

# Cesarean delivery on maternal request: maternal and neonatal complications

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## Purpose of review

A complicated but relevant and timely concept, cesarean delivery on maternal request (CDMR) is defined as a cesarean delivery for a singleton pregnancy on maternal request at term in the absence of medical or obstetrical indications.

## Recent findings

Multiple potential risks and benefits exist with both vaginal and cesarean deliveries. A CDMR performed prior to the onset of labor for a mother planning on only one or two children may be reasonable after informed consent and counseling. However, the most concerning complications from cesareans are the neonatal respiratory morbidity and the impact on a mother's future reproductive health, including the risk of abnormal placentation such as placenta previa or accreta. The literature on CDMR is limited and is derived primarily from observational or extrapolated studies. A well designed prospective study does not currently exist but is needed comparing the optimal groups of planned vaginal delivery and planned CDMR.

## Summary

Discussions regarding CDMR should be individualized. Until there are more data on CDMR and guidelines implemented, an explicitly executed informed consent should form the framework of any decision regarding mode of delivery.

## Keywords

cesarean, maternal morbidity, maternal request, neonatal morbidity

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## Introduction

Cesarean delivery on maternal request (CDMR) is defined as a cesarean delivery for a singleton pregnancy on maternal request at term in the absence of medical or obstetrical indications [1<sup>••</sup>]. The most recent national statistics estimates that in 2006, over 30% or 1.3 million births were via cesarean, a national record, and an estimated 2.5% of all births in United States were CDMR [1<sup>••</sup>,2]. The controversy and debate surrounding CDMR not only reflects changing medical practice but a shift in attitude of both healthcare providers and patients. In March 2006, the National Institute of Child Health and Human Development (NICHD) branch of the National Institutes of Health (NIH) sponsored a State-of-the-Science conference on CDMR to analyze and systematically review the current evidence, educate the public of the findings, and identify potential areas of future research. Conclusions drawn from the 2006 NIH State-of-the-Science conference and 2007 American College of Obstetricians and Gynecologists (ACOG) Committee Opinion on CDMR are as follows [3]:

- (1) More research on CDMR is needed.
- (2) Decision to perform a CDMR should be individualized and consistent with ethical principles.
- (3) CDMR should not be performed prior to 39 weeks' gestation unless there is documentation of fetal lung maturity.
- (4) Effective pain management services should be available to all laboring women and their unavailability should not be the motivator for CDMR.
- (5) CDMR is not recommended for women desiring several children.
- (6) Potential risks of CDMR include a longer maternal hospital stay, hemorrhage, neonatal respiratory morbidity, and complications in subsequent pregnancies such as uterine rupture, placenta previa, or accreta.

A variety of maternal and fetal outcomes were examined in the conference but an extensive literature search identified only five areas supported by moderate level evidence: maternal length of stay, hemorrhage, neonatal respiratory morbidity, subsequent placenta previa or

accreta, and subsequent uterine rupture [1\*\*,3]. The data on CDMR are sparse but suggest that there are a number of important risks and benefits from both vaginal and cesarean deliveries. Although the safest route of delivery may be an uncomplicated vaginal delivery, accurately predicting who will achieve this outcome is currently not possible. The impact on future pregnancies should be carefully considered; however, a CDMR performed prior to the onset of labor for a mother planning on only one or two children may be reasonable after informed consent and counseling on the risks and benefits. Since the 2006 NIH conference, few studies on CDMR have been published with the majority remaining observational or extrapolated research, leaving many questions unanswered.

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### Neonatal respiratory morbidity

The most concerning impact on the neonate from CDMR appears to be the risk of neonatal respiratory morbidity. Potential benefits for the neonate from planned vaginal delivery include a lower risk of respiratory problems, less risk of iatrogenic prematurity, and shorter length of hospital stay. Although serious respiratory distress primarily follows iatrogenic prematurity, transient tachypnea of newborn and persistent pulmonary hypertension are both increased with elective cesarean regardless of gestational age [4]. Respiratory distress syndrome requiring mechanical ventilation is significantly reduced to one in 10 000 newborns if elective cesarean delivery is delayed until after 39 weeks' gestation [5]. This stresses the importance of accurate dating and adherence to ACOG guidelines disapproving of elective delivery prior to 39 completed weeks without documentation of fetal lung maturity [1\*\*].

Morrison *et al.* [5] prospectively collected data on over 33 000 deliveries at term ( $\geq 37$  weeks' gestation) over 9 years and found that the respiratory morbidity was significantly higher for neonates delivered by cesarean before the onset of labor (35.5/1000) compared with cesarean during labor [12.2/1000; odds ratio (OR) 2.9; 95% confidence interval (CI) 1.9–4.4;  $P < 0.001$ ] or vaginal delivery (5.3/1000; OR 6.8; 95% CI 5.2–8.9;  $P < 0.0001$ ). These findings are consistent with the widely held belief that neonatal passage through the birth canal accompanied by exposure to endogenous steroids and catecholamines released in normal labor and delivery improve the neonatal pulmonary transition from amniotic fluid to breathing air [4].

The general impression about respiratory morbidity in term infants is that of benign self-limited disease requiring limited intervention; however, some of these neonates become seriously ill and may require prolonged oxygen therapy, mechanical ventilation, extracorporeal membrane oxygenation (ECMO), or rarely end in death

[4]. Unlike premature births, term births lack large databases from which reliable estimates of specific outcomes can be determined. Respiratory complications often seen in term neonates include transient tachypnea of the newborn, respiratory distress syndrome resulting from iatrogenic prematurity, and persistent pulmonary hypertension of the newborn or hypoxic respiratory failure.

At least one study suggests that corticosteroid administration in the term gestation may be beneficial in reducing respiratory distress. In the antenatal steroids for term caesarean section (ASTECS) trial, 998 patients were randomized to steroid administration or no medication prior to elective cesarean at term (at or greater than 37 weeks) [6]. The incidence of admission with respiratory distress was 0.051 in the control group and 0.024 in the treatment group [relative risk (RR) 0.46, 95% CI 0.23–0.93] [6]. The findings raise the question on the role antenatal steroids may play in the growing CDMR debate. However, the potential long-term consequences remain a concern and more studies are needed. Until then, current recommendations advise limiting administration of corticosteroids to enhance fetal lung maturation to those gestations between 24 and 34 weeks who are at risk for preterm delivery within 7 days [7].

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### Neonatal morbidity

Rare but serious complications such as intracranial hemorrhage and neonatal asphyxia and encephalopathy are all more frequently found with complicated vaginal deliveries and unplanned cesareans. Using some epidemiological models, adopting a universal approach of cesarean delivery on all women at 39 weeks has the potential of reducing our nation's numbers of both transient and permanent brachial plexus injury, neonatal encephalopathy, intrapartum death, and intrauterine fetal death beyond 39 weeks [8]. Not surprisingly, the potential for brachial plexus injury is highest for assisted vaginal delivery and higher for infants born via the vaginal route as compared with cesarean. The risk of fetal trauma is increased with a difficult delivery, whether vaginal or cesarean, such as sequential instrumentation like vacuum followed by forceps or vice versa or an emergent situation such as stat cesarean for cord prolapse. Although elective cesarean would reduce these risks, the magnitude of reduction would be minimal as these risks with planned vaginal delivery remain low.

In 1998, Badawi *et al.* [9,10] published a case–control study of 164 term infants with moderate or severe newborn encephalopathy and observed a decreased risk of neonatal encephalopathy with elective cesarean compared with spontaneous vaginal delivery (adjusted OR 0.17, 95% CI 0.05–0.56). In patients who underwent elective cesarean without labor, there was an 83% reduction in risk of moderate or severe neonatal encephalopathy but this

hypothetically amounts to approximately 5000 cesareans to prevent one case of hypoxic ischemic encephalopathy [8]. One must also acknowledge that reduction in long-term outcome is less clear as this does not eliminate the possibility of permanent neurologic injury such as cerebral palsy. Despite the rising cesarean rates over the last decade, the number of neonates with cerebral palsy and other long-term neurologic conditions has remained relatively stable over the same time period.

Unexplained stillbirth remains a devastating and common obstetrical problem occurring in nearly 1% (6.4 per 1000) of all births in the United States [11]. Particularly frustrating is the fact that unexplained intrauterine fetal death comprises a substantial number of cases. If one weighs the prospective risk of fetal death in ongoing pregnancies, or the risk of fetal death beyond a given gestational age, against the risks of neonatal morbidity at birth, there may be an argument for delivery at 39 weeks, thus obviating the risk of stillbirth [12,13]. Delivery at a given gestational age averts the risk of stillbirth, but there has been some concern that this thought has contributed to a rise in the number of births between 34 and 37 weeks' gestation, exposing a large number of neonates to complications of late preterm birth [14]. The experience in Brazil, a country where cesarean rates exceed that of the United States, warns that acknowledging maternal request as an indication for cesarean may open the door for iatrogenic late preterm births. Barros *et al.* [15] analyzed a prospective cohort study of all urban births in Brazil in 1982, 1993, and 2004 and found that the prevalence of preterm births increased from 6.3 to 16.2% and rate of cesareans increased from 28 to 43% with cesareans performed for 82% of all private deliveries in 2004.

### Maternal morbidity and mortality

The current literature suggests that term planned cesarean and planned vaginal deliveries have similar low absolute and relative rates of maternal morbidity [16]. A *Cochrane Database Systematic Review* studying short-term maternal outcomes of three randomized trials compared planned cesarean with planned vaginal delivery for breech [17]. The review noted a somewhat increased overall maternal morbidity in the planned cesarean group (9.1 versus 8.6%, RR 1.29, 95% CI 1.03–1.61). Two of the three studies were conducted several decades ago and randomized participants in labor, thus potentially increasing the operative morbidity among cesareans and questioning their applicability to CDMRs today [16].

The largest and most recent randomized trial with proxy comparison groups is the Term Breech Trial evaluating 2088 women from 121 centers in 26 countries with term ( $\geq 37$  weeks), singleton breech fetuses [18]. Of 1041

women for planned cesarean, 90.4% delivered by cesarean; of which 50% were in labor. Of 1042 women for planned vaginal delivery, 56.7% delivered vaginally and 22% with forceps. The two study groups had no significant differences in overall composite morbidity (planned cesarean versus planned vaginal delivery, RR 1.13, 95% CI 0.92–1.39) or specific outcomes of hemorrhage, transfusion, genital tract injury, wound complications, systemic infection, or depression [18,19]. There were no hysterectomies or cases of thromboembolism and no significant differences in rates of pain or depression were appreciated at 3-month follow-up.

Benefits of a vaginal delivery include shorter length of hospital stay and lower rates of infection such as endometritis and urinary tract infections [3]. Anesthesia complications are lowest in vaginal deliveries and highest during emergency induction of anesthesia such as those performed for unplanned, emergent cesareans. Although a meta-analysis suggests that neonates delivered by cesarean are less likely to initiate breastfeeding, there does not appear to be any difference at 3 or 24 months [19,20]. On the other hand, postpartum hemorrhage occurs less frequently in planned cesareans than planned vaginal or unplanned cesareans. However, much of the higher hemorrhage incidence in planned vaginal delivery group reflects the contribution of operative vaginal deliveries and cesarean in labor [3]. Maternal mortality, hysterectomy, and thromboembolism are rare outcomes and therefore the data on their impact are limited. Data are lacking for other important variables such as depression, bonding, and postpartum pain. Overall, however, the current literature suggests that composite short-term maternal morbidity is similar in women undergoing planned vaginal and planned cesarean deliveries.

Regarding pelvic floor dysfunction, the data are unclear. There may be a potential benefit of planned cesareans on short-term stress urinary incontinence; however, any benefit may be decreased or eliminated in older, parous, and obese patients [21]. Only one randomized trial has studied the difference in pelvic floor symptoms after planned vaginal or cesarean birth and the investigators found an initial lower rate after planned cesarean at 3-month postpartum (4.5 versus 7.3%; RR 0.62, 95% CI 0.41–0.93) but no difference at 2 years [20]. In a recent large population-based publication, investigators of the Norwegian Epidemiology of Incontinence in the County of Nord-Trøndelag (EPINCONT) study [22] found no difference at 5 years regardless of delivery type. The literature on anorectal dysfunction, sexual function, and pelvic organ prolapse is weak and favors neither route. Anal incontinence following vaginal delivery is strongly associated with overt and occult sphincter lacerations and operative vaginal delivery [23]. More research is needed in

this area, especially as pregnancy itself appears to have a role in pelvic organ dysfunction and cesarean does not eliminate the risks for urinary or anorectal incontinence, pelvic organ prolapse, or sexual dysfunction.

Fortunately, death associated with pregnancy rarely occurs today but has become a greater concern with an increasing number of complications such as placenta previa and accreta, uterine rupture, or cesarean scar ectopic pregnancy. Current studies often lack adequate power to clearly discern a relationship between mortality and method of delivery. However, studies from the United Kingdom emphasize the difference between cesareans performed electively and those unplanned or performed after the onset of labor [24,25]. Although one might anticipate a slight increase in maternal deaths with cesareans as compared with vaginal delivery, one must also acknowledge a potential concomitant decrease in mortality associated with intrapartum, unplanned cesareans. Therefore, the current data are inadequate to accurately estimate the absolute risk of maternal mortality with CDMR but suggests there may not be a significant net increased risk of maternal death with CDMR.

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### Subsequent pregnancies

One of the most serious complications of cesarean delivery is the impact on a woman's future reproductive health. Cesareans are a well established risk factor for subsequent development of abnormal placentations such as placenta previa and/or accreta [3,26]. Placenta accreta occurs most frequently in women with a prior history of cesarean and current placenta previa with studies estimating the risk for placenta previa-accreta to be 11–24% in women with one prior cesarean [27,28\*,29]. The incidence of placenta accreta appears to be rising coincident with higher cesarean rates as a recent study reported that one of 533 deliveries was complicated by accreta at their institution over a two-decade period from 1982 to 2002 [30]. A potentially life-threatening condition, placenta accreta has become the leading indication for cesarean hysterectomy in many centers and can lead to massive obstetrical hemorrhage with subsequent disseminated intravascular coagulopathy, surgical visceral injury, renal failure, acute respiratory failure, or death [31].

Four major studies [32\*,33–35] have focused on the potential relationship between prior cesarean and stillbirth and found no consistent direction of effect with two showing an increased risk and no difference in another two. In a study of 120 633 births in Scotland, Smith *et al.* [35] analyzed linked datasets from 1980 to 1998 and found that a risk of unexplained stillbirth in women with a history of cesarean was apparent from 34 weeks (adjusted hazard ratio 2.23, 95% CI 1.48–3.36). The absolute risk of unexplained stillbirth at or after 39 weeks'

gestation was 1.1 per 1000 for women who had a previous cesarean and 0.5 per 1000 for those who had not [35].

Other potential reproductive consequences from cesarean delivery on request that have been raised are increased risk of spontaneous abortion and ectopic pregnancy, infertility, uterine scar dehiscence, uterine rupture, and placental abruption. In addition, an entity rarely seen in the past, cesarean scar ectopic pregnancies have recently demonstrated a considerable increase [36]. Awareness of these complications is critical as the rates of these potentially lethal sequelae rise.

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### Conclusion

Well designed, systematic data on CDMR are lacking and many questions remain unanswered. Potential medical risks that should be emphasized include neonatal respiratory morbidity and risks to future pregnancies such as abnormal placentation. The primary advantage of cesareans on maternal request is avoiding emergent or unplanned cesareans, which carry higher risks for morbidity and potential psychological trauma than scheduled or planned cesareans [3]. Other potential benefits include scheduling convenience, lower risk of hemorrhage, and decreased neonatal neurologic injury. Most obstetrician–gynecologists recognize an increased demand for CDMR within their practices and agree that studies regarding risks and benefits are crucial to guiding decision-making with regard to CDMR. Because of the complexity of this question, the decision-making process will vary for each individual [37\*\*,38\*]. Mothers should be counseled that the most concerning risks involve her future obstetrical health. In addition to the medical impact, discussions should also include psychological, economic, and sociologic considerations and may focus on mental and behavioral characteristics, probabilities and finances, or societal implications [39]. There are no current studies comparing the optimal groups of planned vaginal delivery with CDMR. The most feasible, optimal study on CDMR may be a large multicenter, multidisciplinary prospective cohort trial following short and long-term outcomes. Such a study would ideally include analysis on strategies to predict and influence likelihood of successful vaginal birth and modifiable factors in labor management that can affect outcomes. Although literature on CDMR has been published since the 2006 NIH conference, it comprises primarily commentaries, editorials, and review articles but few original studies. A concerted, rigorous effort is needed to gather more information on CDMR. Until then, an explicitly executed informed consent should form the framework of any decision regarding CDMR and mode of delivery.

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## References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 000–000).

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