



Setting standards to improve women's health

## BIRTH AFTER PREVIOUS CAESAREAN BIRTH

This is the first edition of this guideline.

### 1. Purpose and scope

To provide evidence-based information to inform the care of women undergoing either planned vaginal birth after previous caesarean section (VBAC) or elective repeat caesarean section (ERCS).

### 2. Introduction and background

There is widespread public and professional concern about the increasing proportion of births by caesarean section.<sup>1</sup> Increasing rates of primary caesarean section have led to an increased proportion of the obstetric population who have a history of prior caesarean delivery. Pregnant women with a previous section may be offered either planned VBAC or ERCS. The proportion of women who decline VBAC is, in turn, a significant determinant of overall rates of caesarean birth.<sup>2-5</sup>

New evidence is emerging to indicate that VBAC may not be as safe as originally thought.<sup>6,7</sup> These factors, together with medico-legal fears, have led to a recent decline in clinicians offering and women accepting planned VBAC in the UK and North America.<sup>2-5</sup> This guideline presents the best available evidence to facilitate antenatal counselling in women with prior caesarean birth and to inform the intrapartum management of women undergoing planned VBAC. Prior to this guideline, the National Collaborating Centre for Women's and Children's Health (NCCWCH) clinical guideline, *Caesarean Section*, published in April 2004, provided the only UK-generated guidance on the management of childbirth after caesarean.<sup>8</sup> This guideline supports the recommendations made in the NCCWCH guideline but addresses VBAC in more detail.

### 3. Identification and assessment of evidence

Electronic searches were performed in Medline (Ovid version 1996–October 2006) and EMBASE (Ovid version 1996–October 2006) using relevant medical subject headings and text words. Evidence-based reviews and guidance from the American College of Obstetricians and Gynecologists,<sup>9,10</sup> the Society of Obstetricians and Gynaecologists of Canada,<sup>11</sup> the US Agency for Healthcare Research and Quality,<sup>12</sup> the New Zealand Guidelines Group<sup>13</sup> and the Cochrane Database of Systematic Reviews (2006)<sup>14</sup> were identified and used in the development of this guideline. The definitions of the types of evidence used in this guideline originate from the US Agency for Health Care Research and Quality. Where possible, recommendations are based on and explicitly linked to the evidence that supports them. Areas lacking evidence are highlighted and annotated as 'good practice points'.

## 4. Definition of terms used in this guideline

### 4.1 *Planned VBAC*

Planned VBAC (vaginal birth after caesarean) refers to any woman who has experienced a prior caesarean birth who plans to deliver vaginally rather than by ERCS (elective repeat caesarean section).

### 4.2 *Successful and unsuccessful planned VBAC*

A vaginal birth (spontaneous or assisted) in a woman undergoing planned VBAC indicates a successful VBAC. Birth by emergency caesarean section during the labour indicates an unsuccessful VBAC.

### 4.3 *Maternal outcomes*

- **Uterine rupture** is defined as a disruption of the uterine muscle extending to and involving the uterine serosa or disruption of the uterine muscle with extension to the bladder or broad ligament.<sup>6</sup>
- **Uterine dehiscence** is defined as disruption of the uterine muscle with intact uterine serosa.<sup>6</sup>
- **Other outcomes:** hysterectomy, thromboembolism, haemorrhage, transfusion requirement, viscus injury (bowel, bladder, ureter), endometritis, maternal death.

### 4.4 *Fetal outcomes*

- **Term** is defined in this guideline as, at or beyond 37 completed weeks of gestation.
- **Term perinatal mortality** in this guideline is defined as the combined number of stillbirths (antepartum and intrapartum) and neonatal deaths (death of a live born infant from birth to age 28 days) per 10 000 live births and stillbirths, at or beyond 37 completed weeks of gestation. Term perinatal mortality rates exclude deaths due to fetal malformation unless otherwise stated.<sup>6,15</sup>
- **Term delivery-related perinatal death** is defined as the combined number of intrapartum stillbirths and neonatal deaths per 10 000 live births and stillbirths, at or beyond 37 completed weeks of gestation. Birth-related perinatal mortality rates exclude antepartum stillbirths and deaths due to fetal malformation unless otherwise stated.<sup>6,15</sup>
- **Neonatal respiratory morbidity** is defined as the combined rate of transient tachypnoea of the newborn (TTN) and respiratory distress syndrome (RDS).<sup>6,15</sup>
- **Hypoxic ischaemic encephalopathy (HIE)** is defined as hypoxia resulting from a decrease in the blood supply to a bodily organ, tissue, or part caused by constriction or obstruction of the blood vessels, which results in compromised neurological function manifesting during the first few days after birth. HIE refers to a subset of the much broader category of neonatal encephalopathy, in which the aetiology is felt to be intrapartum hypoxic-ischemic injury.

## 5. Limitations of data used in this guideline

There are no randomised controlled trials comparing planned VBAC with planned ERCS and this may be an unrealistic aspiration.<sup>14</sup> Evidence for these interventions is obtained mainly from retrospective non-randomised studies. Furthermore, many of the main outcomes of interest are relatively uncommon. Adequately powered studies require large numbers and these frequently rely on routinely collected data. Consequently, many studies have limitations in terms of definition of exposures and outcomes, ascertainment bias and selection bias. Furthermore, the consequent interstudy heterogeneity precludes reliable meta-analyses.<sup>16,17</sup> A recently published study by the National Institute of Child Health and Human Development (NICHD) Maternal-Fetal Medicine Units Network<sup>6</sup> has overcome many of these shortcomings by having a large sample size, a prospective cohort design and by using standardised definitions for assessing outcomes. However, this comparison is undermined by the fact that the group delivered by ERCS in that study included women in whom planned VBAC was absolutely or relatively contraindicated, such as women with placenta praevia, high

numbers of previous caesarean births or maternal medical disorders. Therefore, the presence of these conditions may have led to an overestimate of the risk of adverse outcomes associated with ERCS.

## 6. Antenatal counselling

### 6.1 How should women be counselled in the antenatal period?

**Women with a prior history of one uncomplicated lower-segment transverse caesarean section, in an otherwise uncomplicated pregnancy at term, with no contraindication to vaginal birth, should be able to discuss the option of planned VBAC and the alternative of a repeat caesarean section (ERCS).**



**The antenatal counselling of women with a prior caesarean birth should be documented in the notes. There should be provision of a patient information leaflet with the consultation.**



**A final decision for mode of birth should be agreed between the woman and her obstetrician before the expected/planned delivery date (ideally by 36 weeks of gestation).**



**A plan for the event of labour starting prior to the scheduled date should be documented.**



**Women considering their options for birth after a single previous caesarean should be informed that, overall, the chances of successful planned VBAC are 72–76%.**



All women who have experienced a prior caesarean birth should be counselled about the maternal and perinatal risks and benefits of planned VBAC and ERCS when deciding the mode of birth. The key issues to include in the discussion are listed below under specific risks and benefits (section 6.3).

The risks and benefits should be discussed in the context of the woman's individual circumstances, including her personal motivation and preferences to achieve vaginal birth or ERCS, her attitudes towards the risk of rare but serious adverse outcomes, her plans for future pregnancies and her chance of a successful VBAC (principally whether she has previously had a vaginal birth; see below). In addition, where possible, there should be review of the operative notes of the previous caesarean to identify the indication, type of uterine incision and any perioperative complications.

Evidence level IV

As up to 10% of women scheduled for ERCS go into labour before the 39th week, it is good practice to have a plan for the event of labour starting prior to the scheduled date.<sup>6</sup>

Evidence level IIa

Individual studies report success rates of 72–76%<sup>6,7,18</sup> for planned VBAC after a single previous caesarean, which concurs with pooled rates derived by systematic and summative reviews.<sup>16,19,20</sup>

Evidence levels IIa, IIb

A number of factors are associated with successful VBAC. Previous vaginal birth, particularly previous VBAC, is the single best predictor for successful VBAC and is associated with an approximately 87–90% planned VBAC success rate.<sup>21–23</sup> Risk factors for unsuccessful VBAC are: induced labour, no previous vaginal birth, body mass index greater than 30,<sup>24–26</sup> previous caesarean section for dystocia.<sup>21</sup> When all these factors are present, successful VBAC is achieved in only 40% of cases.<sup>21</sup> There are numerous other factors associated with a decreased likelihood of planned VBAC success:<sup>21,22,27–30</sup> VBAC at or after 41 weeks of gestation, birth weight greater than 4000 g; no epidural anaesthesia, previous preterm caesarean birth, cervical dilatation at admission less than 4 cm, less than 2 years from previous caesarean birth, advanced maternal age, non-white ethnicity, short stature and a male infant. Where relevant to the woman's circumstances, this information should be shared during the antenatal counselling process to enable the woman to make the best informed choice.

Evidence level IIa, IIb, III

There is limited and conflicting evidence on whether the cervical dilatation achieved at the primary caesarean for dystocia impacts on the subsequent VBAC success rate.<sup>31,32</sup> Unfortunately, the NICHD study was unable to address this concern as data relating to the labour of the primary caesarean were not collected during the study.<sup>21</sup>

Evidence level IIB and III

Several preadmission and admission-based multivariate models have been developed to predict the likelihood of VBAC success<sup>22,31,33-36</sup> or uterine rupture<sup>37</sup> in planned VBAC. However, their usefulness in assisting women to make the decision about whether VBAC or ERCS is the best choice in their personal situation remains to be determined.

Evidence level IIB

## 6.2 What are the contraindications to VBAC?

**Women with a prior history of one classical caesarean section are recommended to give birth by ERCS.**



**Women with a previous uterine incision other than an uncomplicated low transverse caesarean section incision who wish to consider vaginal birth should be assessed by a consultant with full access to the details of the previous surgery.**



**Women with a prior history of two uncomplicated low transverse caesarean sections, in an otherwise uncomplicated pregnancy at term, with no contraindication for vaginal birth, who have been fully informed by a consultant obstetrician, may be considered suitable for planned VBAC.**



There is limited evidence on whether maternal or neonatal outcomes are significantly influenced by the number of prior caesarean births or type of prior uterine scar.<sup>6,21,38-41</sup> Nonetheless, due to higher absolute risks of uterine rupture or unknown risks, planned VBAC is contraindicated in women with:-

Evidence level IIB III and IV

- previous uterine rupture- risk of recurrent rupture is unknown<sup>40,42</sup>
- previous high vertical classical caesarean section (200-900/10,000 risk of uterine rupture) where the uterine incision has involved the whole length of the uterine corpus.<sup>40,42</sup>
- three or more previous caesarean deliveries (reliable estimate of risks of rupture unknown).

However, it is recognised that, in certain extreme circumstances (such as miscarriage, intrauterine fetal death) for some women in the above groups, the vaginal route (although risky) may not necessarily be contraindicated. A number of other variants are associated with an increased risk of uterine rupture. These include: women with a prior inverted T or J incision (190/10,000 rupture risk)<sup>6</sup> and women with prior low vertical incision (200/10,000 rupture risk).<sup>6</sup>

Evidence level IIa

There is insufficient and conflicting information on whether the risk of uterine rupture is increased in women with previous myomectomy or prior complex uterine surgery.<sup>43-45</sup>

Evidence level III

A multivariable analysis of the NICHD study showed that there was no significant difference in the rates of uterine rupture in VBAC with two or more previous caesarean births (9/975, 92/10,000) compared with a single previous caesarean birth (115/16,915, 68/10,000).<sup>46</sup> However, the rates of hysterectomy (60/10,000 compared with 20/10,000) and transfusion (3.2% compared with 1.6%) were increased in the former group.<sup>46</sup> These findings concur with other observational studies, which, overall, have shown similar rates of VBAC success with two previous caesarean births (VBAC success rates of 62-75%) and single prior caesarean birth.<sup>39,47-49</sup> Therefore, provided that the woman has been fully informed by a consultant obstetrician of these increased risks and a comprehensive individualised risk analysis has been undertaken of the indication for and the nature of the previous caesarean sections, then planned VBAC may be supported in women with two previous low transverse caesarean births.

Evidence level IIIa, IIB, III

### 6.3 What are the specific risks and benefits of VBAC?

**Women considering the options for birth after a previous caesarean should be informed that planned VBAC carries a risk of uterine rupture of 22–74/10,000. There is virtually no risk of uterine rupture in women undergoing ERCS.**

**B**

Uterine rupture in an unscarred uterus is extremely rare at 0.5–2.0/10,000 deliveries; this risk is mainly confined to multiparous women in labour.<sup>50</sup> The NICHD study reported that the overall risk for symptomatic uterine rupture at term was 74/10,000 planned VBAC.<sup>6</sup> There was zero risk in women undergoing ERCS.<sup>6</sup> Studies with differing methodological designs and definitions of scar rupture report similar estimates for risk of uterine rupture/10,000 planned VBAC deliveries: systematic and non-systematic reviews of 39,<sup>20</sup> 43<sup>17</sup> and 62/10,000;<sup>19</sup> retrospective studies of 22,<sup>51</sup> 33,<sup>52</sup> 35<sup>53</sup> and 65/10,000.<sup>18</sup> Although a rare outcome, uterine rupture is associated with significant maternal and perinatal morbidity and perinatal mortality (see below).

Evidence levels  
IIa, IIb

There is limited evidence from a case-control study that women who experienced both intrapartum and postpartum fever in their prior caesarean birth were at increased risk of uterine rupture in their subsequent planned VBAC labour (OR 4.02, 95% CI 1.04–15.5).<sup>54</sup> There is conflicting evidence on whether single-layer compared with double-layer uterine closure may increase the risk of uterine rupture in subsequent planned VBAC.<sup>8,55</sup>

Evidence level IIb,  
III

The NCCWCH guideline has recommended a two-layer closure of the uterine incision pending the availability of more robust evidence.<sup>8</sup> Closure of the uterus is currently being investigated by a large UK randomised controlled trial (CAESAR; see section 12).

Evidence level IV

**Women considering the options for birth after a previous caesarean should be informed that planned VBAC compared with ERCS carries around 1% additional risk of either blood transfusion or endometritis.**

**B**

Women undergoing planned VBAC compared with ERCS are at greater risk of blood transfusion requirement (170/10,000 versus 100/10,000) and endometritis (289/10,000 versus 180/10,000).<sup>6</sup> There was no statistically significant difference between planned VBAC and ERCS groups in relation to hysterectomy (23/10,000 versus 30/10,000), thromboembolic disease (4/10,000 versus 6/10,000) or maternal death (17/100,000 versus 44/100,000).<sup>6</sup> The vast majority of cases of maternal death in women with prior caesarean section arise due to medical disorders (such as thromboembolism, amniotic fluid embolism, pre-eclampsia and surgical complications).

Evidence level IIa

Maternal death from uterine rupture in planned VBAC occurs in less than 1/100,000 cases in the developed world; this estimate is based on information from case reports.<sup>18,56</sup>

Evidence level III

The increased risk of morbidity overall among women attempting VBAC is due to higher rates among women who attempt VBAC and are unsuccessful. The NICHD study<sup>6</sup> showed that unsuccessful planned VBAC compared with successful VBAC is associated with an increased risk of uterine rupture (231/10,000 versus 11/10,000), uterine dehiscence (210/10,000 versus 14.5/10,000), hysterectomy (46/10,000 versus 14.5/10,000), transfusion (319/10,000 versus 116/10,000) and endometritis (767/10,000 versus 116/10,000). Similar trends were identified in a retrospective study from a Canadian dataset.<sup>18</sup>

Evidence level IIa

**Women considering planned VBAC should be informed that this decision carries a 2–3/10,000 additional risk of birth-related perinatal death when compared with ERCS. The absolute risk of such birth-related perinatal loss is comparable to the risk for women having their first birth.**

**B**

In the NICHD study,<sup>6</sup> perinatal mortality at term was significantly greater among women having a planned VBAC than ERCS. Overall perinatal mortalities for planned VBAC versus ERCS, respectively, were 32/10,000 versus 13/10,000 (RR 2.40, 95% CI 1.43–4.01) and perinatal mortalities after excluding fetal malformation were 24/10,000 versus 9.3/10,000 (RR 2.52, 95% CI 1.37–4.62). The increased risk of perinatal mortality is largely attributable to the statistically significantly increased risk of antepartum stillbirth beyond 37 weeks of gestation in planned VBAC compared with ERCS (19.6/10,000 versus 8.0/10,000; RR 2.45, 95% CI 1.27–4.72) in infants without fetal malformation. Approximately 43% of such stillbirths in planned VBAC were at or after 39 weeks of gestation (approximately 9/10,000 women delivering at or after 39 weeks) and may have been prevented by ERCS at 39 weeks of gestation. A similar estimate was identified from analysis of a Scottish dataset which showed that the absolute risk of antepartum stillbirth at or after 39 weeks of gestation among women with one prior caesarean birth was 10.6/10,000.<sup>57</sup>

Evidence level IIa

In the NICHD study, rates of delivery-related perinatal death were 4/10,000 for planned VBAC and 1.4/10,000 for ERCS.<sup>6</sup> A report of data for the whole of Scotland demonstrated higher overall rates of birth-related perinatal death associated with attempted VBAC of 12.9/10,000, whereas the risk of death associated with ERCS was comparable to the US study at 1.1/10,000.<sup>7</sup> The reason for the higher rate of birth-related deaths among women attempting VBAC in Scotland may reflect the fact that these were population-based data whereas the US data were exclusively from tertiary centres. Consistent with this interpretation, a further study of data from Scotland demonstrated a lower risk of perinatal death from uterine rupture in larger centres.<sup>53</sup>

Accepting the limitations of using these observational data, a reasonable summary is that planned VBAC is associated with a 10/10,000 risk of antepartum stillbirth beyond 39 weeks of gestation and a 4/10,000 risk of delivery related perinatal death (if conducted in a large centre). It is likely that these risks can be reduced by ERCS at the start of the 39th week but direct evidence to support this is lacking. It may be helpful to emphasise to women that the absolute risks of birth-related perinatal death associated with VBAC are comparable to the risks for nulliparous women.<sup>7,58</sup>

**Women considering the options for birth after a previous caesarean should be informed that planned VBAC carries an 8/10,000 risk of the infant developing hypoxic ischaemic encephalopathy. The effect on the long-term outcome of the infant upon experiencing HIE is unknown.**

**B**

The incidence of intrapartum HIE at term is significantly greater in planned VBAC (7.8/10,000) compared with ERCS (zero rate).<sup>6</sup> Approximately 50% of the increased risk in planned VBAC arises from the additional risk of HIE caused by uterine rupture (4.6/10,000).<sup>6</sup> The definition used and distribution of severity of HIE is not stated in the NICHD study.<sup>6</sup> Severe neonatal metabolic acidosis (pH less than 7.00) occurred in 33% of term uterine ruptures.<sup>6</sup> There is no information comparing long-term outcome, such as cerebral palsy, associated with VBAC and ERCS. Given that cerebral palsy following term birth is rare (approximately 10/10,000) and only 10% of cases are thought to be related to intrapartum events,<sup>59</sup> appropriate analysis of this question would require a scale involving hundreds of thousands of women. No adequate study has currently been reported.

Evidence level IIa

**Women considering the options for birth after a previous caesarean should be informed that attempting VBAC probably reduces the risk that their baby will have respiratory problems after birth: rates are 2–3% with planned VBAC and 3–4% with ERCS.**

**B**

Three observational studies, pooling data from around 90,000 deliveries, have shown an increased risk of neonatal respiratory morbidity (defined earlier) among term infants delivered by elective caesarean (3.5–3.7%) compared with vaginal birth (0.5–1.4%).<sup>60–62</sup> The NICHD study<sup>6</sup> ( $n = 30,352$  deliveries) reported a similar trend in women with prior caesarean section, where the incidence of

Evidence level IIa

TTN in ERCS versus planned VBAC was 3.6% versus 2.6% (RR 1.40, 95% CI 1.23–1.59; NNT 98). These rates concur with rates of TTN derived from a smaller data set that examined women with prior caesarean birth (Two studies,  $n = 4478$  deliveries) of 2.4–6.0% versus 1.3–3.0%<sup>62,63</sup> for ERCS versus planned VBAC, respectively. The NICHD study did not report rates of RDS but the smaller dataset reported respiratory distress syndrome as 0.4–0.6% versus 0.0–0.05% for ERCS versus planned VBAC, respectively.<sup>62,63</sup>

Evidence  
level IIa

Evidence from observational studies<sup>60–62</sup> and a recently published trial<sup>64</sup> has shown a beneficial effect on reducing respiratory morbidity by delaying elective caesarean section to at least 39 weeks. The trial reported respiratory morbidity was 11.4%, 6.2% and 1.5% at 37, 38 and 39 weeks of gestation, respectively.<sup>64</sup> Thus, delaying birth by 1 week from 38 to 39 weeks of gestation enables around a 5/100 reduction in the incidence of respiratory morbidity, although this delay may be associated with a 5/10,000 increase in the risk of antepartum stillbirth.<sup>57,58</sup>

Evidence  
levels  
Ib, IIa

Furthermore, the trial demonstrated an approximate 50% reduction in respiratory morbidity (for both TTN and RDS components) by administering prophylactic betamethasone to women having elective caesarean deliveries beyond 37 weeks of gestation (steroid versus control; 2.4% versus 5.1%; RR 0.46, 95% CI 0.23–0.93) and this treatment effect was still apparent at 39 weeks of gestation (steroid versus control; 0.6% versus 1.5%).<sup>64</sup> However, it has been suggested that even a single course of antenatal steroids may have long-term consequences for the baby<sup>65</sup> and therefore it may be safer to delay ERCS until 39 weeks of gestation rather than give steroids and deliver at 38 weeks of gestation. The routine use of prophylactic betamethasone in ERCS is beyond the scope of this guideline.

Evidence  
level Ib

**Women considering the options for birth after a previous caesarean should be informed that the risk of anaesthetic complications is extremely low, irrespective of whether they opt for planned VBAC or ERCS.**

**B**

Anaesthetic procedure-related complications are extremely rare.<sup>66</sup> Of the women undergoing caesarean section (emergency and elective) in the NICHD study ( $n = 37,142$ ), 93% received regional anaesthesia and only 3% of regional procedures failed. There was one maternal death (2.7/100,000) attributed to an anaesthetic problem (failed intubation).<sup>67</sup>

Evidence  
level IIa

**Women considering the options for birth after a previous caesarean should be informed that ERCS may increase the risk of serious complications in future pregnancies.**

**B**

The following risks significantly increase with increasing number of repeated caesarean deliveries: placenta accreta; injury to bladder, bowel or ureter; ileus; the need for postoperative ventilation; intensive care unit admission; hysterectomy; blood transfusion requiring four or more units and the duration of operative time and hospital stay.<sup>68–72</sup> In the NICHD study of 30132 prelabour caesarean sections, placenta accreta was present in 0.24%, 0.31%, 0.57%, 2.13%, 2.33% and 6.74% of women undergoing their first, second, third, fourth, fifth, and sixth or more caesarean births, respectively.<sup>72</sup> Hysterectomy was required in 0.65%, 0.42%, 0.90%, 2.41%, 3.49% and 8.99% of women undergoing their first, second, third, fourth, fifth, and sixth or more caesarean births, respectively.<sup>72</sup> In the 723 women with placenta praevia, the risk for placenta accreta was 3%, 11%, 40%, 61%, and 67% for first, second, third, fourth, and fifth or more repeat caesarean births, respectively.<sup>72</sup> A retrospective study of approximately 3000 women from Saudi Arabia showed a linear increase in the risk of bladder injury (0.3%, 0.8%, 2.4%), hysterectomy (0.1%, 0.7%, 1.2%) and transfusion requirement (7.2%, 7.9%, 14.1%) with a history of two, three and five caesarean births, respectively.<sup>70</sup> Thus, knowledge of the woman's intended number of future pregnancies may be an important factor to consider during the decision-making process for either planned VBAC or ERCS.<sup>73</sup>

Evidence  
level IIa,  
IIb, III

## 7. Planned VBAC in special circumstances

*How should women be counselled in the context of obstetric complications?*

### 7.1 Preterm birth

**Women who are preterm and considering the options for birth after a previous caesarean should be informed that planned preterm VBAC has similar success rates to planned term VBAC but with a lower risk of uterine rupture.**

**B**

A retrospective cohort study showed women who were preterm (24–36 weeks of gestation) and undergoing planned VBAC had higher success rates when compared with women at term undergoing planned VBAC (82% versus 74%) and non-significantly lower risks of uterine rupture.<sup>74</sup> The prospective NICHD study showed planned VBAC success rates for preterm and term pregnancies were similar (72.8% versus 73.3%) but the rates of uterine rupture (34/10,000 versus 74/10,000, respectively) and dehiscence (26/10,000 versus 67/10,000, respectively) were significantly lower in preterm compared with term VBAC.<sup>75</sup> Thromboembolic disease, coagulopathy and transfusion were more common in women undergoing preterm than term VBAC, although overall combined absolute risks were less than 3% in the preterm VBAC group. Perinatal outcomes were similar with preterm VBAC and preterm ERCS.<sup>75</sup> Therefore, following appropriate counselling and in a carefully selected population, planned VBAC may be offered as an option to women undergoing preterm birth with a history of prior caesarean birth.

Evidence levels  
IIa, IIb

### 7.2 Twin gestation, fetal macrosomia, short interdelivery interval

**A cautious approach is advised when considering planned VBAC in women with twin gestation, fetal macrosomia and short interdelivery interval, as there is uncertainty in the safety and efficacy of planned VBAC in such situations.**

**C**

Study sample sizes are underpowered to provide reliable evidence suitable for any clinical practice recommendation in relation to twin gestation, fetal macrosomia and short interdelivery interval.

The NICHD study<sup>76</sup> ( $n = 186$  twins), US retrospective study<sup>77</sup> ( $n = 535$  twins) and a review<sup>40</sup> (seven studies,  $n = 233$  twins) have reported similar successful rates of VBAC in twin pregnancies to that in singleton pregnancies (65–84%). However, a population based study reported a lower VBAC success rate (45%) but a comparable risk of uterine rupture (90/10,000).<sup>78</sup> A review of four retrospective studies<sup>40</sup> and the NICHD study<sup>21</sup> has reported a significantly decreased likelihood of successful trial of VBAC for pregnancies with infants weighing 4000 g or more (55–67%) compared with smaller infants (75–83%). The risk of uterine rupture was reported in one of the retrospective studies to be only increased in those who did not have previous vaginal birth (relative risk, 2.3;  $P < .001$ ).<sup>79</sup> A subgroup analysis of the NICHD study showed that women with previous caesarean birth for dystocia, greater birth weight in the subsequent planned VBAC labour relative to the first birth weight decreased the likelihood of VBAC success.<sup>80</sup> However, in reality, birth weight cannot be accurately predicted by antenatal ultrasound which limits the clinical usefulness of discussing these observations when counselling women for planned VBAC and ERCS.

Evidence levels  
IIa, IIb, III

Three observational studies of limited size<sup>81–83</sup> have shown a two- to three-fold increased risk of uterine scar rupture for women with a short inter-delivery interval (below 12–24 months) from their previous caesarean section. In the NICHD study, women undergoing planned VBAC whose previous caesarean birth was within 2 years of their labour had an increased risk of caesarean birth compared with women whose labour was more than 2 years from their previous caesarean (32% versus 25%, respectively).<sup>21</sup> Although this information is useful antenatally, it should also be shared with women postnatally to enable them to plan their preferred spacing intervals for subsequent pregnancies.

Evidence levels  
IIa, III



## 8. Intrapartum support and intervention during planned VBAC

*Where and how should VBAC be conducted?*

**Women should be advised that planned VBAC should be conducted in a suitably staffed and equipped delivery suite, with continuous intrapartum care and monitoring and available resources for immediate caesarean section and advanced neonatal resuscitation.**

**B**

Obstetric, midwifery, anaesthetic, operating theatre, neonatal and haematological support should be continuously available throughout planned VBAC and ERCS.

Evidence level IV

A retrospective study of Canadian data showed that the relative risk of uterine rupture when comparing planned VBAC with ERCS increased two-fold in low-volume obstetric units (less than 500 births/year) than high-volume (500 or more births/year) units, even though lower-volume units had a lower-risk obstetric population.<sup>18</sup> A retrospective study of Scottish data showed that planned VBAC in low-volume hospitals (less than 3000 births/year) was not associated with an increased risk of uterine rupture overall but was associated with an increased risk of uterine rupture that led to perinatal death.<sup>53</sup> It is likely that the availability of resources for immediate delivery and neonatal resuscitation may reduce the risk of infant morbidity and mortality due to uterine rupture.

Evidence level IIa

**Epidural anaesthesia is not contraindicated in planned VBAC.**

**C**

In the NICHD study, planned VBAC success rates were higher among women receiving epidural analgesia than those not receiving epidural analgesia (73.4% versus 50.4%).<sup>21</sup> The authors suggested that this difference may relate to the disproportionate use of spinal anaesthesia in short, planned VBAC labours or opting for non-epidural analgesia in cases with non-reassuring fetal wellbeing.

Evidence level IIa

A smaller observational study showed comparable rates of unsuccessful VBAC and operative delivery in those women receiving epidural analgesia compared with those not receiving epidural, even when correcting for oxytocin usage.<sup>84</sup>

Evidence level III

Concerns that epidural analgesia might mask the signs and symptoms associated with uterine rupture were based on a single case report<sup>85</sup> and VBAC is not a contraindication for epidural analgesia.<sup>66</sup> A retrospective comparative study showed that within the planned VBAC group, infants of mothers who received epidural analgesia were more likely to be subjected to diagnostic tests and therapeutic interventions (including sepsis evaluation and antibiotic treatment) compared with infants from a matched no-epidural analgesia group.<sup>86</sup>

Evidence levels III, IV

**Women should be advised to have continuous electronic fetal monitoring following the onset of uterine contractions for the duration of planned VBAC.**

**B**

An abnormal cardiotocograph (CTG) is the most consistent finding in uterine rupture and is present in 55–87% of these events.<sup>17</sup>

Evidence level IIb

Continuous electronic fetal monitoring is generally used among women during planned VBAC and thus the estimates of risk of both lethal and non-lethal perinatal asphyxia associated with VBAC are in this context.<sup>87</sup> The relative and absolute risks of severe adverse events in the absence of continuous electronic fetal monitoring are unknown.

Evidence level IV

**Continuous intrapartum care is necessary to enable prompt identification and management of uterine scar rupture.**

✓

Early diagnosis of uterine scar rupture followed by expeditious laparotomy and resuscitation is essential to reduce associated morbidity and mortality in mother and infant. There is no single pathognomic clinical feature that is indicative of uterine rupture but the presence of any of the following peripartum should raise the concern of the possibility of this event:<sup>42</sup>

- abnormal CTG
- severe abdominal pain, especially if persisting between contractions
- chest pain or shoulder tip pain, sudden onset of shortness of breath
- acute onset scar tenderness
- abnormal vaginal bleeding or haematuria
- cessation of previously efficient uterine activity
- maternal tachycardia, hypotension or shock
- loss of station of the presenting part.

Evidence levels III, IV

The diagnosis is ultimately confirmed at emergency caesarean section or postpartum laparotomy.

**The routine use of intrauterine pressure catheters in the early detection of uterine scar rupture is not recommended.**

**C**

Observational studies, with varying methodology and case mix, have shown that intrauterine pressure catheters may not always be reliable and are unlikely to add significant additional ability to predict uterine rupture over clinical and CTG surveillance.<sup>88-90</sup> Intrauterine catheter insertion may also be associated with risk.<sup>91</sup> Some clinicians may prefer to use intrauterine pressure catheters in special circumstances (such as in women who are obese, to limit the risk of uterine hyperstimulation); this should be a consultant-led decision.

Evidence level III

## 9. Induction and augmentation

*How should women with a previous caesarean birth be advised in relation to induction of labour or augmentation?*

**Women should be informed of the two- to three-fold increased risk of uterine rupture and around 1.5-fold increased risk of caesarean section in induced and/or augmented labours compared with spontaneous labours.**

**B**

**Women should be informed that there is a higher risk of uterine rupture with induction of labour with prostaglandins.**



**There should be careful serial cervical assessments, preferably by the same person, for both augmented and non-augmented labours, to ensure that there is adequate cervicometric progress, thereby allowing the planned VBAC to continue.**



**The decision to induce, the method chosen, the decision to augment with oxytocin, the time intervals for serial vaginal examination and the selected parameters of progress that would necessitate and advise on discontinuing VBAC should be discussed with the woman by a consultant obstetrician.**



Systematic reviews examining induction and augmentation of labour for women with previous caesarean birth have found no randomised controlled trials comparing induction/augmentation in planned VBAC with ERCS.<sup>92-95</sup> In the NICHD study, the risks of uterine rupture/10,000 planned VBAC deliveries were 102, 87 and 36/10,000 for induced, augmented and spontaneous labour groups, respectively.<sup>6</sup> This compares with an overall risk of uterine rupture of 2/10,000 in women with unscarred uteri; this risk includes the combined risks of women undergoing induction,

Evidence level IIIa

augmentation and spontaneous labour.<sup>50</sup> In the NICHD study, the rates of caesarean section in women undergoing planned VBAC were 33%, 26% and 19% for induced, augmented and spontaneous labour groups, respectively.<sup>21</sup>

Two studies have expanded on the differences in adverse outcomes between prostaglandin and non-prostaglandin (such as intracervical Foley catheter) based induction regimens.<sup>6,53</sup> In the NICHD study, prostaglandin induction compared with non-prostaglandin induction incurred a non-significantly higher risk of uterine rupture (140/10,000 versus 89/10,000;  $P = 0.22$ ).<sup>6</sup> In an analysis of nationally collected data from Scotland, prostaglandin induction compared with non-prostaglandin induction was associated with a statistically significantly higher uterine rupture risk (87/10,000 versus 29/10,000) and a higher risk of perinatal death from uterine rupture (11.2/10,000 versus 4.5/10,000).<sup>53</sup> This compares with 6/10,000 risk of perinatal death in women with an unscarred uterus induced by prostaglandin identified by a Cochrane review.<sup>96</sup>

Evidence level IIa

Given these risks and the absence of direct robust evidence, it is important not to exceed the safe recommended limit for prostaglandin priming in women with prior caesarean birth.<sup>92</sup> Due consideration should be given to restricting the dose and adopting a lower threshold of total prostaglandin dose exposure. Importantly, the decision to induce and the method chosen (prostaglandin or non-prostaglandin methods) should be consultant-led.

Evidence level IV

There is no direct evidence to recommend what is acceptable or unacceptable cervicometric progress in women being augmented with a previous caesarean birth.<sup>97-101</sup> Among women with unscarred uteri, it is suggested that there is unlikely to be a higher vaginal birth rate if augmentation continues beyond 6–8 hours.<sup>102</sup> Awareness of the increased risk of uterine rupture in scarred uteri justifies adopting a more conservative threshold to the upper limit of augmentation in women with prior caesarean birth. A small-sized retrospective case-control study suggested that early recognition and intervention for labour dystocia (specifically, not exceeding 2 hours of static cervicometric progress) may have prevented a proportion of uterine ruptures among women attempting VBAC.<sup>101</sup>

Evidence level III

The additional risks in augmented VBAC mean that:

- although augmentation is not contraindicated it should only be preceded by careful obstetric assessment, maternal counselling and by a consultant-led decision
- oxytocin augmentation should be titrated such that it should not exceed the maximum rate of contractions of four in 10 minutes; the ideal contraction frequency would be three to four in 10 minutes<sup>92</sup>
- careful serial cervical assessments, preferably by the same person, are necessary to show adequate cervicometric progress, thereby allowing augmentation to continue.

The intervals for serial vaginal examination and the selected parameters of progress that would necessitate discontinuing VBAC labour should be consultant-led decisions.

Evidence level IV

When informing a woman about induction (prostaglandin or non-prostaglandin methods) and/or augmentation, clear information should be provided on all potential risks and benefits of such a decision and how this may impact on her long-term health. For example, women who are contemplating future pregnancies may accept the short-term additional risks associated with induction and/or augmentation in view of the reduced risk of serious complications in future pregnancies if they have a successful VBAC.

## 10. Auditable standards

### Standards for audit of practice should include the following:

- use of continuous electronic fetal monitoring during VBAC labour.

### Standards for audit of documentation could include the following:

- documented discussion of risks and benefits of VBAC and ERCS
- documentation of consultant involvement in:
  - deciding to induce or augment labour
  - establishing a plan for induction or augmentation (such as preferred vaginal examination interval, expected minimal cervicometric progress and the criteria needed to discontinue labour and proceed to emergency caesarean section).

## 11. Future research

- Development, validation and pragmatic clinical evaluation of a scoring system to identify women at high or low risk of unsuccessful VBAC that is antenatally and/or intrapartum based.
- The clinical effectiveness of differing induction and augmentation regimens, perhaps individualised according to clinical features rather than standardised strategies.
- Identify whether there are differences in long-term maternal and infant outcomes between planned VBAC and ERCS, such as subfertility, depression, pelvic floor dysfunction, incontinence, psychosexual problems, respiratory illness, and neurodevelopmental disorders (this list is not exhaustive).
- Investigate the aetiology and prevention (such as specific antenatal monitoring strategies) of the increased risk of stillbirth in women with previous caesarean delivery, in the presence or absence of other previous complications (for example, pre-eclampsia, preterm delivery, small for gestational age).<sup>57,105</sup>
- Research into factors that may explain the regional and unit-based variation in uptake of VBAC and which factors impact most on women accepting or declining VBAC (such as a patient information leaflet, previous childbirth experiences, desired family size, understanding the risk analysis during counselling, how to reduce any decisional conflict, variation in case mix).<sup>73,104-113</sup>
- Assess maternal satisfaction,<sup>114-116</sup> quality-of-life measures and health-state utilities in women following VBAC and ERCS to undertake robust economic modelling assessments.

## 12. Pending relevant trials

- BAC (Birth After Caesarean) – planned vaginal birth or planned caesarean section for women at term with a single previous caesarean birth. ISRCTN 53974531, Professor C Crowther, University of Adelaide, Australia.
- The Twin Birth Study – a multicentre randomised controlled trial comparing planned caesarean section with planned vaginal birth for twins at 32–38 weeks of gestation. ISRCTN 74420086, Dr J Barrett, Toronto, Canada.
- DiAMOND (Decision Aids for Mode Of Next Delivery). ISRCTN 84367722, Dr A Montgomery, Bristol, UK.
- CAESAR (Caesarean Section Surgical Techniques). ISRCTN 11849611, Dr P Brocklehurst, National Perinatal Epidemiology Unit, Oxford, UK.

## References

1. Parliamentary Office of Science and Technology. Caesarean sections. *Postnote* 2002;(184):1-4 [www.parliament.uk/post/pn184.pdf].
2. Menacker F. Trends in cesarean rates for first births and repeat cesarean rates for low-risk women: United States, 1990-2003. *Natl Vital Stat Rep* 2005;54:1-8.
3. Liu S, Rusen ID, Joseph KS, Liston R, Kramer MS, Wen SW, *et al*. Recent trends in caesarean delivery rates and indications for caesarean delivery in Canada. *J Obstet Gynaecol Can* 2004;26:735-42.
4. Black C, Kaye JA, Jick H. Cesarean delivery in the United Kingdom: time trends in the general practice research database. *Obstet Gynecol* 2005;106:151-5.
5. Yeh J, Wactawski-Wende J, Shelton JA, Reschke J. Temporal trends in the rates of trial of labor in low-risk pregnancies and their impact on the rates and success of vaginal birth after cesarean delivery. *Am J Obstet Gynecol* 2006;194:144.
6. 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. *N Engl J Med* 2004;351:2581-9.
7. 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.
8. National Collaborating Centre for Women's and Children's Health. *Caesarean Section*. London: RCOG Press; 2004 [www.rcog.org.uk/index.asp?PageID=694].
9. American College of Obstetricians and Gynecologists Committee on Obstetric Practice. ACOG Committee Opinion No. 342: Induction of labor for vaginal birth after cesarean delivery. *Obstet Gynecol* 2006;108:465-8.
10. American College of Obstetricians and Gynecologists Committee on Obstetric Practice. ACOG Practice Bulletin No. 54: Vaginal birth after previous cesarean. *Obstet Gynecol* 2004;104:203-12.
11. Society of Obstetricians and Gynaecologists of Canada. SOGC Clinical Practice Guidelines. Guidelines for vaginal birth after previous caesarean birth. Number 155 (Replaces guideline Number 147), February 2005. *Int J Gynaecol Obstet* 2005;89:319-31.
12. Guise JM, McDonagh MS, Hashima J, Kraemer DF, Eden KB, Berlin M, *et al*. Vaginal birth after cesarean (VBAC). *Evid Rep Techn Assess (Summ)* 2003;(71):1-8.
13. New Zealand Guidelines Group. *Care of Women with Breech Presentation or Previous Caesarean Birth*. Best Practice Evidence-based Guideline. Wellington: NZGG; 2004 [www.nzgg.org.nz/guidelines/dsp\_guideline\_popup.cfm?guidelineCatID=53&guidelineID=74].
14. Dodd JM, Crowther CA, Huertas E, Guise JM, Horey D. Planned elective repeat caesarean section versus planned vaginal birth for women with a previous caesarean birth. *Cochrane Database Syst Rev* 2006;(4):CD004224.
15. Confidential Enquiry into Maternal and Child Health. Stillbirth, Neonatal and Post-neonatal Mortality 2000-2003, England, Wales and Northern Ireland. London: RCOG Press; 2005 [www.cemach.org.uk/publications/CEMACHPerinatalMortalityReportApril2005.pdf].
16. Guise JM, Berlin M, McDonagh M, Osterweil P, Chan B, Helfand M. Safety of vaginal birth after cesarean: a systematic review. *Obstet Gynecol* 2004;103:420-9.
17. Guise JM, McDonagh MS, Osterweil P, Nygren P, Chan BK, Helfand M. Systematic review of the incidence and consequences of uterine rupture in women with previous caesarean section. *BMJ* 2004;329:19-25.
18. Wen SW, Rusen ID, Walker M, Liston R, Kramer MS, Baskett T, *et al*. Comparison of maternal mortality and morbidity between trial of labor and elective cesarean section among women with previous cesarean delivery. *Am J Obstet Gynecol* 2004;191:1263-9.
19. 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.
20. Mozurkewich EL, Hutton EK. Elective repeat cesarean delivery versus trial of labor: a meta-analysis of the literature from 1989 to 1999. *Am J Obstet Gynecol* 2000;183:1187-97.
21. 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. *Am J Obstet Gynecol* 2005;193:1016-23.
22. Smith GC, White IR, Pell JP, Dobbie R. Predicting cesarean section and uterine rupture among women attempting vaginal birth after prior cesarean section. *PLoS Med* 2005;2:871-8.
23. Gyamfi C, Juhasz G, Gyamfi P, Stone JL. Increased success of trial of labor after previous vaginal birth after cesarean. *Obstet Gynecol* 2004;104:715-19.
24. Hibbard JU, Gilbert S, Landon MB, Hauth JC, Leveno KJ, Spong CY, *et al*. Trial of labor or repeat cesarean delivery in women with morbid obesity and previous cesarean delivery. *Obstet Gynecol* 2006;108:125-33.
25. 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.
26. 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.
27. Bujold E, Hammoud AO, Hendler I, Berman S, Blackwell SC, Duperron L, *et al*. Trial of labor in patients with a previous cesarean section: does maternal age influence the outcome? *Am J Obstet Gynecol* 2004;190:1113-18.
28. 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.
29. Hollard AL, Wing DA, Chung JH, Rumney PJ, Saul L, Nageotte MP, *et al*. Ethnic disparity in the success of vaginal birth after cesarean delivery. *J Matern Fetal Neonatal Med* 2006;19:483-7.
30. Rochelson B, Pagano M, Conetta L, Goldman B, Vohra N, Frey M, *et al*. Previous preterm cesarean delivery: identification of a new risk factor for uterine rupture in VBAC candidates. *J Matern Fetal Neonatal Med* 2005;18:339-42.
31. Durnwald C, Mercer B. Vaginal birth after cesarean delivery: predicting success, risks of failure. *J Matern Fetal Neonatal Med* 2004;15:388-93.
32. 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.
33. Flamm BL, Geiger AM. Vaginal birth after cesarean delivery: an admission scoring system. *Obstet Gynecol* 1997;90:907-10.
34. 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.
35. Hashima JN, Eden KB, Osterweil P, Nygren P, Guise JM. Predicting vaginal birth after cesarean delivery: a review of prognostic factors and screening tools. *Am J Obstet Gynecol* 2004;190:547-55.
36. Dinsmoor MJ, Brock EL. Predicting failed trial of labor after primary cesarean delivery. *Obstet Gynecol* 2004;103:282-6.
37. 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.
38. Lieberman E, Ernst EK, Rooks JP, Stapleton S, Flamm B. Results of the national study of vaginal birth after cesarean in birth centers. *Obstet Gynecol* 2004;104:933-42.

39. 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.
40. Guise JM, Hashima J, Osterweil P. Evidence-based vaginal birth after Cesarean section. *Best Prac Res Clin Obstet Gynaecol* 2005;19:117–30.
41. Spaans WA, van der Vliet LM, Roell-Schorer EA, Bleker OP, van Roosmalen J. Trial of labour after two or three previous cesarean sections. *Eur J Obstet Gynecol Reprod Biol*. 2003;110:16–19.
42. Turner MJ. Uterine rupture. *Best Prac Res Clin Obstet Gynaecol* 2002;16:69–79.
43. Seracchioli R, Manuzzi L, Vianello F, Gualerzi B, Savelli L, Paradisi R, et al. Obstetric and delivery outcome of pregnancies achieved after laparoscopic myomectomy. *Fertil Steril* 2006;86:159–65.
44. Dubuisson JB, Fauconnier A, Babaki-Fard K, Chapron C. Laparoscopic myomectomy: a current view. *Hum Reprod Update* 2000;6:588–94.
45. Seracchioli R, Rossi S, Govoni F, Rossi E, Venturoli S, Bulletti C, et al. Fertility and obstetric outcome after laparoscopic myomectomy of large myomata: a randomized comparison with abdominal myomectomy. *Hum Reprod* 2000;15:2663–8.
46. 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. *Obstet Gynecol* 2006;108:12–20.
47. Spaans WA, van der Vliet LM, Roell-Schorer EA, Bleker OP, van Roosmalen J. Trial of labour after two or three previous cesarean sections. *Eur J Obstet Gynecol Reprod Biol* 2003;110:16–19.
48. 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.
49. Miller DA, Diaz FG, Paul RH. Vaginal birth after cesarean: a 10-year experience. *Obstet Gynecol* 1994;84:255–8.
50. Ofir K, Sheiner E, Levy A, Katz M, Mazor M. Uterine rupture: risk factors and pregnancy outcome. *Am J Obstet Gynecol* 2003;189:1042–6.
51. Turner MJ, Agnew G, Langan H. Uterine rupture and labour after a previous low transverse cesarean section. *BJOG* 2006;113:729–32.
52. Gardeil F, Daly S, Turner MJ. Uterine rupture in pregnancy reviewed. *Eur J Obstet Gynecol Reprod Biol* 1994;56:107–10.
53. Smith GC, Pell JP, Pasupathy D, Dobbie R. Factors predisposing to perinatal death related to uterine rupture during attempted vaginal birth after cesarean section: retrospective cohort study. *BMJ* 2004;329:375.
54. Shipp TD, Zelop C, Cohen A, Repke JT, Lieberman E. Post-cesarean delivery fever and uterine rupture in a subsequent trial of labor. *Obstet Gynecol* 2003;101:136–9.
55. Durnwald C, Mercer B. Uterine rupture, perioperative and perinatal morbidity after single-layer and double-layer closure at cesarean delivery. *Am J Obstet Gynecol* 2003;189:925–9.
56. Farmer RM, Kirschbaum T, Potter D, Strong TH, Medearis AL. Uterine rupture during trial of labor after previous cesarean section. *Am J Obstet Gynecol* 1991;165:996–1001.
57. Smith GC, Pell JP, Dobbie R. Cesarean section and risk of unexplained stillbirth in subsequent pregnancy. *Lancet* 2003;362:1779–84.
58. Smith GC. Life-table analysis of the risk of perinatal death at term and post term in singleton pregnancies. *Am J Obstet Gynecol* 2001;184:489–96.
59. Badawi N, Felix JF, Kurinczuk JJ, Dixon G, Watson L, Keogh JM, et al. Cerebral palsy following term newborn encephalopathy: a population-based study. *Dev Med Child Neurol* 2005;47:293–8.
60. Levine EM, Ghai V, Barton JJ, Strom CM. Mode of delivery and risk of respiratory diseases in newborns. *Obstet Gynecol* 2001;97:439–42.
61. Morrison JJ, Rennie JM, Milton PJ. Neonatal respiratory morbidity and mode of delivery at term: influence of timing of elective cesarean section. *Br J Obstet Gynaecol* 1995;102:101–6.
62. Richardson BS, Czikk MJ, daSilva O, Natale R. The impact of labor at term on measures of neonatal outcome. *Am J Obstet Gynecol* 2005;192:219–26.
63. 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.
64. Stutchfield P, Whitaker R, Russell I. Antenatal betamethasone and incidence of neonatal respiratory distress after elective cesarean section: pragmatic randomised trial. ASTECS study. *BMJ* 2005;331:662.
65. Dalziel SR, Walker NK, Parag V, Mantell C, Rea HH, Rodgers A, et al. Cardiovascular risk factors after antenatal exposure to betamethasone: 30-year follow-up of a randomised controlled trial. *Lancet* 2005;365:1856–62.
66. Lewis G, editor. *Why Mothers Die 2000–2002; the Sixth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom*. London: RCOG Press; 2004 [www.cemach.org.uk/publications/WMD2000\_2002/content.htm].
67. Bloom SL, Spong CY, Weiner SJ, Landon MB, Rouse DJ, Varner MW, et al. Complications of anesthesia for cesarean delivery. *Obstet Gynecol* 2005;106:281–7.
68. 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.
69. Miller DA, Chollet JA, Goodwin TM. Clinical risk factors for placenta previa-placenta accreta. *Am J Obstet Gynecol* 1997;177:210–214.
70. Makoha FW, Felimban HM, Fathuddien MA, Roomi F, Ghabra T. Multiple cesarean section morbidity. *Int J Gynaecol Obstet* 2004;87:227–32.
71. Wu S, Kocherginsky M, Hibbard JU. Abnormal placentation: twenty-year analysis. *Am J Obstet Gynecol* 2005;192:1458–61.
72. Silver RM, Landon MB, Rouse DJ, Leveno KJ, Spong CY, Thom EA, et al. Maternal morbidity associated with multiple repeat cesarean deliveries. *Obstet Gynecol* 2006;107:1226–32.
73. Pare E, Quinones JN, Macones GA. Vaginal birth after cesarean section versus elective repeat cesarean section: assessment of maternal downstream health outcomes. *BJOG* 2006;113:75–85.
74. Quinones JN, Stamilio DM, Pare E, Peipert JF, Stevens E, Macones GA. The effect of prematurity on vaginal birth after cesarean delivery: success and maternal morbidity. *Obstet Gynecol* 2005;105:519–24.
75. Durnwald CP, Rouse DJ, Leveno KJ, Spong CY, MacPherson C, Varner MW, et al. The Maternal-Fetal Medicine Units Cesarean Registry: safety and efficacy of a trial of labor in preterm pregnancy after a prior cesarean delivery. *Am J Obstet Gynecol* 2006;195:1119–26.
76. Varner MW, Leindecker S, Spong CY, Moawad AH, Hauth JC, Landon MB, et al. The Maternal-Fetal Medicine Unit cesarean registry: trial of labor with a twin gestation. *Am J Obstet Gynecol* 2005;193:135–40.
77. 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.
78. Ford AA, Bateman BT, Simpson LL. Vaginal birth after cesarean delivery in twin gestations: a large, nationwide sample of deliveries. *Am J Obstet Gynecol* 2006;195:1138–42.
79. 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.
80. 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. *Am J Obstet Gynecol* 2006;195:1127–31.
81. Bujold E, Mehta SH, Bujold C, Gauthier RJ. Interdelivery interval and uterine rupture. *Am J Obstet Gynecol* 2002;187:1199–202.

82. Esposito MA, Menihan CA, Malee MP. Association of interpregnancy interval with uterine scar failure in labor: a case-control study. *Am J Obstet Gynecol* 2000;183:1180-3.
83. Shipp TD, Zelop CM, Repke JT, Cohen A, Lieberman E. Interdelivery interval and risk of symptomatic uterine rupture. *Obstet Gynecol* 2001;97:175-7.
84. 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.
85. Rowbottom SJ, Critchley LA, Gin T. Uterine rupture and epidural analgesia during trial of labour. *Anaesthesia* 1997;52:486-8.
86. Fisler RE, Cohen A, Ringer SA, Lieberman E. Neonatal outcome after trial of labor compared with elective repeat cesarean section. *Birth* 2003;30:83-8.
87. Royal College of Obstetricians and Gynaecologists. *The Use of Electronic Fetal Monitoring. The use and interpretation of cardiotocography in intrapartum fetal surveillance*. Evidence-based Clinical Guideline Number 8. London: RCOG Press; 2001.
88. Arulkumaran S, Chua S, Ratnam SS. Symptoms and signs with scar rupture: value of uterine activity measurements. *Aust N Z J Obstet Gynaecol* 1992;32:208-12.
89. Beckley S, Gee H, Newton JR. Scar rupture in labour after previous lower uterine segment cesarean section: the role of uterine activity measurement. *Br J Obstet Gynaecol* 1991;98:265-9.
90. 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.
91. Madanes AE, David D, Cetrulo C. Major complications associated with intrauterine pressure monitoring. *Obstet Gynecol* 1982;59:389-91.
92. Royal College of Obstetricians and Gynaecologists. *Induction of labour*. Evidence-based Clinical Guideline Number 9. London: RCOG Press; 2001.
93. McDonagh MS, Osterweil P, Guise JM. The benefits and risks of inducing labour in patients with prior cesarean delivery: a systematic review. *BJOG* 2005;112:1007-15.
94. Dodd J, Crowther C. Induction of labour for women with a previous Caesarean birth: a systematic review of the literature. *Aust N Z J Obstet Gynaecol* 2004;44:392-5.
95. Dodd JM, Crowther CA. Elective repeat cesarean section versus induction of labour for women with a previous cesarean birth. *Cochrane Database Syst Rev* 2006;CD004906.
96. Kelly AJ, Kavanagh J, Thomas J. Vaginal prostaglandin (PGE2 and PGF2a) for induction of labour at term. *Cochrane Database Syst Rev* 2006;CD003101.
97. Arulkumaran S, Gibb DM, Ingemarsson I, Kitchener HC, Ratnam SS. Uterine activity during spontaneous labour after previous lower-segment cesarean section. *Br J Obstet Gynaecol* 1989;96:933-8.
98. Arulkumaran S, Ingemarsson I, Ratnam SS. Oxytocin augmentation in dysfunctional labour after previous cesarean section. *Br J Obstet Gynaecol* 1989;96:939-41.
99. Goetzl L, Shipp TD, Cohen A, Zelop CM, Repke JT, Lieberman E. Oxytocin dose and the risk of uterine rupture in trial of labor after cesarean. *Obstet Gynecol* 2001;97:381-4.
100. 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.
101. Hamilton EF, Bujold E, McNamara H, Gauthier R, Platt RW. Dystocia among women with symptomatic uterine rupture. *Am J Obstet Gynecol* 2001;184:620-4.
102. Arulkumaran S, Koh CH, Ingemarsson I, Ratnam SS. Augmentation of labour: mode of delivery related to cervimetric progress. *Aust N Z J Obstet Gynaecol* 1987;27:304-8.
103. Smith GC, Shah I, White IR, Pell JP, Dobbie R. Previous preeclampsia, preterm delivery, and delivery of a small for gestational age infant and the risk of unexplained stillbirth in the second pregnancy: a retrospective cohort study, Scotland, 1992-2001. *Am J Epidemiol* 2007;165:194-202.
104. Eden KB, Hashima JN, Osterweil P, Nygren P, Guise JM. Childbirth preferences after cesarean birth: a review of the evidence. *Birth* 2004;31:49-60.
105. Horey D, Weaver J, Russell H. Information for pregnant women about caesarean birth. *Cochrane Database Syst Rev* 2004; CD003858.
106. Gamble JA, Creedy DK. Women's preference for a cesarean section: incidence and associated factors. *Birth* 2001;28:101-110.
107. 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.
108. Mankuta DD, Leshno MM, Menasche MM, Brezis MM. Vaginal birth after cesarean section: trial of labor or repeat cesarean section? A decision analysis. *Am J Obstet Gynecol* 2003;189:714-19.
109. Dodd J, Pearce E, Crowther C. Women's experiences and preferences following Caesarean birth. *Aust N Z J Obstet Gynaecol* 2004;44:521-4.
110. David S, Mamelle N, Riviere O. Estimation of an expected caesarean section rate taking into account the case mix of a maternity hospital. Analysis from the AUDIPOG Sentinelle Network (France). Obstetricians of AUDIPOG. Association of Users of Computerised Files in Perinatology, Obstetrics and Gynaecology. *BJOG* 2001;108:919-26.
111. Sur S, Mackenzie IZ. Does discussion of possible scar rupture influence preferred mode of delivery after a caesarean section? *J Obstet Gynaecol* 2005;25:338-41.
112. Paglia M, Murtha A, Smith T. Factors influencing a woman's desire to choose vaginal birth after cesarean section. *Am J Obstet Gynecol* 2003;189(6, Supplement 1):S142.
113. Garrison F, Smith L, Givens L, Strassner H, Studee L, Judith H, et al. Provider and hospital factors associated with vaginal birth after cesarean: A survey of obstetric providers at two inner city teaching hospitals. *Am J Obstet Gynecol* 2005;193(6, Supplement 1):S124.
114. Dunn EA, O'Herlihy C. Comparison of maternal satisfaction following vaginal delivery after caesarean section and caesarean section after previous vaginal delivery. *Eur J Obstet Gynecol Reprod Biol* 2005;121:56-60.
115. Cleary-Goldman J, Cornelisse K, Simpson LL, Robinson JN. Previous cesarean delivery: understanding and satisfaction with mode of delivery in a subsequent pregnancy in patients participating in a formal vaginal birth after cesarean counseling program. *Am J Perinatol* 2005;22:217-21.
116. Gerber S, Sharp L, O'Toole C. Comparison of postpartum quality of life between patients with repeat cesarean delivery and vaginal birth after cesarean. *Am J Obstet Gynecol* 2003;189(6, Supplement 1):S157.

## APPENDIX

Clinical guidelines are: 'systematically developed statements which assist clinicians and patients in making decisions about appropriate treatment for specific conditions'. Each guideline is systematically developed using a standardised methodology. Exact details of this process can be found in Clinical Governance Advice No. 1: *Guidance for the Development of RCOG Green-top Guidelines* (available on the RCOG website at [www.rcog.org.uk/clingov1](http://www.rcog.org.uk/clingov1)). These recommendations are not intended to dictate an exclusive course of management or treatment. They must be evaluated with reference to individual patient needs, resources and limitations unique to the institution and variations in local populations. It is hoped that this process of local ownership will help to incorporate these guidelines into routine practice. Attention is drawn to areas of clinical uncertainty where further research may be indicated.

The evidence used in this guideline was graded using the scheme below and the recommendations formulated in a similar fashion with a standardised grading scheme.

Classification of evidence levels	Grades of recommendations
Ia Evidence obtained from meta-analysis of randomised controlled trials.	<b>A</b> Requires at least one randomised controlled trial as part of a body of literature of overall good quality and consistency addressing the specific recommendation. (Evidence levels Ia, Ib)
Ib Evidence obtained from at least one randomised controlled trial.	<b>B</b> Requires the availability of well controlled clinical studies but no randomised clinical trials on the topic of recommendations. (Evidence levels IIa, IIb, III)
IIa Evidence obtained from at least one well-designed controlled study without randomisation.	<b>C</b> Requires evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities. Indicates an absence of directly applicable clinical studies of good quality. (Evidence level IV)
IIb Evidence obtained from at least one other type of well-designed quasi-experimental study.	<b>Good practice point</b>
III Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies.	<input checked="" type="checkbox"/> Recommended best practice based on the clinical experience of the guideline development group.
IV Evidence obtained from expert committee reports or opinions and/or clinical experience of respected authorities.	



This Guideline was produced on behalf of the Guidelines and Audit Committee of the Royal College of Obstetricians and Gynaecologists by:

**Mr R Varma MRCOG, Birmingham; Professor JK Gupta FRCOG, Birmingham and Professor GCS Smith MRCOG, Cambridge**

and peer reviewed by:

The Association for Improvements in the Maternity Services; Professor S Arulkumaran FRCOG, London; Dr Susan Bewley FRCOG, London; British Association of Perinatal Medicine; British Maternal and Fetal Medicine Society; Caesarean Birth and VBAC Information ([www.caesarean.org.uk](http://www.caesarean.org.uk)); Dr SIMF Ismail MRCOG, Yeovil; Professor DK James FRCOG, Nottingham; Dr W Liston, Edinburgh; Dr KT Moriarty MRCOG, London; Mr IZ MacKenzie FRCOG, Oxford; The National Childbirth Trust; Mr KSJ Oláh FRCOG, Warwick; Professor SC Robson MRCOG, Newcastle-Upon-Tyne; RCOG Consumers Forum; Royal College of Midwives; Mr EJ Shaxted FRCOG, Northampton; Dr MJA Turner FRCOG, Dublin, Ireland; Ms J Thomas, Former Director NCCWCH; Professor JG Thornton FRCOG, Nottingham.

The Guidelines and Audit Committee lead peer reviewers were Dr RG Hughes FRCOG, Edinburgh; Mr SA Walkinshaw FRCOG, Liverpool, Ms T Belfield and Prof DJ Murphy MRCOG, Dublin, Ireland.

The final version is the responsibility of the Guidelines and Audit Committee of the RCOG

#### DISCLAIMER

The Royal College of Obstetricians and Gynaecologists produces guidelines as an educational aid to good clinical practice. They present recognised methods and techniques of clinical practice, based on published evidence, for consideration by obstetricians and gynaecologists and other relevant health professionals. The ultimate judgement regarding a particular clinical procedure or treatment plan must be made by the doctor or other attendant in the light of clinical data presented by the patient and the diagnostic and treatment options available.

This means that RCOG Guidelines are unlike protocols or guidelines issued by employers, as they are not intended to be prescriptive directions defining a single course of management. Departure from the local prescriptive protocols or guidelines should be fully documented in the patient's case notes at the time the relevant decision is taken.

The guideline review process will commence in March 2010  
unless otherwise indicated