaking TOLAC and those undergoing a repeat cesarean delivery. Instead, recommendations regarding the approach to delivery are based on observational data that have reported the probability of VBAC once TOLAC is attempted, and compared the maternal and neonatal morbidities associated with TOLAC and repeat cesarean delivery (3–5, 12–14, 22–29). These data were summarized in the Evidence Report/Technology Assessment that provided background for the 2010 NIH Consensus Conference (30).

Before considering the results of any analysis, it is important to note that the appropriate statistical comparison is by intention to deliver (TOLAC versus elective repeat cesarean delivery). Comparing outcomes from VBAC or repeat cesarean delivery after TOLAC with those from a planned repeat cesarean delivery is inappropriate because no one patient can be guaranteed VBAC, and the risks and benefits may be disproportionately associated with a failed TOLAC.

Clinical Considerations and Recommendations

▶ ***What are the risks and benefits associated with a trial of labor after previous cesarean delivery?***

Neither elective repeat cesarean delivery nor TOLAC are without maternal or neonatal risk (see Table 1 and Table 2). The risks of either approach include maternal hemorrhage, infection, operative injury, thromboembolism, hysterectomy, and death (4, 5, 13, 22, 31). Most maternal morbidity that occurs during TOLAC occurs when repeat cesarean delivery becomes necessary (3–5, 23). Thus, VBAC is associated with fewer complications, and a failed TOLAC is associated with more complications, than elective repeat cesarean delivery (3–5, 22). Consequently, risk for maternal morbidity is integrally related to a woman's probability of achieving VBAC (32).

Uterine rupture or dehiscence* is the outcome associated with TOLAC that most significantly increases the chance of additional maternal and neonatal morbidity. The reported incidence of uterine rupture varies, in part because some studies have grouped true, catastrophic uterine rupture together with asymptomatic scar dehiscence. Additionally, early case series did not stratify rupture rates by the type of prior cesarean incision (ie, low transverse versus classical) (29).

One factor that markedly influences the chance of uterine rupture is the location of the prior incision on the uterus. Several large studies of women with a prior low

Table 1. Composite Maternal Risks from Elective Repeat Cesarean Delivery and Trial of Labor After Previous Cesarean Delivery

Maternal Risks	ERCD (%)	TOLAC (%)	
		One CD	Two or more CDs
Endometritis	1.5–2.1	2.9	3.1
Operative injury	0.42–.6	0.4	0.4
Blood transfusion	1–1.4	0.7–1.7	3.2
Hysterectomy	0–0.4	0.2–0.5	0.6
Uterine rupture	0.4–0.5	0.7–0.9	0.9–1.8
Maternal death	0.02–0.04	0.02	0

Abbreviations: CD, cesarean delivery; ERCD, elective repeat cesarean delivery; TOLAC, trial of labor after cesarean delivery; VBAC, vaginal birth after cesarean.

Data from Landon MB, Hauth JC, Leveno KJ, Spong CY, Leindecker S, Varner MW, et al. Maternal and perinatal outcomes associated with a trial of labor after prior cesarean delivery. National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. N Engl J Med 2004;351:2581–9; Landon MB, Spong CY, Thom E, Hauth JC, Bloom SL, Varner MW, et al. Risk of uterine rupture with a trial of labor in women with multiple and single prior cesarean delivery. National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. Obstet Gynecol 2006;108:12–20; Macones GA, Peipert J, Nelson DB, Odibo A, Stevens EJ, Stamilio DM, et al. Maternal complications with vaginal birth after cesarean delivery: a multicenter study. Am J Obstet Gynecol 2005;193:1656–62; Hibbard JU, Ismail MA, Wang Y, Te C, Karrison T, Ismail MA. Failed vaginal birth after a cesarean section: how risky is it? I. Maternal morbidity. Am J Obstet Gynecol 2001;184:1365–71; *and* Rossi AC, D'Addario V. Maternal morbidity following a trial of labor after cesarean section vs elective repeat cesarean delivery: a systematic review with metaanalysis. Am J Obstet Gynecol 2008;199:224–31.

*The terms *uterine rupture* and *uterine dehiscence* are not consistently defined in the literature so as to distinguish them from each other and are often, seemingly, used interchangeably. Although some connotations may suggest that dehiscence is less morbid than rupture, that convention is not used in this document. In this document these terms refer to symptomatic or clinically significant events unless otherwise noted.

transverse uterine incision reported a clinically determined uterine rupture rate of approximately 0.5–0.9% after TOLAC (4, 5, 12–14, 22). As discussed as follows, the risk of uterine rupture is higher in women with other types of hysterotomies.

In addition to providing an option for those who want the experience of a vaginal birth, VBAC has several potential health advantages for women. Women who achieve VBAC avoid major abdominal surgery, resulting in lower rates of hemorrhage, infection, and a shorter recovery period compared with elective repeat cesarean delivery (2, 6, 33). Additionally, for those considering larger families, VBAC may avoid potential future maternal consequences of multiple cesarean deliveries such as hysterectomy, bowel or bladder injury, transfusion, infection (34, 35), and abnormal placentation such as placenta previa and placenta accreta (35, 36).

Table 2. Composite Neonatal Morbidity from Elective Repeat Cesarean Delivery and Trial of Labor After Previous Cesarean Delivery

Neonatal Risks	ERCD (%)	TOLAC (%)	Comment
Antepartum stillbirth*[1]			
37–38 weeks	0.08	0.38	
39 weeks or greater	0.01	0.16	
HIE[1]	0–013	0.08	Secondary analysis (Spong, 2007 had three cases of HIE in cesarean delivery group)
Neonatal death[1]	0.05	0.08	Not significant
Perinatal death[2]	0.01	0.13	Increase seen due to intrapartum hypoxia
Neonatal admission[3]	6.0	6.6	Not significant
Respiratory morbidity[4]	1–5	0.1–1.8	
Transient tachypnea[5]	6.2	3.5	
Hyperbilirubinemia[5]	5.8	2.2	

*Excludes malformations

Abbreviations: ERCD, elective repeat cesarean delivery; HIE, hypoxic ischemic encephalopathy; TOLAC, trial of labor after previous cesarean delivery.

If uterine rupture, risk of HIE 6.2% (95% confidence interval, 1.8–10.6%), risk of neonatal death 1.8% (95% CI, 0–4.2%)

1. Landon MB, Hauth JC, Leveno KJ, Spong CY, Leindecker S, Varner MW, et al. Maternal and perinatal outcomes associated with a trial of labor after prior cesarean delivery. National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. N Engl J Med 2004;351:2581–9.
2. Smith GC, Pell JP, Cameron AD, Dobbie R. Risk of perinatal death associated with labor after previous cesarean delivery in uncomplicated term pregnancies. JAMA 2002;287:2684–90.
3. Tan PC, Subramaniam RN, Omar SZ. Labour and perinatal outcome in women at term with one previous lower-segment Caesarean: a review of 1000 consecutive cases. Aust N Z J Obstet Gynaecol 2007;47:31–6.
4. Signore C, Hemachandra A, Klebanoff M. Neonatal mortality and morbidity after elective cesarean delivery versus routine expectant management: a decision analysis. Semin Perinatol 2006;30:288–95.
5. Hook B, Kiwi R, Amini SB, Fanaroff A, Hack M. Neonatal morbidity after elective repeat cesarean section and trial of labor. Pediatrics 1997;100:348–53.

▶ *What is the vaginal delivery rate in women undergoing a trial of labor after previous cesarean delivery?*

Most published series of women attempting TOLAC have demonstrated a probability of VBAC of 60–80% (4, 5, 12–14, 22, 23). However, the chance of VBAC for an individual varies based on demographic and obstetric characteristics (see box). For example, women whose first cesarean delivery was performed for an arrest of labor disorder are less likely than those whose first cesarean delivery was for a nonrecurring indication (eg, breech presentation) to succeed in their attempt at VBAC (37–43). Similarly, there is consistent evidence that women who undergo labor induction or augmentation are less likely to have VBAC when compared with those at the same gestational age with spontaneous labor without augmentation (44–47). Other factors that negatively influence the likelihood of VBAC include increasing maternal age, high body mass index, high birth weight, and advanced gestational age at delivery (44, 48–54). A shorter interdelivery interval and the presence of preeclampsia at the time of delivery also have been associated with a reduced chance of achieving VBAC (55, 56). Conversely, women who have had a prior vaginal delivery are more likely than those who have not to succeed in their TOLAC (44, 57).

Selected Clinical Factors Associated with Trial of Labor After Previous Cesarean Delivery Success

Increased Probability of Success (Strong predictors)

- Prior vaginal birth
- Spontaneous labor

Decreased Probability of Success (Other predictors)

- Recurrent indication for initial cesarean delivery (labor dystocia)
- Increased maternal age
- Non-white ethnicity
- Gestational age greater than 40 weeks
- Maternal obesity
- Preeclampsia
- Short interpregnancy interval
- Increased neonatal birth weight

The probability that a woman attempting TOLAC will achieve VBAC depends on her individual combination of factors. Several investigators have attempted to create scoring systems to assist in the prediction of VBAC, but most have had limited success (46, 58–60). However, one model was developed specifically for women undergoing TOLAC at term with one prior low transverse cesarean delivery incision, singleton pregnancy, and cephalic fetal presentation (61). This model may have utility for patient education and counseling for those considering TOLAC at term (http://www.bsc.gwu.edu/mfmu/vagbirth.html).

▶ *Who are candidates for a trial of labor after previous cesarean delivery?*

Good candidates for planned TOLAC are those women in whom the balance of risks (low as possible) and chances of success (as high as possible) are acceptable to the patient and health care provider. The balance of risks and benefits appropriate for one patient may seem unacceptable for another. Because delivery decisions made during the first pregnancy after a cesarean delivery will likely affect plans in future pregnancies, decisions regarding TOLAC should ideally consider the possibility of future pregnancies.

Although there is no universally agreed on discriminatory point, evidence suggests that women with at least a 60–70% chance of VBAC have equal or less maternal morbidity when they undergo TOLAC than women undergoing elective repeat cesarean delivery (62, 63). Conversely, women who have a lower than 60% probability of VBAC have a greater chance of morbidity than woman undergoing repeat cesarean delivery. Similarly, because neonatal morbidity is higher in the setting of a failed TOLAC than in VBAC, women with higher chances of achieving VBAC have lower risks of neonatal morbidity. One study demonstrated that composite neonatal morbidity is similar between TOLAC and elective repeat cesarean delivery for the women with the greatest probability of achieving VBAC (63).

The preponderance of evidence suggests 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. Conversely, those at high risk for complications (eg, those with previous classical or T-incision, prior uterine rupture, or extensive transfundal uterine surgery) and those in whom vaginal delivery is otherwise contraindicated are not generally candidates for planned TOLAC. Individual circumstances must be considered in all cases, and if, for example, a patient who may not otherwise be a candidate for TOLAC presents in advanced labor, the patient and her health care providers may judge it best to proceed with TOLAC. Some common situations that may modify the balance of risks and benefits are considered as follows.

More Than One Previous Cesarean Delivery

Studies addressing the risks and benefits of TOLAC in women with more than one cesarean delivery have reported a risk of uterine rupture between 0.9% and 3.7%, but have not reached consistent conclusions regarding how this risk compares with women with only one prior uterine incision (64–68). Two large studies, with sufficient size to control for confounding variables, reported on the risks for women with two previous cesarean deliveries undergoing TOLAC (66, 67). One study found no increased risk of uterine rupture (0.9% versus 0.7%) in women with one versus multiple prior cesarean deliveries (66), whereas the other noted a risk of uterine rupture that increased from 0.9% to 1.8% in women with one versus two prior cesarean deliveries (67). Both studies reported some increased risk in morbidity among women with more than one prior cesarean delivery, although the absolute magnitude of the difference in these risks was relatively small (eg, 2.1% versus 3.2% composite major morbidity in one study) (67). Additionally, the chance of achieving VBAC appears to be similar for women with one or more than one cesarean delivery. Given the overall data, it is reasonable to consider women with two 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. Data regarding the risk for women undergoing TOLAC with more than two previous cesarean deliveries are limited (69).

Macrosomia

Women undergoing TOLAC with a macrosomic fetus (defined variously as birth weight greater than 4,000–4,500 g) have a lower likelihood of VBAC (50, 70–72) than women attempting TOLAC who have a nonmacrosomic fetus. Similarly, women with a history of past cesarean delivery performed for the indication of dystocia, have a lower likelihood of VBAC if the current birth weight is greater than that of the index pregnancy with dystocia (73). Some limited evidence also suggests that the uterine rupture rate is increased (relative risk 2.3, $P<.001$) for women undergoing TOLAC without a prior vaginal delivery and neonatal birth weights greater than 4,000 g (72). These studies used actual birth weight as opposed to estimated fetal weight thus limiting the applicability of these data when making decisions regarding mode of delivery antenatally (74). Despite

this limitation, it remains appropriate for health care providers and patients to consider past and predicted birth weights when making decisions regarding TOLAC, but suspected macrosomia alone should not preclude the possibility of TOLAC.

Gestation Beyond 40 Weeks

Studies evaluating the association of gestational age with VBAC outcomes have consistently demonstrated decreased VBAC rates in women who undertake TOLAC beyond 40 weeks of gestation (49, 75–77). Although one study has shown an increased risk of uterine rupture beyond 40 weeks of gestation (76), other studies, including the largest study that has evaluated this factor, have not found this association (77). Although chances of success may be lower in more advanced gestations, gestational age of greater than 40 weeks alone should not preclude TOLAC.

Previous Low Vertical Incision

The limited number of studies that have evaluated TOLAC in women with prior low vertical uterine incisions have reported similar rates of successful vaginal delivery compared with women with a previous low transverse uterine incision (78–81). In addition, there has not been consistent evidence of an increased risk of uterine rupture, or maternal or perinatal morbidity associated with TOLAC in the presence of a prior low vertical scar. Recognizing the limitations of available data, health care providers and patients may choose to proceed with TOLAC in the presence of a documented prior low vertical uterine incision.

Unknown Type of Previous Uterine Incision

The type of uterine incision performed at the time of a prior cesarean delivery cannot be confirmed in some patients. Although some have questioned the safety of offering VBAC under these circumstances, two case series, both from large tertiary care facilities, reported rates of VBAC success and uterine rupture similar to those from other contemporaneous studies of women with documented previous low transverse uterine incisions (82, 83). Additionally, in one study evaluating risk factors for uterine rupture, no significant association was found with the presence of an unknown scar (84). The absence of an association may result from the fact that most cesarean incisions are low transverse, and the uterine scar type can often be inferred based on the indication for the prior cesarean delivery. Therefore, TOLAC is not contraindicated for women with one previous cesarean delivery with an unknown uterine scar type unless there is a high clinical suspicion of a previous classical uterine incision.

Twin Gestation

The studies of women with twin gestations who attempt VBAC have consistently demonstrated that their outcomes are similar to those of women with singleton gestations who attempt VBAC (85–90). In two analyses of large populations, women with twin gestations had a similar chance of achieving VBAC as women with singleton gestations and did not incur any greater risk of uterine rupture or maternal or perinatal morbidity (89, 90). Women with one previous cesarean delivery with a low transverse incision, who are otherwise appropriate candidates for twin vaginal delivery, may be considered candidates for TOLAC.

▶ *How does management of labor differ for patients undergoing vaginal birth after cesarean delivery?*

Induction and Augmentation of Labor

Induction of labor for maternal or fetal indications remains an option for women undergoing TOLAC. However, the potential increased risk of uterine rupture associated with any induction, and the potential decreased possibility of achieving VBAC, should be discussed. Several studies have noted an increased risk of uterine rupture in the setting of induction of labor in women attempting TOLAC (4, 5, 81, 91–93). One study of 20,095 women who had undergone prior cesarean delivery (81) found a rate of uterine rupture of 0.52% for spontaneous labor, 0.77% for labor induced without prostaglandins, and 2.24% for prostaglandin-induced labor. This study was limited by reliance on the *International Classification of Diseases, 9th Revision* coding for diagnosis of uterine rupture and the inability to determine whether prostaglandin use itself or the context of its use (eg, unfavorable cervix, need for multiple induction agents) was associated with uterine rupture.

In a multicenter study of 33,699 women undergoing TOLAC, augmentation or induction of labor also was associated with an increased risk of uterine rupture compared with spontaneous labor (0.4 % for spontaneous labor, 0.9% for augmented labor, 1.1% for oxytocin alone, and 1.4% for induction with prostaglandins with or without oxytocin) (4). A secondary analysis of 11,778 women from this study with one prior low transverse cesarean delivery showed an increase in uterine rupture only in women undergoing induction who had no prior vaginal delivery (1.5% versus 0.8%, $P=.02$). Additionally, uterine rupture was no more likely to occur when labor induction was initiated with an unfavorable cervix than with a favorable cervix (91). Another secondary analysis examined the association between maximum oxytocin dose and the risk of uterine rupture (94).

They noted a dose response effect with increasing risk of uterine rupture with higher maximum doses of oxytocin. Because studies have not identified a clear threshold for rupture, an upper limit for oxytocin dosing with TOLAC has not been established.

Studies of the effects of prostaglandins, grouped together as a class of agents, on uterine rupture in women with a prior cesarean delivery have demonstrated inconsistent results. Among three large studies investigating prostaglandins for induction of labor for women with a previous cesarean delivery, one found an increased risk of uterine rupture (81), a second reported no increased rupture risk (4), and a third found no increase risk of rupture when prostaglandins were used alone (with no subsequent oxytocin) (5). Studies of specific prostaglandins are limited in size, but indicate that rupture risk may vary among these agents. Evidence from small studies show that the use of misoprostol (prostaglandin E_1) in women who have had cesarean deliveries is associated with an increased risk of uterine rupture (95–98). Therefore, misoprostol should not be used for third trimester cervical ripening or labor induction in patients who have had a cesarean delivery or major uterine surgery (95–98).

Because data are limited, it is difficult to make definitive recommendations regarding the use of prostaglandin E_2. One large study found an increase in uterine rupture only when oxytocin was used after cervical ripening with prostaglandins (5). Therefore, selecting women most likely to give birth vaginally while avoiding sequential use of prostaglandins and oxytocin appears to have the lowest risks of uterine rupture.

Induced labor is less likely to result in VBAC than spontaneous labor (44, 47, 92, 99). There is some evidence that this is the case regardless of whether the cervix is favorable or unfavorable, although an unfavorable cervix decreases the chance of success to the greatest extent (91, 100, 101). These factors may affect patient and health care provider decisions as they consider the risks and benefits of TOLAC associated with labor induction.

The use of oxytocin for augmentation of contractions, separate from induction of labor, during TOLAC has been examined in several studies. Some have found an association between oxytocin augmentation and uterine rupture (4, 93) whereas others have not (5, 102, 103). The varying outcomes of available studies and small absolute magnitude of the risk reported in those studies support that oxytocin augmentation may be used in patients undergoing TOLAC.

Studies on TOLAC outcomes after mechanical cervical ripening and labor induction with a transcervical catheter are retrospective and have relatively small sample sizes. Two studies showed no increase in the risk of uterine rupture (92, 104) whereas another reported an increase compared with women in spontaneous labor (105). Similar to other methods of cervical ripening and labor induction, it is unknown whether any increased risk is due to an unfavorable cervix or the method of ripening. Given the lack of compelling data suggesting increased risk with mechanical dilation and transcervical catheters, such interventions may be an option for TOLAC candidates with an unfavorable cervix.

External Cephalic Version

Limited data regarding external cephalic version for breech presentation in a woman with a prior uterine incision suggest that external cephalic version is not contraindicated if a woman is at low risk of adverse maternal or neonatal outcomes from external cephalic version and TOLAC (106–108). The chances of successful external version have been reported to be similar in women with and without a prior cesarean delivery.

Analgesia

Epidural analgesia for labor may be used as part of TOLAC, and adequate pain relief may encourage more women to choose TOLAC (109, 110). No high quality evidence suggests that epidural analgesia is a causal risk factor for an unsuccessful TOLAC (44, 110, 111). In addition, effective regional analgesia should not be expected to mask signs and symptoms of uterine rupture, particularly because the most common sign of rupture is fetal heart tracing abnormalities (24, 112).

Other Elements of Intrapartum Management

Once labor has begun, a patient with TOLAC should be evaluated by her obstetric provider. Most authorities recommend continuous electronic fetal monitoring. No data suggest that intrauterine pressure catheters or fetal scalp electrodes are superior to external forms of monitoring, and there is evidence that the use of intrauterine pressure catheters does not assist in the diagnosis of uterine rupture (113, 114).

Personnel familiar with the potential complications of TOLAC should be present to watch for fetal heart rate patterns that are associated with uterine rupture. Uterine rupture is often sudden and may be catastrophic, and accurate antenatal predictors of uterine rupture do not exist (115, 116). Acute signs and symptoms of uterine rupture are variable and may include fetal bradycardia, increased uterine contractions, vaginal bleeding, loss of fetal station, or new onset of intense uterine pain (25, 84, 112). However, the most common sign associated with uterine rupture is fetal heart rate abnormality, which has been associated with up to 70% of cases of uterine rup-

tures. This supports the recommendation of continuous fetal heart rate monitoring in labor (25, 29, 84).

Delivery

There is nothing unique about the delivery of the fetus or placenta during VBAC. Manual uterine exploration after VBAC and subsequent repair of asymptomatic scar dehiscence have not been shown to improve outcomes. Excessive vaginal bleeding or signs of hypovolemia are potential signs of uterine rupture and should prompt complete evaluation of the genital tract.

▶ *How should future pregnancies be managed after uterine rupture?*

If the site of the ruptured scar is confined to the lower segment of the uterus, the rate of repeat rupture or dehiscence in labor is 6% (117). If the scar includes the upper segment of the uterus, the repeat rupture rate has been reported to be as high as 32% (117, 118). Given both these rates, it is recommended that women who have had a previous uterine rupture should give birth by repeat cesarean delivery before the onset of labor. Because spontaneous labor is unpredictable and could occur before the recommended 39 weeks for an elective delivery, earlier delivery should be contemplated with consideration given to amniocentesis to document fetal lung maturity.

▶ *How should second trimester delivery or delivery of an intrauterine fetal demise be accomplished in women with a previous cesarean delivery?*

Some women with a history of a cesarean delivery will require delivery during the second trimester in a subsequent pregnancy. Although published series are relatively small, women with a prior cesarean delivery who undergo labor induction with prostaglandins (including misoprostol) have been shown to have outcomes that are similar to those women with an unscarred uterus (eg, length of time until delivery, failed labor induction, and complication rates) (119–124). The frequency of uterine rupture with labor induction in this setting in most series is less than 1% (125–127). For these women, dilation and evacuation as well as labor induction with prostaglandins are reasonable options (124, 125, 127–129).

In patients after 28 weeks of gestation with an intrauterine fetal demise and a prior cesarean scar, cervical ripening with a transcervical Foley catheter has been associated with uterine rupture rates comparable with spontaneous labor (105) and this may be a helpful adjunct in patients with an unfavorable cervical examination. Because there are no fetal risks to TOLAC in these circumstances, TOLAC should be encouraged, and after the patient and the health care provider weigh the risks and benefits, TOLAC may even be judged appropriate for women at higher risk for cesarean scar complications (eg, prior classical uterine incision).

▶ *How should women considering a trial of labor after previous cesarean delivery be counseled?*

The interest in considering TOLAC varies greatly among women, and this variation is at least partly related to differences in the way individuals value the potential risks and benefits (1, 130–132). Accordingly, potential benefits and risks of both TOLAC and elective repeat cesarean delivery should be discussed and these discussions documented. Discussion should consider individual characteristics that affect the chances of complications associated with VBAC and TOLAC so that a patient can choose her intended route of delivery based on data that is most personally relevant.

A discussion of VBAC early in a woman's prenatal care course, if possible, will allow the most time for her to consider options for TOLAC or elective repeat cesarean delivery. Many of the factors that are related to the chance of VBAC or uterine rupture are known early in pregnancy (60, 61, 116). If the type of previous uterine incision is in doubt, reasonable attempts should be made to obtain the patient's medical records. As the pregnancy progresses, if other circumstances arise that may change the risks or benefits of TOLAC (eg, need for labor induction), these should be addressed. Counseling also may include consideration of intended family size and the risk of additional cesarean deliveries, with the recognition that the future reproductive plans may be uncertain or change.

Counseling should consider the resources available to support women electing TOLAC at their intended delivery site, and whether such resources match those recommended for caring for women electing TOLAC (discussed and detailed in the next section). Available data support that TOLAC may be safely undertaken in both university and community hospitals and facilities with and without residency programs (5, 23, 26, 27, 133).

After counseling, the ultimate decision to undergo TOLAC or a repeat cesarean delivery should be made by the patient in consultation with her health care provider. Global mandates for TOLAC are inappropriate because individual risk factors are not considered. Documentation of counseling and the management plan should be included in the medical record.

▶ *What resources are recommended for health care providers and facilities offering a trial of labor after previous cesarean delivery?*

Trial of labor after previous cesarean delivery should be undertaken at facilities capable of emergency deliveries. The American College of Obstetricians and Gynecologists (the College) and international guidelines have recommended that resources for emergency cesarean delivery should be "immediately available." Some have argued that this stipulation and the difficulty in providing required resources—especially in smaller centers with lower delivery volumes—limit women's access to TOLAC. This may be particularly true in rural areas where the option to travel to larger centers is difficult.

Restricting access was not the intention of the College's past recommendation. Much of the data concerning the safety of TOLAC was obtained from centers capable of performing immediate, emergency cesarean delivery. Although there is reason to think that more rapid availability of cesarean delivery may provide a small incremental benefit in safety, comparative data examining in detail the effect of alternate systems and response times are not available (134).

Because of the risks associated with TOLAC and that uterine rupture and other complications may be unpredictable, the College recommends that TOLAC be undertaken in facilities with staff immediately available to provide emergency care. When resources for immediate cesarean delivery are not available, the College recommends that health care providers and patients considering TOLAC discuss the hospital's resources and availability of obstetric, pediatric, anesthetic, and operating room staffs. These recommendations are concordant with those of other professional societies (135, 136). The decision to offer and pursue TOLAC in a setting in which the option of immediate cesarean delivery is more limited should be carefully considered by patients and their health care providers. In such situations the best alternative may be to refer patients to a facility with available resources. Another alternative is to create regional centers where patients interested in TOLAC can be readily referred and needed resources can be more efficiently and economically organized. Health care providers and insurance carriers should do all they can to facilitate transfer of care or comanagement in support of a desired TOLAC, and such plans should be initiated early in the course of antenatal care. However, in areas with fewer deliveries and greater distances between delivery sites, organizing transfers or accessing referral centers may be untenable. Respect for patient autonomy supports the concept that patients should be allowed to accept increased levels of risk, however, patients should be clearly informed of such potential increase in risk and management alternatives. Evaluation of a patient's individual chance of VBAC and risk for uterine rupture are central to these considerations. Such conversations and decisions should be documented, including reference to site-specific resources and anticipated risks. Referral also may be appropriate if, after discussion, health care providers find themselves uncomfortable with choices patients have made. Importantly, however, none of the principles, options, or processes outlined here should be used by centers, health care providers, or insurers to avoid appropriate efforts to provide the recommended resources to make TOLAC as safe as possible for those who choose this option. In settings where the staff needed for emergency delivery are not immediately available, the process for gathering needed staff when emergencies arise should be clear, and all centers should have a plan for managing uterine rupture. Drills or other simulation may be useful in preparing for these rare emergencies.

Respect for patient autonomy also argues that even if a center does not offer TOLAC, such a policy cannot be used to force women to have cesarean delivery or to deny care to women in labor who decline to have a repeat cesarean delivery. When conflicts arise between patient wishes and health care provider or facility policy or both, careful explanation and, if appropriate, transfer of care to facilities supporting TOLAC should be used rather than coercion. Because relocation after the onset of labor is generally not appropriate in patients with a prior uterine scar, who are thereby at risk for uterine rupture, transfer of care to facilitate TOLAC, as noted previously, is best effected during the course of antenatal care. This timing places a responsibility on patients and health care providers to begin relevant conversations early in the course of prenatal care.

Summary of Recommendations

The following recommendations are based on good and consistent scientific evidence (Level A):

- Most women with one previous cesarean delivery with a low-transverse incision are candidates for and should be counseled about VBAC and offered TOLAC.
- Epidural analgesia for labor may be used as part of TOLAC.
- Misoprostol should not be used for third trimester cervical ripening or labor induction in patients who have had a cesarean delivery or major uterine surgery.

The following recommendations are based on limited or inconsistent scientific evidence (Level B):

- Women with two previous low transverse cesarean deliveries may be considered candidates for TOLAC.
- Women with one previous cesarean delivery with a low transverse incision, who are otherwise appropriate candidates for twin vaginal delivery, may be considered candidates for TOLAC.
- External cephalic version for breech presentation is not contraindicated in women with a prior low transverse uterine incision who are at low risk for adverse maternal or neonatal outcomes from external cephalic version and TOLAC.
- Those at high risk for complications (eg, those with previous classical or T-incision, prior uterine rupture, or extensive transfundal uterine surgery) and those in whom vaginal delivery is otherwise contraindicated (eg, those with placenta previa) are not generally candidates for planned TOLAC.
- Induction of labor for maternal or fetal indications remains an option in women undergoing TOLAC.
- TOLAC is not contraindicated for women with previous cesarean delivery with an unknown uterine scar type unless there is a high clinical suspicion of a previous classical uterine incision.

The following recommendations are based primarily on consensus and expert opinion (Level C):

- A trial of labor after previous cesarean delivery should be undertaken at facilities capable of emergency deliveries. Because of the risks associated with TOLAC and that uterine rupture and other complications may be unpredictable, the College recommends that TOLAC be undertaken in facilities with staff immediately available to provide emergency care. When resources for immediate cesarean delivery are not available, the College recommends that health care providers and patients considering TOLAC discuss the hospital's resources and availability of obstetric, pediatric, anesthetic, and operating room staffs. Respect for patient autonomy supports that patients should be allowed to accept increased levels of risk, however, patients should be clearly informed of such potential increase in risk and management alternatives.
- After counseling, the ultimate decision to undergo TOLAC or a repeat cesarean delivery should be made by the patient in consultation with her health care provider. The potential risks and benefits of both TOLAC and elective repeat cesarean delivery should be discussed. Documentation of counseling and the management plan should be included in the medical record.

Proposed Performance Measure

Percentage of women who are candidates for TOLAC with whom discussion of the risk and benefits of TOLAC compared with a repeat cesarean delivery has been documented in the medical record

References

1. Little MO, Lyerly AD, Mitchell LM, Armstrong EM, Harris LH, Kukla R, et al. Mode of delivery: toward responsible inclusion of patient preferences. Obstet Gynecol 2008;112:913–8. (Level III)
2. Curtin SC. Rates of cesarean birth and vaginal birth after previous cesarean, 1991-95. Mon Vital Stat Rep 1997;45(11 suppl 3):1–12. (Level II-3)
3. Hibbard JU, Ismail MA, Wang Y, Te C, Karrison T, Ismail MA. Failed vaginal birth after a cesarean section: how risky is it? I. Maternal morbidity. Am J Obstet Gynecol 2001;184:1365–71. (Level II-2)
4. Landon MB, Hauth JC, Leveno KJ, Spong CY, Leindecker S, Varner MW, et al. Maternal and perinatal outcomes associated with a trial of labor after prior cesarean delivery. National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. N Engl J Med 2004;351:2581–9. (Level II-2)
5. Macones GA, Peipert J, Nelson DB, Odibo A, Stevens EJ, Stamilio DM, et al. Maternal complications with vaginal birth after cesarean delivery: a multicenter study. Am J Obstet Gynecol 2005;193:1656–62. (Level II-3)
6. Rates of cesarean delivery--United States, 1991. Centers for Disease Control and Prevention (CDC). MMWR Morb Mortal Wkly Rep 1993;42:285–9. (Level II-3)
7. Hamilton BE, Martin JA, Ventura SJ. Births: preliminary data for 2007. Natl Vital Stat Rep 2009;57(12):1–23. (Level II-3)
8. Clark SL, Hankins GD. Temporal and demographic trends in cerebral palsy--fact and fiction. Am J Obstet Gynecol 2003;188:628–33. (Level III)
9. Lee HC, El-Sayed YY, Gould JB. Population trends in cesarean delivery for breech presentation in the United States, 1997-2003. Am J Obstet Gynecol 2008;199:59.e1–59.e8. (Level II-3)
10. Goetzinger KR, Macones GA. Operative vaginal delivery: current trends in obstetrics. Womens Health 2008; 4:281–90. (Level III)
11. Cragin EB. Conservatism in obstetrics. N Y Med J 1916; 104:1–3. (Level III)

12. Lavin JP, Stephens RJ, Miodovnik M, Barden TP. Vaginal delivery in patients with a prior cesarean section. Obstet Gynecol 1982;59:135–48. (Level III)

13. Flamm BL, Newman LA, Thomas SJ, Fallon D, Yoshida MM. Vaginal birth after cesarean delivery: results of a 5-year multicenter collaborative study. Obstet Gynecol 1990;76:750–4. (Level II-3)

14. Miller DA, Diaz FG, Paul RH. Vaginal birth after cesarean: a 10-year experience. Obstet Gynecol 1994;84: 255–8. (Level III)

15. Menacker F, Declercq E, Macdorman MF. Cesarean delivery: background, trends, and epidemiology. Semin Perinatol 2006;30:235–41. (Level III)

16. Sachs BP, Kobelin C, Castro MA, Frigoletto F. The risks of lowering the cesarean-delivery rate. N Engl J Med 1999;340:54–7. (Level III)

17. Phelan JP. VBAC: time to reconsider? OBG Manage 1996;8(11):62, 64–8. (Level III)

18. Flamm BL. Once a cesarean, always a controversy. Obstet Gynecol 1997;90:312–5. (Level III)

19. Yang YT, Mello MM, Subramanian SV, Studdert DM. Relationship between malpractice litigation pressure and rates of cesarean section and vaginal birth after cesarean section. Med Care 2009;47:234–42. (Level III)

20. Martin JA, Hamilton BE, Sutton PD, Ventura SJ, Menacker F, Kirmeyer S, et al. Births: final data for 2006. Natl Vital Stat Rep 2009;57(7):1–104. (Level II-3)

21. National Institutes of Health. NIH Consensus Development Conference: vaginal birth after cesarean: new insights. Consensus Development Conference statement. Bethesda (MD): NIH; 2010. Available at: http://consensus.nih.gov/2010/images/vbac/vbac_statement.pdf. Retrieved April 23, 2010. (Level III)

22. McMahon MJ, Luther ER, Bowes WA Jr, Olshan AF. Comparison of a trial of labor with an elective second cesarean section. N Engl J Med 1996;335:689–95. (Level II-2)

23. Gregory KD, Korst LM, Cane P, Platt LD, Kahn K. Vaginal birth after cesarean and uterine rupture rates in California. Obstet Gynecol 1999;94:985–9. (Level II-3)

24. Kieser KE, Baskett TF. A 10-year population-based study of uterine rupture. Obstet Gynecol 2002;100:749–53. (Level II-3)

25. Yap OW, Kim ES, Laros RK Jr. Maternal and neonatal outcomes after uterine rupture in labor. Am J Obstet Gynecol 2001;184:1576–81. (Level II-3)

26. Raynor BD. The experience with vaginal birth after cesarean delivery in a small rural community practice. Am J Obstet Gynecol 1993;168:60–2. (Level III)

27. Blanchette H, Blanchette M, McCabe J, Vincent S. Is vaginal birth after cesarean safe? Experience at a community hospital. Am J Obstet Gynecol 2001;184: 1478–84; discussion 1484–7. (Level II-2)

28. Poma PA. Rupture of a cesarean-scarred uterus: a community hospital experience. J Natl Med Assoc 2000; 92:295–300. (Level II-2)

29. Leung AS, Leung EK, Paul RH. Uterine rupture after previous cesarean delivery: maternal and fetal consequences. Am J Obstet Gynecol 1993;169:945–50. (Level II-2)

30. Guise JM, Denman MA, Emeis C, Marshall N, Walker M, Fu R, et al. Vaginal birth after cesarean: new insights on maternal and neonatal outcomes. Obstet Gynecol 2010;115:1267–78. (Level III)

31. Chauhan SP, Martin JN Jr, Henrichs CE, Morrison JC, Magann EF. Maternal and perinatal complications with uterine rupture in 142,075 patients who attempted vaginal birth after cesarean delivery: A review of the literature. Am J Obstet Gynecol 2003;189:408–17. (Level III)

32. Gregory KD, Korst LM, Fridman M, Shihady I, Broussard P, Fink A, et al. Vaginal birth after cesarean: clinical risk factors associated with adverse outcome. Am J Obstet Gynecol 2008;198:452.e1–10; discussion 452.e10–2. (Level II-2)

33. Scheller JM, Nelson KB. Does cesarean delivery prevent cerebral palsy or other neurologic problems of childhood? Obstet Gynecol 1994;83:624–30. (Level III)

34. Nisenblat V, Barak S, Griness OB, Degani S, Ohel G, Gonen R. Maternal complications associated with multiple cesarean deliveries. Obstet Gynecol 2006;108:21–6. (Level II-2)

35. Silver RM, Landon MB, Rouse DJ, Leveno KJ, Spong CY, Thom EA, et al. Maternal morbidity associated with multiple repeat cesarean deliveries. National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. Obstet Gynecol 2006; 107:1226–32. (Level II-2)

36. Ananth CV, Smulian JC, Vintzileos AM. The association of placenta previa with history of cesarean delivery and abortion: a metaanalysis. Am J Obstet Gynecol 1997;177:1071–8. (Meta-analysis)

37. Bedoya C, Bartha JL, Rodriguez I, Fontan I, Bedoya JM, Sanchez-Ramos J. A trial of labor after cesarean section in patients with or without a prior vaginal delivery. Int J Gynaecol Obstet 1992;39:285–9. (Level II-2)

38. Shipp TD, Zelop CM, Repke JT, Cohen A, Caughey AB, Lieberman E. Labor after previous cesarean: influence of prior indication and parity. Obstet Gynecol 2000;95:913–6. (Level II-2)

39. Demianczuk NN, Hunter DJ, Taylor DW. Trial of labor after previous cesarean section: prognostic indicators of outcome. Am J Obstet Gynecol 1982;142:640–2. (Level II-3)

40. Hoskins IA, Gomez JL. Correlation between maximum cervical dilatation at cesarean delivery and subsequent vaginal birth after cesarean delivery. Obstet Gynecol 1997;89:591–3. (Level II-2)

41. Impey L, O'Herlihy C. First delivery after cesarean delivery for strictly defined cephalopelvic disproportion. Obstet Gynecol 1998;92:799–803. (Level II-2)

42. Jongen VH, Halfwerk MG, Brouwer WK. Vaginal delivery after previous caesarean section for failure of second stage of labour. Br J Obstet Gynaecol 1998;105:1079–81. (Level II-2)

43. Bujold E, Gauthier RJ. Should we allow a trial of labor after a previous cesarean for dystocia in the second stage of labor? Obstet Gynecol 2001;98:652–5. (Level II-3)

44. Landon MB, Leindecker S, Spong CY, Hauth JC, Bloom S, Varner MW, et al. The MFMU Cesarean Registry: factors affecting the success of trial of labor after previous cesarean delivery. National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. Am J Obstet Gynecol 2005;193:1016–23. (Level II-2)

45. Rageth JC, Juzi C, Grossenbacher H. Delivery after previous cesarean: a risk evaluation. Swiss Working Group of Obstetric and Gynecologic Institutions. Obstet Gynecol 1999;93:332–7. (Level III)

46. Macones GA, Hausman N, Edelstein R, Stamilio DM, Marder SJ. Predicting outcomes of trials of labor in women attempting vaginal birth after cesarean delivery: a comparison of multivariate methods with neural networks. Am J Obstet Gynecol 2001;184:409–13. (Level II-2)

47. Sims EJ, Newman RB, Hulsey TC. Vaginal birth after cesarean: to induce or not to induce. Am J Obstet Gynecol 2001;184:1122–4. (Level II-2)

48. Zelop CM, Shipp TD, Cohen A, Repke JT, Lieberman E. Trial of labor after 40 weeks' gestation in women with prior cesarean. Obstet Gynecol 2001;97:391–3. (Level II-2)

49. Zelop CM, Shipp TD, Repke JT, Cohen A, Lieberman E. Outcomes of trial of labor following previous cesarean delivery among women with fetuses weighing >4000 g. Am J Obstet Gynecol 2001;185:903–5. (Level II-2)

50. Chauhan SP, Magann EF, Carroll CS, Barrilleaux PS, Scardo JA, Martin JN Jr. Mode of delivery for the morbidly obese with prior cesarean delivery: vaginal versus repeat cesarean section. Am J Obstet Gynecol 2001;185:349–54. (Level II-2)

51. Carroll CS Sr, Magann EF, Chauhan SP, Klauser CK, Morrison JC. Vaginal birth after cesarean section versus elective repeat cesarean delivery: Weight-based outcomes. Am J Obstet Gynecol 2003;188:1516–20; discussion 1520–2. (Level II-2)

52. Srinivas SK, Stamilio DM, Sammel MD, Stevens EJ, Peipert JF, Odibo AO, et al. Vaginal birth after caesarean delivery: does maternal age affect safety and success? Paediatr Perinat Epidemiol 2007;21:114–20. (Level II-2)

53. Goodall PT, Ahn JT, Chapa JB, Hibbard JU. Obesity as a risk factor for failed trial of labor in patients with previous cesarean delivery. Am J Obstet Gynecol 2005; 192:1423–6. (Level II-3)

54. Juhasz G, Gyamfi C, Gyamfi P, Tocce K, Stone JL. Effect of body mass index and excessive weight gain on success of vaginal birth after cesarean delivery. Obstet Gynecol 2005;106:741–6. (Level II-3)

55. Huang WH, Nakashima DK, Rumney PJ, Keegan KA Jr, Chan K. Interdelivery interval and the success of vaginal birth after cesarean delivery. Obstet Gynecol 2002;99: 41–4. (Level II -2)

56. Srinivas SK, Stamilio DM, Stevens EJ, Peipert JF, Odibo AO, Macones GA. Safety and success of vaginal birth after cesarean delivery in patients with preeclampsia. Am J Perinatol 2006;3:145–52. (Level II-2)

57. Caughey AB, Shipp TD, Repke JT, Zelop C, Cohen A, Lieherman E. Trial of labor after cesarean delivery: the effect of previous vaginal delivery. Am J Obstet Gynecol 1998;179:938–41. (Level II-2)

58. Troyer LR, Parisi VM. Obstetric parameters affecting success in a trial of labor: designation of a scoring system. Am J Obstet Gynecol 1992;167:1099–104. (Level II-3)

59. Hashima JN, Guise JM. Vaginal birth after cesarean: a prenatal scoring tool. Am J Obstet Gynecol 2007;196:e22–3. (Level III)

60. Srinivas SK, Stamilio DM, Stevens EJ, Odibo AO, Peipert JF, Macones GA. Predicting failure of a vaginal birth attempt after cesarean delivery. Obstet Gynecol 2007;109:800–5. (Level II-2)

61. Grobman WA, Lai Y, Landon MB, Spong CY, Leveno KJ, Rouse DJ, et al. Development of a nomogram for prediction of vaginal birth after cesarean delivery. National Institute of Child Health and Human Development (NICHD) Maternal-Fetal Medicine Units Network (MFMU). Obstet Gynecol 2007;109:806–12. (Level III)

62. Cahill AG, Stamilio DM, Odibo AO, Peipert JF, Ratcliffe SJ, Stevens EJ, et al. Is vaginal birth after cesarean (VBAC) or elective repeat cesarean safer in women with a prior vaginal delivery? Am J Obstet Gynecol 2006; 195:1143–7. (Level II-2)

63. Grobman WA, Lai Y, Landon MB, Spong CY, Leveno KJ, Rouse DJ, et al. Can a prediction model for vaginal birth after cesarean also predict the probability of morbidity related to a trial of labor? Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. Am J Obstet Gynecol 2009;200:56.e1–56.e6. (Level III)

64. Asakura H, Myers SA. More than one previous cesarean delivery: a 5-year experience with 435 patients. Obstet Gynecol 1995;85:924–9. (Level III)

65. Caughey AB, Shipp TD, Repke JT, Zelop CM, Cohen A, Lieberman E. Rate of uterine rupture during a trial of labor in women with one or two prior cesarean deliveries. Am J Obstet Gynecol 1999;181:872–6. (Level II-2)

66. Landon MB, Spong CY, Thom E, Hauth JC, Bloom SL, Varner MW, et al. Risk of uterine rupture with a trial of labor in women with multiple and single prior cesarean delivery. National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. Obstet Gynecol 2006;108:12–20. (Level II-2)

67. Macones GA, Cahill A, Pare E, Stamilio DM, Ratcliffe S, Stevens E, et al. Obstetric outcomes in women with two prior cesarean deliveries: is vaginal birth after cesarean delivery a viable option? Am J Obstet Gynecol 2005;192:1223–8. (Level II-2)

68. Tahseen S, Griffiths M. Vaginal birth after two caesarean sections (VBAC-2)-a systematic review with meta-analysis of success rate and adverse outcomes of VBAC-2 versus VBAC-1 and repeat (third) caesarean sections. BJOG 2010;117:5–19. (Meta-analysis)

69. Cahill AG, Tuuli M, Odibo AO, Stamilio DM, Macones GA. Vaginal birth after caesarean for women with three

or more prior caesareans: assessing safety and success. BJOG 2010;117:422–7. (Level II-2)

70. Flamm BL, Goings JR. Vaginal birth after cesarean section: is suspected fetal macrosomia a contraindication? Obstet Gynecol 1989;74:694–7. (Level II-2)
71. Phelan JP, Eglinton GS, Horenstein JM, Clark SL, Yeh S. Previous cesarean birth. Trial of labor in women with macrosomic infants. J Reprod Med 1984;29:36–40. (Level II-2)
72. Elkousy MA, Sammel M, Stevens E, Peipert JF, Macones G. The effect of birth weight on vaginal birth after cesarean delivery success rates. Am J Obstet Gynecol 2003; 188:824–30. (Level II-2)
73. Peaceman AM, Gersnoviez R, Landon MB, Spong CY, Leveno KJ, Varner MW, et al. The MFMU Cesarean Registry: impact of fetal size on trial of labor success for patients with previous cesarean for dystocia. National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. Am J Obstet Gynecol 2006;195:1127–31. (Level II-2)
74. Chauhan SP, Grobman WA, Gherman RA, Chauhan VB, Chang G, Magann EF, et al. Suspicion and treatment of the macrosomic fetus: a review. Am J Obstet Gynecol 2005;193:332–46. (Level III)
75. Yeh S, Huang X, Phelan JP. Postterm pregnancy after previous cesarean section. J Reprod Med 1984;29:41–4. (Level II-2)
76. Kiran TS, Chui YK, Bethel J, Bhal PS. Is gestational age an independent variable affecting uterine scar rupture rates?. Eur J Obstet Gynecol Reprod Biol 2006;126: 68–71. (Level II-2)
77. Coassolo KM, Stamilio DM, Pare E, Peipert JF, Stevens E, Nelson DB, et al. Safety and efficacy of vaginal birth after cesarean attempts at or beyond 40 weeks of gestation. Obstet Gynecol 2005;106:700–6. (Level II-2)
78. Martin JN Jr, Perry KG Jr, Roberts WE, Meydrech EF. The case for trial of labor in the patient with a prior low-segment vertical cesarean incision. Am J Obstet Gynecol 1997;177:144–8. (Level III)
79. Naef RW 3rd, Ray MA, Chauhan SP, Roach H, Blake PG, Martin JN Jr. Trial of labor after cesarean delivery with a lower-segment, vertical uterine incision: is it safe? Am J Obstet Gynecol 1995;172:1666–73. (Level II-2)
80. Shipp TD, Zelop CM, Repke JT, Cohen A, Caughey AB, Lieberman E. Intrapartum uterine rupture and dehiscence in patients with prior lower uterine segment vertical and transverse incisions. Obstet Gynecol 1999;94:735–40. (Level II-2)
81. Lydon-Rochelle M, Holt VL, Easterling TR, Martin DP. Risk of uterine rupture during labor among women with a prior cesarean delivery. N Engl J Med 2001;345:3–8. (Level II-2)
82. Pruett KM, Kirshon B, Cotton DB, Poindexter AN 3rd. Is vaginal birth after two or more cesarean sections safe?. Obstet Gynecol 1988;72:163–5. (Level III)
83. Beall M, Eglinton GS, Clark SL, Phelan JP. Vaginal delivery after cesarean section in women with unknown types of uterine scar. J Reprod Med 1984;29:31–5. (Level II-2)
84. Leung AS, Farmer RM, Leung EK, Medearis AL, Paul RH. Risk factors associated with uterine rupture during trial of labor after cesarean delivery: a case-control study. Am J Obstet Gynecol 1993;168:1358–63. (Level II-2)
85. Miller DA, Mullin P, Hou D, Paul RH. Vaginal birth after cesarean section in twin gestation. Am J Obstet Gynecol 1996;175:194–8. (Level II-2)
86. Strong TH Jr, Phelan JP, Ahn MO, Sarno AP Jr. Vaginal birth after cesarean delivery in the twin gestation. Am J Obstet Gynecol 1989;161:29–32. (Level III)
87. Myles T. Vaginal birth of twins after a previous Cesarean section. J Matern Fetal Med 2001;10:171–4. (Level II-2)
88. Sansregret A, Bujold E, Gauthier RJ. Twin delivery after a previous caesarean: a twelve-year experience. J Obstet Gynaecol Can 2003;25:294–8. (Level II-2)
89. Cahill A, Stamilio DM, Pare E, Peipert JP, Stevens EJ, Nelson DB, et al. Vaginal birth after cesarean (VBAC) attempt in twin pregnancies: is it safe? Am J Obstet Gynecol 2005;193:1050–5. (Level II-2)
90. Varner MW, Thom E, Spong CY, Landon MB, Leveno KJ, Rouse DJ, et al. Trial of labor after one previous cesarean delivery for multifetal gestation. National Institute of Child Health and Human Development (NICHD) Maternal-Fetal Medicine Units Network (MFMU. Obstet Gynecol 2007;110:814–9. (Level II-3)
91. Grobman WA, Gilbert S, Landon MB, Spong CY, Leveno KJ, Rouse DJ, et al. Outcomes of induction of labor after one prior cesarean. Obstet Gynecol 2007; 109:262–9. (Level II-2)
92. Ravasia DJ, Wood SL, Pollard JK. Uterine rupture during induced trial of labor among women with previous cesarean delivery. Am J Obstet Gynecol 2000;183: 1176–9. (Level II-3)
93. Zelop CM, Shipp TD, Repke JT, Cohen A, Caughey AB, Lieberman E. Uterine rupture during induced or augmented labor in gravid women with one prior cesarean delivery. Am J Obstet Gynecol 1999;181:882–6. (Level II-2)
94. Cahill AG, Waterman BM, Stamilio DM, Odibo AO, Allsworth JE, Evanoff B, et al. Higher maximum doses of oxytocin are associated with an unacceptably high risk for uterine rupture in patients attempting vaginal birth after cesarean delivery. Am J Obstet Gynecol 2008;199:32.e1–32.e5. (Level II-2)
95. Bennett BB. Uterine rupture during induction of labor at term with intravaginal misoprostol. Obstet Gynecol 1997;89:832–3. (Level III)
96. Wing DA, Lovett K, Paul RH. Disruption of prior uterine incision following misoprostol for labor induction in women with previous cesarean delivery. Obstet Gynecol 1998;91:828–30. (Level III)
97. Plaut MM, Schwartz ML, Lubarsky SL. Uterine rupture associated with the use of misoprostol in the gravid patient with a previous cesarean section. Am J Obstet Gynecol 1999;180:1535–42. (Level III)

98. Aslan H, Unlu E, Agar M, Ceylan Y. Uterine rupture associated with misoprostol labor induction in women with previous cesarean delivery. Eur J Obstet Gynecol Reprod Biol 2004;113:45–8. (Level III)

99. Delaney T, Young DC. Spontaneous versus induced labor after a previous cesarean delivery. Obstet Gynecol 2003; 102:39–44. (Level II-2)

100. Bujold E, Blackwell SC, Hendler I, Berman S, Sorokin Y, Gauthier RJ. Modified Bishop's score and induction of labor in patients with a previous cesarean delivery. Am J Obstet Gynecol 2004;191:1644–8. (Level II-3)

101. Grinstead J, Grobman WA. Induction of labor after one prior cesarean: predictors of vaginal delivery. Obstet Gynecol 2004;103:534–8. (Level II-2)

102. Horenstein JM, Phelan JP. Previous cesarean section: the risks and benefits of oxytocin usage in a trial of labor. Am J Obstet Gynecol 1985;151:564–9. (Level II-2)

103. Flamm BL, Goings JR, Fuelberth NJ, Fischermann E, Jones C, Hersh E. Oxytocin during labor after previous cesarean section: results of a multicenter study. Obstet Gynecol 1987;70:709–12. (Level II-3)

104. Bujold E, Blackwell SC, Gauthier RJ. Cervical ripening with transcervical foley catheter and the risk of uterine rupture. Obstet Gynecol 2004;103:18–23. (Level II-3)

105. Hoffman MK, Sciscione A, Srinivasana M, Shackelford DP, Ekbladh L. Uterine rupture in patients with a prior cesarean delivery: the impact of cervical ripening. Am J Perinatol 2004;21:217–22. (Level II-2)

106. Flamm BL, Fried MW, Lonky NM, Giles WS. External cephalic version after previous cesarean section. Am J Obstet Gynecol 1991;165:370–2. (Level II-2)

107. Clock C, Kurtzman J, White J, Chung JH. Cesarean risk after successful external cephalic version: a matched, retrospective analysis. J Perinatol 2009;29:96–100. (Level II-2)

108. Sela HY, Fiegenberg T, Ben-Meir A, Elchalal U, Ezra Y. Safety and efficacy of external cephalic version for women with a previous cesarean delivery. Eur J Obstet Gynecol Reprod Biol 2009;142:111–4. (Level III)

109. Sakala EP, Kaye S, Murray RD, Munson LJ. Epidural analgesia. Effect on the likelihood of a successful trial of labor after cesarean section. J Reprod Med 1990;35:886–90. (Level II-2)

110. Flamm BL, Lim OW, Jones C, Fallon D, Newman LA, Mantis JK. Vaginal birth after cesarean section: results of a multicenter study. Am J Obstet Gynecol 1988;158: 1079–84. (Level II-2)

111. Stovall TG, Shaver DC, Solomon SK, Anderson GD. Trial of labor in previous cesarean section patients, excluding classical cesarean sections. Obstet Gynecol 1987;70:713–7. (Level II-3)

112. Ridgeway JJ, Weyrich DL, Benedetti TJ. Fetal heart rate changes associated with uterine rupture. Obstet Gynecol 2004;103:506–12. (Level II-2)

113. Devoe LD, Croom CS, Youssef AA, Murray C. The prediction of "controlled" uterine rupture by the use of intrauterine pressure catheters. Obstet Gynecol 1992; 80:626–9. (Level II-2)

114. Rodriguez MH, Masaki DI, Phelan JP, Diaz FG. Uterine rupture: are intrauterine pressure catheters useful in the diagnosis? Am J Obstet Gynecol 1989;161:666–9. (Level III)

115. Macones GA, Cahill AG, Stamilio DM, Odibo A, Peipert J, Stevens EJ. Can uterine rupture in patients attempting vaginal birth after cesarean delivery be predicted? Am J Obstet Gynecol 2006;195:1148–52. (Level II-3)

116. Grobman WA, Lai Y, Landon MB, Spong CY, Leveno KJ, Rouse DJ, et al. Prediction of uterine rupture associated with attempted vaginal birth after cesarean delivery. National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. Am J Obstet Gynecol 2008;199:30.e1–30.e5. (Level III)

117. Ritchie EH. Pregnancy after rupture of the pregnant uterus. A report of 36 pregnancies and a study of cases reported since 1932. J Obstet Gynaecol Br Commonw 1971;78:642–8. (Level III)

118. Reyes-Ceja L, Cabrera R, Insfran E, Herrera-Lasso F. Pregnancy following previous uterine rupture. Study of 19 patients. Obstet Gynecol 1969;34:387–9. (Level III)

119. Bhattacharjee N, Ganguly RP, Saha SP. Misoprostol for termination of mid-trimester post-Caesarean pregnancy. Aust N Z J Obstet Gynaecol 2007;47:23–5. (Level II-2)

120. Marinoni E, Santoro M, Vitagliano MP, Patella A, Cosmi EV, Di Iorio R. Intravaginal gemeprost and second-trimester pregnancy termination in the scarred uterus. Int J Gynaecol Obstet 2007;97:35–9. (Level II-2)

121. Daponte A, Nzewenga G, Dimopoulos KD, Guidozzi F. The use of vaginal misoprostol for second-trimester pregnancy termination in women with previous single cesarean section. Contraception 2006;74:324–7. (Level III)

122. Daskalakis GJ, Mesogitis SA, Papantoniou NE, Moulopoulos GG, Papapanagiotou AA, Antsaklis AJ. Misoprostol for second trimester pregnancy termination in women with prior caesarean section. BJOG 2005; 112:97–9. (Level II-3)

123. Dickinson JE. Misoprostol for second-trimester pregnancy termination in women with a prior cesarean delivery. Obstet Gynecol 2005;105:352–6. (Level II-3)

124. Debby A, Golan A, Sagiv R, Sadan O, Glezerman M. Midtrimester abortion in patients with a previous uterine scar. Eur J Obstet Gynecol Reprod Biol 2003;109: 177–80. (Level II-2)

125. Hammond C. Recent advances in second-trimester abortion: an evidence-based review. Am J Obstet Gynecol 2009;200:347–56. (Level III)

126. Goyal V. Uterine rupture in second-trimester misoprostol-induced abortion after cesarean delivery: a systematic review. Obstet Gynecol 2009;113:1117–23. (Level III)

127. Berghahn L, Christensen D, Droste S. Uterine rupture during second-trimester abortion associated with misoprostol. Obstet Gynecol 2001;98:976–7. (Level III)

128. Schneider D, Bukovsky I, Caspi E. Safety of midtrimester pregnancy termination by laminaria and evacuation

in patients with previous cesarean section. Am J Obstet Gynecol 1994;171:554–7. (Level II-3)

129. Berghella V, Airoldi J, O'Neill AM, Einhorn K, Hoffman M. Misoprostol for second trimester pregnancy termination in women with prior caesarean: a systematic review. BJOG 2009;116:1151–7. (Level III)
130. Emmett CL, Murphy DJ, Patel RR, Fahey T, Jones C, Ricketts IW, et al. Decision-making about mode of delivery after previous caesarean section: development and piloting of two computer-based decision aids. DiAMOND Study Group. Health Expect 2007;10: 161–72. (Decision analysis)
131. Shorten A, Shorten B, Keogh J, West S, Morris J. Making choices for childbirth: a randomized controlled trial of a decision-aid for informed birth after cesarean. Birth 2005;32:252–61. (Level I)
132. Moffat MA, Bell JS, Porter MA, Lawton S, Hundley V, Danielian P, et al. Decision making about mode of delivery among pregnant women who have previously had a caesarean section: a qualitative study. BJOG 2007; 114:86–93. (Level III)
133. DeFranco EA, Rampersad R, Atkins KL, Odibo AO, Stevens EJ, Peipert JF, et al. Do vaginal birth after cesarean outcomes differ based on hospital setting? Am J Obstet Gynecol 2007;197:400.e1–400.e6. (Level II-2)
134. Smith GC, Pell JP, Pasupathy D, Dobbie R. Factors predisposing to perinatal death related to uterine rupture during attempted vaginal birth after caesarean section: retrospective cohort study. BMJ 2004;329:375. (Level II-2)
135. Royal College of Obstetricians and Gynaecologists. Birth after previous caesarean birth. Green-top Guideline No. 45. London (UK): RCOG; 2007. Available at: http://www.rcog.org.uk/files/rcog-corp/uploaded-files/GT45BirthAfterPreviousCeasarean.pdf. Retrieved April 23, 2010. (Level III)
136. Guidelines for vaginal birth after previous Caesarean birth. SOGC Clinical Practice Guidelines No. 155. Society of Obstetricians and Gynaecologists of Canada. J Obstet Gynaecol Can 2005;27:164–88. (Level III)

The MEDLINE database, the Cochrane Library, and the American College of Obstetricians and Gynecologists' own internal resources and documents were used to conduct a literature search to locate relevant articles published between January 1985–February 2010. The search was restricted to articles published in the English language. Priority was given to articles reporting results of original research, although review articles and commentaries also were consulted. Abstracts of research presented at symposia and scientific conferences were not considered adequate for inclusion in this document. Guidelines published by organizations or institutions such as the National Institutes of Health and the American College of Obstetricians and Gynecologists were reviewed, and additional studies were located by reviewing bibliographies of identified articles. When reliable research was not available, expert opinions from obstetrician–gynecologists were used.

Studies were reviewed and evaluated for quality according to the method outlined by the U.S. Preventive Services Task Force:

- I Evidence obtained from at least one properly designed randomized controlled trial.
- II-1 Evidence obtained from well-designed controlled trials without randomization.
- II-2 Evidence obtained from well-designed cohort or case–control analytic studies, preferably from more than one center or research group.
- II-3 Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments also could be regarded as this type of evidence.
- III Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

Based on the highest level of evidence found in the data, recommendations are provided and graded according to the following categories:

Level A—Recommendations are based on good and consistent scientific evidence.

Level B—Recommendations are based on limited or inconsistent scientific evidence.

Level C—Recommendations are based primarily on consensus and expert opinion.

The American College of Obstetricians and Gynecologists
409 12th Street, SW, PO Box 96920, Washington, DC 20090-6920

Vaginal birth after previous cesarean delivery. Practice Bulletin No. 115. American College of Obstetricians and Gynecologists. Obstet Gynecol 2010;116:450–63.