Women Are Designed to Deliver Vaginally and Not by Cesarean Section: An Obstetrician's View

Gerard H.A. Visser

Department of Obstetrics, University Medical Center, Utrecht, The Netherlands

Key Words

Cesarean delivery · Cesarean section · Childhood obesity · Iatrogenic preterm delivery · Maternal morbidity/mortality · Neonatal immune development · Neonatal morbidity

Abstract

Worldwide, there is a rapid increase in deliveries by cesarean section. The large differences among countries, from about 16% to more than 60%, suggest that the cesarean delivery (CD) rate has little to do with evidence-based medicine. In this review, the background for the increasing CD rate is discussed as well as the limited positive effects on neonatal outcome in both term and preterm neonates. Negative effects of CD, including direct maternal morbidity, complications of subsequent pregnancies and iatrogenic early delivery resulting in increased neonatal morbidity, are discussed in addition to long-term implications for the offspring involving altered development of the immune system. The 'battle' to lower the CD rate will be difficult, but we should not forget that women are designed to deliver vaginally and not by cesarean section.

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Introduction

Worldwide, an explosion of cesarean deliveries (CDs) has occurred, ranging from below 20% in the northwestern European countries to about 50% in southeastern Europe and to over 60% in some Latin-American countries. This wide range suggests that the CD incidence has little to do with evidence-based medicine. It is more likely due to a loss of practical skills, to erroneous interpretation of fetal electronic monitoring tracings, to an increase in so-called failed inductions of labor, to the loss of adequate care during labor, to financial incentives, to outpatient clinics far away from the birthing center and – last but not least – to medicolegal issues. There is no proof that this increase in CDs has resulted in improved outcomes.

On the other hand, CDs carry several unwanted side effects:

- (1) Increase in direct maternal morbidity
- (2) Increase in uterine rupture and placenta previa/accreta in a subsequent pregnancy

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- (3) Iatrogenic early delivery in the case of elective CD, resulting in an increase in perinatal morbidity
- (4) Altered colonization of the infant's gastrointestinal tract, resulting in a 20–30% increase in autoimmune disorders and childhood obesity.

In this review, I will discuss the reasons for the explosion of CDs, the limited advantages of such an explosion and the disadvantages. I have also devoted a specific paragraph on CDs in relation to (very) preterm infants.

Why Do Cesarean Deliveries Continue to Rise?

Rates of CDs increased very gradually after the introduction of modern technology in the early 1970s. The introduction of electronic fetal heart rate monitoring is likely to have been the first drive behind this increase, with an almost 3-fold higher CD rate in continuously monitored labors compared to those monitored with intermittent auscultation, with only limited evidence for an improved outcome [1]. Prolonged labors were initially common and accepted, and in a prospective study on inductions of labor in high-risk patients monitored continuously in the mid-1970s, we experienced a CD rate of only 6% in my hospital [2]. However, the relative safety of cesarean sections and changing patient expectations contributed to a further rise in CDs. Obstetricians working privately discovered that planned CDs took up much less of their time, leading to greater profits, and in countries with a large private sector like Brazil, CDs are performed at present in about 70% of women, with 'only' 25% in general hospitals [3]. It is regularly quoted that women want a CD, but in my opinion it has been mainly the doctors who have promoted the elective CD, and, as a consequence, women started to ask for it. In some large and busy cities such as Istanbul, private offices tend to be far away from the hospital, hampering the ability to attend a vaginal delivery, again resulting in an increase in CDs. Also, with time indications widened, for example multiple pregnancies, maternal diabetes and – after publication of the Term Breech Trial – breech presentation [4]. An increase in CDs has also resulted in the so-called repeat CD. Given the risks for uterine rupture after a previous cesarean section, up to 85% of women may undergo abdominal delivery in a subsequent pregnancy [5]. Repeat CDs now account for approximately 25% of all cesarean sections in various countries [6]. The increase in CDs also leads to a decrease in practical skills to attend a difficult vaginal birth (breech, twins or shoulder dystocia), with ap-

propriate training disappearing in the registrar programs in several countries.

Another factor that may be involved is the loss of care during labor. Even in a busy well-staffed hospital, a mother may feel alone and in need of attention. A review of 11 randomized controlled trials published in 1991 showed a 50% lower incidence of CDs in women supported by a so-called 'doula', a layperson providing continuous support. The duration of labor was significantly shorter, vaginal instrumental deliveries were reduced, and the need for oxytocin augmentation and pain relief was significantly lower in the doula arm of the trials [7]. A recent Cochrane review also including continuous support by professional caregivers showed similar results albeit less obvious [8].

Finally, medicolegal problems are almost exclusively restricted to vaginal birth, which – again – leads to an increase in CDs in the context of 'defensive medicine'. In the USA, this is likely to have played a considerable role in the downtrend in vaginal birth after a previous CD [5, 9].

CD in Relation to (Very) Preterm Infants

'Preterm birth is associated with higher neonatal morbidity and mortality. However, the effect of planned CD in improving these outcomes remains uncertain and therefore CD should not routinely be offered outside a research context' [NICE guidelines, 10]. Randomized trials comparing a policy of planned immediate CD versus planned vaginal delivery for preterm birth thus far only include 122 patients due to recruitment difficulties and therefore do not provide enough evidence for evaluation or to guide clinical practice [11].

Nationwide data from the USA from 2000 to 2003 have shown that primary CD significantly reduced the risk of neonatal death for deliveries between 22 and 25 weeks of gestation [adjusted odds ratio (aOR) 0.58 at 22 weeks, increasing to 0.81 at 25 weeks], independent of other risk factors that may lead to a CD. Between 26 and 31 weeks, there was no overall favorable effect of CD compared to vaginal delivery, but only in pregnancies with additional risk factors [12]. Between 26 and 31 weeks, small-for-gestational-age infants only had a significantly higher survival in planned CDs at 31 weeks. From 32 to 36 weeks, neonatal mortality was increased in the primary CD group compared to vaginal delivery (aORs ranging from 1.08 to 2.31; significantly higher at all ages, apart from 34 weeks) [13]. Similarly, the need for mechanical ventilation was significantly increased (aORs ranging from 1.28

to 1.63) as was the incidence of the respiratory distress syndrome (aOR 1.32–1.68). These data have been adjusted by logistic regression for infant size at birth, birth weight, sex, Apgar score at 5 min <4, multiple births, breech presentation, presence of an anomaly, presence of any maternal medical condition or complication of labor and delivery, labor induction, maternal race, age, education and gravidity. In these publications, the definition of primary CD is unclear (CD before labor or also intrapartum CDs; only the first CD in a particular women and not repeat CDs). The favorable effect of CD at the limits of viability might be prevention of a traumatic birth. The unfavorable effect in late preterm infants is thought to be related to inadequate respiratory adaptation [13]. One-year outcome data from the Swedish express study for deliveries between 22 and 27 weeks did not show an independent favorable effect of CDs [14].

Given the limited data and absence of randomized trials, the role of CD to improve neonatal outcome in the preterm period remains unclear. In accordance with the NICE guidelines, CDs should be restricted to pregnancies with additional risk factors, such as fetal growth restriction with impaired fetal-placental blood flow and/or fetal heart rate abnormalities, and to multiple pregnancies with signs of twin-twin transfusion and/or breech presentation of the first twin. Cohort studies of singleton preterm breech delivery indicate that CD reduces neonatal mortality compared to vaginal delivery [pooled risk ratio (RR) 0.63; 95% CI 0.48–0.81] [15]. However, in decision making, the future reproductive career of the couple should be taken into account and decisions as to the mode of delivery should be taken in close collaboration with the patient.

Does the Increase in CDs Result in Improved Outcomes?

Nationwide or regional data on cerebral palsy in early childhood, some going back to the 1950s, have shown no evident decrease with time. This especially holds for infants born at term [16]. This provides indirect evidence that the increase in CDs does not reduce severe perinatal morbidity. Such a lack of improvement may, however, also be due to the fact that labor is not the most important factor determining outcome, due to inadequate intrapartum fetal surveillance and/or due to changes in patient populations with nowadays older pregnant women, more obesity and more women with medical diseases. In Sweden, no relation with direct neonatal outcome and CD rate

in various hospitals has been found, which also stresses the absent or limited effect of CD rate on outcome [17].

Clear benefits of CDs even seem to be absent in breech deliveries, twins and maternal diabetes. In breech deliveries, direct perinatal outcome is improved after CDs. After publication of the Term Breech Trial in 2000 [18], the CD rate for term breech presentations increased from 50 to 80% in the Netherlands. Comparing outcomes between the years before and after this change in policy, we found that an extra of 2,000 CDs were performed with probable prevention of 11 perinatal deaths [19]. However, this improved outcome was partly undone by the risks of uterine rupture in a subsequent pregnancy. If half of these women would experience a subsequent pregnancy then that would result in approximately 10 uterine ruptures (1%; ‘about 1 uterine rupture for each infant saved’) and 1 fetus who would die as a consequence of the rupture. Moreover, for 80 breech infants ‘saved’ by a CD, 1 mother would die in a subsequent pregnancy due to uterine rupture or placenta previa/accreta [19–25]. In the latter case, the confidence interval is wide, but such cases have already been published [26]. Counseling of these women is therefore important, with a vaginal delivery as a preference if future pregnancies are desired. Recently, a large randomized controlled trial also showed that perinatal outcome did not improve in twins with planned CD [27]. In maternal diabetes, CD seems the mode of choice when there is fetal macrosomia; however, all in all, CD will result in a poorer outcome due to complications in a subsequent pregnancy (‘for each shoulder dystocia with lasting complications that will be prevented, one fetus will die in a subsequent pregnancy due to uterine rupture’). In otherwise uncomplicated pregnancies, the risk-benefit ratio is likely to be worse.

Side Effects of CDs

Maternal Complications

CDs carry direct and late maternal side effects. Although CDs have become rather safe over the years, complications are still higher than after a vaginal delivery. From a large overview of CDs in Southeast Asia it is clear that an elective antepartum CD carries a 2.7-fold higher RR (95% CI 1.4–5.5) of maternal mortality, intensive care admission, blood transfusion, hysterectomy and internal artery ligation than a vaginal delivery. For an intrapartum CD without indication, the RR was 14.2 (9.8–20.7) [28]. In the NICE guidelines, the effects on maternal and infant health of a planned (elective) CD have been compared

with those of a planned vaginal birth (which sometimes ended in a cesarean section during labor) for women with an uncomplicated pregnancy and no previous CD [10]. A planned CD was associated with a lower incidence of early postpartum hemorrhage, obstetric shock, injury to the vagina and perineal and abdominal pain in the first 3 days after delivery. Duration of hospital stay was significantly longer as was the incidence of hysterectomy due to postpartum hemorrhage and cardiac arrest. The only significant finding regarding the newborn was a higher admission rate to the neonatal intensive care unit in the CD group. The evidence quality of the reviewed papers was generally low.

Complications in a subsequent pregnancy include among others an approximate 1% risk of uterine rupture, a twofold increase in placenta previa and an incidence of placenta accreta/increta of approximately 0.2% compared to 0.01% in women without a CD in their obstetric history [20–25].

Immediate Neonatal Complications

Elective CD is associated with a reduced incidence of neonatal hypoxic-ischemic encephalopathy [29]. However, other outcome variables after elective CD are poorer, since obstetricians tend to do these interventions too early. In the USA and the Netherlands, 36 and 56% of elective (repeat) CDs are performed before 39 weeks of gestation, respectively [30, 31]. This results in significantly increased incidence rates of the respiratory distress syndrome, neonatal hypoglycemia, hyperbilirubinemia, sepsis and neonatal intensive care unit admission. The OR for the respiratory distress syndrome is about 2 for an elective CD at 38 weeks and 4 at 37 weeks. CD should, therefore, never take place before 39 weeks of gestation unless there is documentation of lung maturation [32], but even when amniocentesis has shown sufficient lung maturation before 39 weeks, neonatal morbidity is still increased [33]. Nevertheless, obstetricians continue to perform CDs too early, sometimes for logistic reasons (for example, holidays) and to avoid an unexpected vaginal breech or twin delivery.

Long-Term Implications for the Offspring

CDs result in a 20–30% higher incidence of autoimmune diseases and obesity in the offspring. This has been shown most convincingly in meta-analyses of observational studies regarding childhood diabetes and asthma [34, 35]. Although these data did not derive from randomized controlled trials, subanalysis did not reveal effects of low-birth-weight infants, breast-feeding and

passive smoking. Moreover, funnel plots did not show evidence of publication bias [34]. Other autoimmune diseases which have been related to CDs are later risks for allergy and celiac disease [36]. The effects of CDs on the immune response may be due to the absence of the stress of the normal labor process, resulting in maladaptive immune activation. Other possibilities include altered epigenetic regulation of gene expression and perturbed bacterial colonization of the gastrointestinal tract [36]. After CD, there is delayed and altered bacterial colonization with reduced variation [37, 38]. This may result in delayed developmental balance between Th1 and Th2 immune responses [39]. For the future, probiotics may partly prevent such an altered colonization. A meta-analysis of 2 case-control and 7 observational studies showed a 20–50% increase in obesity in children, adolescents and adults after having been born by cesarean section. The OR for high-quality trials was 1.18 (95% CI 1.09–1.27) [40]. In 1 of 3 more recent studies, the relationship between CD and childhood obesity was confirmed [41–43]. The microflora in the gut may stimulate fat deposition and promote obesity through several mechanisms, e.g. by improving energy yield from food, by regulating gut permeability, low-grade inflammation and immune balance or by modulating metabolism and/or genes directly in the liver (JE Friedman, presentation at the 13th Annual Meeting of the Diabetes in Pregnancy Study Group of North America, Washington, October 31 to November 2, 2013). All in all, it can be concluded that during early life the microflora plays a significant role in health and disease [44]. CD may well hamper normal development with possible long-term consequences for the offspring. Many of these possible consequences may still be unknown.

Concluding Remarks

Consequently, incentives should be encouraged to reduce CDs. In Portugal, a reduction in CDs has recently been implemented successfully by dissemination of knowledge, a uniform CD classification system, publication of annual hospital CD figures, implementation of new technology and lowering the fee of a CD to that of a vaginal delivery [D. Ayres-de Campos, pers. commun.]. In other countries, such as Turkey, measures to reduce CDs have failed thus far. Other important factors are the presence of a companion during the whole process of labor (doula: care vs. cure), the reestablishment of the practical skills of doctors and changes in the medicolegal sys-

tem. Concerted nationwide actions are necessary to lower the CD epidemic. Long-term consequences of CDs on the immune system of the newborn need to be further investigated. Women are designed to deliver vaginally and they only need a CD if this is really indicated.

Disclosure Statement

The author has no conflict of interest to disclose.

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