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Guidelines for Vaginal Birth After Previous Caesarean Birth

This guideline has been prepared and reviewed by the Clinical Practice Obstetrics Committee and approved by the Executive and Council of the Society of Obstetricians and Gynaecologists of Canada.

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Abstract

Objective: To provide evidence-based guidelines for the provision of a trial of labour (TOL) after Caesarean section.

Outcome: Fetal and maternal morbidity and mortality associated with vaginal birth after Caesarean (VBAC) and repeat Caesarean section.

Evidence: MEDLINE database was searched for articles published from January 1, 1995, to February 28, 2004, using the key words "vaginal birth after Caesarean (Cesarean) section." The quality of evidence is described using the Evaluation of Evidence criteria outlined in the Report of the Canadian Task Force on the Periodic Health Exam.

Key Words: Vaginal birth after Caesarean, trial of labour, uterine rupture, induced labour, oxytocin, prostaglandins, misoprostol

Recommendations:

1. Provided there are no contraindications, a woman with 1 previous transverse low-segment Caesarean section should be offered a trial of labour (TOL) with appropriate discussion of maternal and perinatal risks and benefits. The process of informed consent with appropriate documentation should be an important part of the birth plan in a woman with a previous Caesarean section (II-2B).
2. The intention of a woman undergoing a TOL after Caesarean section should be clearly stated, and documentation of the previous uterine scar should be clearly marked on the prenatal record (II-2B).
3. For a safe labour after Caesarean section, a woman should deliver in a hospital where a timely Caesarean section is available. The woman and her health care provider must be aware of the hospital resources and the availability of obstetric, anesthetic, pediatric, and operating-room staff (II-2A).
4. Each hospital should have a written policy in place regarding the notification and (or) consultation for the physicians responsible for a possible timely Caesarean section (III-B).
5. In the case of a TOL after Caesarean, an approximate time frame of 30 minutes should be considered adequate in the set-up of an urgent laparotomy (III-C).
6. Continuous electronic fetal monitoring of women attempting a TOL after Caesarean section is recommended (II-2A).
7. Suspected uterine rupture requires urgent attention and expedited laparotomy to attempt to decrease maternal and perinatal morbidity and mortality (II-2A).
8. Oxytocin augmentation is not contraindicated in women undergoing a TOL after Caesarean section (II-2A).
9. Medical induction of labour with oxytocin may be associated with an increased risk of uterine rupture and should be used carefully after appropriate counselling (II-2B).
10. Medical induction of labour with prostaglandin E2 (dinoprostone) is associated with an increased risk of uterine rupture and should not be used except in rare circumstances and after appropriate counselling (II-2B).
11. Prostaglandin E1 (misoprostol) is associated with a high risk of uterine rupture and should not be used as part of a TOL after Caesarean section (II-2A).
12. A foley catheter may be safely used to ripen the cervix in a woman planning a TOL after Caesarean section (II-2A).
13. The available data suggest that a trial of labour in women with more than 1 previous Caesarean section is likely to be successful but is associated with a higher risk of uterine rupture (II-2B).
14. Multiple gestation is not a contraindication to TOL after Caesarean section (II-2B).

15. Diabetes mellitus is not a contraindication to TOL after Caesarean section (II-2B).
16. Suspected fetal macrosomia is not a contraindication to TOL after Caesarean section (II-2B).
17. Women delivering within 18 to 24 months of a Caesarean section should be counselled about an increased risk of uterine rupture in labour (II-2B).
18. Postdatism is not a contraindication to a TOL after Caesarean section (II-2B).
19. Every effort should be made to obtain the previous Caesarean section operative report to determine the type of uterine incision used. In situations where the scar is unknown, information concerning the circumstances of the previous delivery is helpful in determining the likelihood of a low transverse incision. If the likelihood of a lower transverse incision is high, a TOL after Caesarean section can be offered (II-2B).

Validation: These guidelines were approved by the Clinical Practice Obstetrics and Executive Committees of the Society of Obstetricians and Gynaecologists of Canada.

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BACKGROUND

This document reviews the contraindications to and maternal and fetal risks of a trial of labour (TOL) after Caesarean birth and makes recommendations for achieving vaginal birth after Caesarean (VBAC) safely. Delivery by Caesarean section occurs in 15% to 25% of births.[1–5] In 2000 and 2001, the Caesarean section rate in Canada was 21.2%.[6] The most frequent indications for Caesarean delivery are previous Caesarean delivery, dystocia, malpresentation, and nonreassuring fetal status.[7,8] In any given region, the rate of birth by Caesarean section and the rate of VBAC tend to be inversely related.[4] Schell first reported VBAC in 1923, describing the successful vaginal delivery of 34 infants in 23 mothers with previous Caesarean deliveries.[9]

A trial of labour after Caesarean should be considered in women who present for prenatal care with a history of previous Caesarean birth.[10–12] In certain situations, a TOL after Caesarean will be contraindicated[3] and a repeat Caesarean section will be advised, but in most cases, successful vaginal birth can be safely achieved for both mother and infant.[13–15] Women and their health care providers will need to discuss the risks and benefits of VBAC when planning the birth.

A Canadian consensus statement on VBAC was published in 1985, and Clinical Practice Guidelines were published by the Society of Obstetricians and Gynaecologists of Canada (SOGC) in 1997.[3] This document updates the 1997 SOGC Guidelines with articles published from January 1, 1995, to February 28, 2004. Articles were obtained by searching the MEDLINE database, using the key words "vaginal birth after Caesarean (Cesarean) section." The data are limited by 3 important factors: first, there are no randomized trials of TOL versus elective repeat Cesarean section (ERCS); second, adverse maternal or perinatal outcomes are rare, and large study populations are necessary to observe a significant difference in maternal and perinatal outcomes; and finally, a woman's choice to attempt TOL after Caesarean is heavily influenced by her health care provider and local resources, often leading to selection bias in published reports.[12,16]

The level of evidence and quality of the recommendations in this guideline have been determined using the criteria described by the Canadian Task Force on the Periodic Health Examination (Table).[17]

TRIAL OF LABOUR VERSUS ELECTIVE REPEAT CAESAREAN SECTION

The success rate of a TOL after Caesarean ranges between 50% and 85%.[3,4,14,18–21] In a study examining 1776 women undergoing TOL after Caesarean, the overall success rate was 74%.[14] A Canadian study reported similar results, quoting a success rate of 76.6%.[2] Predictors of successful VBAC include nonrecurring indication for Caesarean birth, such as malpresentation (odds ratio [OR], 1.9; 95% confidence interval [CI], 1.0–3.7)[22] or gestational hypertension (OR, 2.3; 95% CI, 1.0–5.8),[22] and a previous vaginal delivery (OR, 1.8; 95% CI, 1.1–3.1),[22] where success rates are as high as 82%.[1,22,23] When the previous Caesarean birth was for dystocia, failure to progress, or cephalopelvic disproportion, some studies found the rates of successful VBAC comparable,[24,25] while others reported lower-than-expected rates.[14,18,22,26]

In 1996 McMahon *et al.* published a report of maternal morbidity in TOL compared with ERCS in Nova Scotia from 1986 to 1992.[1] In an examination of 3249 women undergoing a TOL and 2889 women who delivered by ERCS, the risk of major complications (for example, hysterectomy, uterine rupture, and operative injury) was almost doubled (1.6% vs. 0.8%) in the TOL group (OR, 1.8; 95% CI, 1.1–3.0).[1] Complications like puerperal fever, transfusion, and abdominal wound infection were comparable. When comparing women who had a successful TOL with those who required a repeat Caesarean section after failed TOL, the risks were greater of operative injury (3.0% vs. 0.1%; OR, 5.1; 95% CI, 2.5–10.7) and fever (8.0% vs. 3.5%; OR, 1.5; 95% CI, 1.3–1.8) in the failed TOL group.[1] Hibbard *et al.* also reported a greater rate of complication in women who attempted a TOL and failed.[27]

In 1999 Rageth *et al.* reviewed 17 613 TOL and 11 433 ERCS deliveries.[20] The rates of hysterectomy (relative risk [RR], 0.36; 95% CI, 0.23–0.56), febrile morbidity (RR, 0.65; 95% CI, 0.55–0.77), and thromboembolic complications (RR, 0.52; 95% CI, 0.34–0.78) were less in the TOL group than in the ERCS group.[20] There is less blood loss with a successful VBAC (OR, 0.50; 95% CI, 0.3–0.9)[27] and a shorter hospital stay with a more rapid recovery and return to full activity.

Table Criteria for quality of evidence assessment and classification of recommendations

Level of results*	Classification of recommendations†
I: Evidence obtained from at least one properly randomized controlled trial.	A. There is good evidence to support the recommendation that the condition be specifically considered in a periodic health examination.
II-1: Evidence from well-designed controlled trials without randomization.	B. There is fair evidence to support the recommendation that the condition be specifically considered in a periodic health examination.
II-2: Evidence from well-designed cohort (prospective or retrospective) or case-control studies, preferably from more than one centre or research group.	C. There is poor evidence regarding the inclusion or exclusion of the condition in a periodic health examination, but recommendations may be made on other grounds.
II-3: Evidence obtained from comparisons between times or places with or without intervention. Dramatic results in uncontrolled experiments (such as the results of treatment with penicillin in the 1940s) could also be included in this category.	D. There is fair evidence to support the recommendation that the condition not be considered in a periodic health examination.
III: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.	E. There is good evidence to support the recommendation that the condition be excluded from consideration in a periodic health examination.

*The quality of evidence reported in these guidelines has been described using the Evaluation of Evidence criteria outlined in the Report of the Canadian Task Force on the Periodic Health Exam.

†Recommendations included in these guidelines have been adapted from the ranking method described in the Classification of Recommendations found in the Report of the Canadian Task Force on the Periodic Health Exam.

Rosen *et al.* also reported that the risk of febrile morbidity is lower in women who attempt a TOL after Caesarean (OR, 0.5; 95% CI, 0.5–0.6) and is lowest in those who succeed (OR, 0.2; 95% CI, 0.2–0.2), compared with ERCS, but is increased in those who attempt a TOL and ultimately deliver by Caesarean (OR, 2.0; 95% CI, 1.7–2.5).[28]

An examination of 16 938 Finnish women who had undergone a Caesarean delivery found that previous Caesarean section is associated with an increased risk of ectopic pregnancy (RR, 1.28), placenta previa (RR, 3.89), and abruptio placenta (RR, 2.41).[29] A repeat Caesarean has been associated with an increase in the risk of placenta previa (OR, 1.59; 95% CI, 1.21–2.08)[30] and placenta accreta in subsequent pregnancies.[31]

A meta-analysis published in 2000 demonstrated that the overall risk of perinatal death is increased in women attempting a TOL (OR, 1.71; 95% CI, 1.28–2.28).[32] The risks of perinatal mortality and severe morbidity are directly related to uterine rupture as a sentinel event. If uterine rupture occurs, the risks of perinatal mortality and severe morbidity are increased. The risk of suspected neonatal sepsis is greater in women attempting TOL but appears to be confined to those who fail TOL and require a repeat Caesarean section (OR, 4.8; 95% CI, 2.6–9.0).[33] In women who choose ERCS, the risk of respiratory problems in the newborn is increased (6% vs. 3%), compared with women who have a successful VBAC (OR, 2.3; 95% CI, 1.4–3.8).[33]

CONTRAINDICATIONS TO VAGINAL BIRTH AFTER CAESAREAN SECTION

The following situations are contraindications to a TOL after Caesarean:

1. previous classical or inverted "T" uterine scar[3,13];

2. previous hysterotomy or myomectomy entering the uterine cavity[3,19];

3. previous uterine rupture[3,19];

4. presence of a contraindication to labour, such as placenta previa or malpresentation[3];

5. the woman declines a TOL after Caesarean and requests ERCS.[3,19]

Recommendation

1. Provided there are no contraindications, a woman with 1 previous transverse low-segment Caesarean section should be offered a trial of labour after Caesarean with appropriate discussion of maternal and perinatal risks and benefits. The process of informed consent with appropriate documentation should be an important part of the birth plan in women with a previous Caesarean section (II-2B).

PLANNING A TRIAL OF LABOUR AFTER CAESAREAN SECTION

A woman and her health care provider must decide together whether an appropriate situation exists for considering TOL after Caesarean. The evaluation and discussion should address the issues outlined below and should be well documented in the prenatal record or chart.

Documentation of Previous Uterine Incision

Documentation of the location and type of uterine incision used during the previous Caesarean section is ideal.[3] In most cases, this information can be obtained by reviewing the operative record from the previous surgery. Other information in this record, such as the indication for the Caesarean section and the opinion of the previous surgeon, may be helpful in counselling as well. The fact that the record has been reviewed and that no contraindications to a TOL after Caesarean are present should be documented clearly on the prenatal record.[34] If the operative record is not available, the scar is considered "unknown." Review of the operative report from previous hysterotomy or myomectomy should be documented in detail.

Recommendation

2. The intention of a woman undergoing a TOL after Caesarean should be clearly stated, and documentation of the previous uterine scar should be clearly marked on the prenatal record (II-2B).

Facilities and Resources

A trial of labour after Caesarean is always associated with a risk of uterine rupture, however small, and a good outcome is not guaranteed under any circumstances. Further, little evidence exists about the exact timing of a Caesarean section following a suspected uterine rupture, which would prevent a poor neonatal outcome. A TOL after Caesarean can be offered to women within any hospital setting where there is an ability to perform a Caesarean section.[13,34,35] This document does not intend to set a standard regarding whether staff must be "in house" or "on site" to provide safe intrapartum care and therefore makes no statements on such attendance. Facilities providing TOL after Caesarean should have a policy in place to manage such parturients, so that all resources are mobilized promptly if an intrapartum emergency occurs.[23] The SOGC recognizes that in such cases of maternal fetal compromise, necessitating timely Caesarean section, an approximate time frame of 30 minutes may be required to assemble the team and commence laparotomy. This availability and time required for obstetric, anesthetic, and pediatric services to attend such an emergency should be fully discussed with the woman. Women who live in areas where local hospitals cannot provide a timely Caesarean section should be offered the opportunity for transfer to a facility where this service is available, in order to permit a TOL after Caesarean.[13] The members of the team who could be called urgently in the case of an intrapartum complication (anesthetic, pediatric, and obstetric services) should be notified that the woman is in hospital and in labour, and their availability should be confirmed.

Labour and delivery in women who have had a previous Caesarean section should be conducted in a hospital setting with facilities for a laparotomy.

Recommendation

3. For a safe labour after Caesarean section, the woman should deliver in a hospital where a timely Caesarean section is available. The woman and her health care provider must be aware of the hospital resources and the availability of obstetric, anesthetic, pediatric, and operating-room staff (II-2A).

4. Each hospital should have a written policy in place regarding the notification and (or) consultation for the physicians responsible for a possible timely Caesarean (III-B).

5. In the case of a TOL after Caesarean, an approximate time frame of 30 minutes should be considered adequate in the set-up of an urgent laparotomy (III-C).

Maternal Monitoring

Women planning a TOL after Caesarean should have appropriate monitoring in labour. The presence of a devoted birth attendant is ideal. Progress of labour should be assessed frequently, as there is some evidence that prolonged or desultory labour is associated with an increased risk of failure and uterine rupture.[19,36,37] Epidural analgesia is not contraindicated.[7,19,34,38]

Fetal Monitoring

Continuous electronic fetal monitoring in labour is recommended for all women attempting TOL after Caesarean.[19,34,39] The most reliable first sign of uterine rupture is a nonreassuring fetal heart tracing.[34] This may be sudden in onset and may not be related to contractions.[40]

Recommendation

6. Continuous electronic fetal monitoring of women attempting TOL after Caesarean is recommended (II-2A).

POSTPARTUM EVALUATION

Routine digital exploration of the Caesarean scar postpartum is not necessary, except when signs or symptoms suggest uterine rupture.[41]

UTERINE RUPTURE

Uterine rupture, the most serious complication of a TOL after Caesarean, is defined as complete separation of the myometrium with or without extrusion of the fetal parts into the maternal peritoneal cavity and requires emergency Caesarean section or postpartum laparotomy.[19,42] It is an uncommon complication of VBAC but is associated with significant maternal and perinatal morbidity and mortality.[1,7] The most common sign or symptom of uterine rupture is nonreassuring fetal heart rate monitoring.[18,20,43] Other clinical signs include the cessation of contractions,

loss of the presenting part on vaginal examination, abdominal pain, vaginal bleeding, hematuria, or maternal cardiovascular instability.[16,44]

The type and location of the previous uterine incision helps to determine the risk of uterine rupture. The incidence of uterine rupture is 0.2% to 1.5% in women who attempt labour after a transverse lower uterine segment incision[14,16,18,27,45] and 1% to 1.6% in women who have had a vertical incision in the lower uterine segment.[46–49] The risk is 4% to 9% with a classical or "T" incision; thus TOL after Caesarean is contraindicated in these situations.[16,19,30] Shimonovitz *et al.* found the risk of uterine rupture after 0, 1, 2, and 3 VBAC deliveries to be 1.6%, 0.3%, 0.2%, and 0.35%, respectively, indicating that the risk of uterine rupture decreases after the first successful VBAC.[50]

Since uterine rupture is a rare event, a realistic appraisal of potential maternal and perinatal risks is difficult to accomplish outside of large series, literature reviews, or meta-analyses. The most important published reports in this area are discussed below, as well as those applicable to the Canadian population.

In 1991 Rosen *et al.* performed a meta-analysis of 10 studies that examined a total of 4617 women who had a TOL after Caesarean compared with 3831 women who had ERCS births.[28] The rate of uterine rupture was similar in the 2 groups: TOL 0.18% and ERCS 0.19% ($P = 0.5$). There was no difference in the rate of maternal death (0.028% vs. 0.024%) or perinatal death (0.3% vs. 0.4%) in the TOL group, compared with the ERCS group.[28]

In 2000 Mozurkewich and Hutton published a meta-analysis of 15 studies that examined a total of 28 813 women undergoing a TOL compared with ERCS between 1989 and 1999.[32] There was an increased rate of uterine rupture (0.39% vs. 0.16%; OR, 2.1; 95% CI, 1.45–3.05) and perinatal mortality (0.58% vs. 0.28%; OR, 1.71; 95% CI, 1.28–2.28) in the TOL group. The rates of maternal mortality and low 5-minute Apgar scores were not different.[32]

In 2002 Keiser *et al.* reviewed the incidence and consequences of uterine rupture in Nova Scotia from 1988 to 1997.[51] Among 4516 women undergoing a TOL, 18 (0.39%) uterine ruptures were documented over 10 years. All women underwent laparotomy, and there were no maternal deaths. Of those who had a uterine rupture, 3 women underwent hysterectomy, 10 required transfusion, and 5 suffered a cystotomy. After excluding lethal anomalies, there was 1 perinatal death (0.02%) and 6 neonates with severe asphyxia (0.13%).[51]

In 2002 Bujold *et al.* examined the risk factors for serious neonatal morbidity associated with 23 cases of uterine rupture among 2233 women attempting a TOL (rate 1.03%).[52] Nine neonates (0.4%) had a pH < 7.0 (severe metabolic acidosis), 3 (0.13%) were diagnosed with hypoxic ischemic encephalopathy, and 1 (0.04%) died.[52] The presence of placental or fetal part extrusion at laparotomy was associated with severe metabolic acidosis ($P < 0.001$).[52] Other variables (e.g., induction, birth weight, or use of epidural) did not demonstrate an association with uterine rupture. Even in situations where very rapid decision to delivery times were recorded, some cases of perinatal acidosis could not be avoided.[52]

Smith *et al.* published a large series of 15 515 women undergoing a TOL after Caesarean compared with 9014 women who underwent ERCS between 1992 and 1997.[53] The rate of perinatal death in the TOL group was 0.129%, 11.6 times higher than that of the ERCS group (OR, 11.6; 95% CI, 1.6–86.7).[53] Smith compared this to the risk of perinatal death in other common obstetrical situations: TOL compared with multiparous women in labour (OR, 2.2; 95% CI, 1.3–3.5) and TOL compared with nulliparous women in labour (OR, 1.3; 95% CI, 0.8–21).[53]

In 2003 Chauhan *et al.* published a review of data on the maternal and perinatal complications of uterine rupture in those attempting a TOL after Caesarean.[54] Examining 142 075 trials of labour revealed an overall rate of uterine rupture of 0.62%.[54] The rate of maternal death was 0.002%; hysterectomy, 0.09%; transfusion, 0.18%; and genitourinary tract injury, 0.08%.[54] In this study, the rate of neonatal acidosis was 0.15%, and the rate of perinatal death was 0.04%.[54] Oxytocin was involved in 43% of the uterine ruptures in this series.[54]

The data indicate that the relative risk of uterine rupture, maternal morbidity, and perinatal mortality or severe morbidity is increased in women undergoing a TOL after Caesarean, compared with ERCS, but that the absolute risk remains very low.

The treatment of suspected uterine rupture is timely laparotomy after maternal stabilization and anaesthesia. Urgent intervention is mandatory to obtain the best possible outcome for both mother and fetus. Once the fetus is delivered, maternal hemorrhage must be arrested, and if the uterus cannot be salvaged, hysterectomy may be required.

Although the risk of uterine rupture has been found to be increased in situations of prolonged labour with augmentation,[55] when Phelan *et al.* retrospectively examined the patterns of uterine activity before uterine rupture, no association with frequency or intensity of contractions could be discerned.[40]

In 1996 Rozenberg *et al.* examined ultrasonographic measurement of the lower uterine segment's myometrial thickness at 36 to 38 weeks' gestation as a predictor of uterine rupture and found that if the lower segment thickness was less than 3.5 mm, the risk of uterine rupture or dehiscence was 11.8%; if the measurement was greater than 3.5 mm, the risk of uterine rupture was minimal.[56] However, the

incidence of uterine rupture in this population was 2.3%, significantly greater than the usually quoted 1%. Therefore, the positive predictive value of this test in clinical practice will be much lower.[56] In a follow-up open study, Rozenberg *et al.* found that the use of the lower-uterine-segment measurement helped clinicians select women for a TOL after Caesarean.[57] The rate of successful VBAC for those with 1 previous Caesarean section did not change but was increased in those with 2 previous Caesarean deliveries.[57] These findings will need to be confirmed in further randomized studies before ultrasonography can be used to make a decision about the safety of TOL after Caesarean.

Recommendation

7. Suspected uterine rupture requires urgent attention and expedited laparotomy to attempt to decrease maternal and perinatal morbidity and mortality (II-2A).

OXYTOCICS AND TOL AFTER CAESAREAN SECTION

Augmentation

In 1987 Flamm *et al.* performed a multicentre examination of 485 women who received oxytocin to augment their spontaneous labour in a planned TOL after Caesarean.[58] No increase in the risk of uterine rupture, maternal morbidity, or perinatal morbidity or mortality was detected.[58] Zelop *et al.* supported the same conclusion about the risk of uterine rupture with augmentation in a 1999 study (OR, 2.3; 95% CI, 0.8–7.0).[59] Goetzl *et al.* examined the relation between the dose of oxytocin used and the risk of uterine rupture in women undergoing a TOL after Caesarean.[60] No significant association was detected between exposure to oxytocin and the risk of uterine rupture.[60] Careful surveillance for progress of labour is required, especially when the diagnosis of dystocia is being considered.[19,34] There are insufficient studies examining the use of other agents to augment labour, such as prostaglandins, and their safety in a TOL after Caesarean.

Induction

In 2000 Ravasia *et al.* reviewed the risk of uterine rupture in women undergoing an induction TOL after Caesarean.[61] In 575 women with a previous Caesarean section, labour was induced with prostaglandin E2 gel (n = 172), intracervical foley catheter (n = 129), or amniotomy and (or) oxytocin (n = 274).[61] Outcomes were compared with women undergoing a TOL with spontaneous labour. The risk of uterine rupture was not increased in women who underwent either amniotomy/oxytocin or foley catheter induction but was significantly increased in those who underwent a prostaglandin E2 induction ($P = 0.004$).[61]

Also in 2000, Sanchez-Ramos *et al.* performed a meta-analysis looking at the efficacy and safety of prostaglandin E2 for cervical ripening in women with a previous Caesarean section and found it to be effective and not associated with an increased risk of uterine rupture (OR, 1.46; 95% CI, 0.96–2.22), compared with spontaneous labour.[62]

In 2003 Delaney and Young reported the examination of 3746 women with a prior Caesarean delivery who underwent either induced or spontaneous labour.[63] They found that induced labour was associated with a greater risk of early postpartum hemorrhage (7.3% vs. 5.0%: OR, 1.66; 95% CI, 1.18–2.32), Caesarean delivery (37.5% vs. 24.2%: OR, 1.84; 95% CI, 1.51–2.25), and admission to a neonatal intensive care unit (13.3% vs. 9.4%: OR, 1.69; 95% CI, 1.25–2.29).[63] There was a trend toward a higher rate of uterine rupture, but this was not statistically significant (0.7% vs. 0.3%, $P = 0.128$).[63]

In another retrospective study of 560 women, the rate of uterine rupture in women whose labour was induced with oxytocin was 2%, with prostaglandin was 2.9%, and with both was 4.5%.[59]

Up to 2001, there were conflicting data on the risk of labour induction with prostaglandin E2. Several other smaller studies reported that it appeared to be safe, effective, and not associated with an increased risk of uterine rupture.[45,64–66]

In the largest study published to date, conducted by Lydon-Rochelle *et al.*, the incidence of uterine rupture was reviewed retrospectively in 20 095 women with a previous Caesarean section and was reported as follows: ERCS (no labour) 0.16%; spontaneous labour 0.52% (RR, 3.3; 95% CI, 1.8–6.0); labour induced without prostaglandin 0.77% (RR, 4.9; 95% CI, 2.4–9.7); and labour induced with prostaglandin 2.45% (RR, 15.6; 95% CI, 8.1–30.0).[67]

As for all inductions, the indication for induction in women undergoing a planned TOL after Caesarean should be compelling and documented. The possibility that the use of oxytocin and (or) prostaglandin for labour induction in women considering TOL after Caesarean may be associated with an increased risk of uterine rupture and its sequelae must be discussed with the parturient. The absolute risks of uterine rupture are low, but the relative risks (especially with the use of prostaglandin E2, compared with spontaneous labour) are greater.

Misoprostol

Misoprostol has been proposed as an effective and economical agent for cervical ripening and induction.[68] In 1998 Sciscione *et al.* reported a case of uterine rupture in a woman with 2 previous Caesarean deliveries after misoprostol was administered as a cervical ripening agent.[69] Several small series reported a risk from 0% to 11.7% of uterine rupture with misoprostol in women undergoing a TOL after Caesarean [43,70–73] Blanchette *et al.* compared prostaglandin E2 to misoprostol in women undergoing induction TOL after

Caesarean and found them to be equally effective, but misoprostol was associated with a higher incidence of uterine rupture (18.8% compared to no ruptures in the prostaglandin E2 group).[74] The numbers in all these studies are small, and it is difficult to draw meaningful conclusions. Until further randomized studies are completed, misoprostol should be discouraged as a method of induction or cervical ripening in women with previous Caesarean delivery.[74,75]

CERVICAL PREPARATION

In situations where delivery is indicated and the cervix is unfavourable, TOL after Caesarean can be considered. Various methods of cervical ripening have been examined. In a cohort study published in 2002, Ben-Aroya *et al.* compared women undergoing a trial of labour after Caesarean section in 3 situations: spontaneous labour (n = 1432), prostaglandin cervical ripening (n = 55), and cervical ripening by foley catheter (n = 161).[76] There was a significantly higher rate of dystocia (30.4% vs. 11.6%, $P < 0.01$) and repeat Caesarean section in the second stage (49.1% vs. 35.2%, $P < 0.01$) in the foley catheter group, compared with the control group.[76] There was no difference in the rate of uterine rupture, fetal distress, or Apgar scores.[76] In a Canadian study published in 2004, Bujold *et al.* compared the rate of uterine rupture in 1807 women who presented in spontaneous labour, 417 induced with amniotomy with or without oxytocin, and 255 induced with transcervical foley catheter.[77] The rate of successful vaginal birth was 78% in the spontaneous group, 77.9% in the amniotomy group, and 55.7% in the transcervical foley group ($P < 0.001$).[77] However, the rates of uterine rupture did not differ significantly: 1.1%, 1.2%, and 1.6%, respectively ($P = 0.81$).[77] These data support the use of the foley catheter for cervical ripening of an unfavourable cervix in women undergoing a TOL after Caesarean.

Recommendations

8. Oxytocin augmentation is not contraindicated in women undergoing a TOL after Caesarean (II-2A).

9. Medical induction of labour with oxytocin may be associated with an increased risk of uterine rupture and should be used carefully after appropriate counselling (II-2B).

10. Medical induction of labour with prostaglandin E2 (dinoprostone) is associated with an increased risk of uterine rupture and should not be used except in rare circumstances after appropriate counselling (II-2B).

11. Prostaglandin E1 (misoprostol) is associated with a high risk of uterine rupture and should not be used as part of a TOL after Caesarean (II-2A).

12. A foley catheter may be used safely to ripen the cervix in a woman planning a TOL after Caesarean (II-2A).

SPECIAL CIRCUMSTANCES

More Than 1 Previous Low Transverse Caesarean Section

Several authors have assessed the rate of successful VBAC and the risk of uterine rupture in women with more than 1 previous low transverse Caesarean section.[8,78–84] All indicated success rates between 62% and 89% and uterine rupture rates between 0% and 3.7%. In the largest study, Miller *et al.* demonstrated a VBAC success rate of 75.3% in 1827 women with 2 or more previous low transverse Caesarean deliveries, with a uterine rupture rate of 1.7% versus 0.6% in the ERCS group (OR, 3.06; 95% CI, 1.95–4.79).[8] Unfortunately, the use of prostaglandins or oxytocin for induction or augmentation was not considered. Caughey *et al.* reported a uterine rupture rate of 3.7% versus 0.8% (RR, 4.8; 95% CI, 1.8–13.2) in a retrospective review of 134 women undergoing labour after 2 previous Caesarean deliveries after correction for prostaglandin, oxytocin, and epidural use.[84]

Recommendation

13. The available data suggest that a trial of labour in women with more than 1 previous Caesarean is likely to be successful but is associated with a higher risk of uterine rupture (II-2B).

Multiple Pregnancy

Seven studies have examined a total of 233 women attempting VBAC in multiple pregnancy.[85–91] All support a trial of VBAC in multiple pregnancy as being safe and effective, with success rates of 69% to 84% and without increased maternal or fetal morbidity or mortality.[85–91] In one study, uterine dehiscence was noted in 1 woman on manual exploration after successful vaginal delivery of both twins, and no treatment was required.[86] Each of these studies examined a small number of women, however, and greater numbers would be required to detect rare outcomes such as uterine rupture and maternal and perinatal mortality.

Recommendation

14. Multiple gestation is not a contraindication to a TOL after Caesarean (II-2B).

Breech Presentation

A large multicentre trial by Hannah *et al.* demonstrated that a planned Caesarean birth is associated with better perinatal and neonatal outcomes in breech presentation at term.[92] This recommendation has been adopted by the SOGC and would therefore preclude a planned TOL after Caesarean in women presenting with a singleton fetus in breech presentation at term.[92,93] Vaginal delivery of premature fetuses and the second twin were not addressed in the study; therefore, no recommendations can be made in this regard. It would seem appropriate to consider these cases individually.

External cephalic version is not contraindicated in women with a previous Caesarean birth.[94,95]

Diabetes Mellitus

In a retrospective cohort study, Coleman *et al.* examined the issue of TOL after Caesarean in women with gestational diabetes mellitus (GDM).[96] Coleman examined 156 women with GDM and planned TOL after Caesarean and compared them with women with no GDM and attempting TOL after Caesarean. They reported that the success rate for VBAC of 64.1% in women with GDM was lower than the 77.2% of women without GDM ($P < 0.001$).[96] Maternal and fetal morbidities were comparable.[96] A retrospective study of TOL after Caesarean in women with pregestational or gestational diabetes found similar results.[97] Based on these studies, diabetes mellitus should not be considered a contraindication to TOL after Caesarean.

Recommendation

15. Diabetes mellitus is not a contraindication to TOL after Caesarean (II-2B).

Macrosomia

In a study examining the outcome of 365 women who underwent a TOL after Caesarean and who were giving birth to neonates weighing more than 4000 g, Zelop *et al.* demonstrated a success rate of 60%, with no increase in maternal or fetal morbidity and no increase in the risk of uterine rupture.[98] These data support previously reported findings by Flamm (success rate 58%)[99] and Phelan (success rate 67%).[100] In 2003 Elkousy *et al.* reported an examination of 9960 women with a previous Caesarean section planning a trial of labour. The study was further stratified by neonatal birth weights and birth history (primarily, whether they had a previous vaginal delivery and whether it occurred before or after their Caesarean).[101] Their results indicate that the likelihood of successful VBAC decreases with increasing birth weight and is lowest in women who have never had a successful vaginal birth.[101] According to these results, suspected macrosomia is not a contraindication to TOL after Caesarean, though it may be associated with a lower chance of success.

Recommendation

16. Suspected fetal macrosomia is not a contraindication to a TOL after Caesarean (II-2B).

Interdelivery Interval

Four studies have examined the relation between the interdelivery interval and the rate of successful VBAC and uterine rupture.[102–105] Esposito *et al.* examined 23 cases of uterine rupture and compared them with 127 control subjects.[102] There was an increased risk of uterine rupture with a short interpregnancy interval (< 6 months between pregnancies; < 15 months between deliveries), compared with control subjects (17.4% vs. 4.7%, $P = 0.05$).[102] Shipp *et al.* reviewed 311 women who underwent a TOL after Caesarean less than 18 months after their Caesarean section and compared them with 2098 women who underwent a TOL after Caesarean after more than 18 months.[103] The shorter interval was associated with a threefold increase in the risk of uterine rupture (2.25% vs. 1.05%: OR, 3.0; 95% CI, 1.2–7.2).[103] Huang *et al.* reviewed 1185 women undergoing a TOL after Caesarean and noted no difference in the success of vaginal delivery in women with a shorter interval of less than 19 months (79% vs. 85.5%, $P = 0.12$); however, they did note a significant difference in successful VBAC in women who underwent medical induction, compared with spontaneous labour (14.3% vs. 86.1%, $P < 0.01$).[104] Their study noted no difference in the rate of uterine rupture.[104] In 2002 Bujold *et al.* reported an observational study of 1527 women undergoing a planned TOL after Caesarean at different intervals from the index Caesarean delivery.[105] The rates of uterine rupture were as follows: < 12 months, 4.8%; 13 to 24 months, 2.7%; 25 to 36 months, 0.9%; and > 36 months, 0.9%.[105] After adjusting for such confounders as number of layers in the uterine closure, induction, oxytocin, and epidural use, the odds ratio for uterine rupture in a woman less than 24 months from her last delivery was 2.65 (95% CI, 1.08–6.46).[105]

Recommendation

17. Women delivering within 18 to 24 months of a Caesarean section should be counselled about an increased risk of uterine rupture in labour (II-2B).

Postdatism

Three studies have examined postdatism and TOL after Caesarean.[106–108] In 2 of these studies, the rate of successful VBAC and uterine rupture in women who delivered at less than 40 weeks' gestation was compared with those who delivered at more than 40 weeks.[106,107] Success rates for VBAC after 40 weeks were reported from 65.6%[107] to 73.1%[106] and were comparable to success rates for women who delivered before 40 weeks' gestation.[106,107] Zelop *et al.* also compared the risk of uterine rupture in women who delivered before and after 40 weeks' gestation in spontaneous labour and induced labour.[108] They reported that the risk of uterine rupture in a TOL after Caesarean after 40 weeks' gestation was not significantly increased when compared with women who delivered before 40 weeks, whether in spontaneous labour (1.0 % vs. 0.5%, $P = 0.2$, adjusted OR, 2.1; 95% CI, 0.7–5.7) or after induction (2.6% vs. 2.1%, $P = 0.7$, adjusted OR, 1.1; 95% CI, 0.4–3.4).[108]

Recommendation

18. Postdatism is not a contraindication to a TOL after Caesarean (II-2B).

One- Versus 2-Layer Closure of Low Transverse Caesarean Section

In 1992 Hauth *et al.* published data comparing operative time, endometritis, transfusion, and placement of extra hemostatic sutures in women undergoing uterine closure in 1 layer compared with 2 layers.[109] The only significant difference was in operative time: 44 minutes with 1-layer closure, compared to 48 minutes with 2-layer closure ($P < 0.05$).[109] Ohel *et al.* published similar findings in 1996.[110] The trend shifted in many centres toward single-layer closure.

In 1997 Chapman *et al.* published a review of 145 women who underwent a TOL after Caesarean after being randomized to either 1-layer or 2-layer closure in the previous Caesarean section.[111] They reported no significant difference in the outcome of the next pregnancy.[111] In a 2002 review of 2142 women who underwent a TOL after Caesarean, Bujold *et al.* noted that a 1-layer interlocking closure was associated with an increased risk of uterine rupture when compared with a 2-layer closure (3.1% vs. 0.5%, $P < 0.001$; OR, 3.95; 95% CI, 1.35–11.49).[112] Further study in this area is recommended.

Unknown Scar

All records available or obtainable describing the woman's previous Caesarean section should be reviewed. If unavailable, information about the circumstances of the Caesarean section will help determine the likelihood of a vertical uterine incision.[113,114] Most unknown scars will be lower transverse incisions (92%) and therefore at low risk for uterine rupture.[115] If the history suggests a reasonable likelihood of a classical incision, it would be prudent to recommend a repeat Caesarean section, but in settings where the history indicates a high likelihood of lower transverse uterine incision and the woman wishes to proceed after counselling, TOL after Caesarean is acceptable.[115]

Recommendation

19. Every effort should be made to obtain the previous Caesarean operative report to determine the type of uterine incision used. In situations where the scar is unknown, information concerning the circumstances of the previous delivery is helpful in determining the likelihood of a low transverse incision. If the likelihood of a lower transverse incision is high, TOL after Caesarean can be offered (II-2B).

Other Factors

Factors such as maternal obesity,[116] presence of postpartum fever after Caesarean section,[117] type of suture material, müllerian duct anomalies,[118] and maternal age[119] and their relation to the risk of uterine rupture have been examined in small studies, but definitive conclusions cannot yet be drawn.

CONCLUSION

Trial of labour after Caesarean section should be considered in women who have no contraindications after appropriate discussion. The efficacy and safety of a TOL after Caesarean in appropriately selected women about to give birth in a hospital where timely Caesarean section facilities are available is well supported. Support of the woman in labour, including close observation of herself and her fetus for signs of complications, is recommended.

Augmentation of labour with oxytocin is safe. Induction of labour may be provided when the indication for induction is compelling and the risks have been fully discussed. The use of prostaglandin E2 (dinoprostone) and prostaglandin E1 (misoprostol) in women planning a TOL is not recommended. The use of a foley catheter for cervical ripening in situations where the cervix is unfavourable is associated with a lower chance of success but no increased risk of uterine rupture.

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