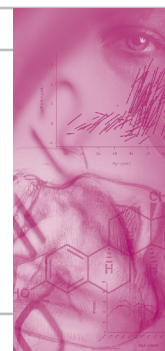


Delivery of the extremely low-birth-weight vertex-presenting baby – caesarean section or the vaginal route?



C A Cluver, MB ChB

D R Hall, MB ChB, MMed, MD

Department of Obstetrics and Gynaecology, Stellenbosch University and Tygerberg Hospital, Tygerberg, W Cape

Improvements in neonatal care have resulted in a downward shift of the viability threshold for preterm babies. In general, the lower the gestational age and birth weight at delivery, the higher the chance of mortality and morbidity. Some may argue that the softer cranium and vulnerable brain of the extremely low-birth-weight baby should not be exposed to the 'stresses' of vaginal birth. In this article we briefly discuss the difficulties in decision making surrounding the lowest thresholds of viability and examine what the literature has to say regarding route of delivery. It is important that parents only make these difficult decisions after being fully informed of the likely short- and long-term outcomes. With regard to route of delivery we conclude that in the absence of an obstetric indication there is no clear evidence to support performing a caesarean delivery.

In many hospitals the answer to a complicated preterm delivery is a caesarean section, but is this really in the best interests of the mother and baby? We will briefly discuss the ethics of caesarean section with regard to viability and the place for caesarean section on demand. We will then review the literature and evaluate what is best for both mother and baby when delivery of an extremely low-birth-weight infant is inevitable.

Over the past few decades there has been a sharp rise in the caesarean section rate.¹ This rise has been disproportionate to obstetric indications. Possible reasons for the rise are the concerns of litigation, the convenience of caesarean section for both patient and practitioner, and possibly the downward shift of the threshold of viability for the fetus.

Fetal viability, mortality and morbidity

According to South African law an unborn fetus lacks rights, which means that parents often have to make very difficult decisions. When counselling the parents of a possible extremely low-birth-weight infant the risks of mortality and short- and long-term morbidity need to be discussed. These infants have a high mortality rate, which is related to gestational age – the lower the gestational age, the higher the risk of morbidity and mortality. Survival at 23 weeks' gestation ranges from 2% to 35%, at 24 weeks' gestation from 17% to 62%, and at 25 weeks' gestation

from 35% to 72%.² The average perinatal mortality rate for extremely low-birth-weight infants is about 55%.³

Acute complications that need to be considered are:

- respiratory distress syndrome
- cerebral haemorrhage
- necrotising enterocolitis
- sepsis.

Long-term complications that need to be considered are:

- bronchopulmonary dysplasia
- retinopathy of prematurity
- growth impairment
- neurodevelopmental delay.

In developed countries the point of viability has been lowered in the past century from 32 weeks to 28 weeks and in recent decades to 24 weeks and below.⁴ There are reports of infants surviving from 22 weeks' gestation.⁵ The general survival of these babies is good, but there are high prevalences of disabilities in surviving children who were born at lower gestational ages. A baby born at a gestational age of less than 26 weeks has a 23% chance of major disability and a 25% chance of minor disability.⁶ A major disability such as cerebral palsy or visual or hearing loss has a lifelong impact on parents and child. Parents need to be fully informed on the risks and to make an informed decision about intervention. In most South African state hospitals the limited resources available

make the decision simpler, but in the private sector it can be very difficult. In the Netherlands the accepted limit of viability has even been pushed upwards.^{4,7}

The chances of a successful subsequent pregnancy also need to be taken into consideration when counselling parents who are deciding whether or not to proceed with an 'unnatural' intervention with significant financial implications. For example, a woman with cervical incompetence who is treated appropriately in her next pregnancy should have a good possibility of carrying the baby close to term with a normal neonatal outcome, whereas a woman of advanced maternal age whose current pregnancy has been complicated by severe early-onset pre-eclampsia may not have nearly as good a chance.

Caesarean section on demand

While patients do have the right to autonomy, in the case of elective caesarean section with no obstetric indication their decision needs to be an informed one. Extreme fear of labour can be addressed by discussing epidural and other options for pain relief. It is more convenient for the patient and practitioner to deliver by caesarean section, but the risks of this procedure need to be weighed against the convenience. Primary elective caesarean sections performed at term should in theory prevent all intra-uterine deaths, all intrapartum deaths and some neonatal deaths, but they do not.

What is the ideal method of delivery for an extremely low-birth-weight baby where there is no obstetric indication (such as placental dysfunction) and the singleton fetus is in a cephalic presentation? Put differently, does delivering such as baby via caesarean section have any obstetric or perinatal benefit?

Is caesarean section safe for the mother?

Caesarean section is generally a safe procedure, but one must remember that safety is based on locality and the number of times this procedure is performed on a patient. A caesarean section in a small rural hospital may not be as safe as one in a referral hospital. In addition, when an extremely low-birth-weight baby is delivered by caesarean section there is an increased likelihood of a midline uterine incision being necessary. Overall, vaginal delivery may be a safer option. The number of pregnancies a woman hopes to have should also be considered. There is a direct correlation between the number of caesarean sections and the incidence of morbidly adherent placenta. The risk of placenta praevia is 0.26% with an unscarred uterus, but increases almost linearly with the number of caesarean sections to 10% in patients with four or more previous caesarean sections. In patients with an unscarred uterus and placenta praevia the risk of placenta accreta is 5%, whereas patients with placenta praevia and one previous caesarean section have a 24% risk of placenta

accreta. This risk continues to increase to 67% with four or more caesarean sections.⁸ The caesarean hysterectomy rate increases, and the mortality rate for placenta accreta is 7%.⁹

Caesarean section is associated with an increased incidence of endometritis, a longer stay in hospital for the mother, an increased risk of haemorrhage, postpartum antibiotic treatment and severe maternal morbidity and mortality.¹ Its role in preventing pelvic floor disorders is controversial. There has been only one randomised controlled trial, which found that there was no difference in pelvic floor symptoms when caesarean section was compared with vaginal delivery at 2 years.¹⁰ In a large Norwegian population-based study there was no difference with regard to incontinence at 5 years when caesarean delivery was compared with vaginal birth. In a minority of women caesarean section may prevent serious pelvic floor damage, but preventing this very unlikely event would have significant impact on economic cost and fetal, neonatal and maternal outcomes. One also needs to question whether a small baby would have the same effect on the pelvic floor as a term infant.

Is caesarean section safer for the baby?

There are differences between abdominal and vaginal birth. In most studies composite neonatal and perinatal outcomes have been used. After studying the literature we grouped these outcomes into mortality, neurodevelopmental problems and respiratory morbidity.

Neonatal mortality

In 2004 Riskin *et al.* published an observational, population-based study that included 2 955 infants with gestational ages between 24 and 34 weeks and birth weights less than 1 500g.¹¹ They looked at the relationship between delivery mode and mortality in very low-birth-weight singleton pregnancies with a vertex presentation. Multivariable logistic regression analysis showed that caesarean section did not enhance survival, and they concluded that caesarean section should not be recommended unless there were other obstetric indications.

In 2006 Lee and Gould attempted to find out whether there was any advantage for very-low-birth-weight babies delivered by caesarean section.¹² To do this they reviewed the US Health Statistics data from 1999 to 2000 using multivariate logistic regression. The caesarean section rates were above 40%, and their analysis showed that caesarean delivery conferred a survival advantage if the fetus weighed less than 1 300g.¹² This article was followed by an editorial discussing its significant limitations.¹³ These included the fact that the Health Statistics were based on birth and death certificates, and there were questions about the depth and accuracy of this clinical information. There were limited data on gestational age, the indication for delivery, whether steroids were given

and the level of care. A subsequent analysis done by the same authors showed benefit only for the small-for-gestational-age subgroup, but again there were questions about the quality of these data and the subsequent analysis was not accepted for re-publication.

MacDorman *et al.* reviewed 8 million births and 17 412 infant deaths with an intention-to-treat approach and looked at the mortality risk according to planned route of delivery in low-risk women at term.¹⁴ They used a multivariable logistic regression analysis and with the most conservative model found a 69% greater risk of mortality with planned caesarean section compared with planned vaginal births in term infants. This illustrates the safety of vaginal delivery, but whether the findings can be extrapolated to extremely low-birth-weight infants is debatable.

Neurodevelopmental morbidity

In 2003 Wadhawan *et al.* published a retrospective study that compared the impact of vaginal delivery versus caesarean section on neurological morbidities and outcomes.¹⁵ They concluded that labour did not appear to play a significant role in adverse neonatal outcomes and was not associated with neurodevelopmental morbidity. In 2008 Adams-Chapman did a detailed review of the long-term neurological outcomes of infants born by caesarean section.¹⁶ Comparison of modes of delivery in vertex-presenting preterm survivors showed no difference in neonatal morbidity or neurodevelopmental outcome, but they concluded that the data should be interpreted with caution owing to the possible confounding effect of obstetric complications indicating preterm delivery. Haque *et al.* investigated whether delivery by caesarean section was associated with a better neurodevelopmental outcome at 2 years than vaginal delivery for preterm infants born weighing 1 250 g or less.¹⁷ They found no difference in neurodevelopmental morbidity. Neurodisability increased equally in both groups for babies born weighing 750 grams or less and/or born at 26 weeks gestation or less. Recently Vimercati *et al.* found that the indicators for poor neurological outcome were gestational age less than 25 weeks and birth weight less than 500 g.¹⁸ Mode and timing of delivery had no impact on neurodevelopmental outcome.

Respiratory morbidity

One of the most concerning problems for infants born by caesarean section is the increase in neonatal respiratory morbidity, regardless of gestational age.¹² Morrison *et al.* evaluated 33 000 term deliveries over 9 years and found that respiratory morbidity was increased in neonates delivered by caesarean section before the onset of labour.¹⁹ The baby's passage through the birth canal stimulates release of endogenous steroids and catecholamines that facilitate pulmonary transition from amniotic fluid to air. Beta-adrenoreceptor stimulation facilitates the rapid switch in direction of net liquid movement from into to out of the respiratory passages via activation of sodium channels. Cortisol increases epithelial permeability. Catecholamine levels at elective caesarean section may not be high enough to stimulate this transition.²⁰

The Cochrane library evaluated elective caesarean section versus expectant management and identified six studies with a total of 122 women. All the trials reported recruiting difficulties. They concluded that there was not enough evidence to evaluate policy, and also stated that 'there was no convincing evidence that caesarean section delivery was of benefit to the infant in this situation'.²¹ Cohorts show no advantage to mother or baby from caesarean section. The National Institute for Clinical Excellence (NICE) guidelines, published in 2004, do not recommend caesarean section for preterm infants.²²

Conclusion

Major neonatal morbidity increases with decreasing gestational age and birth weight. Many women with extremely premature babies needing delivery will have an obstetric indication for caesarean delivery. However, in the absence of such an indication there is no clear evidence to support performing caesarean section. The morbidity of this procedure, especially with classic incision, which is often needed in preterm deliveries, must not be forgotten.

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