

# Neonatal outcomes with caesarean delivery at term

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The caesarean delivery rate continues to increase globally, especially in industrialised nations.<sup>1</sup> Any attempt at reducing or reversing this trend has to consider both fetal and maternal risks and benefits of caesarean delivery. This has been the objective of many studies including that by Liston *et al* in this issue, which examines neonatal morbidity by method of delivery at term in both low- and high-risk women.<sup>2</sup> The size of this study allowed the evaluation of rare outcomes (<1%). By confining the analysis to term, morbidity due to preterm birth was excluded, which allows truly delivery-related events to be studied. Caesarean delivery during labour was associated with an up to sixfold risk of depression at birth and up to threefold risk of neonatal respiratory morbidity, in comparison with spontaneous vaginal delivery. The risk of birth trauma was highest after assisted vaginal delivery, followed in decreasing incidence by spontaneous vaginal delivery, caesarean in labour and caesarean without labour.

Essentially, this study reflects a similar pattern as a large body of existing evidence—namely, that planned caesarean delivery has the advantage of eliminating certain risks of rare complications during labour and delivery at the expense of an increased risk of respiratory morbidity. The bulk of the respiratory morbidity caused by caesarean section is relatively mild, classed as transient tachypnoea of the newborn (TTN). Severe morbidity—namely, respiratory distress syndrome or pulmonary hypertension, are rare. However, TTN at term is associated with an increased risk of admission to hospital for asthma in childhood, and caesarean delivery may, therefore, lead to long-term adverse effects on the health of the offspring.<sup>3</sup> The risks of respiratory morbidity can be reduced by timing the caesarean section to later weeks of gestation at term,<sup>4</sup> or by the administration of

corticosteroids,<sup>5</sup> but only the former is currently in widespread practice.

Caesarean section may also adversely affect the long-term health of the offspring through reduced rates of breast feeding. A report explored the association between initiation of breast feeding, short-term breast feeding (defined as <1 month) and breast feeding duration and mode of delivery. Caesarean delivery was associated with a reduction in initiation, maintenance at 1 month and duration of breast feeding. No distinction was made in the analysis between emergency and elective caesarean delivery.<sup>6</sup> However, other reports have found no difference in breast feeding rates between emergency and elective procedures and suggested that the lower rates may be due to delay in feeding after birth, which is recognised to be independently associated with breast feeding cessation.<sup>7</sup>

These adverse effects of caesarean delivery need to be set against its benefits. An important methodological concern when quantifying risks and benefits of caesarean section is to distinguish between the direct effects of caesarean section and the effects of the factors which led to performance of an emergency procedure. Another key issue is that the choice for a woman is not between planned caesarean section and vaginal birth, but rather an attempt at vaginal birth. In the latter category, the final mode of delivery can be spontaneous vaginal delivery, operative vaginal delivery or emergency caesarean section. This approach, essentially an extension of the principle of analysis by intention to treat, has been used in the evaluation of risks associated with the trial of labour among women with previous caesarean delivery.<sup>8,9</sup> Information used from this analytic approach means that counselling is not performed on the basis of the balance of risks being determined by an unknown quantity (ie, the eventual mode of delivery among women attempting vaginal birth).

The vast majority of planned caesarean deliveries are performed for breech presentation and previous caesarean section.<sup>10</sup> It is by analysis of the outcomes

from these pregnancies that the best estimates of absolute risks associated with planned caesarean delivery can be estimated. The importance of this is not always appreciated in the literature. For example, an analysis of the US birth certificate database concluded that there was a more than twofold increase in neonatal mortality among infants delivered by caesarean section.<sup>11</sup> The study cohort was confined to births with “no indicated risk”. The authors excluded deliveries with malpresentation, previous caesarean deliveries, dysfunctional labour and other comorbidities. Using these criteria, the authors excluded all planned repeat caesarean deliveries and planned caesarean deliveries for breech presentation. Hence, they excluded the vast majority of elective caesarean sections and their comparison was, in essence, between successful vaginal birth and emergency caesarean section. Given this, the greater risk of neonatal death was unsurprising and is unlikely to be explained by direct effects of caesarean delivery. Studies of truly elective procedures report risks of neonatal death which are less than 1 per 1000 live births, and are lower than for the general population born at term.<sup>8,9,12</sup>

## Perspective on the paper by Liston *et al* (see p F176)

Other studies have also indicated that the risk of severe neonatal morbidity due to events during labour and delivery may be lower among infants delivered by planned caesarean section. A case-control study from Australia reported that infants at term with newborn encephalopathy were five times less likely to be delivered by elective caesarean section than controls.<sup>13</sup> Better outcomes following planned caesarean procedures are unlikely to be explained by selection bias as women delivered by this method are more likely, rather than less likely, to have significant comorbidities.<sup>9</sup>

The effects of possible benefits of caesarean section for the infant must be balanced against the risk that the procedure may increase morbidity for the mother. The morbidity may be short term or long term. Short-term morbidity includes infection, bleeding, surgical injury and thromboembolism. Absolute risks of these outcomes are much lower among women having vaginal births.<sup>9</sup>

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However, the attempt at vaginal birth also introduces the risk of emergency intrapartum caesarean section and this carries greater risks. A large-scale prospective study of women with a previous caesarean section demonstrated risks of short-term morbidity of 2–3% among women delivering vaginally, 3–4% among those delivered by planned caesarean section, and around 14% among women delivered by emergency caesarean section during labour. Ironically, this led to higher overall rates of morbidity among women attempting vaginal birth. However, in situations where the risk of emergency intrapartum caesarean delivery is lower, the choice to attempt vaginal birth is likely to reduce the risk of these short-term outcomes. Maternal mortality is too rare for any study to show clear differences with different modes of delivery. However, it is likely that the effect of a decision to perform planned caesarean section on maternal mortality also depends on the background risk of emergency caesarean section should the woman attempt vaginal birth. The importance of this had led to attempts to use maternal characteristics to model the risk of emergency caesarean section.<sup>14</sup>

Finally, caesarean section is associated with an increased risk of complications in future pregnancies. These risks include placenta praevia and abruption, unexplained antepartum stillbirth and perinatal mortality from uterine rupture.<sup>8 15 16</sup>

One of the most concerning associations in future pregnancies is with morbid adherence of the placenta (accreta, increta or percreta). This can lead to life threatening haemorrhage, and the risk increases with greater numbers of previous caesarean deliveries.<sup>17</sup> Hence, a woman's long-term reproductive plans and potential must also inform discussion of the risk and benefits of planned caesarean delivery.

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## REFERENCES

1. **Dobson R.** Caesarean section rate in England and Wales hits 21%. *BMJ* 2001;**323**:951a.
2. **Liston FA,** Allen VM, O'Connell CM, *et al.* Neonatal outcomes with caesarean delivery at term. *Arch Dis Child Fetal Neonatal Ed* 2008;**93**:F176–82.
3. **Smith GCS,** Wood AM, White IR, *et al.* Neonatal respiratory morbidity at term and the risk of childhood asthma. *Arch Dis Child* 2004;**89**:956–60.
4. **Morrison JJ,** Rennie JM, Milton PJ. Neonatal respiratory morbidity and mode of delivery at term: influence of timing of elective caesarean section. *Br J Obstet Gynaecol* 1995;**102**:101–6.
5. **Stutchfield P,** Whitaker R, Russell I. Antenatal betamethasone and incidence of neonatal respiratory distress after elective caesarean section: pragmatic randomised trial. *BMJ* 2005;**331**:662–4.
6. **Leung GM,** Lam TH, Ho LM. Breast-feeding and its relation to smoking and mode of delivery. *Obstet Gynecol* 2002;**99**:785–94.
7. **Rowe-Murray HJ,** Fisher JRW. Baby friendly hospital practices: caesarean section is a persistent barrier to early initiation of breastfeeding. *Birth* 2002;**29**:124–31.
8. **Smith GCS,** Pell JP, Cameron AD, *et al.* Risk of perinatal death associated with labor after previous caesarean delivery in uncomplicated term pregnancies. *JAMA* 2002;**287**:2684–90.
9. **Landon MB,** Hauth JC, Leveno KJ, *et al.* Maternal and perinatal outcomes associated with trial of labor after prior caesarean delivery. *N Engl J Med* 2004;**351**:2581–9.
10. **Macara LM,** Murphy KW. The contribution of dystocia to the caesarean section rate. *Am J Obstet Gynecol* 1994;**171**:71–7.
11. **MacDorman MF,** Declercq E, Menacker F, *et al.* Infant and neonatal mortality for primary caesarean and vaginal births to women with "no indicated risk," United States, 1998–2001 birth cohorts. *Birth* 2006;**33**:175–82.
12. **Rietberg CCT,** Elfrink-Stinkens PM, Brand R, *et al.* Term breech presentation in the Netherlands from 1995–1999: mortality and morbidity in relation to the mode of delivery of 33,824 neonates. *Br J Obstet Gynaecol* 2003;**110**:598–603.
13. **Badawi N,** Kurinczuk JJ, Keogh JM, *et al.* Intrapartum risk factors for newborn encephalopathy: the Western Australian case-control study. *BMJ* 1998;**317**:1554–8.
14. **Smith GC,** White IR, Pell JP, *et al.* Predicting caesarean section and uterine rupture among women attempting vaginal birth after prior caesarean section. *PLoS Med* 2005;**2**:e252.
15. **Smith GC,** Pell JP, Dobbie R. Caesarean section and the risk of unexplained stillbirth in subsequent pregnancy. *Lancet* 2003;**362**:1779–84.
16. **Getahun D,** Oyelese Y, Salihu HM, *et al.* Previous caesarean delivery and risks of placental previa and placental abruption. *Obstet Gynecol* 2006;**107**:771–8.
17. **Grobman WA,** Gersnoviez R, Landon MB, *et al.* Pregnancy outcomes for women with placenta previa in relation to the number of prior caesarean deliveries. *Obstet Gynecol* 2007;**110**:1249–55.

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