15 Cesarean section and vaginal birth after cesarean section

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INTRODUCTION

In the United States, cesarean section was the most common surgical operation in 2006 (1) and about 31.8% of approximately 4.3 million infants born in 2007 were delivered by cesarean section (2). The rates of cesarean section increased dramatically from an annual rate of 5.5% in 1970 to 24.1% in 1986, stabilized between 1986 and 1989, then gradually declined to 21% in 1996, and finally steadily rose again to 31.8% in 2007 (2–5). Between 1996 and 2007, the overall cesarean section rate increased for all pregnant women, regardless of the maternal age, race, and the state of residence (5). The overall rate of cesarean section increased or decreased with the fall or rise in the rate of vaginal birth after previous cesarean section (VBAC), respectively. The overall rate of cesarean section increased by 53% between 1996 and 2007 while the rate of VBAC dramatically declined during the same period (5,6).

Cragin's dictum "once a cesarean, always a cesarean" dates back to 1916, when he suggested that uterine rupture following vaginal delivery after previous cesarean birth was so catastrophic an event that a repeat cesarean should be done prior to the onset of labor (7). This opinion was then cited in the fourth edition of *Williams' Obstetrics* (8) and the attitudes favoring repeat cesarean sections began to prevail. All this dates back to a pre-antibiotic, pre-transfusion era when cesarean section involved a classical uterine incision. In 1980, the *National Institutes of Health (NIH) Consensus Development Conference* pointed out that repeat cesarean was one of the major reasons for the rising cesarean rate. The literature was reviewed and the Consensus Development Task Force on Cesarean Childbirth concurred that labor following a low transverse uterine incision was associated with lower maternal morbidity and mortality, with equivalent infant outcomes. They concluded that VBAC was an appropriate option (9). Subsequently, the rate of VBAC steadily increased from 5% to 28.3% while the overall rate of cesarean section decreased from 25% to 21% between 1985 and 1996 (4). After peaking in 1996, the trend for VBAC was reversed with the rates of VBAC plummeted to 12.6% in 2002 and to 8.5% in 2006 with a concomitant rise of overall cesarean section to 31.1% in 2006 (10). The reverse trend in VBAC could be attributed to (i) the increased number of reports of maternal complications and perinatal morbidities and mortalities associated with VBAC (11–15) and (ii) professional liability concerns (16). The overall success rates of VBAC is about 74% with a range from 54% to 89% (5,6,17–19). The indications for the primary cesarean sections such as failure to progress, breech presentation, fetal distress, and genital herpes infection do not appear to influence the high success rate of VBAC delivery (17–19). Factors that are associated with a higher rate of successful

VBAC include spontaneous labor, birth weight of less than 4000 g, and a history of prior vaginal delivery especially a prior successful VBAC (1,5,6,20–23).

RISK OF UTERINE RUPTURES

Oxytocin

The risk of uterine rupture in patients undergoing trial of labor after cesarean section (TLCS) ranges from 0.4% to 0.5% with spontaneous labor and 0.8% to 1.1% with oxytocin induction of labor (24,25). The higher the maximum dose of oxytocin, the higher the risk of uterine rupture (26). Similarly, overuse of oxytocin to augment labor for prolonged latent phase in patients undergoing TLCS is associated with a risk of uterine rupture 2.7 times that of a control group (26,27). The risk of uterine rupture is not increased if uterine pressure is carefully monitored, preferably with an intrauterine pressure catheter (28).

Prostaglandin Use

The risk of uterine rupture in patients undergoing TLCS ranges from 0.4% to 0.5% with spontaneous labor and 1.4% to 2.2% with prostaglandin induction of labor (24,25). The increased risk of uterine rupture seems to exist only in the setting of sequential process of cervical ripening with prostaglandin E₂ then induction of labor with intravenous oxytocin (29). In addition, the use of prostaglandin E₁ (misoprostol) in patients with previous cesarean sections is consistently associated with a much higher risk of uterine rupture (30–33). Limited data suggest that cervical ripening with prostaglandin (PGE₂) gel alone in patients with a previous low transverse cervical cesarean section appears to be safe, without the increased risk of uterine rupture of maternal perinatal morbidity or mortality (29). Careful monitoring of uterine contraction and fetal heart rates (FHRs) is strongly recommended.

Induction of labor with prostaglandins including misoprostol during the second trimester for fetal demise in patients with previous cesarean sections is a reasonable option since it carries a uterine rupture risk of less than 1% that is comparable with that of unscarred uterus (34–36).

Epidural Anesthesia

The initial concern of epidural anesthesia for analgesia in masking the symptoms and signs of uterine rupture such as pain or hypotension in patients undergoing TLCS has not been supported by clinical data. Epidural anesthesia is not associated with an increased risk of uterine rupture in patients undergoing TLCS (27,37). The use of epidural anesthesia allows adequate pain relief during labor and ready access to safe anesthesia when cesarean section is required.

Fetal Macrosomia

Fetal macrosomia is defined as a fetus having an estimated weight of 4000 g or more (38). Trial of labor in patients with fetal macrosomia is not associated with an increased risk of uterine rupture and perinatal or maternal morbidity or mortality (27,39). It is uncertain whether fetal macrosomia affects the success rates of VBAC (40). One study showed VBAC success rates of 78% with infants having birth weights of <4000 g, 58% with birth weights between 4000 and 4499 g, and 26% with birth weights of >4500 g (41). Another study showed a lower VBAC success rate if the neonatal birth weight of the index pregnancy is larger than the one associated with a prior cesarean section done for cephalopelvic dystocia (42). Trial of labor should not be discouraged because of fetal macrosomia, in view of its safety and the inaccuracy of predicting fetal weight in macrosomic fetuses.

Breech Presentation

External version can be safely performed in patients with a previous cesarean section, followed by a trial of labor and vaginal delivery (43). Success rates of 82% for external cephalic version and 65% for subsequent vaginal delivery have been reported (44).

Twins

The management of patients with multiple gestations remains a topic of debate. There are inadequate data on the management of patients with previous cesarean sections who have multiple gestations (45–48).

Amnioinfusion

Amnioinfusion has been performed for indications such as oligohydramnios, meconium-stained amniotic fluid, and variable FHR decelerations in patients with previous cesarean sections. The success rates of VBAC range from 58% to 83% without a significant increase in the incidences of uterine rupture and maternal or perinatal morbidity/mortality (49,50). The incidence of uterine rupture is 0.8% (49). Amnioinfusion does not appear to be a contraindication for a trial of labor in patients with previous cesarean sections.

Multiple Previous Cesarean Sections

Patients undergoing a trial of labor after having more than one previous cesarean section have VBAC success rates ranging from 64% to 77% that were comparable with those with one previous cesarean section (17,18,51–56). Uterine wound separation appeared to be increased, even though not statistically significantly in patients with multiple previous cesarean sections compared with those with a single previous cesarean section (52). There was no increased perinatal morbidity or mortality that could be attributed to uterine separation or rupture (17,52). More recent studies demonstrated that the risk of uterine rupture was inconsistent, either about the same (0.9% for one previous cesarean section vs. 0.7% for multiple ones) or increased (0.9% for one previous cesarean section vs. 1.8% for two previous ones) (53,54). Thus, a trial of labor for patients with two previous cesarean sections is still a reasonable option in the presence of other favorable factors for successful VBAC.

A Previous Low Uterine Vertical Cesarean Section

Patients who undergo a trial of labor after a previous low uterine vertical cesarean section have VBAC success rates ranging from 83% to 85%, risks of uterine rupture ranging from 1.1% to 1.3%, and no maternal deaths. There is no significantly increased incidence of maternal or perinatal morbidity/mortality due to uterine rupture (57–59). Therefore, a trial of labor could be attempted in patients who had a previous low vertical uterine cesarean section with close maternal and fetal monitoring.

Unknown Uterine Scar

Documentation of the uterine incision in the previous cesarean section is one of the main criteria for undergoing a trial of labor. A dilemma occurs when the type of uterine incision is unknown. Limited data reveal that the rate of uterine rupture is 2.2% without a significant increase in maternal or perinatal mortality or morbidity (60). Augmentation of labor during the latent phase with intravenous oxytocin increased the incidence of uterine separation compared with that of patients who were managed expectantly without oxytocin (61).

In 1984, Beall and coworkers (62) reported on 451 women with unknown types of uterine scar. Ninety-seven patients labored with an 87% vaginal delivery rate. The rate of scar dehiscence in the women who labored was 1% that did not significantly differ from the one in women with unknown scar who did not labor. Perinatal mortality was similar in both groups.

CONCLUSIONS

The risk of uterine rupture in patients undergoing TLCS varies with the type of previous uterine incision and the number of previous cesarean sections. The risks of uterine rupture range from 0.6% to 0.9% with one previous low transverse uterine incision (19,28,53,54,63–66), 0.7% to 1.8% with more than one previous low transverse uterine incision (53,54,56,57), and is about 12% with a previous classical uterine incision (59). Other predisposing factors include excessive amount of intravenous oxytocin for augmentation or induction of labor, and dysfunctional labor. Fetal macrosomia and epidural anesthesia do not appear to increase the risk of uterine rupture (27). Signs of uterine rupture include abdominal pain, vaginal bleeding, abnormal labor, and abnormal FHR patterns such as sudden onset of prolonged fetal bradycardia and severe variable decelerations (18,67). Trial of labor in patients with previous cesarean sections does not increase maternal mortality compared with those undergoing elective cesarean section (59).

Despite the reassuring data, VBAC has been steadily decreased during the last decade. Undue concern from both obstetricians and patients about the potential maternal, fetal complications and legal issues associated with uterine rupture and the convenience of scheduled cesarean sections have contributed to the low rate of trial of labor. Patients with a previous low transverse cervical cesarean section should be encouraged to undergo a trial of labor. In addition to the low risk of uterine rupture, patients who have successful VBAC have significantly lower maternal morbidity in comparing with those undergoing elective repeat cesarean section (19,68). Trial

of labor may be offered to patients who have two previous low transverse cervical cesarean sections. Patients with a low vertical uterine cesarean section or unknown uterine scar should not be discouraged from a trial of labor after being informed of the slightly higher risk of uterine ruptures (up to 2%) and potential-associated maternal or perinatal complications. Fetal macrosomia is not a contraindication for a trial of labor. Epidural anesthesia for pain control may be offered to patients who undergo VBAC. Fetal heart rate, maternal labor and medical condition should be closely monitored during labor. The American College of Obstetricians and Gynecologists has recommended that the institution's resources and the medical staff should be *immediately available* to respond to maternal and perinatal emergencies including *emergency cesarean section delivery* if a trial of labor after a previous cesarean section is undertaken (69).

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