Anaesthetic Considerations for Vaginal Birth After Caesarean Delivery

Lee Jervis[1†], Matt Rucklidge[2]

[1]Anaesthetic Registrar, King Edward Memorial Hospital, Perth, Australia
[2]Consultant Anaesthetist, King Edward Memorial Hospital, Perth, Australia

Edited by: Dr. Gillian Abir, Stanford University School of Medicine, Stanford, CA, USA; Dr. James Brown, BC Women's Hospital, Vancouver, BC, Canada

[†]Corresponding author e-mail: Lee.Jervis@health.wa.gov.au

Published 22 June 2021

KEY POINTS

- Vaginal birth after caesarean delivery may be considered for women with a singleton pregnancy and cephalic presentation with no contraindications to vaginal delivery.
- Benefits of vaginal birth after caesarean delivery compared with repeat caesarean delivery include shorter postpartum recovery and length of hospital stay, less postpartum pain, avoidance of surgical complications and reduced impact on subsequent pregnancies.
- Neuraxial labour analgesia is safe and efficacious for women aiming for a vaginal birth after caesarean delivery.
- The major risk of vaginal birth after caesarean delivery is uterine rupture, which may result in massive obstetric haemorrhage and potentially an emergency hysterectomy.
- Cardinal features of uterine rupture include abnormal fetal heart rate, severe abdominal pain that persists between contractions (despite effective neuraxial labour analgesia), vaginal bleeding, cardiovascular instability and loss of fetal station.
- Management of uterine rupture includes early recognition, immediate transfer to an operating room for emergent delivery and maternal and neonatal resuscitation.

INTRODUCTION

Women with a history of caesarean delivery (CD) with a low transverse uterine incision may be offered a repeat CD or a trial of labour after caesarean (TOLAC) with the aim of vaginal birth after caesarean (VBAC). VBAC has risks and benefits that require careful consideration. VBAC, compared with a repeat CD, is associated with less postpartum pain, faster return to normal function and lower risk of certain obstetric complications in subsequent pregnancies (eg, abnormal placentation). An important risk of TOLAC is uterine rupture (approximately 0.5% incidence after 1 CD), which can lead to significant maternal and neonatal morbidity and mortality.[1,2] Although the rate of successful VBAC varies slightly between women who have had 1 CD (72%-75%) compared with 2 CDs (62%-75%), the incidence of maternal complications such as uterine rupture increases with the number of prior CDs.[1,2] Women undergoing TOLAC require care within an appropriately staffed obstetric unit that is resourced to provide specialist maternal and neonatal care, including facilities for emergent CD, blood transfusion and neonatal resuscitation.

The aim of this tutorial is to outline the risks and benefits of VBAC versus elective repeat CD, highlight factors that favour successful VBAC, provide recommendations on intrapartum anaesthetic care and provide an overview of the presentation and anaesthetic management of uterine rupture.

An online test is available for self-directed continuous medical education (CME). It is estimated to take 1 hour to complete. Please record time spent and report this to your accrediting body if you wish to claim CME points. A certificate will be awarded upon passing the test. Please refer to the accreditation policy here.

TAKE ONLINE TEST

CAESAREAN DELIVERY RATES AND OPTIONS FOR CHILDBIRTH

The rate of birth by CD continues to increase globally. Rates of CD vary within and between countries, for example, 26% in the United Kingdom,[3] 28% in New Zealand,[4] 32% in the United States and 33% in Australia.[5] Of 169 countries, 106 (63%) have CD rates greater than the World Health Organisation's recommendation of 10% to 15%.[3] A study of more than 90 000 Australian women with 1 prior CD who met eligibility criteria for TOLAC found that 67% of women subsequently underwent elective repeat CD, 20% had a successful VBAC, and 13% had a nonelective CD for unsuccessful TOLAC.[6] VBAC and elective repeat CD have their own individual risks and benefits, but successful VBAC is associated with fewer complications.[2]

National guidelines (in the United States, United Kingdom, Australia and New Zealand) recommend that women with a singleton pregnancy and history of a prior uncomplicated lower uterine segment CD be offered a TOLAC.[6–8] After appropriate counselling of the risks and benefits of VBAC versus elective repeat CD, the planned mode of delivery should be finalised by 36 weeks of gestation.[2]

FACTORS AFFECTING THE SUCCESS OF VBAC

Contraindications to VBAC[1]

- Factors associated with high-risk of uterine rupture:
  - Previous uterine rupture
  - Previous classical (vertical uterine incision) CD
  - Full-thickness myomectomy
  - More than 2 previous CDs
- Any contraindication to vaginal delivery:
  - Placenta praevia
  - Abnormal placentation (eg, placenta accreta, increta, percreta)
  - Untreated genital herpes simplex virus infection
  - Untreated human immunodeficiency virus infection

Women with twin pregnancies require careful assessment and education about delivery options and close intrapartum care for TOLAC.[1,2] Successful VBAC occurs in 45% to 76% of women with twin pregnancies, with the rate of uterine rupture being 0.9%.[2]

BENEFITS AND RISKS OF VBAC AND ELECTIVE REPEAT CAESAREAN DELIVERY

Women with a history of CD should receive antenatal counselling regarding the benefits and risks of VBAC versus elective repeat CD and should be offered a TOLAC if appropriate.

Intrapartum Recommendations

Risks of TOLAC and VBAC are greater than for vaginal delivery in women without a history of CD.[1,2] Women planning VBAC should labour in a suitably resourced and staffed hospital that can provide continuous intrapartum care and continuous fetal monitoring during labour, emergent CD and neonatal resuscitation with onsite access to blood products.[1,2] Women should be consented for both VBAC and CD, and large-bore (eg, 16G) intravenous (IV) access should be established at the onset of labour and a full blood count and group and antibody screen obtained.

Anaesthetic Evaluation and Management

Anaesthetic assessment of women undergoing TOLAC should include identification of risk factors that indicate a high possibility of an unsuccessful TOLAC. The anaesthetist should discuss available options for labour analgesia, including neuraxial labour analgesia, patient-controlled IV analgesia (eg, remifentanil) or nitrous oxide and establish a plan for urgent/emergent CD. Appropriate modes of anaesthesia for intrapartum CD include spinal or combined spinal-epidural anaesthesia, conversion of epidural labour analgesia to surgical anaesthesia or general anaesthesia (GA), depending on the maternal/fetal clinical status and urgency.

The woman's acceptance or refusal of blood products should be discussed and documented as part of the consent process. Because of the risk of unsuccessful TOLAC and requirement for urgent/emergent CD, oral intake should be restricted to clear fluids to reduce the risk of pulmonary aspiration during GA.[2]

Women aiming to achieve a VBAC can safely receive neuraxial labour analgesia. Neuraxial labour analgesia does not reduce the chance of a successful VBAC and does not mask symptoms and/or signs of uterine rupture.[9,10] Neuraxial labour analgesia for TOLAC is supported by national guidelines[2,7,8] and is associated with increased VBAC success rates (73% with neuraxial

Factors That Favour Successful VBAC[1,2,7]	Factors That Do Not Favour Successful VBAC[2,8,9]
Previous successful VBAC (strongest predictor of success [85%-90%])	Induction of labour
Previous vaginal birth	No previous vaginal delivery
One prior CD	More than 2 CDs or previous unplanned CD for labour dystocia (at <8 cm) or fetal distress
Current spontaneous labour	Maternal obesity (incidence of uterine rupture increases from 0.5% with a normal BMI to 2.1% with BMI >40 kg/m^2)
Current low-risk, uncomplicated pregnancy	Macrosomia (fetal weight >4000 g)
	Advanced maternal age (>40 years)
	Coexisting fetal, placental or maternal conditions (eg, chorioamnionitis, antepartum bleeding, disengaged head at term, oligohydramnios/polyhydramnios, preeclampsia)
	Gestational age >41 weeks

Table 1. Factors Affecting the Success of VBAC. BMI indicates body mass index; CD, caesarean delivery; VBAC, vaginal birth after caesarean

labour analgesia versus 50% without).[9] In the event that urgent CD is required, an in situ epidural catheter can be dosed with a potent local anaesthetic solution (eg, lidocaine 2% with epinephrine 1:200 000 in 5-mL aliquots) to rapidly achieve the desired block height and density for surgical anaesthesia. Adequate neuraxial anaesthesia for CD decreases the need for GA and associated risks such as difficult/failed intubation, pulmonary aspiration, accidental awareness during GA and adverse neonatal effects (eg, from maternal systemic effects of GA). However, an emergent CD may necessitate GA.

Uterine Rupture

TOLAC and VBAC are associated with an increased risk of uterine rupture, which can lead to significant maternal and neonatal morbidity and mortality as compared with women who have no history of CD.[1,2] The incidence of uterine rupture in women undergoing TOLAC ranges from 0.2% to 0.75%, as compared with <0.02% in women undergoing elective repeat CD and 0.005% to 0.2% in women with no previous CD undergoing vaginal delivery.[2] Uterine rupture typically occurs at the site of the previous CD scar but can arise in other parts of the uterus and may cause bladder or urethral injury.[11] Myometrial thickness in the lower uterine segment of ≥2.1 mm may be associated with a lower risk of scar rupture than myometrial thickness <2.1 mm.[8] However, further prospective studies are required to investigate the utility of antepartum measurements of myometrial thickness before such measurements are used to risk stratify women considering TOLAC.[1,2,11] More than 90% of cases of uterine rupture in women undergoing TOLAC occur during the intrapartum period (most commonly at a cervical dilatation of 4-5 cm), with less than 10% identified in the postpartum period.[1]

The increased incidence of uterine rupture highlights the importance of women to undertake TOLAC/VBAC in an appropriately resourced obstetric unit with an on-site multidisciplinary team experienced in the management of potential complications. The clinical teams should have thorough knowledge and understanding of the risk factors for uterine rupture as the diagnosis is not always obvious. Patients with scar dehiscence can be asymptomatic, and up to 10% of patients with complete uterine rupture do not exhibit the classical triad of acute-onset abdominal pain, vaginal bleeding and an abnormal fetal heart rate.[1]

Benefits of VBAC Compared With ERCD[1,2,7]	Benefits of ERCD Compared With VBAC[1,2]
Less postpartum pain, earlier mobilisation and shorter length of hospital stay	Planned delivery date and no increase in perinatal mortality if delivered at ≥39 wk of gestation
Avoidance of surgical risks associated with CD	Lower incidence of perinatal mortality and morbidity such as HIE, fetal intracranial injury and brachial plexus injury
Lower risk of certain complications in subsequent pregnancies (eg, abnormal placentation)	Lower incidence of complications associated with emergent CD such as major obstetric haemorrhage, blood transfusion, emergency hysterectomy, bladder and/or bowel injury and requirement for postoperative ventilation
Lower incidence of transient respiratory morbidity of the newborn	Reduced risk of perineal injury, including anal sphincter injury
Lower incidence of maternal mortality with VBAC (4:100 000) versus ERCD (13.4:100 000)	

Table 2. Potential Benefits of VBAC and ERCD. ERCD indicates elective repeat caesarean delivery; HIE, hypoxic ischaemic encephalopathy; VBAC, vaginal birth after caesarean

Maternal Risks of VBAC Compared With ERCD[1,2]	Fetal/Neonatal Risk of VBAC Compared With ERCD[1,2]
Incidence of uterine rupture with VBAC is 5-7:1000 (0.5%-0.7%) after 1 CD and 16:1000 (1.6%) after 2 CDs, compared with <2:10 000 (<0.02%) for elective repeat CD	Increased perinatal mortality at ≥39 wk of gestation from stillbirth or intrapartum neonatal death due to uterine rupture • Perinatalmortality: 1.8:1000 (0.18%) with TOLAC, of which 0.4/1000 (0.04%) are related to uterine rupture causing fetal hypoxia • Noincreased risk of perinatal mortality at gestations <39 wk compared with nulliparous women
Maternal morbidity and mortality from unsuccessful TOLAC and subsequent emergency CD (eg, hysterectomy, obstetric haemorrhage) 2-fold higher incidence of PPH and 4-fold higher incidence of blood transfusion[6] Risk of pelvic floor/perineal injury including 5% incidence of rectal sphincter injury	Increased risk of HIE related to TOLAC/VBAC or uterine rupture • 8:10 000 (0.08%) for VBAC compared with <1:10 000 (<0.01%) for elective repeat CD

Table 3. Potential Maternal and Fetal/Neonatal Risks Associated With VBAC Compared With ERCD. CD indicates caesarean delivery; ERCD, elective repeat caesarean delivery; HIE, hypoxic ischaemic encephalopathy; PPH, postpartum haemorrhage; TOLAC, trial of labour after caesarean; VBAC, vaginal birth after caesarean

Risk Factors for Uterine Rupture in Women Undergoing TOLAC[1,2,11]

- Pharmacologic induction and/or augmentation of labour; prostaglandins and oxytocin are associated with a 2- to 3-fold increased risk of uterine rupture and a 1.5-fold greater likelihood of unsuccessful TOLAC necessitating CD
- Pregnancy interval less than 24 months: between 18 and 24 months is associated with a 2-fold increased incidence of uterine rupture and <18 months a 3-fold increased risk
- Advanced maternal age (>40 years)
- Macrosomia (>4000 g)
- Gestational age >40 weeks
- History of >1 CD
- Parity >2

Women with a history of vaginal delivery prior to or after a previous CD have a lower risk of uterine rupture when undergoing TOLAC as compared with women who have had a prior CD and no previous vaginal delivery.[1,2]

Symptoms and Signs of Uterine Rupture[11]

- Abnormal cardiotocography (present in 55%-87% of cases)[2]
- Severe abdominal pain–acute onset, especially if it persists between uterine contractions; scar tenderness; or escalating neuraxial labour analgesic requirements with reduced efficacy
- Vaginal bleeding; may be absent or minimal despite major intra-abdominal haemorrhage
- Loss of fetal station
- Haematuria
- Signs of cardiovascular instability (eg, hypotension, tachycardia, tachypnoea, reduced level of consciousness, cool and clammy skin) and/or raised lactate and raised anion gap metabolic acidosis
- Changes in the pattern or strength of uterine contractions
- Inability to auscultate the fetal heart at the previous transducer site

Acute-onset, severe intrapartum abdominal pain with any of the above features should prompt immediate review by an experienced obstetrician and preparation for an emergency laparotomy.

Differential Diagnosis of Acute Intrapartum Abdominal Pain

It is often difficult to distinguish between uterine rupture and other aetiologies of acute intrapartum abdominal pain. Differential diagnoses include the following[12]:

- Uterine rupture
- Placental abruption
- Chorioamnionitis

- Rupture of a splenic artery aneurysm
- Pregnancy-related liver disease (eg, preeclampsia with hepatic rupture)
- Ovarian cyst torsion or rupture
- Mesenteric ischaemia
- Acute appendicitis or cholecystitis

Evidence of postpartum haemorrhage despite active management of the third stage of labour should raise suspicion for uterine rupture.

Management of Uterine Rupture

Management of suspected or confirmed uterine rupture requires specialist multidisciplinary care with immediate delivery in combination with maternal and neonatal resuscitation. Early recognition and prompt transfer to an operating room for an emergency laparotomy and delivery of the fetus is fundamental to minimise the risk of neonatal hypoxic brain injury and maternal morbidity and mortality.[8]

Resuscitation and treatment priorities include the following[13]:

1. Check for maternal responsiveness
2. Call for help: Seek assistance from multidisciplinary specialists, and if there are signs of major haemorrhage, activate a massive transfusion protocol (or massive haemorrhage protocol, if available)
3. Airway and breathing
   a. Administer high-flow oxygen and ensure the patient is oxygenating and ventilating appropriately
   b. If the patient is unable to effectively oxygenate or protect their airway, consider early intubation using a rapid sequence induction technique; ideally, this will occur in an operating room using appropriate induction drugs for a cardiovascularly unstable patient
4. Circulation
   a. Ensure early left uterine displacement/lateral positioning to minimise aortocaval compression
   b. Ensure IV access with 2 large-bore IV cannulae (eg, 14-16G)
   c. Send blood for full blood count, venous blood gas and coagulation screen (including fibrinogen) or viscoelastic testing (eg, rotational thromboelastometry or thromboelastography), and activate the massive transfusion protocol if not already done
   d. Commence fluid resuscitation in the hypovolaemic patient using a warmed crystalloid solution (eg, normal saline 0.9% or compound sodium lactate) until blood products are available
   e. Administer blood products early if clinically indicated, before blood results are available
   f. Administer tranexamic acid 1 g IV within 3 hours of delivery to reduce systemic hyperfibrinolysis and the risk of maternal mortality secondary to haemorrhage[14]; predelivery administration of tranexamic acid should be considered in women actively bleeding or at high risk of haemorrhage[15]
5. Arrange urgent transfer of the patient to the operating room for emergency CD
6. Administer GA using a rapid sequence induction technique
   a. GA is indicated given the urgency and likely haemodynamic instability associated with uterine rupture, and using a preexisting labour epidural catheter may be appropriate in addition for intra-/postoperative pain management
   b. Take care with induction dosing, with consideration for haemodynamic effects (consider using ketamine if cardiovascularly unstable)
7. Use appropriate surgical techniques to safely deliver the fetus and achieve haemostasis, which in some cases may necessitate emergency hysterectomy
8. Use an arterial line for invasive blood pressure monitoring and blood sampling (insertion of a central venous cannula for venous pressure monitoring, blood sampling and vasopressor administration may be considered but should not delay induction of anaesthesia and/or commencement of surgery)
9. Avoid hypothermia (provide warm IV fluids, warm blankets and a warm operating room), avoid hypocalcaemia (administer 10% calcium chloride, 10 mL, or 10% calcium gluconate, 20-30 mL) and avoid acidosis (aggressive fluid resuscitation may be required)
10. Consider using intraoperative cell salvage for autologous blood transfusion, if available
11. Use point-of-care testing, including rotational thromboelastometry or thromboelastography and blood gas analysis to guide resuscitation and correction of coagulopathy

If the patient is in periarrest, an obstetric advanced life support algorithm should be used.

SUMMARY

Pregnant women with a history of CD and no contraindications to vaginal delivery may be appropriate candidates for VBAC. Given the risk of unsuccessful TOLAC and the need for emergency surgery, the anaesthetist should be made

aware early of women attempting TOLAC to risk stratify and plan appropriate labour analgesia and anaesthetic management. Neuraxial labour analgesia is an effective and safe option for women undergoing a TOLAC, which may be converted to surgical anaesthesia in case of urgent CD. Uterine rupture is a major complication of TOLAC/VBAC, and the clinical team should be aware of this risk factor and its symptoms and signs. Early recognition of uterine rupture and immediate transfer to an operating room for emergent delivery (with GA) and active resuscitation are critical to minimise maternal and fetal morbidity and mortality associated with this serious event.

REFERENCES

1. Gupta JK, Birmingham GCS, Cambridge RR, et al. Birth after previous caesarean birth: green-top guideline No. 45. Royal College of Obstetricians and Gynaecologists (RCOG); 2015. Accessed May 4, 2020. https://www.rcog.org.uk/globalassets/documents/guidelines/gtg_45.pdf
2. Leung Y, Gibson G, White S, et al. Birth after previous caesarean section. Royal Australian and New Zealand College of Obstetricians and Gynaecologists; 2019. Accessed May 4, 2020. https://ranzcog.edu.au/RANZCOG_SITE/media/RANZCOG-MEDIA/Women%27s%20Health/Statement%20and%20guidelines/Clinical-Obstetrics/Birth-after-previous-Caesarean-Section-(C-Obs-38)Review-March-2019.pdf?ext=.pdf
3. Wise J. Alarming global rise in caesarean births, figures show. *BMJ*. 2018;363:k4319.
4. New Zealand Ministry of Health. *Report on Maternity 2017*. Wellington, New Zealand: Ministry of Health; 2019. Accessed May 5, 2020. https://www.health.govt.nz/system/files/documents/publications/report-maternity-2017-may19.pdf
5. Australian Institute of Health and Welfare. *Australian's Health: Births in Australia Ch 7.14 Labour, Birth and Outcomes*. Canberra, Australia: Commonwealth of Australia; 2018. Accessed May 5, 2020. https://www.aihw.gov.au/reports/australias-health/australias-health-2018-in-brief/contents/births-in-australia
6. Pont S, Austin K, Ibiebele I, et al. Blood transfusion following intended vaginal birth after cesarean vs elective repeat cesarean section in women with a prior primary cesarean: a population-based record linkage study. *Acta Obstet Gynecol Scand*. 2019;98(3):382-389.
7. American College of Obstetrics and Gynecology. ACOG practice bulletin No. 205 summary: vaginal birth after cesarean delivery. *Obstet Gynecol*. 2019;133(2):393-395.
8. Hibbard JU, Gilbert S, Landon MB, et al. Trial of labor or repeat cesarean delivery in women with morbid obesity and previous cesarean delivery. *Obstet Gynecol*. 2006;108(1):125-133.
9. Landon MB, Leindecker S, Spong CY, et al. The MFMU Cesarean Registry: factors affecting the success of trial of labor after previous cesarean delivery. *Am J Obstet Gynecol*. 2005;193(3 pt 2):1016-1023.
10. Grisaru-Granovsky S, Bas-Lando M, Drukker L, et al. Epidural analgesia at trial of labor after cesarean (TOLAC): a significant adjunct to successful vaginal birth after cesarean (VBAC). *J Perinat Med*. 2018;46(3):261.
11. Landon MB, Frey H. Uterine rupture: after previous cesarean delivery. UpToDate. 2020. Accessed August 12, 2020. https://www.uptodate.com/contents/uterine-rupture-after-previous-cesarean-delivery?search=uterine-rupture&source=search_result&selectedTitle=1~121&usage_type=default&display_rank=1
12. Kilpatrick CC. Approach to acute abdominal pain in pregnant and postpartum women. UpToDate. 2020. Accessed June 4, 2020. https://www.uptodate.com/contents/approach-to-acute-abdominal-pain-in-pregnant-and-postpartum-women
13. Plaat F, Shonfeld A. Major obstetric haemorrhage. *BJA Educ*. 2015;15(4):190-193.
14. Shakur H, Roberts I, Fawole B, et al. Effect of early tranexamic acid administration on mortality, hysterectomy, and other morbidities in women with post-partum haemorrhage (WOMAN): an international, randomised, double-blind, placebo-controlled trial. *Lancet*. 2017;389(10084):2105-2116.
15. Ahmadzia HK, Phillips JM, Katler QS, James AH. Tranexamic acid for prevention and treatment of postpartum hemorrhage: an update on management and clinical outcomes. *Obstet Gynecol Surv*. 2018;73(10):587-594.